Fish Hatcheries Engineering Studies

Maine Department of Inland Fisheries and Wildlife

Casco State Fish Hatchery
Grand Lake Stream State Fish Hatchery
Expansion Potential

February 1, 2016

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List of Acronyms

Acronym	Phrase
ANS	Aquatic Nuisance Species
ASTM	American Society for Testing and Materials
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AC	Asbestos Concrete
AO	Available Oxygen
AWWA	American Water Works Association
BOD_5	Biochemical oxygen demand
CADD	Computer-Aided Drafting & Design
CMU	Concrete Masonry Units
CF	Cubic Feet
DC	Direct Current
DEP	Department of Environmental Protection
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
DI	Ductile Iron
dia	Diameter
ºF	Fahrenheit
FEMA	Federal Emergency Management Agency
FC	Foot-candle
FIRM	Flood Insurance Rate Map
FRP	Fiberglass Reinforced Plastic
gpm	Gallons per minute
GIS	Geographical Information System
GPA	Great Ponds Class A
HDPE	High Density Polyethylene
HDR	HDR Engineering, Inc.
HVAC	Heating, Ventilating and Air-Conditioning

Acronym	Phrase
hp	Horsepower
HWQS	Hatchery Water Quality Standards
I/O	Input/Output
IF&W	(Maine Department of) Inland Fisheries & Wildlife
IRC	International Residential Code
IBC	International Building code
IEBC	International Existing Building Code
IECC	International Energy Conservation Code
kW	Kilowatt
LOX	Liquid Oxygen
LHO	Low Head Oxygenator
μ	Micron
MGD	Million gallons per day
mph	Miles per Hour
MUBEC	Maine Uniform Building and Energy Code
NAIP	National Agriculture Imagery Program
NPDES	National Pollutant Discharge Elimination System
PC	Personal Computer
PVC	Polyvinyl Chloride
PDF	Portable Document Format
lb	Pounds
PSI	Pounds per Square Inch
PLC	Programmable Logic Controller
ROW	Right-of-Way
SCUBA	Self-Contained Underwater Breathing Apparatus
SF	Square Feet
SFH	State Fish Hatchery
TBB	Telephone Terminal Board
TP	Total Phosphorus

Acronym	Phrase
TSS	Total Suspended Solids
UV	Ultraviolet
USFWS	United States Fish and Wildlife Service
VCT	Vinyl Composite Tile
V	Volt

1 Introduction

1.1 Project Description

Several planning documents have been written about Maine's hatchery system to help document the existing condition and potential future capacity of the statewide hatchery system. First, the **Strategic Fish Hatchery Planning and Engineering Study** was completed (HDR/FishPro, 2000) to provide an overview of the existing system. During the same time frame, several other reports were written to address immediate effluent and discharge concerns: **Fish Hatchery Effluent Study** (HDR/FishPro, 2000) and **Alternate Discharge Study** (HDR/FishPro, 2002).

Next, **the Maine Comprehensive Statewide Fish Hatchery System Engineering Study** (Study) (HDR/FishPro, 2002) was developed to provide a more detailed evaluation of all nine (in 2002) of the hatcheries located throughout the state. The Study recommended infrastructure improvements related to renovating water supply, fish production units, general site and buildings, effluent treatment and overall electrical issues. Each facility was evaluated with respect to meeting both the current and the proposed increased fish production levels outlined in the report. Each recommendation was described, conceptually illustrated and assigned a cost. The Study was used to appropriate funding to allow the highest priority improvements to be constructed. Using Bond Bills for funding, several effluent treatment enhancement projects were constructed, oxygenation upgrades completed and the Embden State Fish Hatchery (SFH) was completely renovated.

The purpose of this report is to re-evaluate and update the costs associated with the three following Maine Department of Inland Fisheries & Wildlife (IF&W) scope items:

- Feasibility of replacing and improving the Casco SFH water intake supply line at the same time the water supply dam is replaced on Pleasant Lake. The firm may be required to coordinate this work or additional work with other consultants contracted by the Owner.
- Production upgrades to the Grand Lake Stream SFH Including an analysis of the feasibility and cost of a new cold water supply to that hatchery. The option of extending the existing intake line to deeper water will also be evaluated.
- Construction of a new fish hatchery in the State, which must include a comparative analysis on whether the State can best achieve its fish stocking objectives through the construction of a new hatchery or through upgrades to existing State-owned fish hatcheries.

Some of the data and drawings provided in the original Study are reproduced herein since this effort is to re-evaluate and update some of the original recommendations. Only Information pertinent to the proposed two intake renovation projects, fish production expansion and the new facility are duplicated and have been modified as needed for this new study effort.

1.2 Project Authorization

This study has been developed under a consultant services contract made by and between the State of Maine through the Department of Inland Fisheries and Wildlife and HDR Engineering, Inc. (HDR), 5201 South Sixth Street Road, Springfield, Illinois, 62703, 217.585.8300. The original agreement was signed on November 5, 2015. The project scope narrative, as specified in the contract, is summarized below. The project includes six main work tasks:

STUDY PHASE SERVICES	
Task 1	Project Management
Task 2	Kick-Off Meeting and Project Discussions
Task 3	Grand Lake Stream Project
Task 4	Conceptual New Hatchery Project
Task 5	Casco Project
Task 6	Report Development

1.3 Acknowledgements

The following individuals have been involved in the development and review of this report entitled, **Fish Hatcheries Engineering Studies.** Their cooperation and assistance is gratefully acknowledged.

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2 Executive Summary and Recommendations

2.1 Report Overview

Section 1 of the report provides an introduction to the report, the project authorization and contains the acknowledgements. **Section 2** presents a summary of the report and provides recommendations (herein). The Casco State Fish Hatchery (SFH) and Grand Lake Stream SFH facility water supply intake renovation projects are outlined in **Sections 3** and **4.** Each section provides an overview of the facility and the existing water supply systems and then provides options and recommendations for enhancement. **Section 5** provides a discussion about the fish production expansion potential for the system. First a statewide fish production overview is provided and production increase options are then discussed. General Design Criteria and assumptions are outlined in **Section 6** which will serve as the Basis of Design for the rest of the project. **Section 7** provides an overview of construction cost projections and an explanation of how the costs were projected and related assumptions. Drawings, Detailed Costs, fish production data, and Geographical Information System (GIS) records are provided in the Appendices.

2.2 Overall Recommendations

2.2.1 Casco SFH Water Supply

- Add second deeper intake and new pipeline (Option 1)
- Request funding for future replacement of asbestos concrete (AC) pipeline portion of existing shallow intake (Option 2)
- Optional Add-On – Replace existing UV disinfection equipment and add microscreen
- If new water supply work is not completed prior to completion of City's dam renovation work (outside this project), some piping provisions should be put in the dam for the future installation of the new water supply line.

2.2.2 Grand Lake Stream SFH Water Supply

- Add deeper intake on existing pipeline (Option 2)
- Optional Add-on – Replace existing water treatment equipment
- Optional Add-on – Add five new rearing tanks for increased production

2.2.3 Hatchery System Expansion

Four production increase tiers were proposed for the statewide fish production program – 10 percent, 25 percent, 39 percent and 124 percent in pounds from 2015 for comparative purposes. Next, methods for meeting those production goals were evaluated.

- Raise more fish within existing infrastructure

- Tier 1 levels (10 percent increases) only may be achievable under ideal conditions but only with careful adjustments to rearing densities and monitoring effluent permit levels. Not viable at all facilities.

- Expand infrastructure at current facilities
  - Expansion not viable at Dry Mills SFH, Embden SFH, Governor Hill SFH, New Gloucester SFH
  - Production level increase viable at Casco SFH due to cooler temperatures (~4,000 to 6,000 pounds [lbs]) with no new flow or rearing units
  - Production level increase viable at Enfield SFH with a new tank farm of size equal to Embden SFH (~35,000 additional lbs.). Additional effluent treatment would be required.
  - Production level increase viable at Grand Lake Stream SFH by adding five new rearing tanks and using the cooler water from the intake piping modifications (~18,000 lbs) by providing cooler water and utilizing surplus influent flows.
  - Small production level increase viable at Palermo SFH if additional effluent treatment (i.e., chemical treatment) is added to reduce monthly phosphorus levels.
  - Total production level for only Tier 1 can be achieved by expanding the existing infrastructure. Tier 2 can be achieved if a new Enfield tank farm is added in conjunction with all the other expansion opportunities.
- Build a New Facility(s)
  - A generic facility was sized to produce enough brook trout for the Tier 3 scenario (39 percent increase in pounds).
  - Specific site and water supply requirements were outlined.
  - This new facility will include broodstock holding, spawning, incubation, isolation, early rearing and grow-out rearing spaces.
  - All associated support functions were also described and illustrated.
  - The generic facility was prorated to illustrate costs associated with the three remaining production tiers.

Finally, a desktop siting evaluation was completed utilizing available GIS database information for narrowing down locations within the state that would be suited for a new facility. A few iterations were completed to further narrow down potential locations by searching for water supply bearing areas in the state. These results can be utilized by Maine Department of Inland Fisheries & Wildlife (IF&W) to begin searching for an optimal site within state holdings to locate the potential new facility. However, additional investigations with field visits and obtaining locked GIS layers will need to be completed to determine a final location. DEP should be brought into potential siting location discussion once the choices are narrowed down to weigh in on water supply allocation and discharge permit issues.

2.3 Cost Summary

The summary costs for the two water supply renovation projects at Casco SFH and Grand Lake Stream SFH are outlined below. Component numbers match those already presented in the text and were illustrated on the Drawings.

In addition to the costs outlined next, funding for increased operating budget needs must be factored in beyond any initial capital expenditures to successfully achieve a substantial increase in fish production. A new facility(s) would assume significant increases in both “all other” and “personnel services” costs.

Table 2-1. Cost Summary for New Intake Projects

ITEM	I.D. #	ROUNDED CONSTRUCTION COST			
Location		Casco SFH	Casco SFH	GLS SFH	GLS SFH
		Option 1	Option 2	Option 1	Option 2
		Recommended			Recommended
Project Costs		**$943,000**	**$1,278,000**	**$4,047,000**	**$2,790,000**
Construction Operations Cost	1	$190,000	$237,000	$677,000	$465,000
Site Prep	2	$33,000	$28,000	$13,000	$13,000
Excavation Earthwork and Demolition	3	$93,000	$93,000	$223,000	$223,000
Pipe and Valving	4	$572,000	$865,000	$3,107,000	$2,062,000
Concrete	5	$3,000	$3,000	$3,000	$3,000
Miscellaneous Fabrications	6	$52,000	$52,000	$24,000	$24,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$142,000	$192,000	$608,000	$419,000
C. Construction Contingencies					
Construction Contingency	10%	$95,000	$128,000	$405,000	$279,000
Total Costs		**$1,180,000**	**$1,598,000**	**$5,060,000**	**$3,488,000**
Optional Costs		**$770,000**	**$770,000**	**$1,607,000**	**$1,607,000**
Optional Intake Screen	7	$21,000	$21,000	$21,000	$21,000
Optional Water Treatment Replacement	8	$749,000	$749,000	$749,000	$749,000
Optional Added Tanks	9	$0	$0	$837,000	$837,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$116,000	$116,000	$242,000	$242,000
C. Construction Contingencies					
Construction Contingency	10%	$77,000	$77,000	$161,000	$161,000
Total Optional Costs		**$963,000**	**$963,000**	**$2,010,000**	**$2,010,000**

Costs do **NOT** include: Design Reimbursables (Variable) or escalation beyond 2016 Construction.

The projected costs for the Casco SFH renovation project will be between $**0.9 million and $1.3 million** to construct depending on which option is selected. After the budgeting contingencies are added to the total, the **project budget** will need to be between **$1.2 million and $1.6 million**. The projected costs for the Grand Lake Stream SFH renovation project will be higher and between **$2.8 million and $4.0 million** to construct. After the budgeting contingencies are added to the total, the **project budget** will need to be between **$3.5 million and $5.0 million**. If further water quality and temperature analysis warrants moving the Grand Lake Stream intake closer to shore (~1,300 feet) pending further discussions with IF&W, approximately $275,000 can potentially saved. For Casco SFH, if the UV water supply treatment is replaced and microscreens are added, an additional **$1.0 million** would need to be budgeted ($0.8 million construction costs). Approximately half would need to be budgeted if only the UV units were replaced at Casco SFH. For Grand Lake Stream SFH, if the water supply treatment is replaced with new (both microscreens and UV equipment) and new tanks are added, an additional **$2.0 million** would need to be budgeted ($1.6 million construction costs). If work is completed at Enfield to convert the facility to a tank farm, costs will range from **$5-$7 million**.

Costs were projected for all four fish production increase tiers assuming a brand new facility would be constructed somewhere in the state and are outlined below.

Table 2-2. Summary Costs for New Facilities

ITEM	I.D. #	ROUNDED CONSTRUCTION COST			
Location		Tier 1 - 10%	Tier 2 - 25%	Tier 3 - 49%	Tier 4 - 124%
Production Increases in Pounds		38,616	96,541	150,846	478,913
				IF&W Request	Commission Rpt.
New Facility Costs per Tier		**$8,716,000**	**$15,755,000**	**$22,302,000**	**$72,481,500**
Hatchery Supply and Treatment	A1	$1,138,000	$1,928,000	$2,420,000	$7,865,000
Oxygenation System	A2	$225,000	$353,000	$452,000	$1,469,000
Production Grow-Out Systems (Circular Units)	B1	$1,966,000	$4,793,000	$7,304,000	$23,738,000
Egg Incubation and Early Rearing	B2	$583,000	$1,429,000	$2,160,000	$7,020,000
Broodstock Facility	B3	$656,000	$1,556,000	$2,363,000	$7,679,750
Isolation/Quarantine Building	B4	$266,000	$664,000	$956,000	$3,107,000
Hatchery Building	C1	$205,000	$477,000	$720,000	$2,340,000
Vehicle/Chemical Storage Building	C2	$228,000	$456,000	$456,000	$1,482,000
Residences	C3	$594,000	$594,000	$594,000	$1,930,500
Land Acquisition and Site Work	D1	$676,000	$1,173,000	$1,610,000	$5,232,500
Paved Access to State or Local Highways	D2	$294,000	$79,000	$390,000	$1,267,500
Security Fence	D3	$36,000	$42,000	$48,000	$156,000
Domestic Water	D4	$30,000	$30,000	$30,000	$97,500
Domestic Wastewater	D5	$123,000	$123,000	$123,000	$399,750
Disinfection Station	D6	$32,000	$32,000	$32,000	$104,000
Effluent Treatment	E1	$1,020,000	$1,197,000	$1,534,000	$4,985,500
Effluent Monitoring	E2	$39,000	$39,000	$39,000	$126,750
Electrical Service	F1	$204,000	$258,000	$345,000	$1,121,250
Emergency Power	F2	$131,000	$172,000	$216,000	$702,000
Instrumentation and Alarm System	F3	$210,000	$300,000	$450,000	$1,462,500
Hatchery Building - Displays	G1	$60,000	$60,000	$60,000	$195,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$1,308,000	$2,364,000	$3,346,000	$10,873,000
C. Construction Contingencies					
Construction Contingency	10%	$872,000	$1,576,000	$2,231,000	$7,249,000
Total Costs		**$10,896,000**	**$19,695,000**	**$27,879,000**	**$90,603,500**

Costs do **NOT** include: Design Reimbursables (Variable) or escalation beyond 2016 Construction.

The projected costs for the new facility will be between **$8.7 million and $72.5 million** to construct. After the budgeting contingencies are added to the total, the project budget will need to be between **$10.9 million and $90.6 million**. It is recommended to pursue a Tier 3 production level facility to provide fish goals as outlined by IF&W regions and to budget **$27.9 million** to complete this project. Costs will vary depending on whether land needs to be purchased (assumed that 40 acres would be purchased at cost of ~$400,000).

2.4 Implementation Plan and Schedule

It is recommended that IF&W use this report and its supporting information as a framework and guideline to direct the final design phase(s) and implement recommended capital improvements for the new water supply intakes and new facility as outlined in this report. This report can be used to assist in obtaining appropriate funding for this project.

This is a planning document and is not intended to be used as a substitute for Construction Phase Documents, which provide detailed drawings, specifications, and construction level opinions of probable cost. These documents will be developed as a component of Final Design Phase of this project. Construction Documents must be developed to specifically define construction details, existing site conditions, site geotechnical and hydrological conditions, and to be in full compliance with all applicable Federal, State and local codes, permitting requirements, and all state agency construction guidelines. The Planning, Design, and Construction Phases of the project will involve direct participation and involvement of all the appropriate staff of IF&W and reviewing agencies, the Consultant Design Team and Contractors throughout the execution of the project.

For planning and budgeting purposes, a Planning and Design Engineering Contingency budget of approximately 15 percent of the authorized construction cost is included in this report (See **Section 7** for details). This engineering fee is generally divided into eight percent for design and seven percent for construction phase services. Cost Escalation of three to four percent per year should be expected. (Costs in the Report are in 2016 dollars)

Table 2-1 provides an overview of the entire project duration using anticipated time requirements.

Table 2-3. Projected Time Requirements for Projects

	Duration (months)		
	Casco and GLS SFH	New Facility	Enfield Expansion
Phase I – Study Phase			
Consultant Selection	2 (completed)	2 (completed)	2 (completed)
Study Preparation	3 (herein)	3 (herein)	3 (herein)
Phase II – Design Phase			
Funding Approval (for Design and Construction)	4	4	4
Land Acquisition	Not applicable	Unknown	Not applicable
Consultant Selection	0 (completed)	0 (completed)	0 (completed)
Design	4	9-12	6-9
Phase III- Construction Phase			
Bidding/Tender	3	3	3
Construction	4	18-24	12-18
Start Up	1	2	2
Total Phase II and III	16 (1.2 years)	36-45 (3-3.75 years)	27-36 (2.25-3 years)

This plan assumes that funding and execution of planning, final design engineering, and construction by project can be completed in a proposed period. The proposed implementation plan should be considered flexible and can be adjusted to meet IF&W needs. For the water supply intake projects, an estimated 16 month period will be required to complete the design and construction. For a new facility, the largest factor will be related to land acquisition. If land is in IF&W holdings, expected project duration will range from 3-4 years. Work to renovate the Enfield facility will range from 2.25 to 3 years.

It is important to state that this Implementation Plan must accompany continued funding of day-to-day maintenance and repair items. Critical components of fish culture system infrastructure may continue to break or fail, requiring repair. The IF&W must provide funding for these repairs as well as this long-term capital improvements project. Due to the design and construction complexity and cost, we recommend that the improvement projects outlined in this report be completed as major capital improvement projects.

2.5 Action Needed by IF&W

In order to implement the renovation and expansion projects as outlined in this report, the IF&W needs to perform the following generalized tasks:

- IF&W to seek funding sources for design and construction of the recommendations outlined in this report. Due to the success of obtaining Bond Bills in the past, this option should be pursued first. Other options include license increases or a fish hatchery stamp. A user-pays stamp option could provide long-term sustainable construction and operational funding. The Texas Parks and Wildlife Department has found this funding option to be acceptable to anglers and provides dedicated hatchery funding independent from other agency programs.
- Provide funding and authorization of the design phase of the renovation project so that construction documents are ready whenever capital construction costs are released. Planning and Design Engineering costs will be about eight percent of the authorized project construction total.
- Begin preparing environmental permitting documentation in conjunction with design due to long lead times for permit reviews, especially for the new facility.
- Continue coordination and communication with reviewing agencies, user groups, legislative staff and the general public.

3 Casco State Fish Hatchery

3.1 General Facility Description

Casco SFH is located approximately one-half mile north of the town of Casco in Cumberland County, Maine, within the lakes region of southwestern Maine (see **Figure 3-1, USGS map**). Also known as Wade Fish Hatchery, the facility was dedicated to Mr. Gray Wade who was superintendent of the hatcheries division from 1934 to 1961. The mailing address for the facility is:

Casco State Fish Hatchery
Maine Department of Inland Fisheries & Wildlife
70 Fish Hatchery Road
Casco, Maine 04015
Telephone: 207.627.4358

Originally constructed in 1955, the facility is situated on four developed acres (8.5 total acres) of State owned land. Additional raceways were constructed in 1960; fish hatching facilities were added in 1962; and ultraviolet (UV) water treatment equipment was installed in 1979.

Conditions (i.e., mainly warm summer water temperatures) at this hatchery are best suited for the production of landlocked Atlantic salmon, rainbow trout and brown trout. This facility has focused primarily on the production of the Sebago Lake strain landlocked Atlantic salmon. This involves oversight of the Panther Pond Dam in Raymond, and the operation of the wild broodstock capture, egg taking and fertilization program located at the dam. Egg hatching, early rearing and grow-out occurs at the main fish hatchery location. Brown trout and recently rainbow trout raised at this facility are transferred as fry from the New Gloucester Fish SFH. Water temperatures during the summer months are too warm for lake or brook trout, however, these species could be held during the winter months for a spring stocking program. Current production includes of 17,000 landlocked salmon and 60,000 brown and rainbow trout from 8" to 13" from this facility. Approximately, 45,000 pounds (lbs) to 50,000 lbs of fish are stocked in 28 rivers and 84 ponds in 12 counties per year. Three full-time employees operate the facility.

An aerial photograph and existing site plans (**Drawings C1 and C2, Appendix A**) illustrate the hatchery boundary, approximate topographical information and general hatchery infrastructure (e.g., water supply, fish rearing units, drainage piping, production buildings, support buildings, roads, and wastewater treatment facilities). Please note that the drawings were generated using information compiled from existing IF&W engineering drawings. The study drawings were developed using map overlays and digitizing techniques. The drawings are believed to be reasonable, to-scale representations of hatchery resources for planning purposes. New aerial photography and contour mapping at one-foot intervals will be required for design engineering of improvements recommended in this report.

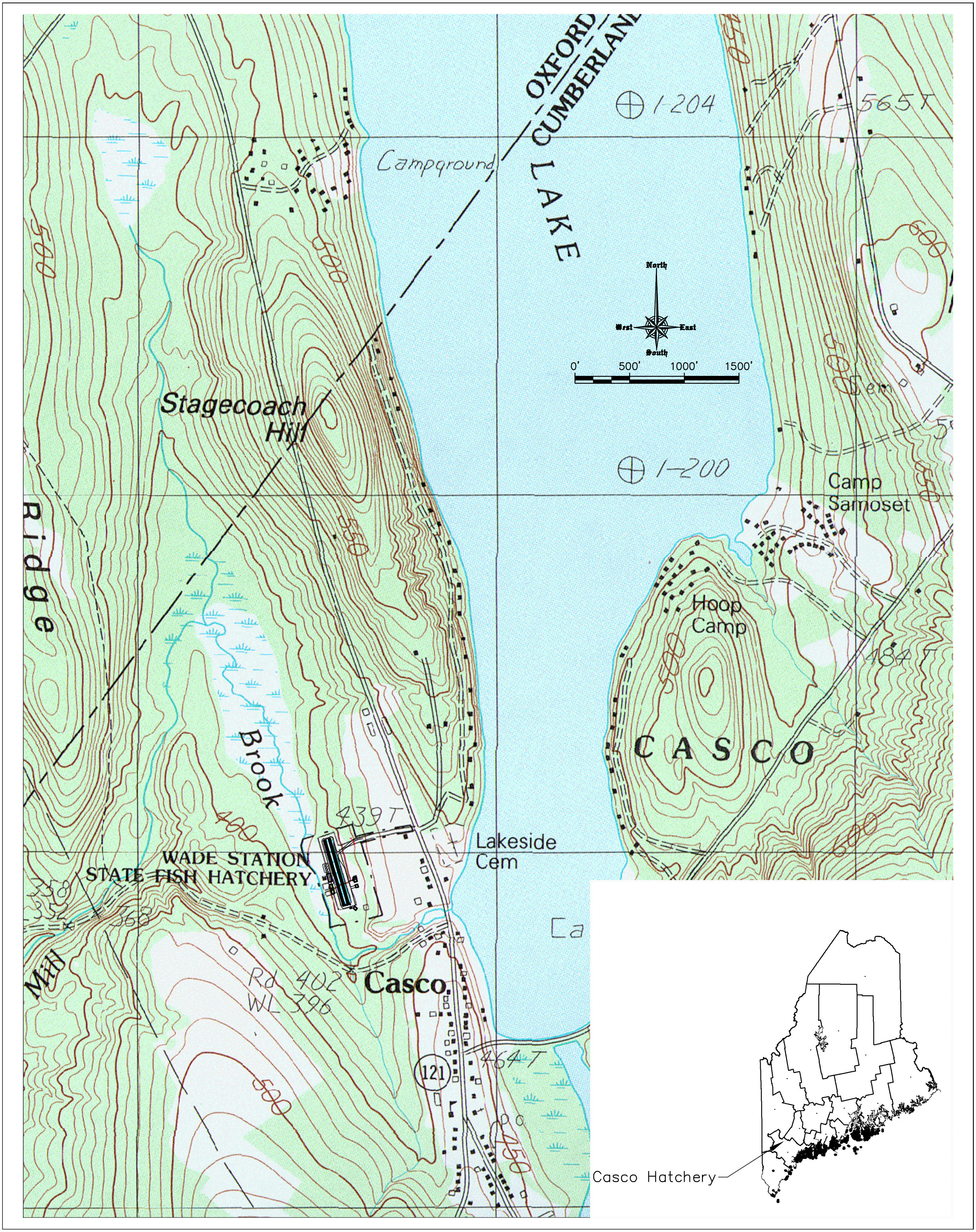


Figure 3-1. USGS Map

Fish Rearing Units

Exterior Raceways

Fish are reared in two raceway series. There are 32 concrete raceways (38,800 cubic feet [CF] water volume) that are completely covered with a wooden superstructure to provide snow control and shade for the fish (see **Table 3-1**).

Table 3-1. Exterior Raceway Overview

	5′ Wide Raceways	8′ Wide Raceways
Series (Number)	1 through 24 (24)	25 through 32 (8)
Year Constructed	1955	1960
Material	Concrete	Concrete
Dimensions	100' L x 5' W x 2.5' D	100' L x 8' W x 2.5' D
Water Depth	24"	24"
Serial Reuse	Four times	Two times
Individually Drainable (Duration of Drainage)	Yes (20 min.)	Yes (20 min.)
Source Water	UV Treated Lake Water	UV Treated Lake Water
Fish Feeders (Quantity)	Demand (72 units)	Demand (24 units)
Oxygenation/Aeration	Low Head Oxygenator (LHO), 9 units	LHO, 6 units
Electrical Service	At 10 locations	At four locations
Predation Protection	Wooden Structure	Wooden Structure
Flow Baffles	None	None
Quiescent Zones	Yes	Yes
Cleaning	Once per week, varies	Once per week, varies
Discharge Location	Outfall 005A	Outfall 005A

Raceways are in fair condition and concrete erosion has adversely impacted the surface of the units which impacts fin erosion and cleaning operations. Electrical power is located throughout the raceway buildings at each quiescent zone vacuum station as well as near the lighted areas around the broodstock pools. Low water alarms powered by direct current are located at six locations across the end of the 5′ pool sections and at four locations across the end of the 8′ pool sections. Show pools of fish for public display are maintained in an area where all raceway effluent combines below the end of the 8′ pool raceway banks. The 5' wide raceways are some of the narrowest in the hatchery system.

Indoor Rearing Units

Egg incubation and early rearing is conducted within the hatchery building which receives disinfected lake water. The hatchery building contains eight indoor aluminum troughs(10' L x 1.2' W x 9" D), which maintain 6" operating depths, in addition to

32 Heath trays. Both types are used for egg incubation. There are six circular combi-tanks (5′ wide x 3′ deep) that are used in conjunction with the aluminum troughs for early rearing. Water for the combi-tanks is not serially reused, however water for four of the troughs is serially reused a second time. The flow rate for the troughs ranges between 3 gallons per minute (gpm) to 6 gpm each, the combi-tanks between 3 gpm to 10 gpm each, and the heath incubation at 3 gpm for two stacks for a total up to 90 gpm. Semi-automatic belt feeders along with hand feeding are utilized throughout early rearing. There is space for additional combi-tanks that have yet to be installed in the hatchery based on the need for early rearing on colder water at this location during the winter months.

Predator Control System

The exterior raceways are all covered with wooden frame structures with an aluminum roof and wire mesh enclosures. The covers are in fair condition (constructed in the 1970s). Mammalian and bird predation have been reduced.

Buildings

The following buildings are found at Casco SFH: hatchery building, UV building, grinding building, effluent treatment building, clarifier building, and residences (three). All buildings are considered to be in good condition.

Site Drainage and Flooding

According to the Flood Insurance Rate Map (FIRM) from the National Flood Insurance Program (Community-Panel Number 230044-0010B, effective May 5, 1981), Casco SFH does not lie within the 100-year floodplain (see **Drawing C3**).

Casco SFH staff have reported that no incidences of flooding have occurred. Currently, site drainage can enter the raceways via surface runoff due to the slope of the road where there are no protective bumpers.

Utility Service

The local electric, telephone companies and fire department can be contacted as follows.

Table 3-2. Utility Contact Information

Electric	Telephone	Fire Department
Central Maine Power	Maine Telephone	Casco Fire Department
Bridgeton, ME	P.O. Box 689	Casco, ME 04015
	Standish, ME 04084	
1.800.696.1000	207.655.9911	911

The current site electrical service contains 277/480 volt (V), three-phase power for the UV treatment building and effluent treatment building. The rest of the site utilizes 120/240 V, one-phase power. The site utilizes overhead distribution other than some buried lines that feed power from the back-up generator. Hatchery-owned site lighting is used occasionally.

3.2 Aquaculture Water Supply

3.2.1 Water Supply Overview

Source

Water is gravity supplied to the hatchery from Pleasant Lake, a 1,077-acre lake with a maximum 62' depth. The lake usually freezes over by mid-December. Prior to UV installation, flow to the hatchery was 3,500 gpm. The present UV system and interfacing piping limits the supply of water to the hatchery to about 2,100 gpm. Flow to each raceway is measured with a V-notch weir located at the head of the raceway bank.

Table 3-3. Water Supply Flows

	Raceways	Hatchery Building	Spawning Building
Maximum Flow (gpm)	2,100	220 if available, currently using 90 gpm	500 depending on head
Average Flow (gpm)	1,800	--	--
Avg. Flow per Unit (gpm)	450 (8' units) 300 (5' units)	5	--

The hatchery has no annual water use limits or water withdrawal agreements for usage of Pleasant Lake water. The hatchery has a 10' right-of-way (ROW) easement along the supply pipeline from the lake to the hatchery. Over time, the lake area has experienced increased development with changes from summer and part-time to permanent residences.

There is a spawning and fish trapping facility for landlocked Atlantic salmon located in the nearby town of Raymond. It can be found just downstream of the Panther Pond (1,000 +/- acres) dam which are both owned and operated by IF&W. The spawning program occurs from the middle of October to the middle of November. Water for the spawning facility and fish collection ladder operation is obtained by gravity feed from just above the dam at a rate of up to 500 gpm depending on available head in Panther Pond.

Collection and Distribution

The facility is supplied with water by a single 16" diameter (dia.), ductile iron (DI) pipe from the lake to the shore where the pipeline material transitions from DI to asbestos concrete (AC or transite) before routing to the UV treatment building. There is little information available on the design and construction of the pipeline and the location of the buried pipeline segment is not well defined, although the pipeline alignment has been recently magnetically-located in the field to identify the approximate location.

The pipeline starts as a DI pipe extending from an intake tower located in approximately 42′ of water in Pleasant Lake along the lake bottom, passes under the Route 121 bridge, along the bottom of a small bay, through, or under, a dam at the outlet of the lake, where it transitions to AC pipe and runs through the woods to the UV treatment building. The pipeline is approximately 1,500′ long, with 850′ of DI pipe and 650 feet of AC pipe.

The lake intake is an aluminum pipe tower fitted with a tee that allows the use of either shallow (15′ depth) warmer water or deeper (35′ depth) cooler water depending on fish growth requirements. It is necessary for a Self-Contained Underwater Breathing Apparatus (SCUBA) diver (provided by the IF&W Warden Service) to manipulate the cap on the intake tower inlet in order to change the elevation of the water intake, modifying the inlet water temperatures. Generally after ice out, the upper intake is activated until July to acquire warmer water until it is switched to the lower intake to collect cooler water during the summer months. The intake is screened with a conical grate with 4″ openings which slides over the desired intake location. There is a reported tilt to the present intake riser tower, but the intake structure was re-stabilized in 2013 after a system failure.

The main pipeline contains a manual air release located near the dam that had been vandalized in the past but has since been repaired and has a locked access cover. Hatchery personnel report minor air locking problems that can be avoided as long as water levels do not go below the pipe inverts within the UV building water. The pipeline has no history of clogging, however cannot be totally drained, and has no history of freezing.

An 8" line runs from a tee below the UV treatment building to the hatchery building and has never been cleaned. Large biological debris (i.e., invertebrates and fish) are prevented from passing through the UV system by 1/16″ perforated screening. Many valves in the raceway headbox cannot be shut off and need replacement. Flow to the raceways cannot be completely shut off so raceways cannot be repaired easily. The hatchery plans to do some headbox and valve repairs this spring.

Water Quality

Hatchery personnel have not noted any severe water quality problems. Water quality samples taken at the head box in 1963, 1989, and 1990 indicate low total alkalinity, low calcium, low chloride, slightly elevated nitrate, and elevated zinc. Results were compared to the Hatchery Water Quality Standards (HWQS) established by the United States Fish and Wildlife Service (USFWS). Water temperatures vary from 35 ºFahrenheit (F) to 75 ºF throughout the year. The overall water quality appears adequate for fish rearing purposes with the exception of alkalinity and calcium, which can be supplemented in the hatchery building system to improve fish egg hardening and bone development.

Water Treatment

Hatchery personnel report that disease problems (*furnucolisis*) plagued the hatchery until UV water treatment equipment was installed in 1979. No filtration or microscreening occurs prior to disinfection. The UV equipment operates adequately with no history of major breakdowns, but mechanical parts are becoming difficult to purchase due to the age of the equipment. Lamps are changed annually. Current efficiency is unknown, but it can change throughout the year due to increased water turbidity and lake turnover.

Hydra and other biological contaminants are not being effectively killed by the UV system. Hatchery personnel have periodically observed ice in the UV units.

Since no filtration occurs, debris and organic material can enter the system. The hatchery building adds nylon stockings to each tank inlet for gross screening. The stockings capture freshwater shrimp, brown algae, hydra, and black snails and are cleaned daily. The raceway rearing does not appear to be affected by materials found in the water.

Iodophor is used during all spawning programs as a preventative bacterial disinfectant. All eggs are disinfected prior to entering the hatchery facility. Formalin is used at a 1:600 concentration throughout egg incubation until eye up to prevent fungus on the eggs.

3.2.2 Water Supply Concerns

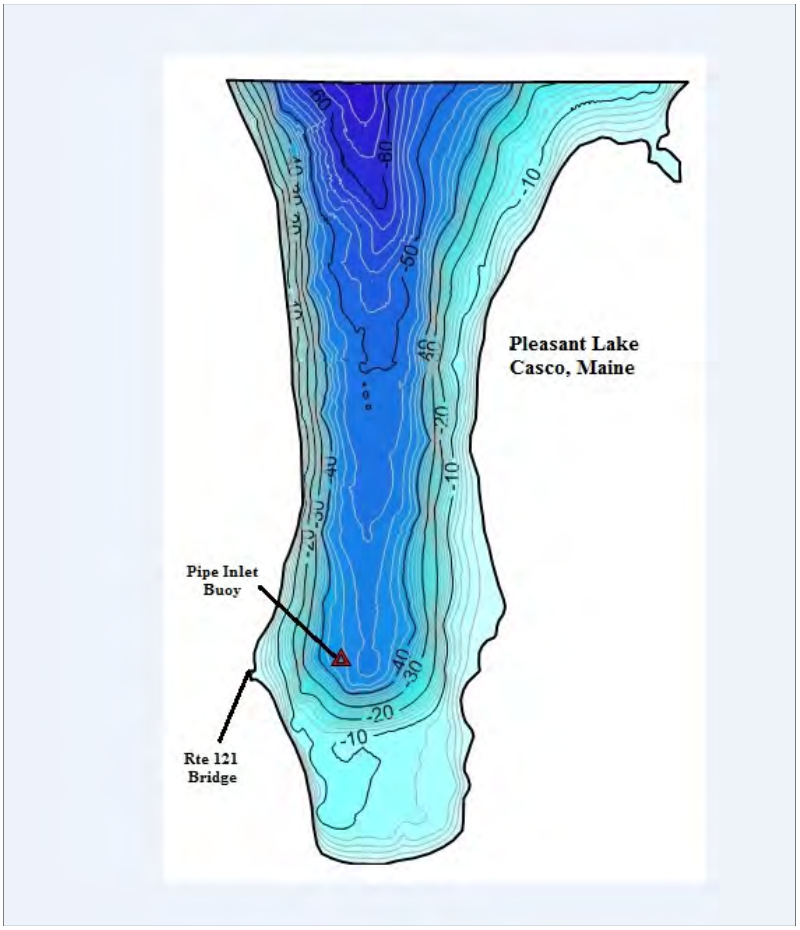
The facility is supplied with water by a single 16″ pipeline that is a mix of a DI and AC constructed in the 1950s, which is nearing the end of its design life. The existing buried pipe has been magnetically located by the IF&W this past summer, but the alignment is not fully defined in the field and the pipe profile is unknown. The ROW for the buried pipeline segment is reported as 10′ wide, which is not wide enough for maintenance access or construction access to replace or repair the pipe. The pipeline alignment has not been maintained to protect the pipe, and large trees have grown along and above the pipeline, which present a threat to the pipeline.

The existing intake tower is located in approximately 42′ of water, and is in a deep portion of Pleasant Lake adjacent to deeper water, as shown on **Figure 3-2**. The existing tower is reported by the IF&W to be founded on a 90-degree bend at the terminus of the pipeline, with a 4′ stub and a fabricated tower that sleeves over the stub. The tower was fabricated for the IF&W from aluminum and is reported to be approximately 30′ tall with two side inlets located at the 35′ water depth and the 15′ water depth, with a conical cap. The tower is reportedly guyed in place using a series of concrete blocks to hold the tower upright. Normal operation of the tower relies on the Maine Warden SCUBA divers to open a side inlet and blind the other side inlet, based on seasonal water temperature variations and production needs. The intake pipe tower stability and condition are a concern, and changes to the tower side inlet setting are affected by State Warden availability. The depth of the intake is a concern as water temperatures at the intake are warmer, seasonally, than needed.

Primary concerns with the existing pipeline are:

- Remaining life in the existing pipeline, especially the AC section. The AC pipe has a typical design life of 50 years, which has already been exceeded.
- Intake depth and limited access to cooler water.
- ROW access along the buried pipeline. Generally, a 50′ ROW is required for pipeline construction and maintenance. The existing buried pipeline segment is overgrown and is susceptible to root damage.

Figure 3-2. IF&W Bathymetry of Pleasant Lake, 2015

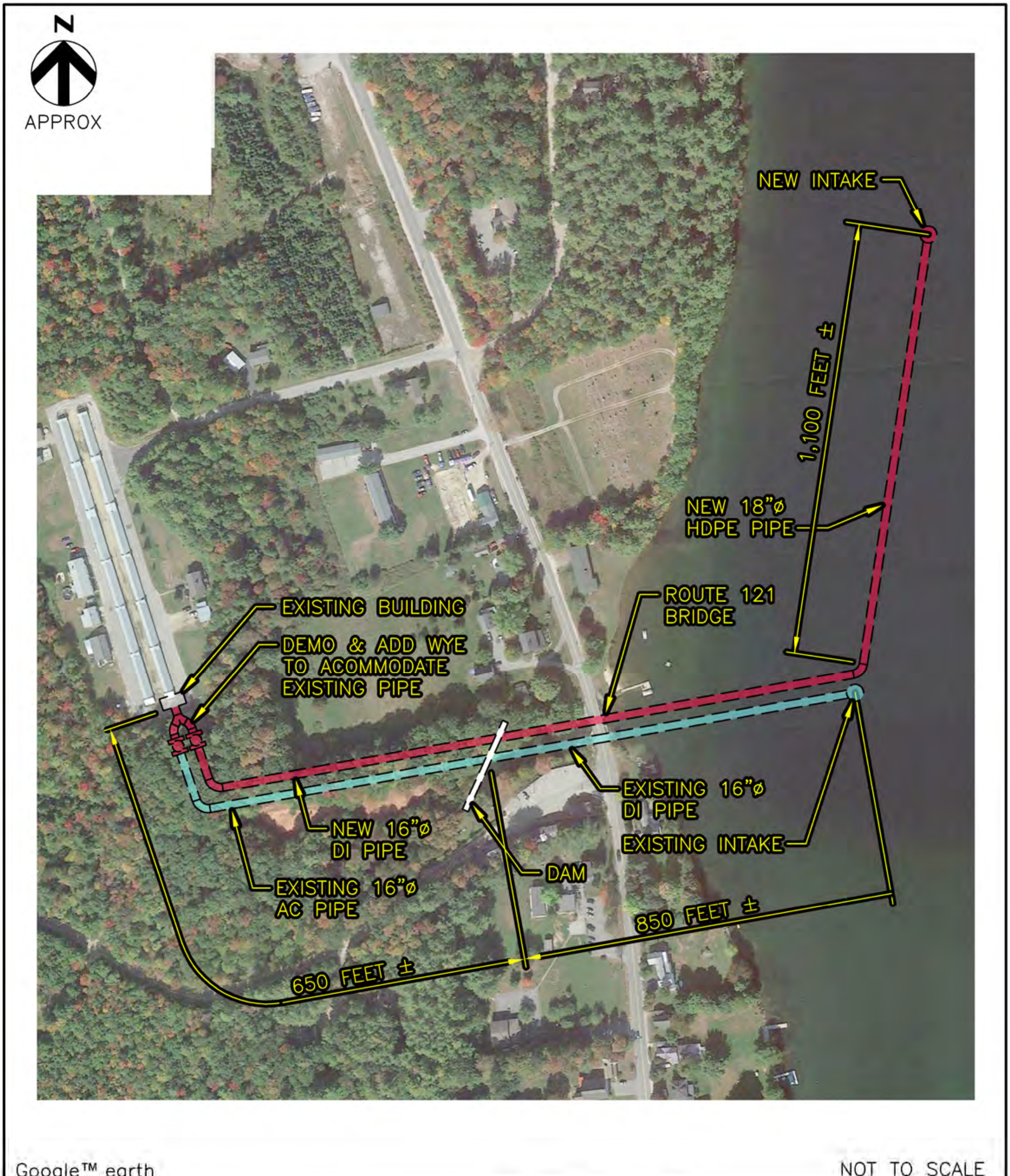


3.2.3 Improvement Options

Option 1 – Install a Second Water Supply Intake

Option 1 is to install a second lake water supply intake line within or adjacent to the existing ROW out to a deeper water location to obtain cooler water (see **Figure 3-3**). Based on the temperature and water quality sampling data at the lake, the IF&W identified a desired intake depth of 48′, which occurs approximately 1,100′ from the existing intake. The existing line would remain to provide additional flow and temperature mixing. A new pipe wye would be installed upstream of the existing UV treatment building, with two new flow control valves on both the existing and new 16″ raw water pipelines, which would provide an opportunity to control and vary water temperatures through the new valving of the existing and new deep water intake lines.

The proposed pipeline selected in this preliminary effort is a combination of DI pipe and high-density polyethylene (HDPE) pipe, based on cost data from manufacturers. The DI is planned to be used in the buried section of the new pipeline and the HDPE is planned for use within the lake. DI is extremely durable, commonly available, long-lived, and is well suited for use in buried applications. The type of DI pipe joints required for routing pipe along the lake bottom are prohibitively expensive so the HDPE pipe was evaluated due to a reduction in costs. The HDPE pipe is a polyethylene thermoplastic, and instead



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OPTION 1

FIGURE 3-3

of mechanical joints uses a field fuse-welding process to produce a continuous pipeline. The HDPE pipe has the needed flexibility to fit the contour of the lake bottom with no additional special joints, and has the added benefits of lower energy losses due to the smoothness of the pipe, increased resistance to biofouling from aquatic growth, and a service life reported to be greatly in excess of the nominal 50-year industry standards requirement. The pipe will be buoyant and requires weighting with simple block anchors deployed during lay of the pipe, which is incorporated into the costs. Due to the field welding, the construction production rates are slightly slower than DI pipe production, but will still be able to deploy approximately 200′ per day from a barge. Potential costs savings with the use of alternate materials and methods will be evaluated during the design process and during the construction bidding process. Other alternatives could include an all HDPE option.

The existing pipeline can still be used until the end of its service life, and then can be abandoned in place, simply by closing the proposed mixing valve near the UV building. Maine and Federal regulations do not call for removal of the asbestos pipe, and it can be left in service and eventually removed or abandoned in place. If IF&W still requires both water supply temperatures and the ability to mix the supplies when this pipeline fails, a replacement pipeline will be required to be installed (see Option 2).

With respect to the ROW and the tree roots potentially causing damage, IF&W should try to clear and grub out the materials along the pipe alignment. It is always good practice to manage vegetation along the pipe alignment. Root issues could be significant, as we don’t know the depth of burial of the pipe, except that it is probably below frost depth (5 or 6 feet). The AC pipe would be more susceptible to root damage than ductile iron. Walking the site grading along the AC pipeline at Casco, HDR felt that, unless the pipe is buried very deeply, there is likely an inverted siphon along the profile. (Further evidence of a siphon is that the operators mentioned that the pipe exit at the screening building needs to be kept submerged in order to flow effectively. Admission of air into the pipe would reduce the siphon efficiency and reduce flow.) Root damage along the top of the siphon section might open a joint and create a location for possible admission of air. This might allow the AC pipeline to be used longer before replacement is required.

No special screening requirements are needed for the new pipeline intake, as the existing hatchery operation has not been negatively affected by the absence of fine screens at the intake. The new pipeline will feature an intake tower similar to the existing.

As an add-on option, other intake screens were evaluated for use at this facility. One alternative is to install a stainless steel T-screens at each intake for wildfish and debris control. T-screens have screening at each end which allows a large surface area for water inflow. Slot size can vary and will depend on specific screening needs. Features can be added such as air-burst, water backwash, or metal alloys to reduce Aquatic Nuisance Species (ANS) infestations (such as zebra mussels). Intake costs include the T-screen and associated piping, fittings and installation. For this report, just a typical screen and installation have been assumed with no backwash or special materials. While the hatchery does not fall under the jurisdiction for the §316(b) of the Clean Water Act, water intake velocities would be designed to stay below the 0.5′ per second threshold for fish impingement or entrainment. If this alternative is added, further input would be required from IF&W to determine optimal screen sizing.

As part of this improvement work, the existing UV treatment equipment is ending its service life and replacement parts are becoming obsolete. Therefore, the UV disinfection system should be replaced in conjunction with the water supply pipeline work. For water treatment sizing purposes, the water flow for the new treatment equipment will be assumed to be 2,100 gpm. For purposes of this report, a new microscreen was assumed to be added to better prepare the water for UV disinfection. If the microscreen is not added, the proposed costs will be about half. The existing building will be reused (assuming the new equipment will fit) so no new building costs have been projected except minor renovation to the structure. To remove and install the new units, the roof may need to be removed from the building if the equipment will not fit through the existing garage door opening. This work is optional and will be dependent on project funding allocation.

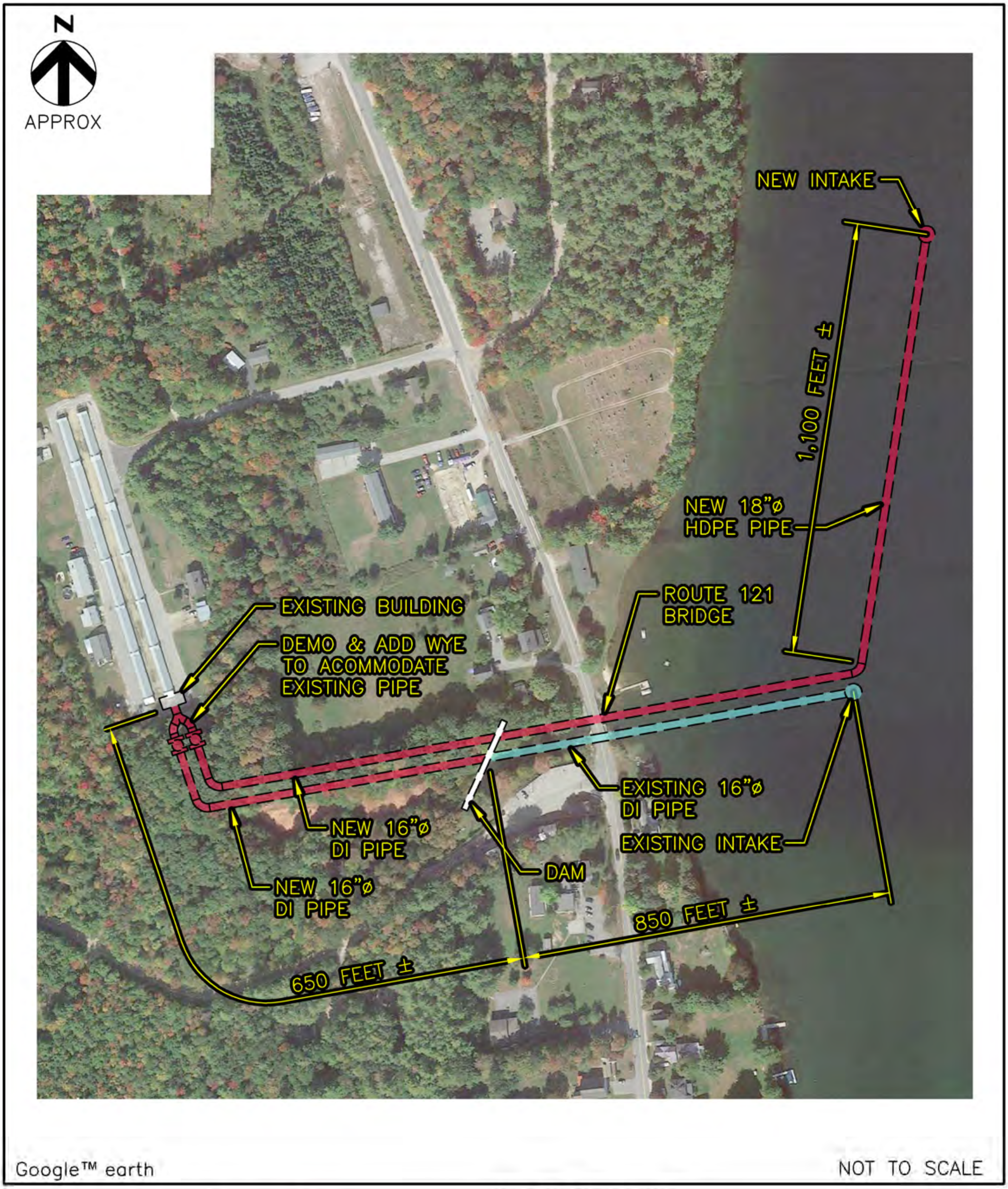
Finally, if the funding for this work is not allocated when the dam is reconstructed by the City (separate project), provisions can be designed for the new dam that will allow the future installation of the new water supply pipeline. A section of new 16-inch pipe with mechanical joints and blinded flanges could be included in the Town of Casco dam rebuild. Pre-construction of that section of the pipe would eliminate work within the dam and a small cofferdam in the headpond of the dam when the new water supply pipeline is installed in the future.

Option 2 - Option 1 plus upgrades to the existing pipeline

Option 2 includes the improvements discussed in Option 1 including upgrades to the existing pipeline to replace the existing buried AC pipe, and inspect and clean the existing DI pipe (see **Figure 3-4**). The removed AC pipe can be disposed at local landfills, providing the asbestos is not friable and complies with the landfill license requirements. The new pipe would be joined with the existing DI pipeline near the dam, preserving the operation of the existing intake line.

3.2.4 Recommendations

- Option 1 is the recommended option, as the additional pipeline creates access to deeper cooler water and provides a dependable water source, while keeping the existing intake active for temperature mixing, and as a redundancy to a critical project feature.
- Funding should be allocated for replacement of the existing AC pipeline portion (Option 2) in the near future.
- The existing UV equipment should be replaced in conjunction with this work if adequate funding is available. At the same time, a new microscreen could be added to better prepare the water for disinfection. Water supply equipment replacement will be less costly to do in conjunction with the main pipeline work due to combined mobilization compared to completing the work separately in the future.



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OPTION 2

FIGURE 3-4

- Since additional screening occurs at the site and IF&W are satisfied with the current level of debris removal, new intake screens are not recommended. However, ANS and/or biosecurity requirements could necessitate finer screening at the water supply location in the future.
- If the dam is rebuilt before these projects move forward, provisions should be placed in the design of the dam for future pipeline installation.

4 Grand Lake Stream State Fish Hatchery

4.1 General Facility Description

Grand Lake Stream SFH is located within the town of Grand Lake Stream in Washington County, Maine (see **Figure 4-1**, USGS map) at the south end of West Grand Lake. The mailing address for the facility is:

Grand Lake Stream State Fish Hatchery
Maine Department of Inland Fisheries & Wildlife
14 Hatchery Lane
Grand Lake Stream, Maine 04668
Telephone: 207.796.5580

The United States government first operated a fish hatchery at Grand Lake Stream in 1875, making this one of the oldest sites of fish hatchery activities in Maine and the entire country. The present facility was built in 1936 on a site that was formerly a tannery. The hatchery is comprised of nine developed acres (13 total acres) of State owned land. In 1962, major renovations of the pools and buildings were undertaken and the old earthen raceways were replaced. A microscreen filter system and UV water treatment equipment were installed in 1973. In 1986, eight raceways were repaired by resetting some walls, injecting epoxy resin into leaks, and refinishing concrete surfaces as needed. Modifications to the raceway drainage system and the addition of a solids settling clarifier were added to the facility in 2005/2006. A single discharge point and measurement was provided.

The facility is currently best suited for the production of the West Grand Lake strain of landlocked Atlantic salmon. A wild capture program is performed by hatchery staff at a location near the hatchery intake. Up to 1,200 wild Atlantic salmon adults are trapped and returned to the Grand Lake after spawning. Egg hatching, early rearing, and grow out occurs at Grand Lake Stream SFH. Captive broodfish are kept on-site for six years as backup for the wild capture program. Water temperatures are considered to be too warm through the summer for most other species of coldwater fish. However, this facility has had some success in holding brook trout fry through their first summer under low densities in recent years. Current production of brook trout includes 25,000 fall fingerlings and 10,000 spring yearlings. Current landlocked Atlantic salmon numbers are 45,000 spring yearlings for stocking from this facility, as well as 25,000 fingerlings that are transferred to Embden and 50,000 eggs to Enfield. Three full-time employees operate the facility.

An aerial photograph and existing site plan (**Drawings G1 and G2, Appendix A**) illustrate the hatchery boundary, approximate topographical information and general hatchery infrastructure (e.g., water supply, fish rearing units, drainage piping, production buildings, support buildings, roads, and wastewater treatment facilities). Please note that the drawings were generated using information compiled from existing IF&W engineering drawings. The study drawings were developed using map overlays and digitizing techniques. The drawings are believed to be reasonable, to-scale representations of

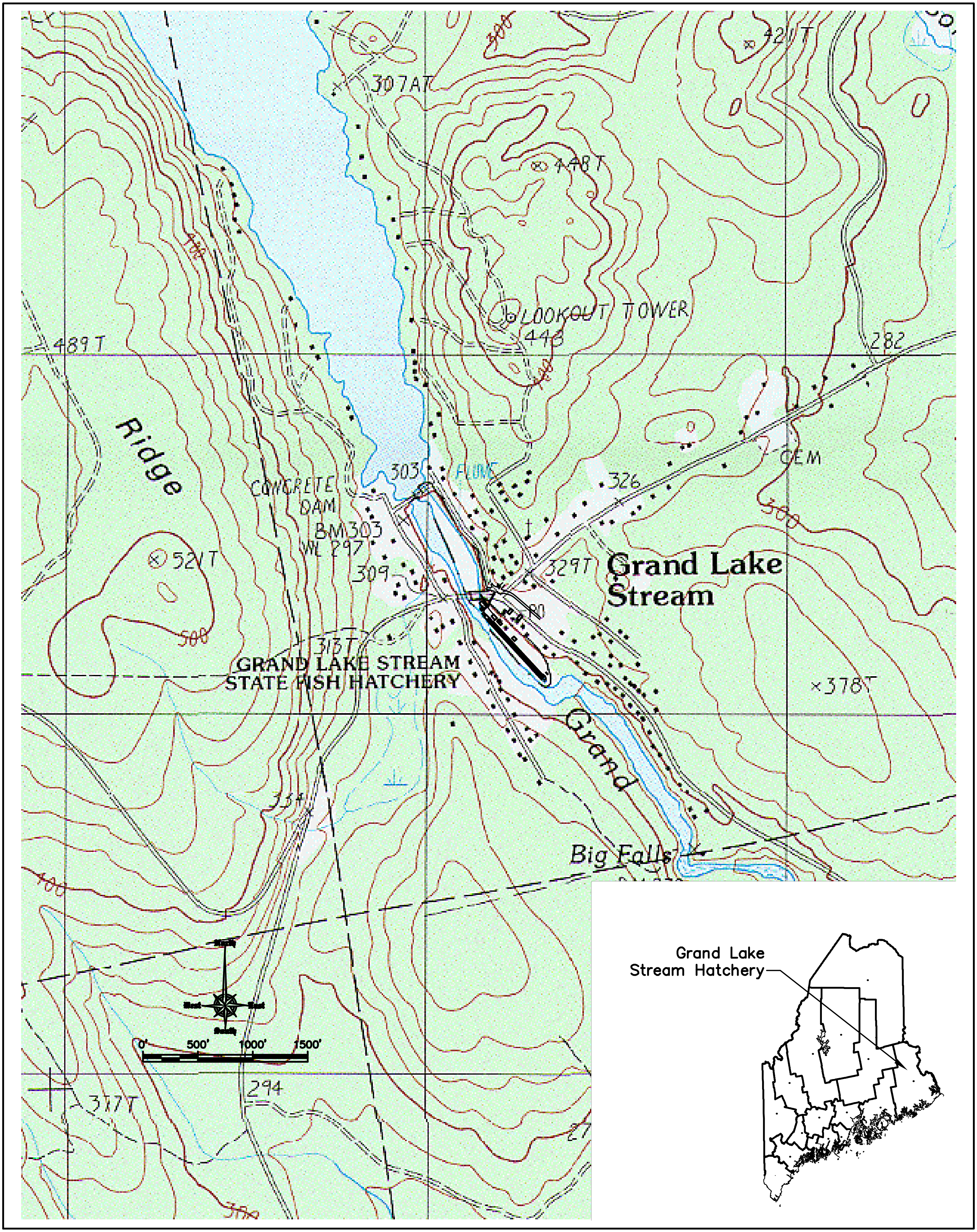


Figure 4-1. USGS Map

hatchery resources for planning purposes. New aerial photography and contour mapping at one-foot

intervals will be required for design engineering of improvements recommended in this report.

Fish Rearing Units

Exterior Raceways

Fish are reared in single bank that contains 14 concrete raceways (22,400 CF water volume). The 8' wide raceways are arranged in two-series that operate under seven-pass serial reuse (see **Table 4-1**).

Table 4-1. Exterior Raceways

	8′ Wide Raceways
Series (Number)	1 though 14 (14)
Year Constructed	1960s
Material	Concrete
Dimensions	100' L x 8' W x 2.5' D
Water Depth	24"
Serial Reuse	seven times
Individually Drainable (Duration of Drainage)	Yes (10 min.)
Source Water	Filtered/UV Treated Lake Water
Fish Feeders (Quantity)	Demand (42)
Oxygenation/Aeration	None
Electrical Service	Yes
Predation Protection	Wooden Structure
Flow Baffles	None
Quiescent Zones	None
Cleaning	Max twice per week, varies
Discharge Location	Direct to creek, Outfall 005A

Power is limited to two units on the west side, outside the garage. A flow alarm is located at these two raceways that have electrical service.

Indoor Rearing Units

There is a landlocked Atlantic salmon wild fish capture operation that occurs annually just above the dam in West Grand Lake. The broodfish are trapped, held in a floating net pen, and then released after spawning. The eggs are disinfected with Iodophore and taken to the hatchery to be incubated in wire mesh baskets suspended in aluminum rearing troughs (see below) or be placed in up to 24 Heath trays. After eye up, some eggs are transferred to the Enfield hatchery as allocated.

The hatchery building contains 42 indoor aluminum troughs (8' L x 14" W x 9" D), which maintain 7" operating depths. The troughs are used for egg incubation and early rearing. The flow rate for the indoor troughs (three pass serial reuse) is 6 gpm times 14 per row or 84 gpm total. With Heath stack and miscellaneous use, total water requirements of the building are about 100 gpm. Water within the indoor units is serially reused three times. The indoor troughs receive microscreened and UV disinfected lake water. Individual indoor troughs can be drained in about five minutes. Semi-automatic belt feeders, along with hand feeding, is utilized throughout early rearing.

Predator Control System

The exterior raceways are all covered with wooden frame structures that have aluminum roofs and wire mesh enclosures. The covers are in fair condition (constructed in the 1970s). Mammalian and bird predation has been reduced.

Buildings

The following buildings are found at Grand Lake Stream SFH: hatchery building, office building, filter building, generator building, garage, pole barn, and residences (three). All buildings are considered to be in good condition.

Site Drainage and Flooding

Drawing G3 provides a Federal Emergency Management Agency (FEMA) Floodplain Insurance Map (FIRM) for the Grand Lake Stream SFH. Based on the FIRM map, it appears as if a portion of the hatchery that borders Grand Lake Stream lies within the 100-year floodplain.

Grand Lake Stream SFH staff reported several incidences of flooding. Currently, site drainage from between the residences runs down the hill and saturates the ground behind the hatchery building approximately three to four times per year.

Underdrains were installed in the 1980s along the easterly side of the hatchery to address high or perched groundwater levels and associated frost issues during cold weather. Our understanding is that the underdrains helped, but did not completely alleviate the frost issues.

Utility Service

The local electric, telephone companies and fire department can be contacted as follows.

Table 4-2. Utility Contact Information

Electric	Telephone	Fire Department
Eastern Maine Electric Corp.		GLS Fire Department
Calias, ME		Grand Lake Stream, ME
1.800.696.7444		796.2288

The site utilizes 120/240V, one-phase power, and utilizes overhead distribution. The facility has hatchery owned site lighting.

4.2 Aquaculture Water Supply

4.2.1 Water Supply Overview

Source

Water is gravity supplied to the hatchery from West Grand Lake, which is a 14,340-acre lake with a maximum depth of 128'. Woodland Pulp LLC uses this lake for hydropower storage, which periodically affects the quantity of water available to the hatchery because of headwater fluctuation. The amount of water that can be run through the current filter complex is limited to 2,000 gpm. Flow to each raceway is measured with a V-notch weir located at the head of the raceway bank.

Table 4-3. Water Supply Flows

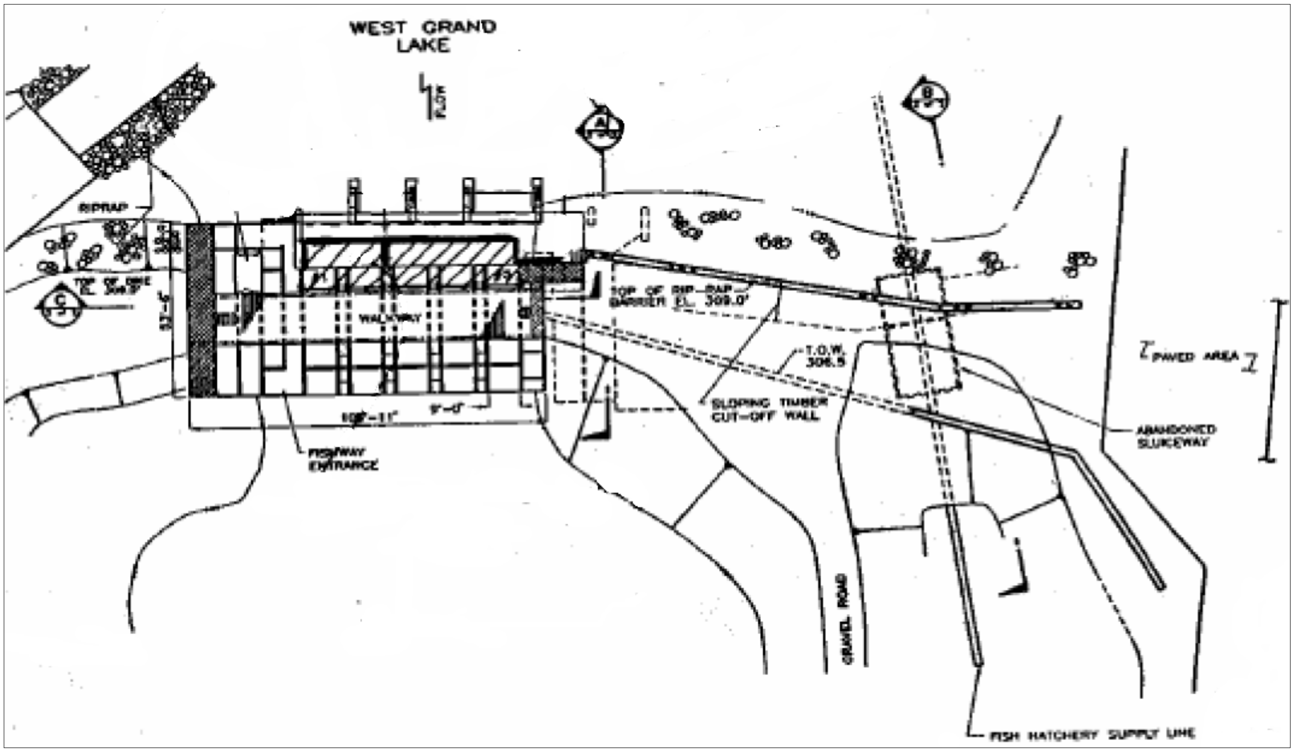
	Raceways	Hatchery Building	Total Flows
Maximum Flow (gpm)	2,000	100	2,100
Average Flow (gpm)	1,600	90	1,690
Flow Range per Unit (gpm)	300-1,000	6	
Avg. Flow per Unit (gpm)	800	6	

The hatchery has no annual use limits or water withdrawal agreements for usage of West Grand Lake water, but the discharge permit limits the facility to a release of 2.9 million gallons per day (MGD) (2,013 gpm) to Grand Lake Stream SFH. However, contact with Woodland Pulp LLC should be maintained to ensure that availability of water to the hatchery is consistent with future hydroelectric plans and dam maintenance work affecting the hatchery pipeline. Hatchery staff has not noted any changes in water flows due to local development. However, lower flows occur in the fall and winter due to the lower lake levels. The loss of head also impairs drumfilter operation so the bypass valve has to be opened to increase flows to the hatchery.

Collection and Distribution

The single 24" dia. DI pipeline from the West Grand Lake has an intake located approximately 800' upstream of the outlet dam at a depth of 15' to 20'. The existing dam is approximately 487′ long, and features a 106′ long concrete and timber crib gated spillway structure and earthen embankments on either side of the spillway. The dam was rebuilt in 1992 and recently repaired in 2003, following a partial failure of a small section of the timber crib foundation. **Figure 4-2**[1] shows an existing conditions plan of the dam, the easterly abutment and the IF&W supply pipeline passing through the abutment and abandoned sluiceway that previously passed water into the downstream canal.

Figure 4-2. Plan of West Grand Lake Dam



Source: Federal Energy Regulatory Commission Licensing exhibit

The hatchery supply line runs through the dam earthen embankment along an abandoned sluiceway. No information was available for the penetration through the dam, or the upstream and downstream concrete walls. The pipeline emerges from the embankment and then runs underwater within an abandoned canal to a small IF&W concrete canal dam, just above the Little River Road. The IF&W canal dam maintains a small impoundment along the canal that is now used for recreational fishing opportunities for young anglers. The pipeline passes through or below the canal dam under the Little River Road within a box culvert and then to hatchery filtration building.

The existing intake structure is a vertical "tee" type intake with half-barrel screens on each tee. The current intake screen system does not prevent small fish (gross screening) from entering the pipeline. Every other year, a SCUBA diver removes algae buildup from the stainless steel intake screen, as shown in **Figure 4-3.**

Figure 4-3. Example of diver cleaning the existing intake

Once inside the UV building, the supply pipeline reduces to 12″ dia., passes through a tee fitting, through a 12″ butterfly valve, and through an additional 10″ reducer before entering the headbox inside the UV building. The pipe reductions, tee, and valve contributes to limiting flow to the facility. The water then gravity flows through the UV disinfection units to the headboxes of the raceways. Water is pumped from a raceway headbox by a submersible pump at a rate up to 250 gpm in order to get disinfected water to the hatchery building. The main pipeline reportedly contains a manual air release, but it is theorized that it may be been buried during the West Grand Lake dam repairs as it cannot be located. The main pipeline has no history of clogging, although it is reportedly affected by icing. During extreme cold weather, anchor or frazil ice is reported to reduce pipeline flows. There is no record of recent pipeline cleaning or condition assessments. The pipeline has no means of dewatering the line or inspection access along the pipeline.

Water Quality

Hatchery personnel have noted low dissolved oxygen (DO) levels, high temperatures, and low alkalinity concentrations in the supply water. During times of low DO, the staff has to decrease feed amounts to compensate. Water quality samples taken at the headbox in 1963, 1989, and 1990 indicate low total alkalinity, low calcium, low chloride, slightly elevated ammonia, slightly elevated nitrate, and elevated zinc concentrations. Results were compared to the HWQS established by the USFWS. Water temperatures vary from 33 ºF to 71 ºF (83 ºF peak) throughout the year. The overall water quality appears adequate for fish rearing purposes, with the exception of alkalinity and calcium, which could be supplemented.

Water Treatment

Hatchery personnel report that disease and siltation problems plagued this hatchery until microstraining and UV water treatment equipment was installed in 1973. The drum screen system utilizes custom made polyester fabric (60 micron [μ]) with Polyvinyl

Chloride (PVC) scrim on the outside. The filter was designed to operate based on head levels. The fabric is replaced roughly every five years. Occasionally, the filter needs to be cleaned with chlorine and thiosulfate (neutralizes chlorine) to prevent clogging. The cleaning process occurs one or two times per year and requires filter shutdown for a few hours.

The UV disinfection system consists of two low-pressure units, which are normally both used in parallel service. Each unit can treat 1,000 gpm each but are typically operated at lower flows. Lamps are changed annually in late March or April and the crystals are also cleaned at the same time. Each UV unit contains 88 lamps (purchased from Sun Ray, Inc. in Vermont). When the bypass water is required to produce adequate flows, the bypass water is still disinfected by the UV system. The UV ballast power system has been totally replaced to provide required performance.

To prevent fungus growth, formalin is used during the egg incubation period from once per day to every other day at a 1:1,600 concentration (mg/l) from mid-November to mid-January.

4.2.2 Water Supply Concerns

The facility is currently supplied with water by a single 24" dia. DI pipeline from the lake to the filter building, which yields water that is considered to be too warm for coldwater species of fish. Additionally, varying lake levels, due to hydropower storage operations in the reservoir lead to decreased water supply to the hatchery during the fall and winter, which are the highest production months.

The IF&W also note further reductions in flow during cold weather which have been attributed to icing issues in the reservoir with anchor or frazil ice on the intake, and potentially ice accumulation within the exposed portions of the existing pipeline. However, as no observations of ice debris in the headbox have been noted by the IF&W, ice accumulation in the pipeline is not suspected.

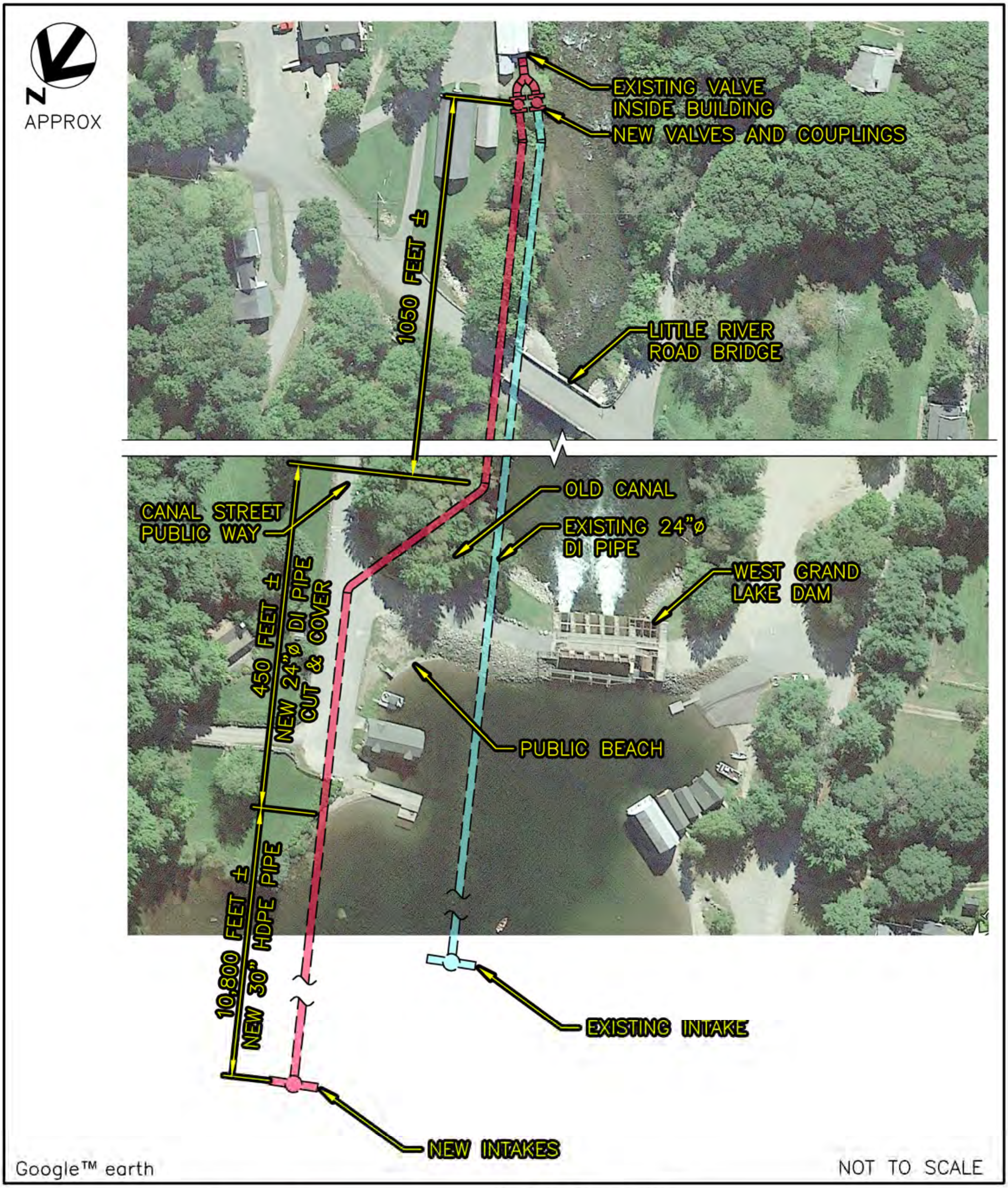
Primary concerns with the existing pipeline are:

- Remaining life in the existing valving at the headbox.
- Considerations over excessive headloss due to pipe reductions and the valve type at the UV building.
- The existing intake depth and limited access to cooler water.
- Impact of frazil and anchor ice on the operation of the existing shallow-water intake and water supply to the hatchery.

4.2.3 Improvement Options

Option 1 – New Deep Lake Supply Pipeline

Option 1 focuses on the installation of a second lake water supply pipeline and intake further out in the lake at a deeper elevation to obtain lower temperature water during the summer months and provide temperature mixing opportunities at the UV building to allow adjustment to optimal rearing temperatures (see **Figure 4-4**). Option 1 would also allow



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GRAND LAKE
CONCEPTUAL PIPE LAYOUT

DATE
JANUARY 2016

GRAND LAKE STREAM
OPTION 1
FIGURE 4-4

the two raceway banks to operate at different temperatures, if desired. The new supply pipeline will also allow higher inflows to the hatchery, which can also support increased production if approved by the Maine Department of Environmental Protection (DEP), or other water use. This facility is supported with a high effluent dilution ratio provided via Grand Lake Stream unlike some other facilities in the state with very limited effluent dilution during low flow periods.

In addition to the new pipeline, the existing piping and valves above the headbox will also be upgraded to handle a 24″ inlet pipe, without the existing reducers. A new tee for the existing 8″ bypass line would be required. The existing piping for the hatchery will need to be evaluated during design to ensure that any higher supply flows can be handled. Also, the existing water supply line from the lake needs to be inspected and repaired as needed to provide optimal water to the hatchery.

Option 1 will require some additional field survey data and hydraulic analysis to finalize the piping configuration, lake operation ranges, and piping alternatives.

No special screening requirements are needed for the new pipeline intake, as the existing hatchery operation has not been negatively affected by the absence of fine screens at the intake. The new pipeline will feature an intake similar to the existing. The deeper location intake should eliminate icing issues since both frazil and anchor ice behavior are associated with shallower depths. However, ice issues might still occur at the existing shallow intake.

Further review of the water quality data is warranted, as there is the potential to locate the intake in slightly shallower water, with the potential of saving $275,000 in piping construction costs for both options. This effort will be completed during the design phase to optimize water quality compared with the cost of new piping.

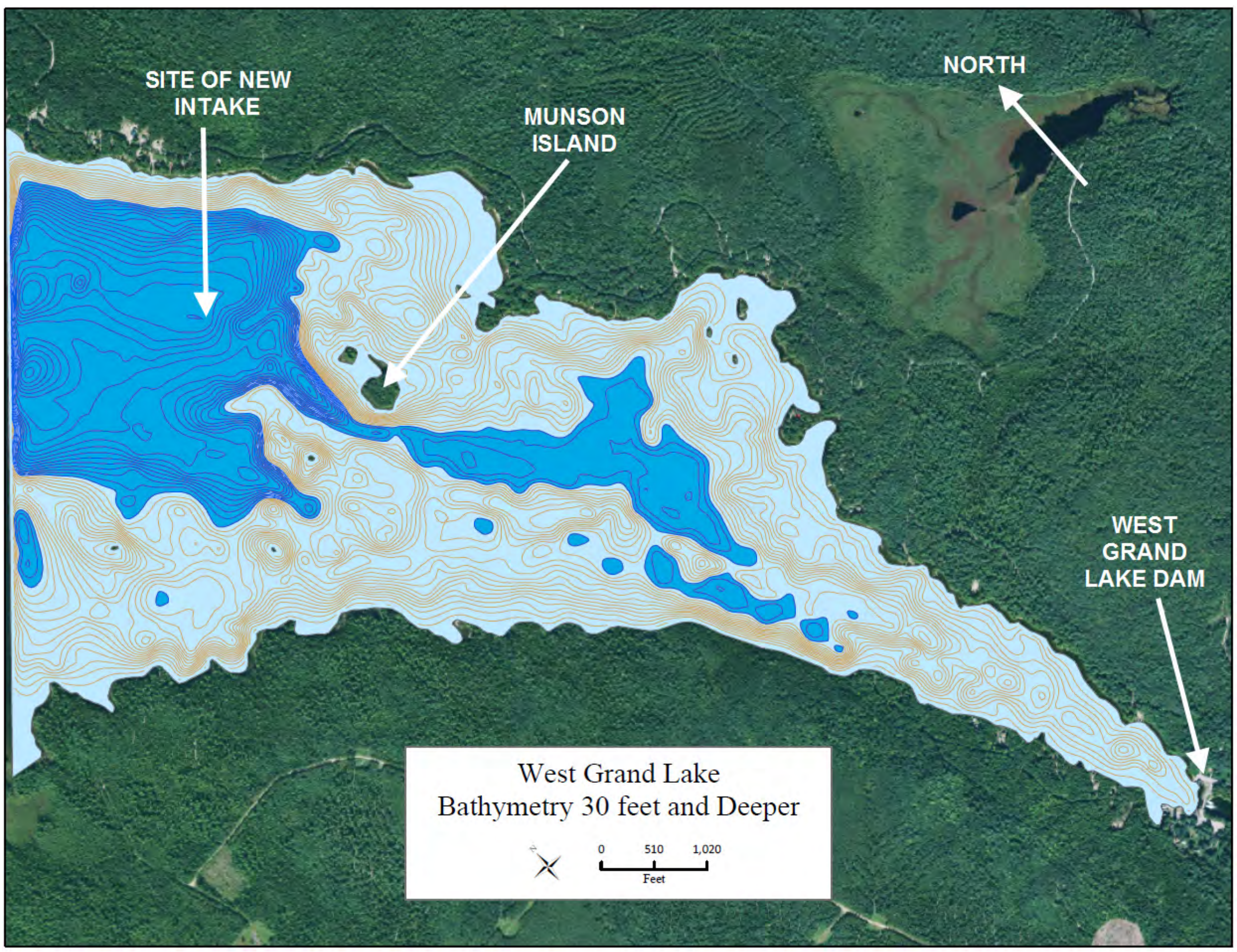
As an add-on option, other intake screens were evaluated for use at this facility. One alternative is to install a stainless steel T-screens at each intake for wildfish and debris control. T-screens have screening at each end which allows a large surface area for water inflow. Slot size can vary and will depend on specific screening needs. Features can be added such as air-burst, water backwash, or metal alloys to reduce ANS infestations (such as zebra mussels). Intake costs include the T-screen and associated piping, fittings and installation. For this report, just a typical screen and installation have been assumed with no backwash or special materials. While the hatchery does not fall under the jurisdiction for the §316(b) of the Clean Water Act, water intake velocities would be designed to stay below the 0.5′ per second threshold for fish impingement or entrainment. If this alternative is added, further input would be required from IF&W to determine optimal screen sizing.

As outlined in **Section 5.4.2**, if additional tanks are provided at this site, a small production increase might be feasible using the available water. The facility is currently using 1,400 gpm (2.02 MGD) vs. the allocated 2,013 gpm (2.9 MGD) which would allow an additional 600 gpm (0.8 MGD) to be available for the new rearing units. The new deeper pipeline will incur additional headloss due to the additional pipe length but the new fittings will provide less headloss, so final flow determination to the site will need to be calculated during design when additional site and water level elevations/fluctuations are determined. At this time, it has been assumed to be similar to the current water flow to the site due to the balance of the head lost and gained.

As part of this improvement work, the existing water supply equipment (i.e., filtration and UV treatment) are ending their service life and replacement parts are becoming obsolete. Therefore, the microscreen and UV should be replaced in conjunction with the water supply pipeline work. For water treatment sizing purposes, the water flow for the new treatment equipment will be assumed to be 2,100 gpm. A new drum filter and UV system will be added to the project. The existing building will be reused (assuming the new equipment will fit) so no new building costs have been projected except minor renovation to the structure. To remove and install the new units, the roof will need to be removed from the building. This work is optional and will be dependent on project funding allocation.

In the fall of 2015 the IF&W performed a bathymetric survey to identify areas of deep water in the lake, as close as possible to the hatchery. Based on the lake water quality data IF&W identified that a water depth of greater than 52′ would be required. **Figure 4-5** presents the 2015 IF&W bathymetry, in which the darker blue areas identify areas deeper than 30′, and a 2′ contour interval is shown.

Figure 4-5. IF&W Bathymetry for West Grand Lake above Grand Lake Stream



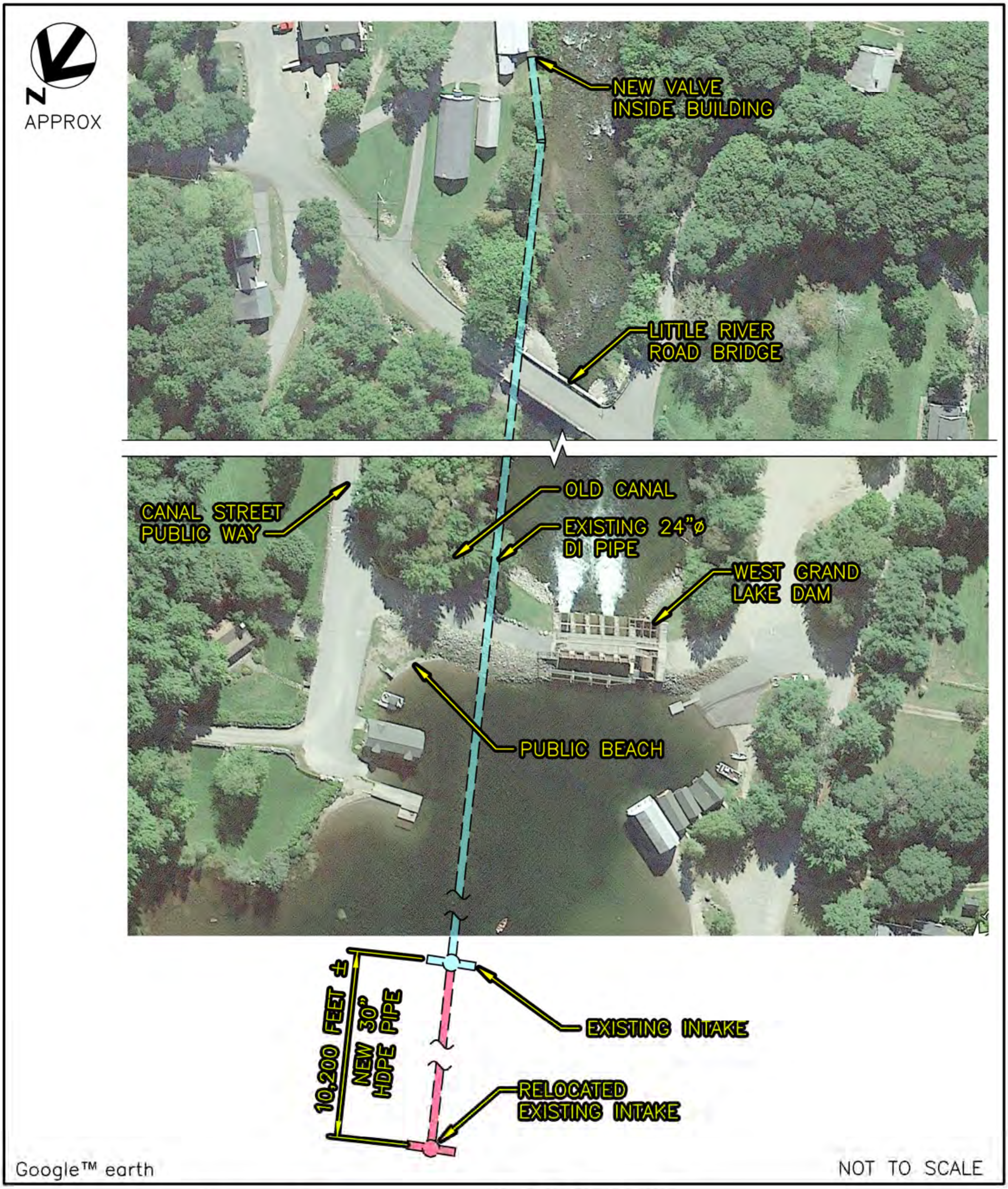
Improvements associated with this option include installation of a pipe wye just upstream of the existing head box/treatment building. Upstream of the wye, two flow control valves would be installed on the existing and new 24″ raw water pipelines, which would provide an opportunity to control discharge from each pipe and vary water temperature in the head box through manipulating the valves of the two intake lines. To minimize headlosses, eccentric plug valves have been selected, which have less headloss than a butterfly valve and are more suited for throttling flow. Above the valve a new 24″ DI pipe would parallel the existing line and run beneath the bridge, through the canal dam, and up the existing shallow water channel (former canal) to a point where the pipe will turn to the north to avoid the earthen dam abutment and concrete structures and will extend into Canal Street. The buried pipe would extend up Canal Street to the public beach, and into the lake, and then extend 10,770′ upstream to the location of the new deep-water intake in approximately 55′ of water. The new intake structure would be constructed similar to the existing intake, as no issues with operation are noted with the coarse existing intake screens (see **Figure 4-2**). The total length of the new pipeline is approximately 12,280′.

Option 2 – Relocate the Existing Intake to Deep Water

Option 2 includes improvements to relocate the existing intake structure to deeper water, the addition of 10,200′ of new HDPE piping, and upgraded piping at the upstream of the headbox within the UV building (see **Figure 4-6**). Option 2 uses the existing piping to the maximum extent and eliminates the excavation and site work involved in Option 1. Option 2 still includes the upgrade of the piping within the UV building up to the headbox to eliminate the headlosses associated with the reducers and substitutes a new 24″ eccentric plug valve for the existing 12″ butterfly valve. The existing intake structure would be re-used and relocated10,200 feet further in the lake to the deep water location identified in Option 1. A tee section with a blind flange would be installed at the end of the existing DI piping (site of the existing intake) for future use as a shallow inlet if IF&W desires to draw from this location May through July when shallower, warmer water would be beneficial from the lake.

A comparison of costs between DI and HDPE show that the HDPE is less expensive to use for the pipeline in the lake. For a 24″ internal dia. pipe, it is necessary to use a 30″ dia. HPDE, due to the wall thickness to have a similar conveyance. The HDPE pipe is a polyethylene thermoplastic, and instead of mechanical joints uses a field fuse-welding process to produce a continuous pipeline. The HDPE pipe has the needed flexibility to fit the contour of the lake bottom with no additional special joints, and has the added benefits of lower energy losses due to the smoothness of the pipe, increased resistance to biofouling from aquatic growth, and a service life reported to be greatly in excess of the nominal 50-year industry standards requirement. The pipe will be buoyant and requires weighting with simple block anchors deployed during lay of the pipe, which is incorporated into the costs.

Due to the field fuse-welding, the construction production rates are slightly slower than for DI pipe construction production rates, but will still be able to deploy approximately 200′ per day from a barge. As there is approximately 10,200′ of HDPE pipe construction, this would represent a 10-week long construction task. Water flow to the hatchery would only need to be disrupted for the duration of the diver work to remove and relocate the



HDR

STATE OF MAINE
DEPARTMENT OF INLAND
FISHERIES AND WILDLIFE

GRAND LAKE
CONCEPTUAL PIPE LAYOUT

DATE
JANUARY 2016
GRAND LAKE
STREAM
OPTION 2
FIGURE 4-6

existing intake structure and to connect the new pipeline to the existing ductile iron system, which would be anticipated to take two to three weeks.

Relocation to deeper water will also help with the reported icing conditions at the existing intake location, as both frazil and anchor ice behavior are associated with shallower depths.

As with Option 1, Option 2 requires additional field survey data and detailed hydraulic analysis to finalize the Option configuration, considering lake operation ranges, and piping options, including a condition assessment of the existing piping upstream of the hatchery to verify pipeline condition and hydraulic characteristics.

4.2.4 Recommendations

- Option 2 is the recommended option, due to the high costs associated with Option 1. Option 2 provides a needed pipeline extension providing access to the required deep, cool water, and provides upgrades to replace older valving and reduce headlosses at the UV building. The existing intake screen equipment can be reused and relocated to the new intake location, saving the expense of purchasing additional screens. However, a condition assessment will need to be completed of the screen prior to reuse. The blind flange T section left in the location of the existing intake will help preserve operation flexibility in the event that warmer water is required for IF&W operation in the future. Unfortunately, this option does not provide for any additional flow potential for production expansion at the site or mixing ability for easier temperature management.
- The existing water supply treatment equipment should be replaced in conjunction with this work if adequate funding is available. Water supply equipment replacement will be less costly to do in conjunction with the main pipeline work due to combined mobilization compared to completing the work separately in the future.
- Since additional water is available at this site, add five new rearing tanks and an associated building to protect the tanks from the elements.
- Since additional screening occurs at the site and IF&W are satisfied with the current level of debris removal, new intake screens are not recommended. However, ANS and/or biosecurity requirements could necessitate finer screening at the water supply location in the future.

5 Hatchery System Expansion Potential

5.1 Purpose

In 2002, a legislative commission, the Commission to Study the Needs and Opportunities Associated with the Production of Salmonid Sport Fish in Maine produced a report (Commission Report), that outlined a series of findings and recommendations for fish production goals in Maine. The Commission was directed by the legislature to:

- Assess and evaluate recreational salmonid fish production facilities in the State
- Set salmonid production goals at state-owned fish production facilities over the next 15 to 20 year planning horizon
- Ensure that these facilities comply with discharge license standards.

The Commission Report summarizes eleven findings and associated recommendations that were either unanimous or carried a majority opinion within the Commission (see **Appendix H).** Included within the outlined recommendations were items related to overall production increases, effluent treatment discussions, species specific recommendations, new facility needs and the role of private hatcheries. The specific details of the report along with discussions with IF&W formed the basis for the expansion discussion below.

5.2 Production Overview

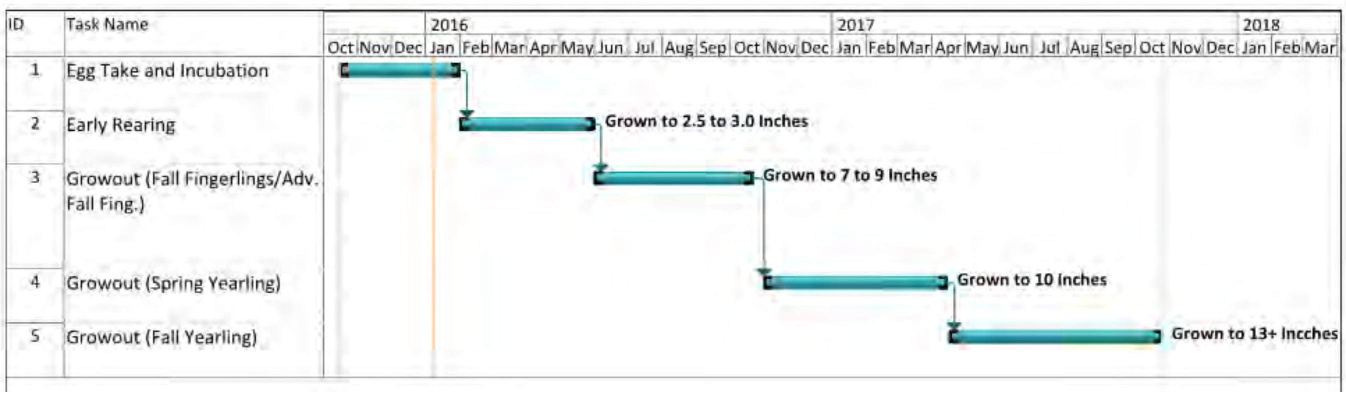
IF&W has traditionally produced brook trout, brown trout, landlocked Atlantic salmon, lake trout, rainbow trout and splake for stocking into Maine waters. The eight facilities currently owned and operated by IF&W, species raised and rearing phases at each facility are listed in **Table 5-1**.

Table 5-1. IF&W Hatcheries, Species and Rearing Phases

Facility	Species	Rearing Phases
Casco	Brook Trout (winter), Brown Trout, Landlocked Atlantic Salmon and Rainbow Trout	Broodstock, Incubation, Early Rearing and Grow Out
Dry Mills	Brook Trout	Broodstock, Incubation, Early Rearing and Grow Out
Embden	Brook Trout, Landlocked Salmon	Grow Out
Enfield	Brook Trout, Landlocked Atlantic Salmon	Broodstock, Incubation, Early Rearing and Grow Out
Governor Hill	Brook Trout, Lake Trout and Splake	Broodstock, Incubation, Early Rearing and Grow Out
Grand Lake Stream	Brook Trout (1st Year) and Landlocked Atlantic Salmon	Broodstock, Incubation, Early Rearing and Grow Out
New Gloucester	Brook Trout (winter), Brown Trout and Rainbow Trout (early rearing)	Broodstock, Incubation, Early Rearing and Grow Out
Palermo	Brook Trout and Brown Trout	Grow Out

Fish life stages managed within the system range from fry to adult broodstock holding. Following effluent treatment upgrades, the renovation of the Embden SFH, oxygenation upgrades, purchasing of fish from private producers and the leasing of facilities for production, the state has been able to increase yearly salmonid production pounds. A typical production year begins in the October timeframe with egg take and incubation and concludes with the stocking of fish. An example production schedule for brook trout is provided in **Figure 5-1**.

Figure 5-1. Example Brook Trout Production Schedule

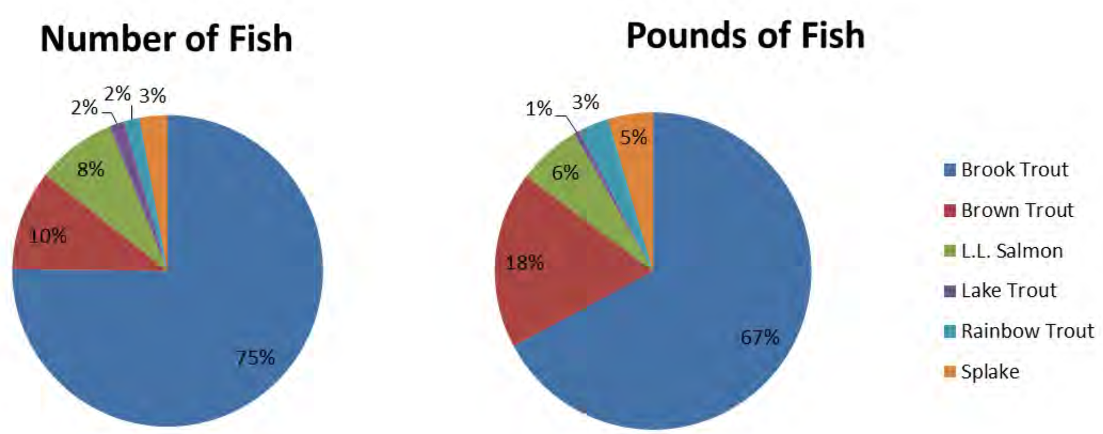


The production cycle and timing is important to the overall rearing cycle since stocking of multiple sizes occurs throughout the year. These sizes include fry, fall fingerlings, advanced fall fingerlings, spring yearlings, fall yearlings and adults. IF&W facilities operate as an entire system with fish transfers occurring between facilities. Six of the eight facilities have four major phases (i.e., broodstock spawning, incubation, early rearing and grow out) while two of the eight complete grow-out only from fish brought on to station from other facilities. The interrelationship between facilities due to required transfers of certain life stages is important to note when discussing production so that impacts to the entire system are realized. For example, the Embden SFH is a grow-out facility that receives three inch fingerlings from other stations for grow out. The facility space is maximized for grow out with no incubation or early rearing facilities available. Increased production at Embden SFH requires transfers from other stations.

5.2.1 Current Production Overview

For the 2015 production year, 1,211,141 fish weighing a total of 386,693 lbs were managed and stocked by IF&W. **Figure 5-2** shows the species and percentage of production for both total number of fish produced and total pounds of fish produced in 2015.

Figure 5-2. Total Number of Fish and Pounds of Fish Produced by Species

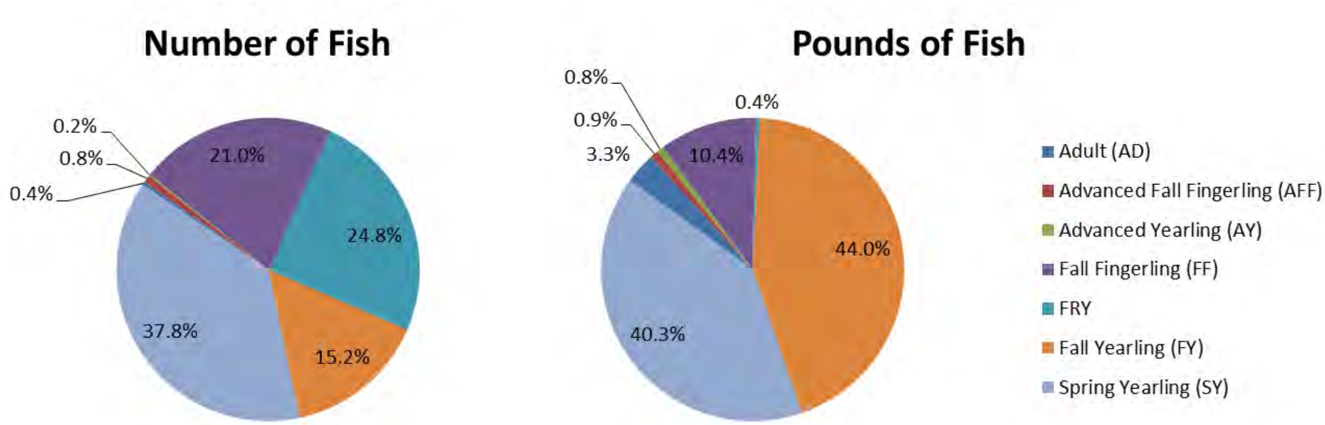


Data provided by IF&W

Brook trout production followed by brown trout and landlocked Atlantic salmon production represent the majority of IF&W fish production. These three species represent over 90 percent of the fish production for the state and will continue to be the species of focus as outlined by IF&W and shown in the Commission report. However, it is reported that brown trout production may decline in favor of rainbow trout in southern and central Maine waters.

In addition to the species, a variety of sizes are produced within the facilities. **Figure 5-3** overviews the 2015 fish production numbers and pounds that were managed by size class.

Figure 5-3. Total Number of Fish and Pounds of Fish Produced by Size Class



Data provided by IF&W

The majority of pounds produced were in the spring yearling and fall yearling size classes in 2015. More variety was witnessed in the total number produced primarily due to the ability to carry high numbers of fish at a smaller size when compared to pounds.

For production discussions, representing the pounds produced will be favored as it is directly proportional to the carrying capacity of the rearing systems expressed as density (number of pounds per cubic foot of rearing space- lbs/ft^3). In general, the stocking of larger fish has shown to improve survivability compared to stocking larger numbers of smaller fish according to IF&W regional fisheries biologists, particularly in waters with high competition and large numbers of predatory species. In many situations, the larger fish ultimately provide a better return to the angler and are a better investment for hatchery resources. However, larger fish are on stations longer and require more feed and will cost more to produce.

5.2.2 Historical Production Comparison

Production numbers and pounds from 2000, 2011 and 2015 used for analysis were supplied by IF&W and are shown in **Figure 5-4** and **Figure 5-5**. The 2000 production year was selected since it was utilized as a benchmark in the 2002 Study and can be considered the historical production level. The 2011 production year was selected since it was the last year of production data before the leasing of facilities and purchase of private fish began. The 2015 production year was selected for analysis as it was the most recent full production year available at the time the report writing. The 2015 production year does include leasing of the Dead River facility to raise fish.

Figure 5-4. Numbers of Fish Produced in 2000, 2011 and 2015

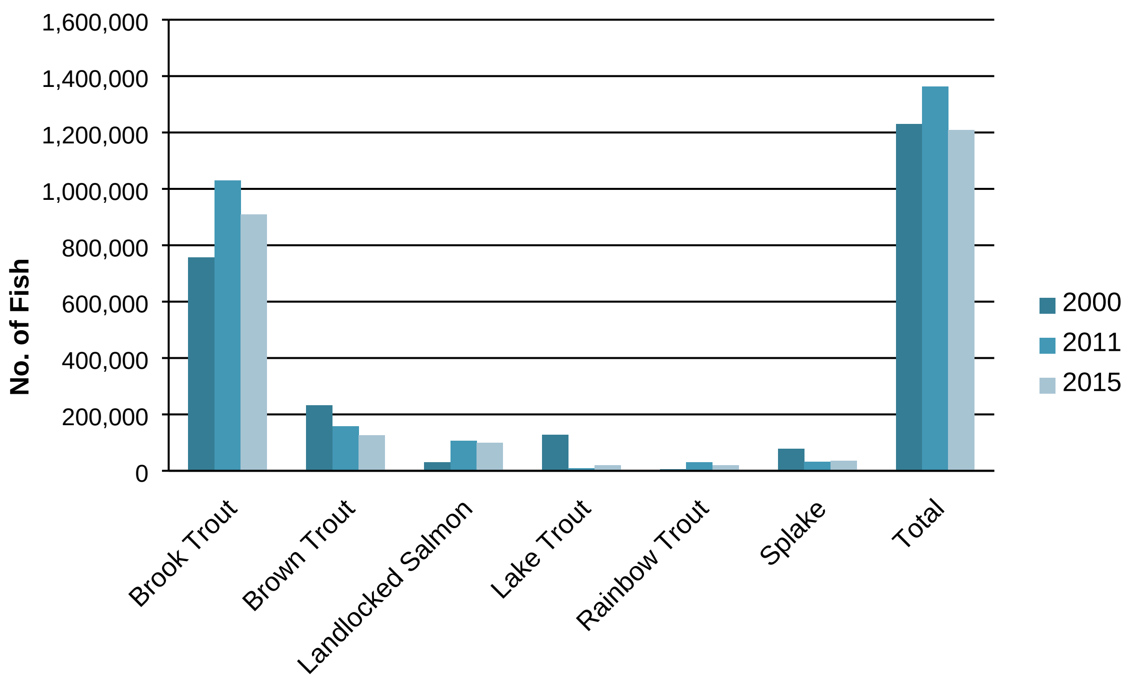
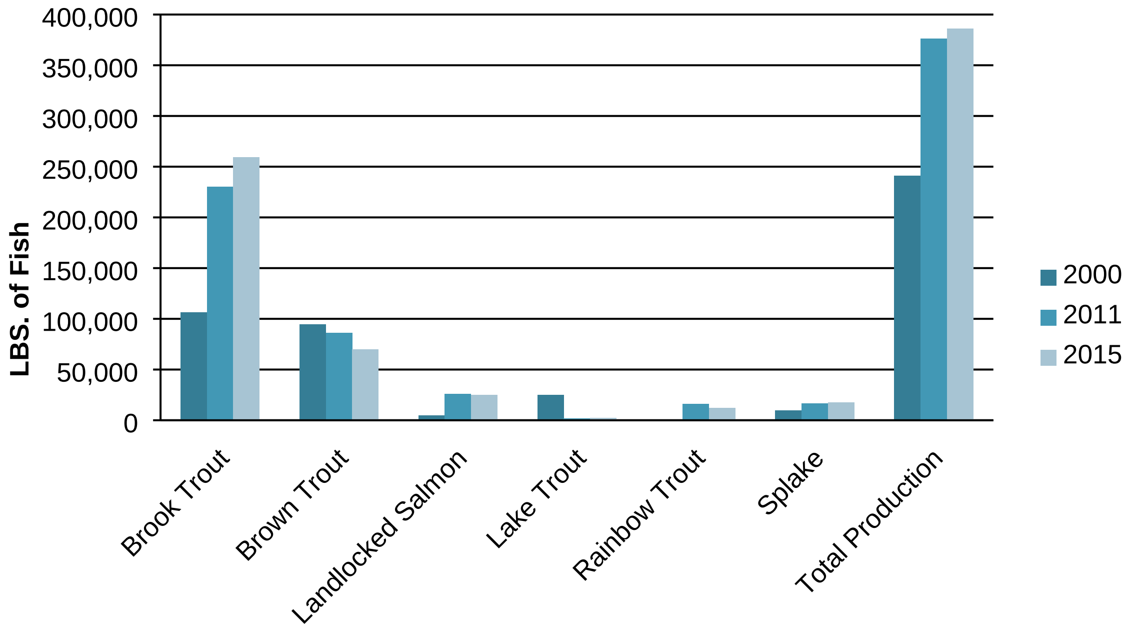


Figure 5-5. Pounds of Fish Produced in 2000, 2011 and 2015



Comparing the 2000 production pounds with the 2015 production pounds, the state has seen a 60 percent pounds increase over historical levels utilizing a variety of strategies and renovations. A portion of this increase, one percent to two percent per year, has come from resources outside of the current IF&W infrastructure (i.e., facility lease or purchase of fish). However, the utilization of outside resources has only partially offset the loss of the Phillips Hatchery which was closed in 2008 due to budget cuts. The remaining increase over the 2000 historical pounds has come from producing larger fish within the IF&W system. A major source of increase occurred following the Embden renovation from a traditional raceway system to a new circular tank farm in 2006. The pounds produced increased by 256 percent (27,453 lbs in 2000 to 97,740 lbs in 2015).

While the total pounds produced have increased significantly statewide, the overall total numbers were two percent less when comparing 2015 to 2000 or 2011 numbers. This slight difference in numbers is partially a function of producing larger fish for stocking into Maine waters. However, stocking numbers are highly variable depending on numbers of excess fry held as insurance until the fish are big enough to get an accurate count on them before being transferred to outdoor rearing areas or other facilities. Many of these extra fry are stocked out each spring even though they are not expected to make a meaningful contribution to the fishery.

5.3 Production Increase Scenarios

Several production increase scenarios are possible and range from maintaining current production to an increase consistent with the levels outlined in the 2002 Commission report. To analyze the impact of increasing production at an existing facility or construction of a new facility, four production tiers were outlined and included:

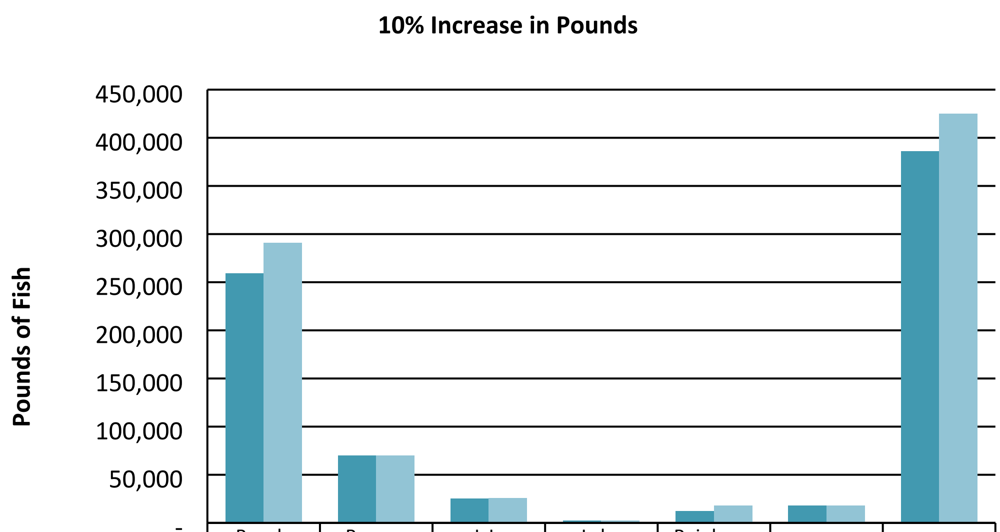
- Tier 1 – 10 percent increase in pounds (38,616 lbs above 2015)
- Tier 2 – 25 percent increase in pounds (96,541 lbs above 2015)

- Tier 3 - 39 percent increase in pounds (150,846 lbs above 2015)
- Tier 4 - 124 percent increase in pounds (478,913 lbs above 2015)

5.3.1 Tier 1 – Ten Percent Production Increases

Tier 1 increases were provided for a modest increase to existing production based on 2015 total pounds produced. **Figure 5-6** summarizes a ten percent increase over 2015 production pounds and shows the 10 percent increase results in 38,616 lbs of additional production in the system. The total pounds were matched to the percentage of regional requests resulting in: 81.7 percent for brook trout, 0.4 percent for brown trout, 2.7 percent for landlocked Atlantic salmon and 15.3 percent rainbow trout. Lake trout and splake (lake x brook trout hybrids) were requests remained unchanged from 2015.

Figure 5-6. Tier 1 – 10 Percent Production Increase in Pounds

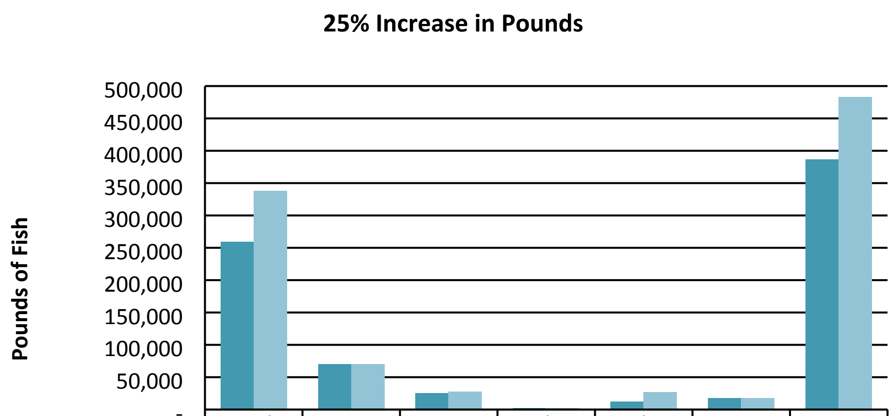


	Brook Trout	Brown Trout	L.L. Salmon	Lake Trout	Rainbow Trout	Splake	Total
2015 Pounds	259,304	69,822	24,958	2,207	12,113	17,760	386,164
10% Increase	290,859	69,959	25,988	2,207	18,008	17,760	424,781

5.3.2 Tier 2 – 25 Percent Production Increases

Tier 2 increases result in an additional 96,541 lbs in the system (25 percent) over 2015 production levels (**Figure 5-7**). The total impact to the numbers produced by this increase would be based on the size of fish produced but in general would approach an increase of 300,000 fish resulting in approximately 1.5 million fish produced annually within the IF&W system. Similar to the Tier 1 production increases, these increases were matched to regional requests for each species (e.g., 81.7 percent brook trout by pounds).

Figure 5-7. Tier 2 – 25 Percent Production Increase in Pounds

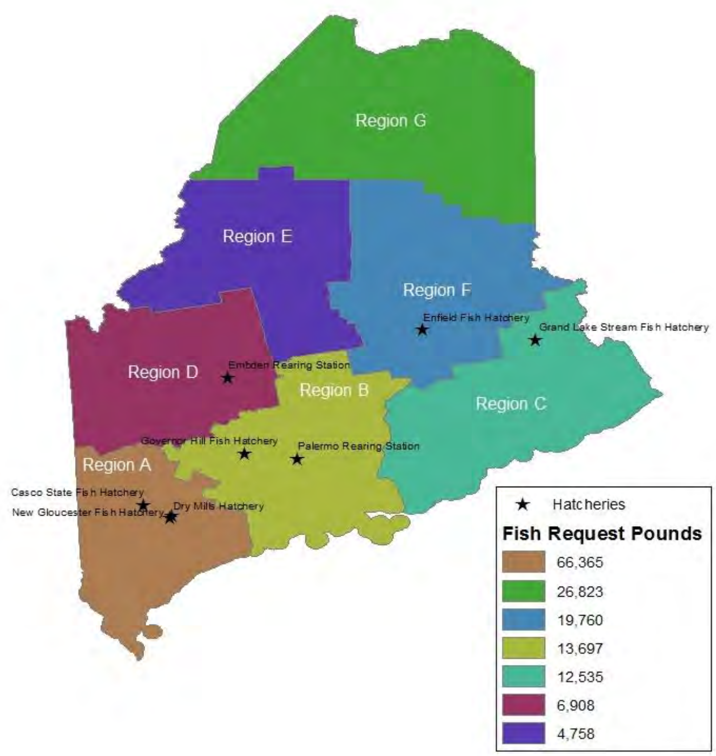


	Brook Trout	Brown Trout	L.L. Salmon	Lake Trout	Rainbow Trout	Splake	Total
2015 Pounds	259,304	69,822	24,958	2,207	12,113	17,760	386,164
25% Increase	338,191	70,164	27,534	2,207	26,849	17,760	482,705

5.3.3 Tier 3 – 39 Percent Production Increases

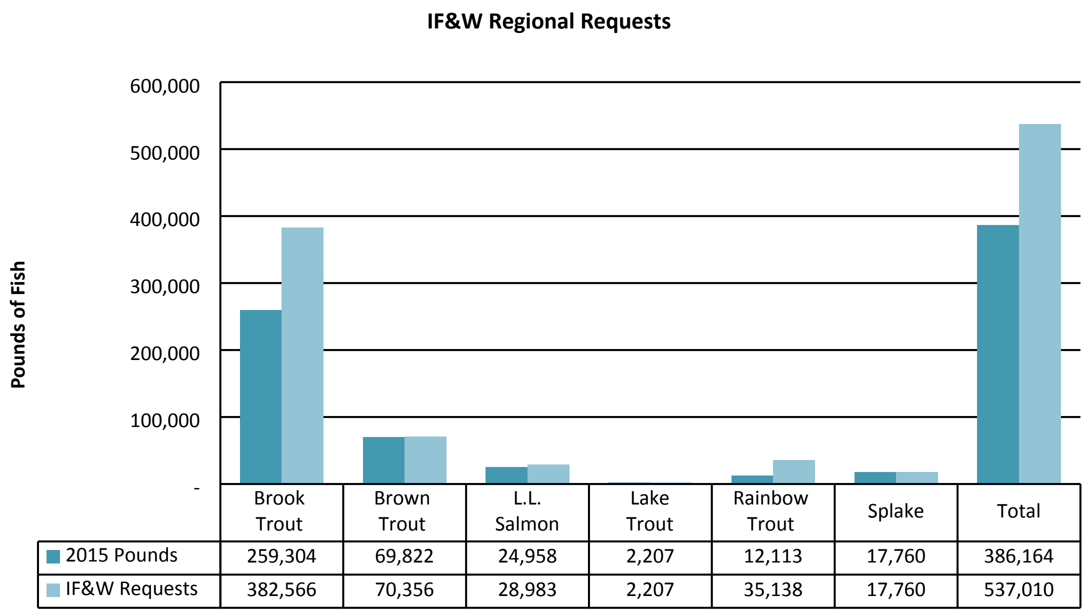
Tier 3 increases reflect the requests in pounds by IF&W regional biologists. These requests are displayed graphically in **Figure 5-8** by IF&W Region. In addition, the locations of the IF&W hatcheries are shown. It is interesting to note that the requested total production of fish by regional biologists in 2015 (537,010 lbs) is similar to the overall level of total requested production outlined in 2002 (555,415 lbs).

Figure 5-8. IF&W Regional Fish Requests in Pounds



A further breakdown of regional increase requests are shown in **Figure 5-9** by species. A total increase of 176,250 fish weighing 150,846 lbs have been requested. The resulting increase is a 39 percent change over the total pounds produced in 2015 and a 15 percent increase in total number produced. Tier 3 production increases would bring the annual production total to 1,385,191 fish weighing 537,010 lbs.

Figure 5-9. Tier 3 – 39 Percent Production Increase in Pounds



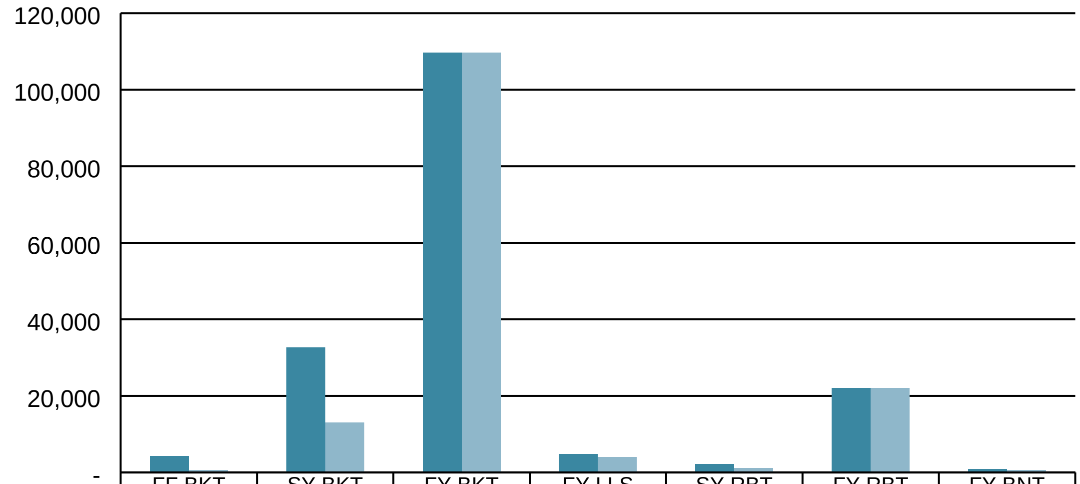
	Brook Trout	Brown Trout	L.L. Salmon	Lake Trout	Rainbow Trout	Splake	Total
2015 Pounds	259,304	69,822	24,958	2,207	12,113	17,760	386,164
IF&W Requests	382,566	70,356	28,983	2,207	35,138	17,760	537,010

Another way to illustrate the regional production increase request is by size class. **Figure 10** shows the Tier 3 increased numbers and pounds by the following size classes:

- Fall Fingerling Brook Trout (FF BKT)
- Spring Yearling Brook Trout (SY BKT)
- Fall Yearling Brook Trout (FY BKT)
- Fall Yearling Landlocked Atlantic Salmon (FY LLS)
- Spring Yearling Rainbow Trout (SY RBT)
- Fall Yearling Rainbow Trout (FY RBT)
- Fall Yearling Brown Trout (FY BNT)

Figure 5-10. Tier 3 – 39 Percent Production Increase by Size

IF&W Production Increases by Size



	FF BKT	SY BKT	FY BKT	FY LLS	SY RBT	FY RBT	FY BNT
#'s	4,250	32,665	109,630	4,830	2,100	21,975	800
Lbs	567	13,066	109,630	4,025	1,050	21,975	533

The majority of increase requests for stocking by regional biologist are for fall yearling brook trout (73% of poundage increase). The production expansion discussions will need to consider maintaining fish in these size classes.

5.3.4 Tier 4 – 124 Percent Production Increases

The production increases outlined within Tier 4 reflect the 2002 Commission Report pounds by species (**Figure 5-11**). The locations of these increases were not included in the original report but are assumed to follow 2015 percentages by region of need.

Figure 5-11. Tier 4 – 124 Percent Production Increase (based on Commission Report)

Commision Report Increases

	Brook Trout	Brown Trout	L.L. Salmon	Lake Trout	Rainbow Trout	Splake	Total
2015 Pounds	259,304	69,822	24,958	2,207	12,113	17,760	386,164
Commission	700,609	77,622	16,457	4,664	60,125	5,600	865,077

While other percentage increases could be evaluated, the four listed above represent a range from a modest increase to doubling of the current state production.

5.4 How to Meet Production Increases?

Accommodating the production increases for tiers above, could be accomplished within one or a mixture of the following three scenarios:

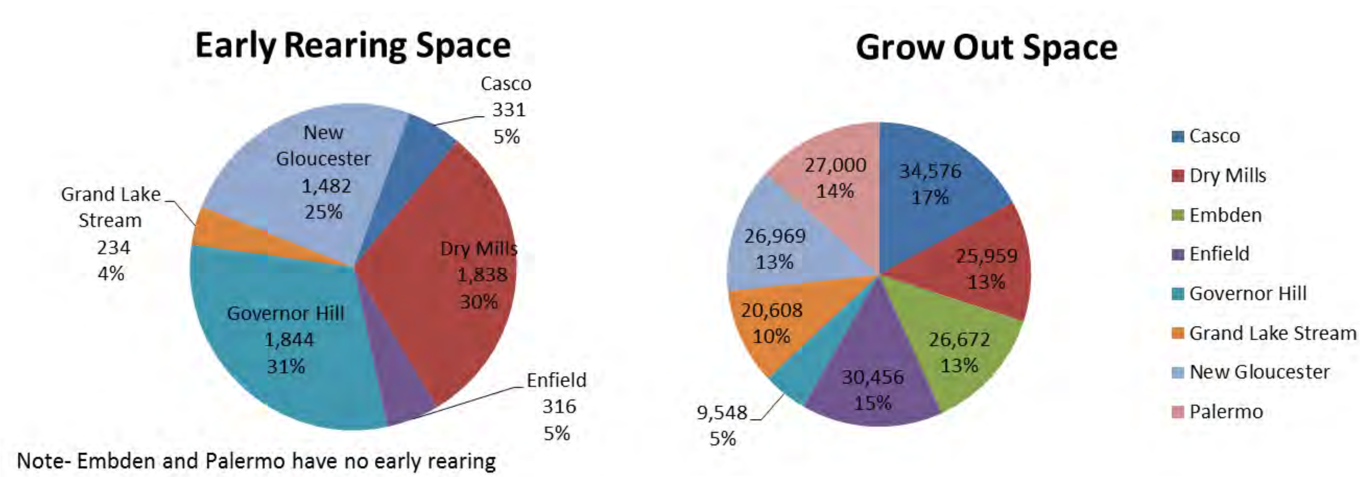
- Raise more fish within existing infrastructure
- Expand infrastructure at current facilities
- Build a New Facility(s)

These scenarios will be discussed in the sections below.

5.4.1 Within Existing Infrastructure

Within the eight operating IF&W facilities, a total of 207,831 CF of incubation/early rearing, grow out and broodstock management space is available for fish production. The spaces are divided into 6,044 CF of space for early rearing (including fry) and 201,787 CF for grow out and broodstock management. **Figure 5-12** provides an overview of the production spaces available by facility.

Figure 5-12. IF&W Production Space Overview



Increasing the pounds of production within the existing IF&W infrastructure would require fish rearing densities to be increased above 2015 levels. While small variances occur between facilities, the overall production densities are typically less than 2 lbs/ft^3 across the state. Densities obtained at the Embden facility are one exception. Theoretically, it is possible to increase rearing densities provided that fish health is managed accordingly. For example, if density was increased from a statewide average of 1.8 lbs/ft^3 to 2.8 lbs/ft^3, the total fish production level would increase by 50 percent statewide. On paper, this density increase would potentially allow production increase Tiers 1 and 2, under ideal rearing conditions, to be reached but Tier 3 and 4 would not be achieved using this expansion method alone.

In order to accommodate production increases simply through density, rearing space, water supply and temperatures, fish health, available oxygen and effluent limits need to be addressed. Other considerations such as budget for feed, stocking costs, staff and similar operational elements would also need to be reviewed. Additionally, year classes, strains and broodstock spaces must also be accounted for and are not reflected in a density only increase. Increase related elements are briefly outlined below relative to density increases.

Rearing Space

As noted above, six of the eight facilities have early rearing phases. For increases to occur at facilities that do not have early rearing space, Embden SFH and Palermo, SFH early rearing densities and/or rearing space must be increased at other facilities that supply the 2.5″ to 3.0″ fingerlings to Embden SFH and Palermo SFH for grow out. This would need to occur for the supply of fingerlings from the early rearing facilities to the grow out only facilities. This space would also need to be accounted for in the grow out phases for each of those facilities that raise fish to the 3″ size common with the end of the early rearing phase. This is necessary because they not only transfer fish but raise them on station as well. The increase also impacts broodstock space. An increase in number requires production of more eggs. Increases in eggs can be achieved, to a limited amount, by the size of the fish, higher fecundity or slight change in egg survival. While theoretically possible, the IF&W system is already operating at high level of egg production meaning more fish means more adult holding space.

Water Supplies

As the bulk of the requested increase in fish relates to the production of fall yearling brook trout, it is important to assess where there may be an option to increase density of this species and age group. Currently only five of the eight IF&W facilities have an adequate cold water supply that can support the production of these fish. One of these five, the Governor Hill SFH, utilizes their cold water supply to fulfill statewide needs for lake trout and splake as well holding both brook trout and lake trout broodstock. The current brook trout densities held at the Embden Rearing Station have also warranted a reduction in order to increase fish quality and appearance. Without improvements to water supply quantities, water supply treatment, cooler temperatures, production increases within the constraints of current water supplies and temperatures would be problematic.

Fish Health

In general, efforts to reduce stressors while fish are on station are paramount to the fish production process. Westers (1987) states that in order to guarantee good performance in the hatchery, fish should not be reared under undue stress, especially for an extended periods of time. Stresses are caused by handling, over-loading (low oxygen, high ammonia, etc.), high rearing densities (over-crowding), low water velocities, temperature extremes, silt loads, gas supersaturation and disturbances such as tank cleaning, people activity, bird predation (fear) and excessive light levels. Increased rearing density is a major stressor to overall fish health which renders fish more susceptible to potential fish diseases or pathogens. For this reason, increasing rearing density is not recommended.

IF&W has routinely managed fish health in order to produce a high quality product and also conducts a semi-annual fish quality report (see **Appendix G**) that aids in the monitoring of all species released. The quality of fish produced by IF&W is a high priority and crowding of fish through the use of higher densities is not desired.

Available Oxygen

If higher densities were used to increase production, increases in oxygen requirements will be required to maintain the appropriate level of available oxygen (AO) to the fish at all times. While the background water can and does supply oxygen, increases in production require more flow to bring the oxygen to the fish. Increases toward any of the four tiers outlined above could be accommodated with the use of the liquid oxygen systems and LHOs currently in place at six of the eight IF&W facilities. An increase in the amount of liquid oxygen (LOX) will be required but existing oxygen infrastructure at six locations would be adequate to supply the oxygen. The increase of carrying capacity by increasing available oxygen to the units is achievable and is utilized at other salmonid facilities operating around the country. The advantage of utilizing LOX achieving high densities of fish and high loadings (lbs/gpm) without increasing the flow rate.

Effluent Limits

As production increases at facilities, the higher feeding levels would translate to higher effluent levels which could cause National Pollutant Discharge Elimination System (NPDES) permit exceedences. The IF&W facilities are already under restrictive discharge permit limits so increases in production without solids and nutrient management considerations may not be permissible under the permit levels (see **Appendix E**). Effluent treatment upgrades at IF&W facilities have greatly improved the permit compliance, however, these treatment improvements were implemented at lower production levels than what is proposed in the tiers outlined above. Most facilities are either just below or exceeding total phosphorus limits established in their discharge permits during the summer through early fall. Therefore, any increase in pounds within an existing footprint would need to be carefully modeled to analyze the impacts to effluent limits.

Increases within Existing Infrastructure Conclusion

IF&W have been successfully raising quality fish at the current densities and do not feel the increase in production warrants the risk to the fish quality and health. While the numbers could go up, the quality of the product produced would suffer. Increasing density requires additional considerations for flow and oxygen to accommodate fish metabolic needs. In addition, crowding of fish, brook trout fall yearlings in particular at temperatures above 65 ºF is very problematic. Additional pounds of production could be realized by maximizing raceway densities of each species and age group through each stocking season. However, in many cases additional fish of some species are not desired by regional biologists as well as additional fish in particular age groups. For example, simply adding more fish to a water where they are expected to grow to larger sizes may be detrimental to the lake’s food supply and ultimately all the fish in the lake. For additional perspective on the different types of stocking see **Appendix F** “Why We Stock”.

The simple math for increasing density shows significant increases in production are possible, however, the actual implications to other facilities, rearing phases and fish health are not accounted for in the density equation alone. Additionally, the implications to effluent levels, phosphorous in particular and meeting DEP discharge limits are also not accounted for when speaking in terms of density alone. For these reasons, density only based increases should be considered very carefully and only after the full implications are understood. It is recommended that density increases happen on a per facility basis and be governed by the fish health and effluent limits. Nominal increases between 1 percent and 10 percent are achievable when the conditions above are managed, however, Tier 2, Tier 3 and Tier 4 production levels cannot be achieved through density increases alone.

5.4.2 Expansion at Existing Facilities

Space is available at IF&W facilities that would allow for increased production through the construction of additional rearing units. These additions will be discussed on a per facility basis below. Please note that each facility addition is subject to review and coordination with current DEP permit limitations. **Appendix E** provides a summary of permit discharge monitoring reports (DMRs) for each facility. In addition, a November 2015 letter from DEP to IF&W regarding permit allowances for expansion is included. Even within cases where space, flow and personnel are available, the discharge permit restrictions may restrict or eliminate the expansion from further consideration. For the purposes of comparison to a new facility, expansion was discussed at each location.

As outlined previously in this report, operation of the eight facilities includes fish transfer between facilities. This is most notable when discussing production increases as all rearing phases must be accounted for in the analysis. For example, expanding grow out tank production at a facility must coincide with the infrastructure to incubate and provide early rearing that supports the level of increase.

Casco SFH

Out of the eight IF&W facilities, Casco SFH potentially has room to increase production and still remain within the limits outlined by DEP for phosphorous based on annual allowable P loadings in pounds. The current permit limit for phosphorous at Casco SFH is 274.5 lbs per year (Outfall 005A) and 5.5 lbs per year (Outfall 006A-hatchery building). The current water use at this facility is near the permitted level (+/- 150 gpm) so additional water will not be available for expansion at this site. Similarly, no new rearing units are proposed. While not a large amount of production increase (estimated 4,000 lbs to 6,000 lbs), the improvements to the water supply as outlined in **Section 3** of this report would allow blending of temperatures which could improve growth throughout the year. The optimum water temperatures would allow slight increases in rearing density which would translate to the increase in production. More importantly, access to cooler water in the summer months achievable through a dedicated deeper water intake would allow production of brook trout fall yearlings currently not possible with the summer and early fall water temperatures at Casco SFH. Production increases beyond this level within the current effluent permit limits would require additional wastewater treatment that would include the use of coagulating chemicals that bind phosphorus and further solids enhancement to manage the coagulated solids.

Dry Mills SFH

The cooler temperatures at Dry Mills SFH (43 ºF to 56 ºF) are ideal for brook trout rearing but the current permit limits of 0.44 lbs/day and 0.35 mg/l monthly average are already problematic for the facility operation making expansion unlikely. Dry Mills SFH is currently a source of brook trout fry and brook trout production. As this function is critical to the overall system goals for brook trout, it is recommended that Dry Mills SFH continue its current production without expansion.

Embden SFH

Recent work completed in 2006 renovated Embden SFH from a traditional raceway system to a circular tank farm for grow out. The facility currently provides grow out only as no incubation or early rearing units are available. The lack of well water at a constant temperature, particularly for the incubation phase, would need to be reviewed before any expansion into incubation and early rearing was discussed at Embden SFH. For this reason and the need/ability to expand at other facilities, no additions for Embden are suggested at this time.

Enfield SFH

Similar to the work completed at Embden SFH, a renovation to a circular tank farm for the Enfield SFH would improve the rearing conditions and thus carrying capacity of the facility within a similar footprint and flow rate. Production levels similar to those exhibited at Embden SFH could be possible (i.e., ~100,000 pounds). This option should be pursued if a new site is not found within the state to construct a new facility. This production level is similar to that outlined for the Tier 2 production increase so costs outlined for a new Tier 2 sized facility were used to develop projected costs for the Enfield renovation.

Expansion at Enfield SFH will likely require enhanced solids and phosphorous coagulation in order to approach the DEP requirements for the “equal or better” standard. In a November 2015 letter to IF&W from DEP (**Appendix E),** the production expansion potential was denied due to concerns over the permit limits and applicable treatment. These concerns would need to be addressed prior to the investment of a tank farm at Enfield SFH for production expansion to prove that effluent treatment can meet the standards outlined in the permit limits.

Costs are projected as follows including engineering fees:

- Grow-Out Facility: $4-5 million
- General Civil Work: $0.5 million
- Enhanced Effluent Treatment: $0.5-1.5 million
- Total projected costs to budget $5-7 million

The Embden project cost for the grow-out facility only was about $2.5 million in 2004 which would escalate to about $4.0 million in 2015 without engineering fees.

Governor Hill SFH

Governor Hill SFH is also a supplier of brook trout fry for the IF&W system. The relatively constant temperatures of the spring fed water supplies are ideal for brook trout but expansion space and flow to support more rearing units for larger fall yearlings is limited. Additionally, phosphorus permit limits are problematic at this facility making expansion of production pounds unlikely. Improved effluent treatment for phosphorus removal is difficult at this location without major effluent treatment expansion and associated increased costs.

Grand Lake Stream SFH

The addition of circular tanks at the Grand Lake Stream SFH could coincide with intake improvements that allow for gravity fed delivery of cooler water needed for fall yearling brook trout production. Bioprogram models were completed (see **Appendix C**) and show that five 20' circular tanks operating at a density of 3.0 lbs/ft^3 has a carrying capacity of to produce 525 fall fingerlings (82 lbs), 3,850 spring yearlings (1,040 lbs) and 13,125 fall yearlings (13,583 lbs) for a total annual production of 17,500 brook trout (14,704 lbs). In addition, a cooler water intake throughout the summer months would also allow for increased densities in the raceways, i.e., potentially an additional 3,000 lbs or more of production. These production increases would allow the facility to accommodate the regional brook trout requests for Region C that are included in the Tier 3 production increases. The request for Region C included 10,875 lbs of fall yearling brook trout and 560 lbs of spring yearling brook trout. With the addition of the tanks, Grand Lake Stream SFH could accommodate all the Region C requests for brook trout in addition to accommodating a portion of the brook trout increase for Region F or G. To approach the 14,223 lbs of brook trout, approximately 15,500 three-inch fingerlings would need to be supplied to these new units to accommodate for mortality. The current water use at this facility is lower than the permitted level (+/- 600 gpm) so additional water will be available to supply the proposed new tanks at this site. As mentioned above, early rearing must be accomplished elsewhere in the state or new early rearing tanks will need to be added to this site to accommodate the increased production levels.

New Gloucester SFH

Space for circular tank farm expansion may be possible within New Gloucester SFH's current footprint, but similar to other facilities, the current permit limits are problematic for the facility. Phosphorus and solids discharge limit exceedences have occurred at this facility within the current brown trout production. Additionally, the variable brook water temperatures may present a problem for the goal of more fall yearling brook trout as temperatures have been reported up to 70 ºF. Due primarily to permit limits, the expansion at New Gloucester SFH is not recommended.

Palermo SFH

Water temperatures at Palermo SFH are within the desired range for fall yearling brook trout production. The facility is currently flowing under the permitted amount of water flow but exceedences for phosphorus concentrations are problematic during the summer months. Similar to Casco SFH, some room exists within the annual phosphorus permits to increase production by a small amount pounds per year provided that monthly phosphorus concentrations can be managed with the limits outlined by DEP.

Conclusion

Investments for expansion within the existing IF&W properties are possible but approaching the level of production outlined in Tiers 1-4 is unlikely, especially above Tier 2 production levels. Two major issues exist for expanded infrastructure at the existing facilities, effluent permit limitations (primarily phosphorus levels) and water supplies (temperature and/or permitted flow rates).

Outside of the ability to construct a new tank farm at Enfield SFH and operate within permit limits, the expansion within the existing IF&W footprint is limited to infrastructure investments at Casco SFH and Grand Lake Stream SFH. The proposed pipeline and intake projects would allow for additional production to occur for the fall yearling brook trout goals. These investments introduce the ability to rear brook trout at two facilities that currently cannot raise brook trout to a fall yearling size. These investments coupled with a small increase at Palermo SFH would allow IF&W to approach Tier 1 production increases. Additionally, the improved water temperatures made possible by infrastructure investments at Casco SFH and Grand Lake Stream SFH would allow for enhanced management of statewide rearing. With these improvements, shifting production of species between facilities could allow for more pounds of fall yearling brook trout provided effluent permit levels are maintained.

5.4.3 New Facility

Since fish production expansion to meet all Tiers is not feasible using existing or expanded infrastructure at the existing facilities, the third expansion alternative is to construct a new facility(s). The new facility can be sized to meet all four of the proposed production tiers but most likely several facilities will be required to match Tier 4 or the Commission report goals. This next section will outline the general site features and infrastructure required for a generic facility (sized to Tier 3 production in this example) located anywhere in the state. The last subsection will describe specific potential locations throughout Maine that were screened for suitability for further evaluation.

Due to the preliminary nature of this work, development of site-specific construction cost projections was not possible. We have included an estimate of cost for a “generic” hatchery of the size and complexity described in this section. This generic facility has been modeled and found to provide fish production levels outlined in the **Tier 3** production expansion scenario. From there, the Tier 3 facility costs have been pro-rated to illustrate the potential costs related to the remaining three production tiers outlined in this report. Cost summaries are provided in **Section 6** and detailed breakdowns are provided in **Appendix B**.

General Requirements

Site Requirements

The main criteria for a new facility site selection include land area, water supply, electrical service, access to site, and effluent discharge issues. The proposed new facility will require a minimum of a 30 acre to 40 acre site with relatively flat or gently sloping terrain and good access to the state highway system. Three-phase, 480 V electrical service will be required along with access to the state highway system. Effluent discharge (after on-site treatment) will require a river receiving water body sufficient to handle peak hatchery system overflow drainage and effluent estimated at 5,000 gpm. The receiving stream must have a watershed area greater than 10 square miles and must not drain into a Class GPA water (great ponds and natural lakes and ponds less than 10 acres in size).

Siting efforts in this report using GIS screening to highlight the best potential locations in the state are discussed further in the next section. It should be noted that a complete detailed site evaluation study will need to be undertaken to evaluate all the recommended site requirements to determine the best location(s) within the state. Using results from the screening exercise, the detailed site evaluation can be narrowed down to a few viable sites within the high water bearing corridors examined initially. A detailed site evaluation will require site visits and further data collection followed by land acquisition appraisal and acquisition, if needed.

Water Requirements

Ideally, the utilization of a pathogen-free, constant temperature pumped groundwater supply system is recommended over a surface water source (i.e., lake or river) since it is generally more biosecure. In addition, colder waters are optimum for Maine trout production programs. However, finding a site with adequate groundwater volume (~5,000 gpm) might be challenging in Maine. Therefore, both types of water supply should be evaluated to determine viability for a new site. There is a trade-off cost (capital construction and operational) in surface water treatment versus groundwater pumping. Most of the existing facilities in Maine utilize surface water, have implemented water supply treatment (screening and disinfection) to enhance biosecurity and are able to successfully rear fish for the state. The benefit of the surface water supply in the Maine facilities is that most are fed by gravity so overall operational costs are lower compared with pumped supplies.

If found, a constant temperature groundwater supply would likely be obtained from a series of pumped production wells. The major advantage of the constant temperature, pathogen free water supply source is the year round growth potential that will allow accelerated rearing of yearling fish to meet the management requirement for larger trout. Reduced production time requirements of three months to six months would be possible with constant temperature rearing.

Potential water supply sources shall be evaluated both for quantity and quality compared to recommended fish hatchery standards. Problematic water quality issues can include high iron, manganese, heavy metal or unacceptable pesticide/herbicide levels in well water. Surface water can contain debris, pathogens and invasive ANS.

The site screening exercise outlined in the next section evaluated several river and groundwater corridors within the state. When a site is selected, detailed hydrogeological testing will be required to confirm long-term water supply potential. Permitting authorities will also need to be contacted to ensure that the site water supply can be utilized for the new facility.

If first use water of adequate volume and/or temperature cannot be obtained at a new site, IF&W will need to evaluate the option of recirculating water. Many IF&W facilities currently reuse water using the serial reuse flow pattern down a bank of raceways and have been very successful using multi-pass water. For any new facility, effluent treatment will be required to meet the stringent permitting requirements. Therefore, one option will be to capture the overflow water used in the circular tanks and pump it back to the main headbox structure and allow reuse of the water. Recirculation can be completed at varying levels and will depend on the selected recirculation water treatment equipment and the amount of fresh makeup water available. Many facilities throughout the country are relying on treated recycled water for hatchery needs due to water shortages and water conservation efforts. There are biosecurity risks related to recirculation that would need to be evaluated along with IF&W staff to provide the optimal security level for this alternative. Recirculation water treatment systems typically include additional treatment compared with straight surface water use which needs to be factored into the selection.

Another option is to provide water temperature management using chillers for periods when water temperatures are too low. However, water chilling and heating have high capital and operational expenses not currently required at the current facilities. One last option, if adequate coldwater temperature cannot be found, would be to use the new facility for the fish production that is less temperature sensitive and move the more sensitive (mainly brook) trout to the existing facilities with the coldest water supply temperatures.

Staffing Requirements

The operation and management of the proposed new generic-sized (Tier 3) facility will require the addition of full time and part time wage employees to meet facility operating requirements. The following staff positions are recommended:

Hatchery Manager / Facility Manager (1)

Assistant Manager (1)

Fisheries Technicians (2)

Wage Labor (1) at 1,500 Hours / Year

Conceptual Facility Description

This Section of the report provides a general description of the facility infrastructure requirements for constructing a new facility. Conceptual level **Drawings N1 and N2 (Appendix A)** illustrate the general infrastructure requirements of the proposed new salmonid hatchery. The second is a three-dimensional rendering to better illustrate the proposed facility layout. Discussions with IF&W staff indicate that the use of a covered circular tank farm as the primary grow-out unit is preferred. The new fish facility conceptual plan includes the construction of all required infrastructure resources to support and operate a new coldwater production facility including broodstock program, egg incubation and early rearing systems, and intermediate and final grow-out production rearing systems. As proposed, this is a complete, or self-sufficient, coldwater fish hatchery and is not a rearing station that only provides a part of the rearing cycle. Major infrastructure needs have been divided into the following categories:

A.	Aquaculture Water Supply
B.	Fish Rearing Units
C.	Buildings
D.	Site
E.	Aquaculture Wastewater
F.	Electrical
G.	Visitor Education/Interpretation

Aquaculture Water Supply

Item A1 – Facility Water Supply

The proposed facility will require a 5,000 gpm (+/-) water supply source. Due to the limited potential for finding a large-scale groundwater source, it is recommended to try to find enough groundwater to operate the incubation program, at minimum. The hatchery building supply well should be drilled near the building. If additional groundwater is available, it can also be used for the spawning program to speed or retard egg take and/or to run the early rearing program. For this report, it has been assumed that a 1,000 gpm well will be utilized (or about 20 percent of total flow needs). New wells include drilling, casing, screening, pumps, piping, ventilated pump housing, and electrical supply and connection to an emergency generator. It would be beneficial to have a second well as a backup unit for system redundancy.

The rest of the water supply (4,000 gpm +/-) will need to be provided by a surface source. A new intake structure or intake line will be required. The intake will include a gross screening to reduce debris and prevent ANS from entering the system. An additional finer screening system (drumfilter) will also be required to prepare the supply water for ultraviolet disinfection. Similar water supply treatment systems have already been installed in many of the IF&W hatcheries and will be similar in function to those systems. The new treatment will be sized for the proposed flows and to treat IF&W determined target pathogens.

IF&W staff have indicated that colder year-round water supplies will be required for the fall yearling program at a new facility. Therefore, a site with adequate groundwater or a deep lake supply would be optimal. If this cannot be found, as discussed earlier in this section, recirculation might be an option that needs to be evaluated further as this project moves forward.

All groundwater will need to be degassed to remove dissolved gasses using an aeration/degassing headtank. This system includes a reinforced, elevated concrete structure, an aluminum structural support frame, aeration/degassing columns, decking, a cover, associated plumbing and access stairs. The two cell headtank will receive both well and/or river (if used) water sources in order to meet all system water supply requirements.

Item A2 – Oxygenation System

Reduced DO concentrations can stress fish. For coldwater species such as trout and salmon, it is especially critical that DO oxygen levels are maintained at or above saturation. This allows the facility to maximize use of available water supply volumes.

Therefore, it is paramount that DO levels are maintained at the highest most practical level (at or above saturation).

A reliable, cost effective, and unlimited volume oxygen source can be provided by installing a bulk LOX tank, oxygen vaporizer, transmission lines, flow meters, a concrete tank foundation, protective fencing, and LHO contactors or other degassing devices to provide DO management throughout the entire hatchery complex. LHOs or other devices dissolve the oxygen into the water at controlled rates. These rectangular contacting units are generally mounted on raceway influent head boxes or stop logs. Oxygen distribution will be assumed from the bulk tank to the circular rearing units and buildings. Bulk LOX systems have two options for storage tanks, purchase or rental.

Mechanical aeration is a less desirable alternative for oxygen supplementation. Mechanical aeration is not as efficient in maintaining or increasing oxygen levels and will not operate during power failures without emergency power systems.

Fish Rearing Units

Item B1– Production Grow-Out Systems (Circular Tanks)

One rearing configuration (**Drawing N1**) involves the construction of a circular tank production facility similar to the system installed at the Embden SFH. A system of forty-eight 20' dia. tanks is proposed. This layout provides a rearing volume of 37,699 CF. Rearing units will be covered with roofs and sidewalls. Minimum lighting will be provided. Supplemental oxygen can be provided to each unit using ceramic diffusers in addition to oxygen contacting at the proposed headtank. Unit costs include earthwork, reinforced concrete, supply/drain piping, screens, and electrical.

Many other rearing unit configurations and size options are available and would be developed using bioprogramming modeling and IF&W input during design.

Item B2 – Egg Incubation and Early Rearing

Early rearing production will be accomplished in forty 6' dia. combi-tank or fiberglass tanks. The tanks will be located inside the fish hatchery building. Truck access will be provided for ease of fish transport. Egg incubation can be provided by vertical flow incubators or combi-tanks inserts.

Item B3 – Broodstock Facility

Broodstock raceways (ten 100' x 6' units) are included in the proposed broodstock building. Final sizing and orientation of raceways will be determined with input from IF&W staff. Approximately 28,000 CF (water volume) is required for broodstock. This space may be accomplished in circular tanks or linear tanks. The linear tanks generally require a higher flow rate but are easier to manage broodstock within. This building is capable of supporting a brook, brown and rainbow trout broodstock program and could provide eggs for use at other facilities as well as on-site production requirements.

Item B3 – Isolation/Quarantine Facility

For facilities where special project or brood are kept, isolation and/or quarantine areas with separate water supplies and holding units are recommended. This practice essentially keeps potential pathogens from cross-contaminating other lots within the facility. This is a recommended biosecurity practice for management plans. This function can be added onto the existing broodstock building but would have no water or staff connection between the buildings. This space will need to be configured in a variety of layouts and will require IF&W input during design. Structure will be designed to match the other new buildings on the site.

Buildings

Item C1 – Hatchery Building--Production

A 10,000 SF +/- fish hatchery building including fish production/holding tanks, egg incubation and hatching facilities, offices, laboratory, visitor, crew support and shop functions is proposed. Unit cost for this type of hatchery building is based upon prefabricated steel construction on concrete foundations and slabs. The building is fully insulated and includes all plumbing, HVAC, electrical and fire protection systems. Hatchery building spaces include incubation, fish production areas, office, laboratory, crew room, restrooms (both public and staff), visitor space, and all furnishings, incubators, and rearing equipment required to provide a complete functioning facility. Approximately 6,000 SF would be allocated for fish production with the remaining 4,000 SF to serve as offices, crew support, shop, and laboratory and visitor areas.

Item C2 – Vehicle/Equipment Storage Building

A facility of this size would require a separate vehicle and equipment storage building. A 4,000 SF vehicle and equipment storage building is proposed.

Item C3 – Residences

Two to three residences to provide 24-hour site security and emergency response are proposed. Three residences allow the normal IF&W staff work rotation to provide continuous 24-hour security and facility emergency response. Recommended residences shall include 1,500 SF energy efficient home with basement and attached two-car garage. Residences will be of conventional wood frame construction over concrete foundations and includes plumbing, HVAC, and electrical systems. The floor plan consists of three bedrooms, two baths, kitchen, dining and living rooms. All plumbing, HVAC and electrical systems are included in the unit cost.

Site

Item D1 – Land Acquisition

As discussed above, a minimum of 30 acres to 40 acres of state owned land would be required to construct a new production facility. If IF&W does not have an appropriate site (i.e., highway access, adequate groundwater supply, drainage, electrical service, state ROW access) within its current holdings, a 30 acre to 40 acre site may need to be purchased. General site work clearing and development is included in this item and will vary depending upon the site selected. Water supply requirements drive the site selection process.

Item D2 – Paved Access to State or Local Highway

The proposed facility must have easy access to the major state highway system for ease of fish transport. A bituminous paved access road within the facility and to the main state or local road access is proposed. New roads include the following: compaction of subgrade, gravel (8"), compaction of gravel, grading, and bituminous concrete (3") surfacing.

Item D3 – Security Fence

Security of the new facility can be maintained with a chain link fence area and locked production buildings. Fencing includes material and installation for galvanized wire mesh, posts, foundations and attachments.

Items D4 and D5 – Domestic Water and Wastewater

If (municipal) domestic water and wastewater systems are not available, potable water wells and a conventional septic system or other on-site wastewater system will be required to provide water supply and wastewater treatment.

Item D6 – Disinfection Station

Overall biosecurity can be enhanced by isolating and restricting access to certain areas of the new facility. In order to minimize importation contamination, a vehicle (e.g., truck, fish hauling trailer, boat) and equipment disinfection station should be provided prior to entering the facility. A system using cart mounted portable sprayer with disinfectant injection and/or steam cleaning capabilities is suggested. The disinfection wash down water will be directed to a proposed chemical detention tank. Biosecure area signage and site access control gates should be included to restrict access to the hatchery complex. Use of a steam cleaning system will reduce overall tank storage requirements. A location for the disinfection system outside the main entrance could provide improved biosecurity by providing this function before trucks, boats, nets, equipment, etc. enter the hatchery property. Chemical detention tanks can handle both the truck disinfection wash down water and the effluents from chemical treatments, if required. Detention tank costs include pre-fabricated Fiberglass Reinforced Plastic (FRP) or concrete tank, water control valves, and piping. Tank effluent will be processed by commercial hauler or aerated and disposed in the facility effluent stream after chemical breakdown / detoxification.

Aquaculture Wastewater

Item E1 – Effluent Treatment

A modern effluent treatment system designed to meet Maine DEP NPDES discharge license requirements for all fish hatchery building and drainage effluents is proposed. Effluent treatment costs include earthwork, micro-screening, clarification, sludge storage, water control structures and piping. The effluent discharge license will require discharge into an acceptable stream meeting all Maine DEP requirements.

The primary and secondary treatment systems so far described generally target removal of solids (TSS) and biochemical oxygen demand (BOD_5). Tertiary (advanced) treatment is required to remove nutrients such as phosphorus and nitrogen. Hatcheries typically utilize only primary treatment prior to discharge and this serves to generally meet current NPDES permit levels. The State of Maine DEP is requiring high levels of nutrient removal for the proposed future NPDES permit so advanced treatment would be required. The proposed effluent levels are considered extremely low even for a typical municipal treatment plant. Unfortunately, while technology exists that can potentially meet the proposed permit levels, the costs are very high and performance is variable.

Phosphorus removal can occur using the following methods:

- Mechanical (advanced filtration or membrane technology)
- Chemical (precipitation along with filtration or sedimentation)
- Biological (microorganism, plant or algae uptake)

Total phosphorus (TP) is made up of dissolved and particulate (suspended) phosphorus so it is important to target both the portions of the phosphorus when attempting to meet low TP phosphorus limits. Dissolved phosphorus is generally more challenging to remove.

All methods can be used to reduce the TP levels in the wastewater at a new facility, but the key will be to select a system that requires low operational attention and maintenance since the staff at the hatchery need to focus their main efforts on fish rearing. Chemical treatment by adding a coagulant would probably be recommended for the new facility, as well as any existing facilities, to better meet the NPDES phosphorus limits. However, this type of system will require staff to have some chemistry background to be able to calculate dose changes throughout the season due to the varying nature of the fish rearing cycle. Whenever chemicals are added to increase nutrient removal, however, there will be more particulate material to be handled and disposed with additional costs. If the chemical treatment does not work to meet NPDES levels, more technologically advanced treatment will be required which is accompanied by even higher expense and staff educational requirements.

Item E2 – Effluent Monitoring

An automated flow-weighted composite wastewater sampler and a discharge flow measurement system shall be included to meet NPDES permitting requirements.

F. Electrical

Item F1 – Electrical Service

Utility Service includes all costs paid to the local utility company for bringing new three-phase 480 V primary power onto the site. Secondary electrical service to the buildings is included in each building cost. Three-phase, 480 V electrical service will be required to operate the well field and possibly the water supply and effluent treatment. Site Lighting, as needed, includes buried wire in conduit, pole mounted luminaires, and concrete bases. Costs are based upon one pole per 100' of roadway for roads/raceways and four poles in the building complex area.

Item F2 – Emergency Power

The complex will require with an emergency power system. A diesel fuel fired emergency generator system with automatic transfer switch and above ground fuel storage system with leak detection is proposed at this time. Total generator size requirements calculated during design will determine the optimal fuel source. In general, generators smaller than 100 kilowatt (kW) utilize propane and larger units require diesel fuel. Capacity shall provide for complete facility operation during loss of commercial utility systems. Emergency Power costs include only the emergency generator and automatic transfer switch and fuel system. Generator is sized to pick up the entire hatchery and a separate emergency distribution system is not needed.

Item F3 – Instrumentation and Alarm System

The facility will be equipped with modern state-of-the-art process monitoring and alarm system with remote communication features. The proposed instrumentation and alarm system includes a personnel computer linked to a programmable logic controller with distributed input/output cards throughout the complex. Costs include the main personal computer (PC), Programmable Logic Controller (PLC) processor, discrete and analog Input/Output (I/O) cards, interconnecting data wiring, and monitoring devices such as sensors, flow meters, thermostats, and similar process instrumentation components. The system costs include telephone alarm dialer and all programming and software to provide a fully functional system. The system includes complete control and monitoring of the multiple well water system including motor savers, power surge suppression and remote start/stop control.

G. Visitor Education/Interpretation

Item G1 – Hatchery Building--Visitor Interpretation

Visitor interpretation and educational facilities have been allocated in the proposed hatchery building (see **Item B1**). Facilities may include display aquariums, multi-media presentations and graphic displays of IF&W hatchery and other resource management programs.

5.4.4 New Facility Location

A specific task for this project was to analyze potential hatchery locations in Maine to determine the feasibility of developing a new hatchery. Since expansion at the existing facilities was determined not to be viable for all production tiers, a new facility has been deemed the best alternative for larger-scale expansion of fish production levels (i.e., Tiers 2-4) within the state. The previous section outlined both general site and infrastructure requirements for a generic new facility. This section provides a screening of potential locations throughout Maine to site the new facility.

As part of the efforts in the 2002 Study, four potential major river corridors were evaluated for feasibility for a new hatchery to be located.

- Washburn – Aroostock River Corridor (areas adjacent to potato processing plants not now in service)
- Rumford to Bethel – Androscoggin River Corridor

- S. Hiram to Hollis Center – Saco River Corridor
- Former Deblois SFH (now sold) - Narraguagus River Corridor

Using information provided by the Maine Geological Survey and the IF&W, these sites appeared to have high potential for groundwater along the river corridors. The Washburn site was deemed to be too far from potential stocking sites and the Deblois site was already experiencing water shortages back in 2002. Since that time, the private hatchery that was leasing the property has closed down and the property was sold by IF&W. The remaining two sites were recommended to be evaluated further to determine if any specific locations within the corridors meet the other facility site requirements.

GIS Screening Summary

For this report, an overview and initial screening of potential hatchery site areas and their resources to support possible operation of an IF&W production hatchery was completed utilizing readily available GIS layers. Since the screening encompassed the entire state, the two corridors recommended above for further evaluation were included in this new screening effort. The specific screening process is described further in the next section.

For the new statewide screening of potential hatchery locations, the following areas were reviewed:

- Androscoggin River corridor
- Saco River corridor
- Kennebec River corridor
- Penobscot River corridor
- Thompson Lake

A description of the GIS process utilized for this analysis follows.

Screening Stage 1

The data utilized originated from publicly available satellite imagery, existing resource databases, and base infrastructure data. Acquisition, review, and mapping of existing baseline data was presented to IF&W as a portable document format (PDF) mapbook during the site tours in November 2015. The map presented the project hydrological locations on 63 different pages at a scale of 1:63360 or 1″ represents 1 mile (as viewed in GIS) that were shown with both an aerial image and topographic background. Data presented at the initial mapbook included:

- One mile search area along the Saco River, Androscoggin River, Kennebec River, Penobscot River, and Thompson Lake hydrological features
- Other hydrological features (National Hydrological Data streams and waterbodies)
- Watershed Boundaries (HUC 8)
- Civil and Political Boundaries
- Parcel boundaries where available

- Conservation Lands
- Transportation System
- Online Aerial Imagery
- Topographic Maps

Screening Stage 2

After the initial kick off meeting and field visit, a second mapbook was created. In addition to the original data presented, any information on floodplain or flood zones as well as DEP Water Classification Information was presented. Online aerial imagery was replaced with individual county 2013 National Agriculture Imagery Program (NAIP) file. The highlighted search area was reduced to 0.5 mile buffer of the project hydrological features. Per discussions with DEP, a new hatchery will not be allowed to discharge to Class A waters, watershed areas less than 10 square miles, and any tributary up to and including direct discharge to a GPA class water. Therefore, additional research was undertaken to determine more about the DEP's classified streams in Maine.

The Maine Legislature description of the DEP Water Classification system was found online (http://legislature.maine.gov/statutes/38/title38sec467.html). After some additional research, a map was observed on an internet search. HDR contacted DEP which was able to send them the entire DEP classification for the state. This process did delay the new maps being produced, but allowed for a much deeper understanding of the DEP classification system.

Using the new data from the DEP Classification system, Class A waters only were highlighted in red on the maps. Using the same original 63 map book and the new half-mile wide search area, a selection was created to identify those half mile search areas that were classified as Class A waters. Sites matching these two criteria were NOT considered further in determining the potential location(s) for the new facility.

- Much of the Saco River was classified as Class A waters.
- Androscoggin River appears to have most of the Class A waters near the upper reaches.
- Kennebec River middle stretch is Class A waters.
- Penobscot River does not have any stretches that are classified as Class A waters.

Screening Stage 3

Using the narrowed search results, the maps were further evaluated considering additional factors including proximity to major arterial roads and relatively flat topography. The next screening phase looked at eliminating areas that were part of a coastal bluff hazard area due to steep elevations. Any topography greater than 20% was assumed to increase construction costs due to additional earthwork for facility layout so those were also eliminated from the list of potential sites. Finally, areas that were within ¼ mile of access roads (primary or secondary class to support heavy hatchery trucks) were selected for further evaluation. Additional criteria to narrow sites included removing locations that:

- any portion that was classified as Class A was removed
- Any portion was had cliff hazard area was removed
- Any area not within ¼ mile of a highway was remove
- Any area that was part of conservation lands was removed
- Any area with land cover of developed, wetland or barren was removed
- Any area less than 20 acres was removed

A new mapbook was generated that eliminated sites related to the factors outlined above. The results of this narrowing were compiled into a Google Earth layer that was shared electronically with IF&W.

Screening Stage 4

A final exercise was to overlay the potential sites with readily available geologic features to determine the potential for groundwater sources. Ground water or a deep lake intake is necessary in order to support the production of brook trout at the requested sizes. Readily available date yielded the following results

- Data from the Maine Public Water Resources Information System (http://www.maine.gov/dep/gis/datamaps/DWP_Wells/) was utilized to identify areas of public wells and intakes that could be impacted by a large hatchery production well.
- Maine Geological Survey Detailed Surficial Geology Maps Digital Data and Significant Sand and Gravel Aquifer Maps (http://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-aq.htm) – Only two classifications were outlined in the readily available aquifer data that included
    - Surficial deposits with moderate to good potential ground-water yield; yields generally greater than 10 gallons per minute to a properly constructed well.
    - Surficial deposits with good to excellent potential ground-water yield; yields generally greater than 50 gallons per minute to a properly constructed well.

Unfortunately, the data provided for a well greater than 50 gpm is too limited to narrow down sites with respect to a large yielding groundwater resource using this data. For wells in the yield range required for flow through hatchery operations (i.e., greater than 1,000 gpm), more detailed sand and gravel investigations for thick (typically 100-200 feet) aquifers, ideally with a nearby source of recharge (river) would need to be investigated. This investigation would also review other groundwater users in the areas of potential wells, especially municipal wells.

Further groundwater screening is recommended. If a groundwater source is to be developed, a significant aquifer is needed. Such aquifers would be comprised of thick (on the order of 100-200 feet) sequences of sand and gravel, or bedrock that is permeable or well-fractured. The following steps should be completed in a further siting investigation to help determine if adequate groundwater resources are available in Maine.

- Publicly available geology and hydrogeology maps, datasets, and reports should be reviewed on a desktop level. This can provide the potential location of suitable aquifers.
- Locations and yields of water supply wells should be reviewed and mapped. The locations of public water supply wells should be called out, and the area within a 1-mile radius of the public well generally avoided. Disruption of small domestic well supplies should be avoided.
- The presence of high-yield wells can indicate a significant aquifer. Areas of heavy pumping should generally be avoided to eliminate well interference concerns.
- Property acquisition and easements may be required for siting a well field. Multiple high-capacity vertical wells would be required to develop a 5,000 gpm supply. The wells may require spacing on the order of hundreds of feet to accommodate intersecting cones of depression during pumping.
- Significant groundwater withdrawals are subject to permitting under the Natural Resources Protection Act. Copies of the permit application are sent to municipalities that use the same aquifer for their review and comment. Water use also must be reported to the Department of Environmental Protection.

Top Potential Sites

Using all the screening criteria outlined in the four different screening stages, the following sites were identified as the highest potential locations to site a new facility. Data produced through the screening effort has been shared with IF&W to use for further site evaluation. Examples of the map products utilized are included in **Appendix D**.

- Saco River
  - Section of river along Baldwin Township (Cumberland County) and Cornish Township (York County) along State Highway 25 (see page 66 in **Appendix D**)
  - Section along State Highway 11 in Cumberland and York Counties.
- Androscoggin River
  - Section of river between Interstate 95 to State Highway 125. The greatest area for review is before the intersection of State Highways 136 and 9 in Androscoggin County
  - Livermore Township in Androscoggin County
  - Segment from Peru to Canton Township, along State Highway 108 in Oxford County. The greatest concentration is within Peru Township.
  - Segment in Rumford Township, along US 2 in Oxford County (see page 39 in **Appendix D**)

  -

- Kennebec River
  - Segment in Starks and Norridgewock Townships, along US 201 in Somerset County
  - Segment in Skowhegan Township, along US 201 in Somerset County (see page 23 in **Appendix D**)
  - Segment in Benton Township, along US 201 in Somerset County
  - Small Sections within Winslow, Sidney, Vassalboro, Augusta, and Farmingdale Townships, along State Highway 104 and US 201 in Kennebec County.
- Penobscot River
  - Segment along Interstate 95 in Medway Township, Penobscot County
  - Mattawamkeag, Lincoln and Winn Townships, along US 2 in Penobscot County. The largest concentration of areas within Lincoln and Winn Townships.
  - Orono Township along State Highway 178 in Penobscot County
  - Brewer Township along State Highway 9 in Penobscot County
- Thompson Lake
  - In addition to the above sites, initial discussions with DEP have indicated favorable permit conditions for discharge into the outlet of Thompson Lake in Oxford, Maine.
  - Details surrounding the use of this location are included in the DEP response to IF&W located in **Appendix E**.

A further analysis of potential locations beyond this initial screening is needed . The areas need to be screened further with respect to high yielding groundwater potential as outlined in the previous section. Further screening work can be completed simultaneous to obtaining funding for the projects outlined in this report.

Due to the geography, topography, natural water bodies, and demographics of the state of Maine, the existing hatcheries have been located in the areas that provide both the necessary water supplies and are relatively close to where hatchery fish will be stocked. Most of these sites are supplied by surface water sources which feed the site by gravity. This same decision making process will be used in further siting evaluations to compare potential site locations. When narrowed down to a few choices, site visits will need to be undertaken to confirm viability and to assist in final site selection.

5.5 Overall Expansion Summary

The required water supply, land area, site location, fish genetics, climate, utilities and economic issues are major factors that influence the decision concerning a new hatchery. Factors that are generally considered to be benefits of a new large hatchery compared to renovating several smaller facilities include:

- Centralized multi-disciplined aquaculture staff (professional, technical, visitor interpreters, clerical and engineering/maintenance personnel).

- Reduced cost of operation due to more efficient use of staff for year-round operation. (Note: There is not necessarily a reduction in total hatchery system employee requirements.)
- Efficient hatchery administration and stocking coordination.
- “Scaling Factor” cost savings (i.e., one large feed freezer vs. three small, etc.).
- Improved, large-scale public visitation programs.
- Typically utilize state-of-the-art aquaculture technologies and entire facility is “new”, not a hybrid of old and new components.

Factors that are generally considered to be detriments of a new large hatchery include:

- Technologically more complex facilities requiring commensurate staff capabilities to operate.
- Difficult to deal with isolation of fish diseases and genetic strains.
- Stocking trip mileage is typically longer than for a distributed hatchery system.
- Expensive to construct with a long time frame (five years typical from the time funding is appropriated until the hatchery is operational).
- Significant land area and large volume water supply requirements.
- Utility extensions and site access development are significant construction costs.

A substantial time frame is required for new hatchery development and is estimated at two to six years depending upon the execution of detailed water studies, detailed site investigations, land appraisal and acquisition (if required), project funding, design and construction. Land acquisition drives the project length the most so siting a new facility on currently owned state land would be best.

6 Opinions of Probable Cost

6.1 Overview

This report section provides an explanation of cost estimating methodologies, assumptions, unit prices, descriptions, and contingency explanations. Total costs assume all work will be completed in three main projects (Casco SFH, Grand Lake Stream SFH, New SFH Facility). If any project is broken into phases, additional costs will be realized for both design and construction.

All costs are representative of January 2016 prices and must be escalated to the mid-construction dates that the particular project is constructed. An escalation factor of three percent to four percent per year is recommended. For example, a project estimated at $1,000,000 in 2016 that is not appropriated until 2017 and takes one year to construct (2018) would actually cost $1,081,600 ($1,000,000 x 1.04 x 1.04). All opinions of probable costs for the facility improvements are preliminary and will undergo revision as the designs progress.

6.2 Cost Summary

Sections 3 to 5 of the report contains detailed descriptions of all the major components required for the proposed water supply renovations at Casco SFH and Grand Lake Stream SFH as well as the proposed new facility. Intake Options and New Facility Component numbers match those already presented in the text and were illustrated on the Drawings.

Please note that for some components, several alternatives were reviewed for this report. Detailed Costs are provided in **Appendix B** for all major reviewed options and components. Only the recommended solutions were totaled and brought forward in the Summary total cost projections. Alternatives reviewed but not selected are provided for informational purposes. When moving forward with this project, IF&W might decide to select an item that wasn’t recommended by the consultant team so costs are provided to assist in making those decisions.

6.2.1 New Water Supply Intake Projects

The summary costs for the two water supply renovation projects at Casco SFH and Grand Lake Stream SFH are outlined below. Component numbers match those already presented in the text and were illustrated on the Drawings.

Table 6-1. Summary Costs for Water Supply Intake Projects

ITEM	I.D. #	ROUNDED CONSTRUCTION COST			
Location		Casco SFH	Casco SFH	GLS SFH	GLS SFH
		Option 1	Option 2	Option 1	Option 2
		Recommended			Recommended
Project Costs		**$943,000**	**$1,278,000**	**$4,047,000**	**$2,790,000**
Construction Operations Cost	1	$190,000	$237,000	$677,000	$465,000
Site Prep	2	$33,000	$28,000	$13,000	$13,000
Excavation Earthwork and Demolition	3	$93,000	$93,000	$223,000	$223,000
Pipe and Valving	4	$572,000	$865,000	$3,107,000	$2,062,000
Concrete	5	$3,000	$3,000	$3,000	$3,000
Miscellaneous Fabrications	6	$52,000	$52,000	$24,000	$24,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$142,000	$192,000	$608,000	$419,000
C. Construction Contingencies					
Construction Contingency	10%	$95,000	$128,000	$405,000	$279,000
Total Costs		**$1,180,000**	**$1,598,000**	**$5,060,000**	**$3,488,000**
Optional Costs		**$770,000**	**$770,000**	**$1,607,000**	**$1,607,000**
Optional Intake Screen	7	$21,000	$21,000	$21,000	$21,000
Optional Water Treatment Replacement	8	$749,000	$749,000	$749,000	$749,000
Optional Added Tanks	9	$0	$0	$837,000	$837,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$116,000	$116,000	$242,000	$242,000
C. Construction Contingencies					
Construction Contingency	10%	$77,000	$77,000	$161,000	$161,000
Total Optional Costs		**$963,000**	**$963,000**	**$2,010,000**	**$2,010,000**

Costs do **NOT** include: Design Reimbursables (Variable) or escalation beyond 2016 Construction.

The projected costs for the Casco SFH renovation project will be between **$0.9 million and $1.3 million** to construct. After the budgeting contingencies are added to the total, the **project budget** will need to be between **$1.2 million and $1.6 million**. The projected costs for the Grand Lake Stream SFH renovation project will be higher and between **$2.8 million and $4.0 million** to construct. After the budgeting contingencies are added to the total, the **project budget** will need to be between **$3.5 million and $5.0 million**. If further water quality and temperature analysis warrants moving the Grand Lake Stream intake closer to shore (~1,300 feet) pending further discussions with IF&W, approximately $275,000 can potentially saved. For Casco SFH, if the UV water supply treatment is replaced and microscreens are added, an additional **$1.0 million** would need to be budgeted ($0.8 million construction costs). Approximately half would need to be budgeted if only the UV units were replaced at Casco SFH. For Grand Lake Stream SFH, if the water supply treatment is replaced with new (both microscreens and UV equipment) and new tanks are added, an additional **$2.0 million** would need to be budgeted ($1.6 million construction costs). If work is completed at Enfield to convert the facility to a tank farm, costs will range from **$5-$7 million**.

These projects should move immediately into the design phase to allow this work to be completed as soon as funding is available. These projects will allow higher fish production levels due to better water supply temperatures.

6.2.2 New Facility(s)

For the new facility, costs were developed for the facility to meet the Tier 3 (39 percent) production level increase in pounds. From there, the costs were prorated and sized to match the remaining three tiers of production levels for comparison purposes.

Table 6-2. New Facility Cost Summary for each Tier

ITEM	I.D. #	ROUNDED CONSTRUCTION COST			
Location		**Tier 1 - 10%**	**Tier 2 - 25%**	**Tier 3 - 49%**	**Tier 4 - 124%**
Production Increases in Pounds		38,616	96,541	150,846	478,913
				IF&W Request	**Commission Rpt.**
New Facility Costs per Tier		**$8,716,000**	**$15,755,000**	**$22,302,000**	**$72,481,500**
Hatchery Supply and Treatment	A1	$1,138,000	$1,928,000	$2,420,000	$7,865,000
Oxygenation System	A2	$225,000	$353,000	$452,000	$1,469,000
Production Grow-Out Systems (Circular Units)	B1	$1,966,000	$4,793,000	$7,304,000	$23,738,000
Egg Incubation and Early Rearing	B2	$583,000	$1,429,000	$2,160,000	$7,020,000
Broodstock Facility	B3	$656,000	$1,556,000	$2,363,000	$7,679,750
Isolation/Quarantine Building	B4	$266,000	$664,000	$956,000	$3,107,000
Hatchery Building	C1	$205,000	$477,000	$720,000	$2,340,000
Vehicle/Chemical Storage Building	C2	$228,000	$456,000	$456,000	$1,482,000
Residences	C3	$594,000	$594,000	$594,000	$1,930,500
Land Acquisition and Site Work	D1	$676,000	$1,173,000	$1,610,000	$5,232,500
Paved Access to State or Local Highways	D2	$294,000	$79,000	$390,000	$1,267,500
Security Fence	D3	$36,000	$42,000	$48,000	$156,000
Domestic Water	D4	$30,000	$30,000	$30,000	$97,500
Domestic Wastewater	D5	$123,000	$123,000	$123,000	$399,750
Disinfection Station	D6	$32,000	$32,000	$32,000	$104,000
Effluent Treatment	E1	$1,020,000	$1,197,000	$1,534,000	$4,985,500
Effluent Monitoring	E2	$39,000	$39,000	$39,000	$126,750
Electrical Service	F1	$204,000	$258,000	$345,000	$1,121,250
Emergency Power	F2	$131,000	$172,000	$216,000	$702,000
Instrumentation and Alarm System	F3	$210,000	$300,000	$450,000	$1,462,500
Hatchery Building - Displays	G1	$60,000	$60,000	$60,000	$195,000
B. Engineering Fees					
Engineering Design/Construction Phase Services	15%	$1,308,000	$2,364,000	$3,346,000	$10,873,000
C. Construction Contingencies					
Construction Contingency	10%	$872,000	$1,576,000	$2,231,000	$7,249,000
Total Costs		**$10,896,000**	**$19,695,000**	**$27,879,000**	**$90,603,500**

Costs do **NOT** include: Design Reimbursables (Variable) or escalation beyond 2016 Construction.

The projected construction costs for the new facility will range between **$8.7 million and $72.5 million** depending on the selected tier of production. After the engineering and construction phase contingencies are added to the total, the **project budget** will need to be between **$10.9 and $90.6 million**. For purposes of this exercise, it was assumed that three of the Tier 3 facilities will be required to meet Tier 4 production levels. However, costs were generated by using a 3.25 factor to match the production level difference (i.e. Tier 4 production / Tier 3 production ~ 3.25). While larger facilities could be constructed than the Tier 3 model, it would be challenging to find enough water to construct a facility much larger than the generic Tier 3 model.

The Tier 3 facility is recommended to proceed to the next phase of design and construction. IF&W will need to budget **$27.9 million** to complete this project. Costs will vary depending on whether land needs to be purchased (assumed that 40 acres would be purchased at cost of ~$400,000). This option allows the IF&W goals to be achieved by increasing current level productions by about 150,000 pounds. As a long-term goal, at least two more facilities should be planned for future construction if the Commission Report goals are to be met.

6.3 Assumptions

6.3.1 Cost Basis

The purpose of the opinions of probable cost is to provide current information for project planning, phasing and budgeting. This Section provides opinions of probable cost information for the wide variety of items addressed in this Preliminary Engineering Report.

Sources

Unit prices were arrived at through the assistance of the various disciplines at HDR. Manufacturers and suppliers were consulted regarding major cost items. Building construction cost data files (such as Means Estimating Handbook, 2016) were also used. Since there is no direct control over the cost of labor and materials or competitive bidding, a guarantee of the accuracy of any statement of construction cost cannot be given.

Cost Factors and Assumptions

1. Quality of Materials: Prices used are in line with the quality required for U.S. Government and State of Maine specifications and represent low-maintenance construction.
2. Overtime: No additional allowance has been made for overtime work.
3. Material Quality: Prices are representative of large quantity purchases. If smaller quantities are determined, the cost per unit will increase.
4. Weather Conditions: Normal conditions are assumed. No consideration has been given to unusual extremes of weather. The normal outdoor construction season in Maine is estimated to be from April 1 to December 1, annually.
5. Labor: Workmanship of good quality and labor is assumed available in sufficient quantity.
6. Overhead and Profit: The unit prices include 20 percent for overhead and profit, unless noted otherwise.

7. Remoteness: An allowance has not been made for remoteness of the sites from major sources of supply and major construction contractors.
8. Mitigation: Any wetland mitigation work is not included in these cost projections.

Fish Hatchery Unit Cost Assumptions

More specific cost estimating will occur during the planning and design phase of the proposed renovation project. The main purpose of these cost projections is to provide ranges for funding requests and to budget for these major facility enhancements.

Actual capital costs at fish hatchery facilities currently under construction, as well as those at facilities recently constructed, were used as a basis for estimating the capital costs of improvements. A general unit value was assigned to each improvement item. For example, a unit cost was estimated for constructing an individual standard raceway, or a square foot of incubation building space or storage space. The unit cost was then multiplied by the number of such items planned at the fish hatchery. This approach to construction cost estimating is only appropriate in situations where a broad survey of numerous similar project costs are being made and where the projects themselves have not advanced beyond the stage of conceptual design. In actuality, the unit construction cost per raceway or per square foot of building space may vary a great deal depending upon, among other things, the scale of construction and the particular conditions at individual project sites. Costs outlined in this report are those estimated as performed by an outside contractor hired by IF&W. In-house construction may cost less, but cannot be estimated since we are not aware of the capabilities or availability of in-house crews.

6.3.2 Contingency Allowance

Any construction project can have certain unpredictable expenses, including both minor and major changes in preliminary and final design, estimating errors, rapid price changes for various components, labor shortages or strikes affecting both productivity and schedules, and overlooked items. To cover the cost of these unpredictable expenses, an allowance for various contingencies must be included in the total project cost at all levels of preliminary estimating. The contingency is designed to reduce project risk and should be large enough to cover all unforeseen and unpredictable events, conditions and occurrences between preliminary and final design. The contingency will vary according to the type of project, complexity of design, and geographical location. This allowance can be reduced as the design progresses from concept through final working documents, but some of the contingencies must remain throughout the life of the project.

The following recommended contingency allowances and the usual allocation for each is summarized below.

- Estimating Contingency – 15 percent (included)
- General Conditions Contingency – 5 percent (included)
- Escalation Contingency – 4 percent per year (not included)
- State Construction Contingency – 10 percent (included)
- Planning and Design Engineering Contingency – 8 percent (included)
- Design Reimbursable Costs – Variable (not included)

- Construction Engineering Contingency – 7 percent (included)
- State Agency Contingency – Generally 1 percent to 5 percent (not included)

Each contingency is described in detail in the following paragraphs. In general, the construction total, Estimating Contingency, General Conditions Contingency and Escalation is subtotaled and the other contingencies are then calculated and added. For example, if a project occurs three years (four percent escalation/year) after the completion of this study:

Example:	
Construction Total = $25,000	
Estimating Contingency (10 percent of Construction Total)	= $2,500
General Conditions Contingency (5 percent of the Construction Total)	= $1,250
Escalation Contingency (12 percent of Construction Total)	= $3,000
Subtotal	= $31,750
State Construction Contingency (10 percent of Subtotal)	=$3,175
Planning and Design Engineering Contingency (8 percent of Subtotal)	=$2,540
Construction Engineering Contingency (7 percent of Subtotal)	= $2,222
Total Cost	= $39,687
State Agency Contingency (4 percent of Total Cost)	= $1,587
Final Cost	**= $41,275**
Total Contingency: 59.9 percent = *[Total * (1.1+0.05+0.12) * (1.1+0.08+0.07)* (1.04)]*	

The summarized opinions of probable cost in this report include the Estimating, General Conditions, State Construction, Planning and Design Engineering and Construction Engineering contingencies for a total contingency of 50 percent.

Total * (1.15 Estimating + 0.05 General Conditions) * (1.10 Const. Cont. + 0.08 Design Eng. + 0.07 Const. Eng.) = Total * 1.2 * 1.25

In the Detailed Opinions of Cost, the costs are calculated by taking the number of units by cost per unit. This total is multiplied by the estimating contingency (15 percent) and general conditions contingency (5 percent). This value is shown in the fifth column of the spreadsheet and titled **Subtotal + 20 percent Est**. This value is generally considered the **cost to construct**. The next column takes the previous subtotal and multiplies it by 1.25 to include the Design and Construction Contingencies. This column is entitled **Total Cost + 25 percent Cont** and is generally considered to be the **cost needed to budget** for the project.

6.3.3 Overview of Included Contingencies

Estimating Contingency (Included)

Based on HDR's past experience, a minimum preliminary cost estimate contingency, or Estimating Contingency, applicable for this phase of the project is 15 percent and must be added to all of the opinions of probable costs. As final design is completed and more definitive costs are developed, this estimating contingency is no longer required. This contingency has been included in the probable costs presented in this report.

General Conditions Contingency (Included)

The General Contractor will include General Conditions in his/her bid for the project. General Conditions include erosion control, general sitework, mobilization to the site, storage of materials, bonds and insurance, construction trailer, temporary utilities, etc. These kinds of costs are generally not included in their materials or labor costs. Therefore, this contingency is added to the project to ensure adequate funding is acquired. This contingency at five percent has been included in the probable costs presented

Construction Contingency (Included)

All project construction costs should provide adequate contingency funding prior to bidding so that the project may still be awarded if contractor's bids come in slightly higher than the designer's estimate. In addition, a contingency fund should be available during construction to provide for change orders required during actual construction. These types of change orders are typically for additional costs to the contractor due to unforeseen and unanticipated field conditions. Some changes occur as a result of Owner-requested items. In general, a bidding and change order contingency of 10 percent is added to the final opinions of probable cost. The State will need to provide the proper State Construction Contingency during the engineering phase. For example, Pennsylvania and Texas typically utilize 15 percent and 5 percent, respectively for large-scale capital projects. Approximately half of this contingency is for the bidding process and the other half is available throughout construction. This entire contingency is required throughout the design process. This contingency has been assumed at 10 percent in the estimates presented in this report.

Planning and Design Contingency (Included)

The design fee for the work will be negotiated and analyzed at the time that a definitive scope of services is developed. For planning and budgeting purposes, a design budget of approximately eight percent of the construction budget is included in this report. The design fee does not include the cost of reimbursable items (see the discussion later in this section about design reimbursables).

Construction Engineering Contingency (Included)

The Construction Engineering Contingency includes construction observation, testing and construction engineering services. In general, a seven percent additional fee is added to the planning estimates to cover the cost of these services. Construction observation may be intermittent (one or two days per month) to full-time depending upon the requirements of the administering agencies involved. On larger projects, it is strongly recommended that full-time engineering and inspection personnel be available to observe all construction. These personnel may either be IF&W employees or representatives of the design-engineering firm or a combination of both. A combination of IF&W and design consultant provided inspection phase services is suggested. In addition, the design engineer provides construction observation during monthly site meetings. The 7 percent construction-engineering contingency has been added to the probable costs presented in this report.

6.3.4 Overview of Excluded Contingencies

Escalation Contingency (Not Included)

Due to State budgeting time requirements, construction may not occur until future years. Generally funds are requested years before construction will begin. Therefore, a cost escalation contingency of 4 percent per year is required to adequately address the effects of inflation. The cost escalation factor has not been included in the costs presented in this report so all costs represent 2016 prices.

Design Reimbursable Costs (Not Included)

Design reimbursable costs include aerial photography, topographic mapping and surveying; travel compensation; geotechnical soils investigation and engineering report; permit preparation and applications; archaeological investigation (if required); construction document printing; and/or start-up phase services. Each of these reimbursable items is discussed in more detail below. Not every facility will require completion of all of the reimbursable items listed in order to proceed to design. However, the items are mentioned in order to illustrate all that could be involved in a large-scale design project. Due to the variable costs associated with design reimbursables, contingencies for reimbursables have not been allocated in this study.

Aerial Photography & Topographic Mapping (Not Included)

Land surveying is required to obtain topographic information for the proposed pipeline replacement projects. For large projects such as a new facility, aerial photography and topographic mapping should be completed. In general, surveying work may be contracted and executed directly with a surveying or aerial services company prior to the selection of a design consultant. This work is normally completed between mid-November and mid-April to avoid vegetation and foliage interference. Topographic data will be in readable CADD format for direct use in drawings and for engineering design.

Geotechnical, Structural and Groundwater Investigations (Not Included)

It is recommended that a complete soils and geotechnical investigation report be completed for sites whenever new buildings and major structures are being constructed. Groundwater investigations will be required at locations where new wells or spring work is proposed.

Permitting & Agency Coordination (Not Included)

The permit application and coordination process for projects of this size and magnitude have the potential to be very involved and time-consuming. Water withdrawal and Lake Authority Approval, Wetlands, Corps of Engineers Section 404, construction, NPDES effluent and Public Health permits may be required. There may also be a substantial amount of time required for environmental impact coordination if required. Land use and electrical power agreements with the local utility companies may also need modification.

Archaeological Investigations (Not Included)

Archaeological investigations may have to be completed in conjunction with design of the proposed projects. If required, these investigations should be handled directly by IF&W and staff specialists working with the state historical society.

Printing (Not Included)

Construction document printing costs consist of providing and sending plans and specifications to all interested contractors, subcontractors, suppliers, plan houses, permitting agencies and other interested parties. It is estimated that through all phases of the construction work, from 10 sets to 60 sets of documents will be printed and distributed for each improvement project depending upon complexity and size. Printing may be handled by IF&W, but usually requires project funds to execute.

Start-Up & System Testing (Not Included)

Start-up phase services are especially important for a hatchery project involving a new building, a large scale renovation or complex electrical/mechanical systems that require testing and Owner training to operate. This start-up phase service is provided by the design consultant who coordinates individual component start-up with the contractors and suppliers. System shakedown procedures are reviewed when the fish hatchery is run for two to five days within the full production design parameters of the facility. This testing also provides the fish hatchery operating personnel with component training and system capability reviews. The start-up service would be during the late stages of construction and immediately after final construction acceptance, but prior to active fish hatchery operation.

State Agency Contingency (Not Included)

Each client has specific contingencies that are added to the project total after all other contingencies have been accounted. This contingency has not been included in the probable costs presented in this report.

6.3.5 Itemized Costs Key

The summarized probable construction costs for the project are located in at the end of this section. Some of the abbreviations found on these sheets include:

AC	Acre	LS	Lump Sum	SF	Square Feet
CF	Cubic Feet	LF	Linear Feet	SY	Square Yards
CY	Cubic Yards	MI	Miles	T	Tons
EA	Each	PKG	Package		

7 Design Criteria

General design assumptions are outlined throughout this section and were used to assist in generating opinions of probable cost. The basis of design is outlined so that the reader will have an idea about the design features of the proposed construction. The criteria and assumptions will be updated throughout the life of the project both as the design develops and input from regulatory and other decisions makers is provided.

7.1 General Code Information

For all new or renovation work, the design and construction will need to adhere to Maine's construction codes as outlined by the Bureau of Building Codes and Standards.

The Maine Uniform Building and Energy Code (MUBEC) consists of the following codes:

- 2009 International Residential Code (IRC)
- 2009 International Building Code (IBC)
- 2009 International Existing Building Code (IEBC)
- 2009 International Energy Conservation Code (IECC)

The following STANDARDS are also adopted as part of the MUBEC, but are not mandatory:

- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards:

  62.1 - 2007 (Ventilation for Acceptable Indoor Air Quality)

  62.2 - 2007 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings)

  90.1 - 2007 (Energy Standard for Buildings except Low-Rise Residential Buildings) editions without addenda.

- E-1465-2006, Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings.

(http://www.maine.gov/dps/bbcs/)

7.2 Architectural

Buildings

A pre-engineered metal building system is proposed for the buildings. The structure will utilize hot dip galvanized and/or painted steel primary and secondary structural frame members. The sides of the building will consist of non-insulated half-height pre-finished metal wall panels. The roof system will be constructed of either foamed-in-place, pre-finished factory insulated standing seam metal roof panels or a field fabricated standing seam metal roof placed over rigid insulation and a galvanized steel liner panel.

For the main production building, the lower section of the exterior walls will be cast-in-place reinforced concrete approximately 3′ tall to 6″ tall. The area above the concrete wall and below the metal building panels will be enclosed with either chain link fence or predator control fabric. Other buildings will utilize insulated pre-finished metal wall panels. Interior wall finishes and treatment colors shall be coordinated with the Owner. Pre-engineered insulated foam core wall panels with 20-year fluoropolymer paint will be used. Interior masonry walls will be painted with an epoxy-based paint.

All building trim and accessories shall be per the pre-engineered metal building manufacturer's recommendation. The color selection for the insulated metal wall and roof panels shall be based on the standard colors offered by the manufacturer and selected by the Owner. All other features including overhead doors, personnel doors, windows, vents, louvers and bollards shall be coordinated with the selected colors of the building components.

Production Units

Raceways, if used, shall be constructed of cast-in-place reinforced concrete with a 28-day compressive strength of 4,500 pounds per square inch (psi). The interior surface of the raceway walls will be finished to be smooth and free of abrasion. Waterstops will be used at all intersecting wall and floor joints and at all construction, contraction and expansion joints. Embedded inserts will be used for baffle and screen guides. Concrete slab-on-grade floors will be used in the remainder of the buildings.

Circular rearing tanks can be constructed using concrete, fiberglass or steel for the wall construction. Smaller tanks are generally fiberglass and the larger ones can be either concrete or steel walls with concrete floors depending on the User's preference.

Production Areas

It is proposed that the interior walls of the hatchery building production areas be finished with fiberglass-reinforced wall panels. Joints shall be sealed and waterproofed. Floors will be reinforced concrete slab-on-grade with sealer applied. Floors will include non-slip finish with floor trench drains as required. The underside of the roof panels will be exposed with the building primary and secondary structural members painted.

Office Space

Office space will be constructed of steel studs covered with drywall and painted. A suspended metal channel lay-in-tile system would make up the ceiling. Floors will be vinyl composite tile (VCT) with colors selected by the Owner. Vinyl baseboard would finish off the base of the walls and painted trim will be used around windows and doors.

Storage, Mechanical and Electrical Equipment Rooms

Storage rooms and mechanical and electrical equipment rooms located within the hatchery buildings will have walls constructed of concrete masonry units (CMU). The walls will be painted. The use of CMU as a wall material allows equipment to be conveniently mounted to the walls. The ceilings of the rooms would be constructed of pre-cast pre-stressed concrete hollow core planks bearing upon the CMU walls. The area above these rooms may be used for lightweight storage.

Laboratory Rooms

Laboratory rooms will be constructed of steel studs covered with drywall and painted. A suspended metal channel lay-in-tile system will make up the ceiling. Floors will be VCT. Vinyl baseboard would finish off the base of the walls and painted trim will be used around windows and doors. Wall and base cabinets will be provided with laboratory grade laminate countertops.

7.3 Structural

Design Loads

(Note: all values to be verified during actual design for each specific location)

- Seismic: Design Category (to be determined), Soil Site Class D (assumed)

  Acceleration S_S=27 percent Gravity

  S_1=8 percent Gravity

- Wind: 90-mile per hour (MPH) basic wind speed (3-second gust), exposure classification C, and importance factor 1.0.
- Ground Snow Load: 50 lbs to 60 lbs per square foot ground snow loads (50-year mean recurrence).
- Soils: To be determined by Geotechnical Program during Final Design Phase
- Groundwater Elevation: To be determined by Geotechnical Program during Final Design Phase

Miscellaneous Criteria

- Footing Depth: To be determined after Geotechnical Report. Extreme frost penetration is 48″ to 86" according to U.S. Weather Bureau data.
- Allowable Soil Bearing Pressure: To be determined by Geotechnical Program during Final Design Phase

7.4 Mechanical

Design Data and Requirements

Outdoor Temperature

Temperature	Dry Bulb ºF	Wet Bulb ºF
Summer	92	75
Winter	-15	na

(Based on ASHRAE data for 99 percent extremes (average) and to be updated with respect to actual project location)

Indoor Temperature

Building	Winter °F	Summer °F
Office Area	70	76
Production, Incubation, Broodstock Rooms	55	ambient
HVAC and Electrical Room	55	ambient

Ventilation Requirements

Room Use	Air Change/hr	Outside Air CFM/unit
Toilets	-	50 per water closet or urinal
Storage Areas	4	0.05/SF Min
Mechanical Room	4	0.05/SF Min
Production, Incubation, Broodstock Rooms	8	20.0/Person Min
Office Area	8	20.0/Person Min

Space Heating and Cooling System

An area comprised of several offices, crew room, locker rooms, etc. is generally served by a central gas-fired furnace ducted to ceiling diffusers. Either propane or natural gas can be used as the fuel source for the heating systems and will vary depending on the location. Central air conditioning is also common. The conceptual Coldwater Hatchery Building has this type of area.

Where only a few rooms require comfort heating, such as the Crew Room and Lab of the conceptual Cool/Warmwater Hatchery Building, gas-fired room wall heaters or electric wall heaters are available. If cooling is also desired, electric packaged-terminal-air-conditioners are common.

Fish production areas, broodstock holding rooms, incubation areas, shops, etc. are typically only heated using gas fired unit heaters. Hydronic unit heaters, electric unit heaters, furnaces and gas-fired infrared are also applicable.

Cool feed storage areas will be served by commercial air-cooled refrigeration compressors and fan coils. These rooms, as well as rooms strictly for electrical equipment, water treatment equipment or general storage, will normally have unit heaters to keep them above freezing.

Laboratories often warrant fume hoods and self-contained heating and cooling systems capable of conditioning large percentages of fresh air. Gas heaters must employ sealed combustion. Air-to-air heat exchangers can be included to offset the high operating costs of conditioning outside air.

Ventilating System

Ventilation for acceptable indoor air quality in offices, labs, crew rooms, etc. is typically designed into the heating and cooling systems. Toilet and locker rooms will have exhaust fans, as will labs if they are not equipped with fume hoods.

Rooms strictly for electrical equipment, water heating equipment, compressors or other motor-driven machines usually require exhaust fans with interlocked intake dampers to remove machine-generated heat. Exhaust fans with interlocked dampers are also common in rooms for production, broodstock, incubation, etc. Ceiling paddle fans are frequently included in these rooms for personnel comfort and ceiling heat recovery.

7.5 Process Piping and Plumbing

Domestic Water Source

The conceptual Coldwater Hatchery Building and the conceptual Cool/Warmwater Hatchery Building will need domestic water. Small wells with hydropneumatic control systems are required.

Domestic Sewage

Domestic sewage shall be treated in a conventional septic tank / leach field system provided that the soil percolation rates are adequate. A sanitary sewer line from the new buildings will connect via gravity flow to the proposed treatment system. Sizing and percolation requirements must be determined in the final design phase.

Fire Protection

Fire protection system will be provided via fire extinguishers in the buildings. Facilities predominantly for fish production or water treatment typically do not require fire sprinklers. Due to the remote location of the buildings and lack of utility water, little fire protection water will be available. Dry hydrants could be installed at various ponds to provide water source for fire truck with on-board pumps.

Piping and Valve Specifications

Pressure Pipe (Water)

Pressure pipe for the main raw supply line will be cement lined ductile iron, pressure rate PVC or HDPE. Process water supply piping in buildings generally will be Schedule 40 or 80 PVC with a combination of flanged and solvent welded assembly. Flanged PVC is suggested at aquaculture water treatment components to allow modular assembly and reconfiguration. HDPE requirements and fittings were described further in **Sections 3 and 4**.

Pressure pipe for yard piping and pond distribution shall be water main quality PVC, steel, or ductile iron. Galvanized coatings, zinc, copper, brass, and cadmium can be toxic to fish in certain concentrations and will be avoided when in contact with process water.

Process Wastewater & Drain Pipe

Gravity wastewater or drain pipe for process water and pond drainage will be PVC. PVC gravity drain pipe will be DR 35 for sizes to 15" conforming to American Society for Testing and Materials (ASTM) D 3034. PVC gravity drain pipe 18" through 24" shall conform to ASTM F 679. Joints shall be rubber O-ring. Gravity drains 30" and above shall be corrugated polyethylene with a smooth interior wall and watertight joints. Special bedding requirements will be provided for non-rigid pipe. DI pipe will be backfilled with native trench material. Chemical recovery piping shall be polypropylene.

Oxygen Piping

Oxygen piping, if used, will be Type L copper for interior applications. Underground oxygen piping will be Type K copper. Outdoor piping above ground will be Type L copper. Oxygen valves will be brass, cleaned and rated for oxygen service.

Valves

Process water isolation and control valves shall be butterfly valves generally conforming to American Water Works Association (AWWA) 504. Buried butterfly valves shall be extended bonnet with manual gear operators, hand crank (or wheel), and will have valve position indicators. Control valves less than 3″ dia. will be true union ball valves or plug valves of PVC composition.

Air and vacuum release valves shall be heavy-duty combination air/vacuum release units with cast iron body and cover and equipped with stainless steel float.

For drain line or isolation valve applications where sediment is likely to cause operational problems for butterfly valves, plug valves with extended bonnets will be utilized.

Domestic Water and Waste

Domestic water piping shall be copper or SCH 80 PVC. Copper pipe shall be Type L; and soldered with 95/5 tin/silver or tin/antimony solder.

Domestic wastewater piping less than 4” dia. shall be bell-and-spigot cast iron below grade or no-hub cast iron above ground. Above grade, PVC-DWV will be utilized. Buried piping larger than 4” dia. will be PVC where code allows.

Oxygen System

An outdoor bulk liquid oxygen tank will supply oxygen. This project will provide all interconnecting piping and oxygen flow measurement necessary to deliver oxygen to the new building systems.

Low Pressure Air System

Low pressure air will be provided via centrifugal or regenerative low pressure air blowers. Two (five horse power [hp] initial size) blowers will serve the Broodstock Building for airlift purposes. The airlift will allow the broodstock system to utilize less first use water flow but still maintain velocities appropriate for adult fish in a raceway environment. The airlift recirculates water from the tail end of each broodstock raceway, blends it with first use water and treats with oxygen so that recirculated flow remains within each specific broodstock raceway.

7.6 Electrical

Power Distribution

A new separately metered three-phase electric service is proposed. If available, existing overhead three-phase utility primary lines will be extended to the new building locations. A new utility transformer is to be provided at the building supplying 277/480 V, three-phase power. All new loads are to be fed from this new service. Major loads shall be supplied with 480 V power; step down transformers will be provided to supply 120/280 V, three-phase power for lighting receptacles and smaller loads.

An emergency generator will be provided to supply back-up power to all loads on the new service. A single automatic transfer switch will start the generator during a power outage and transfer the loads automatically to the generator and back to normal once power is restored. Within the control package provided will be an automatic exerciser that will start the generator on a regular basis to ensure reliability. The transfer switch will monitor line-to-line voltage with drop out at 80 percent and pick-up at 90 percent nominal voltage. Transfer from normal will be within 10 seconds and transfer back to normal will be time delayed selectable from 0 minutes to 30 minutes. An unloaded engine cool down period of five minutes will be provided. Pilot lights will be provided to indicate the position of the transfer switch.

An aboveground fuel storage tank will be provided for the generator that will be sized for a three-day supply. A double walled fuel tank mounted inside the generator enclosure is proposed.

Lighting Systems

Building interior lighting systems vary depending upon the space. Offices, crew areas, and toilets will be illuminated with sealed, flush-door fluorescent troffer type fixtures. Fish production and broodstock rooms will be primary illuminated with waterproof, tempered glass pendant type metal halide fixtures switched via astronomic program time clocks to stimulate daylight hours. Additional waterproof fluorescent fixtures on switches will be provided in the production and broodstock spaces to provide minimal, instant on lighting for these spaces for use when the primary lighting is off. Storage, mechanical, and electrical spaces will be illuminated with Industrial fluorescent fixtures.

Lighting Design Levels will be as follows:

Labs	50 Foot-candle (FC) min.
Offices	30 FC min.
Crew Areas, Corridors	20 FC
Toilets, Mech., Elect., and Storage Rooms	10 FC

Production/Broodstock Rooms:

Daylight Stimulation:	20 FC
Supplemental Lighting:	10 FC

Communications Systems

A new telephone service will be provided for the facility. A conduit will be provided from the building to the existing telephone service. The telephone service cable is to be provided by the telephone company. The telephone network interface will be provided on the telephone terminal board (TTB); all connections and wiring on TTB and beyond will be part of the project.

Telephone outlets will be provided in the offices, crew and animal culture areas as required by the Owner. Each outlet will be fed from by a three-forth inch conduit drop from a central communications system cable tray across the center of the building. All telephone cable and outlets are to be provided in project. Telephone instruments to be provided by the Owner per telecommunications policy. A category five enhanced, computer network wiring system will also be provided. Along with telephone, data outlets will be provided in the office and animal culture areas. All network wiring will be brought back to the telephone terminal board.

Process Alarm

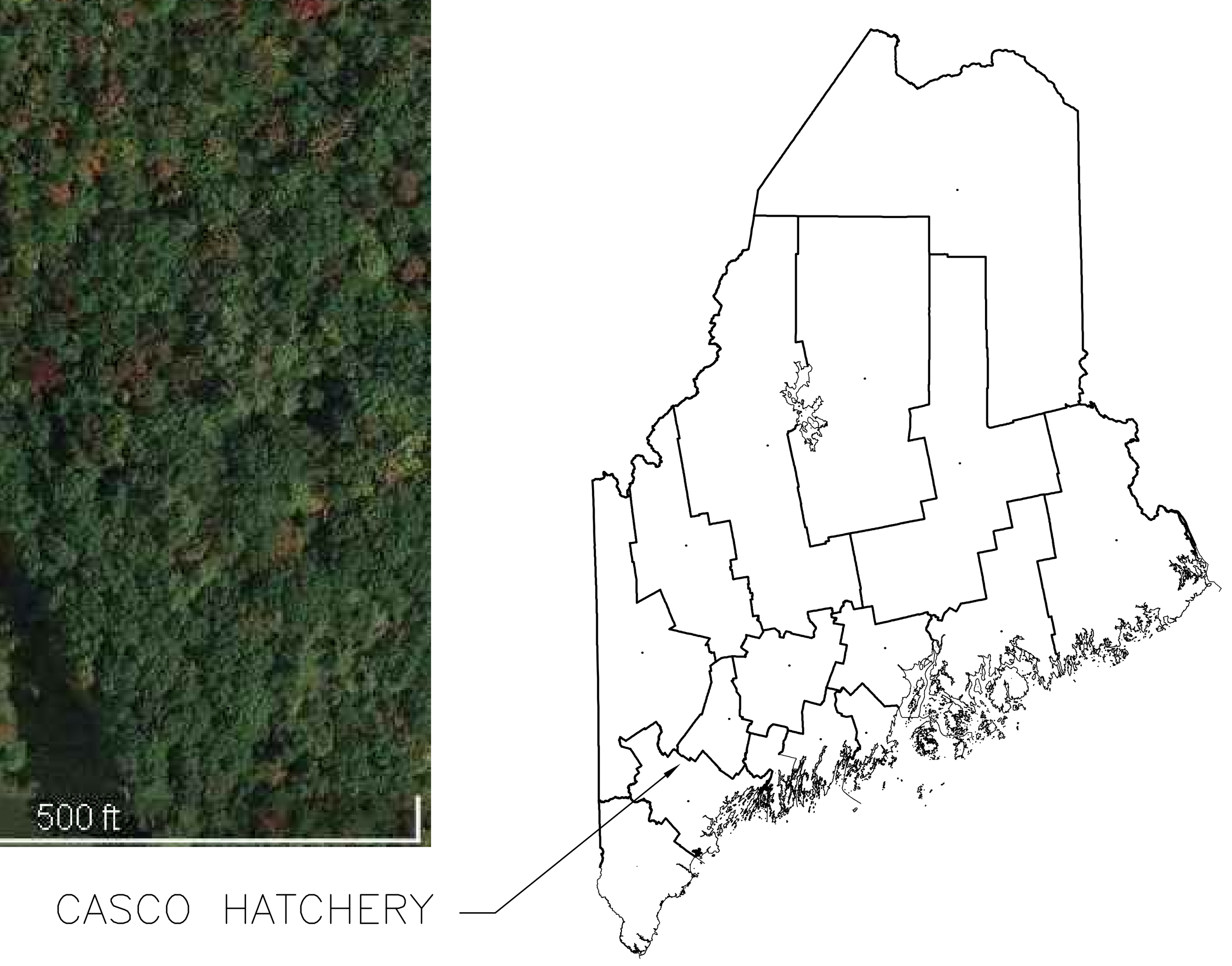
A PLC-based alarm system with a control panel located in the office and monitoring devices throughout the facility is proposed. The alarm panel would consist of the PLC, a color, flat-display, touch-screen interface panel, alarm chime, and acknowledge and reset push buttons, all housed in a wall mounted cabinet. OPTO-22 is a relatively low cost, high performance system that would provide simple, modular instrumentation and alarm capability to the new facility.

Monitoring devices would consist of flow meters, level sensors, temperature sensors, and DO meters. Most outputs from these devices will be a discrete setpoint that sounds an alarm when exceeded. DO outputs shall be analog with the setpoints adjustable on the alarm panel.

APPENDIX

A

Drawings



0 100' 200' 300'

ISSUE	DATE	DESCRIPTION
2	1/29/16	FINAL SUBMITTAL
1	1/11/16	DRAFT SUBMITTAL

PROJECT MANAGER TERRA L. MCPARLAND

PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND
FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

AERIAL PHOTOGRAPH & LOCATION MAP
CASCO STATE FISH HATCHERY

0 1" 2"

FILENAME C1.DWG

SCALE AS NOTED

SHEET C1

ISSUE	DATE	DESCRIPTION
2	1/29/16	FINAL SUBMITTAL
1	1/11/16	DRAFT SUBMITTAL

PROJECT MANAGER TERRA L. MCPARLAND

PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

EXISTING SITE PLAN
CASCO STATE FISH HATCHERY

FILENAME C2.DWG

SCALE AS NOTED

SHEET C2

FEMA FLOOD INSURANCE RATE MAP
COMMUNITY PANEL NUMBER 230044 0010 B
MAY 5, 1981 PANEL 10 OF 30
TOWNSHIP OF CASCO, MAINE CUMBERLAND COUNTY

ZONE A — AREAS OF 100-YEAR FLOOD; BASE FLOOD ELEVATIONS AND FLOOD HAZARD FACTORS NOT DETERMINED.

ISSUE	DATE	DESCRIPTION
2	1/29/2016	FINAL SUBMITTAL
1	1/11/2016	DRAFT SUBMITTAL

PROJECT MANAGER TERRA L. MCPARLAND
PROJECT NUMBER 270180

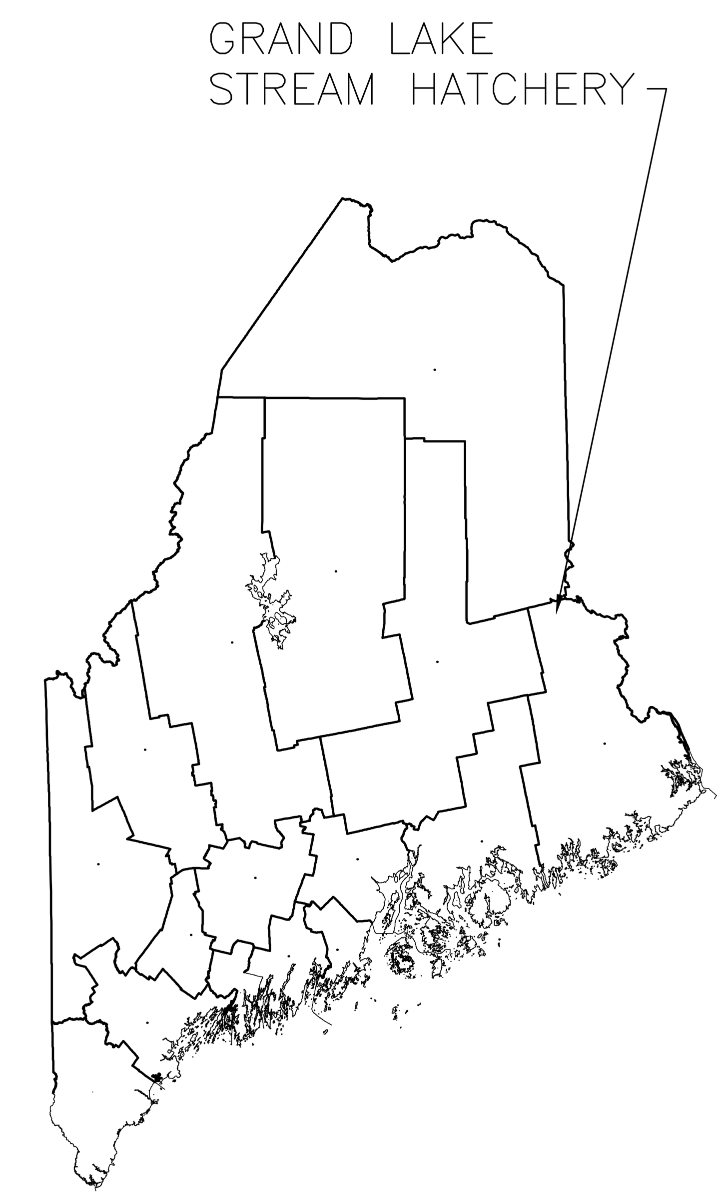
STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

CASCO STATE FISH HATCHERY

FILENAME C3.DWG
SCALE AS NOTED
SHEET C3

0 100' 200' 300'



		PROJECT MANAGER	TERRA L. MCPARLAND
2	1/29/2016	FINAL SUBMITTAL	
1	1/11/2016	DRAFT SUBMITTAL	
ISSUE	DATE	DESCRIPTION	PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND
FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

AERIAL PHOTOGRAPH & LOCATION MAP
GRAND LAKE STREAM STATE FISH HATCHERY

0 1" 2"

FILENAME G1.DWG

SCALE AS NOTED

SHEET G1

		PROJECT MANAGER	TERRA L. MCPARLAND
2	1/29/2016	FINAL SUBMITTAL	
1	1/11/2016	DRAFT SUBMITTAL	
ISSUE	DATE	DESCRIPTION	PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

EXISTING SITE PLAN
GRAND LAKE STREAM STATE FISH HATCHERY

0 1" 2"

FILENAME G2.DWG

SCALE AS NOTED

SHEET G2

FEMA FLOOD INSURANCE RATE MAP
COMMUNITY PANEL NUMBER 230469 A
AUGUST 5, 1985 PANEL 4 OF 4
TOWNSHIP OF GRAND LAKE STREAM, MAINE
WASHINGTON COUNTY

ZONE C – AREAS OUTSIDE 500–YEAR FLOOD

HDR

ISSUE	DATE	DESCRIPTION
2	1/29/2016	FINAL SUBMITTAL
1	1/11/2016	DRAFT SUBMITTAL

PROJECT MANAGER TERRA L. MCPARLAND
PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND
FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

FLOOD PLAIN MAP
GRAND LAKE STREAM STATE FISH HATCHERY

FILENAME G3.DWG
SCALE AS NOTED
SHEET G3

ISSUE	DATE	DESCRIPTION
2	1/29/2016	FINAL SUBMITTAL
1	1/11/2016	DRAFT SUBMITTAL

PROJECT MANAGER TERRA L. MCPARLAND

PROJECT NUMBER 270180

STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

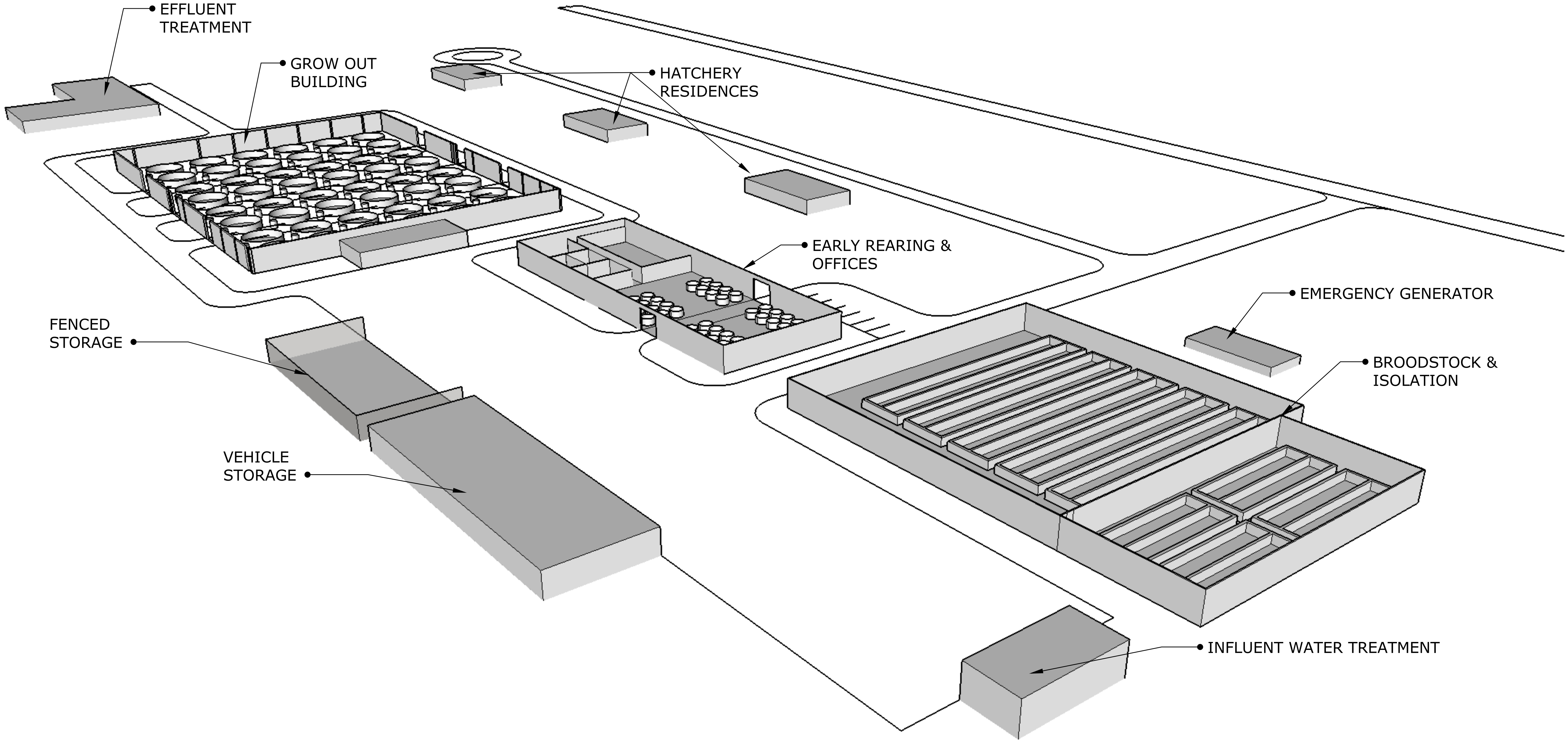
FISH HATCHERIES ENGINEERING STUDIES

GENERAL FACILITY SITE PLAN
GENERIC SITE

FILENAME N1.DWG

SCALE AS NOTED

SHEET **N1**



HDR

STATE OF MAINE
DEPARTMENT OF INLAND
FISHERIES AND WILDLIFE

FISH HATCHERIES ENGINEERING STUDIES

3D NEW FACILITY CONCEPT

SCALE NO SCALE

SHEET N2

APPENDIX

B

Detailed Opinions of Probable Cost

Tier 1 - New Facility Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost		**$8,716,000**	**$10,895,000**
New Facility Features			
Hatchery Supply and Treatment	A1	$1,138,000	$1,423,000
Oxygenation System	A2	$225,000	$281,000
Production Grow-Out Systems (Circular Units)	B1	$1,966,000	$2,457,000
Egg Incubation and Early Rearing	B2	$583,000	$728,000
Broodstock Facility	B3	$656,000	$820,000
Isolation/Quarantine Building	B4	$266,000	$332,000
Hatchery Building	C1	$205,000	$257,000
Vehicle/Chemical Storage Building	C2	$228,000	$285,000
Residences	C3	$594,000	$743,000
Land Acquisition and Site Work	D1	$676,000	$845,000
Paved Access to State or Local Highways	D2	$294,000	$368,000
Security Fence	D3	$36,000	$45,000
Domestic Water	D4	$30,000	$38,000
Domestic Wastewater	D5	$123,000	$154,000
Disinfection Station	D6	$32,000	$40,000
Effluent Treatment	E1	$1,020,000	$1,274,000
Effluent Monitoring	E2	$39,000	$48,000
Electrical Service	F1	$204,000	$255,000
Emergency Power	F2	$131,000	$164,000
Instrumentation and Alarm System	F3	$210,000	$263,000
Hatchery Building - Displays	G1	$60,000	$75,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 6 for further discussion and recommendations regarding contingencies.

HDR

Project: Maine Hatchery Studies
Phase: PER **Hatchery:** New Facility - Tier 1
By: Team **Date:** 1/25/2016

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.

See Report for detailed explanation of fees & contingencies

A.	**Aquaculture Water Supply**					
A1	**Hatchery Supply and Treatment**				**$1,137,900**	**$1,422,375**
	Well Supply			*Subtotal*	*$504,000*	*$630,000*
	Well Water Supply System, 2,000 gpm (1 wells/ 1 back up)	2	EA	$100,000.00	$240,000	$300,000
	Well Water Supply System, 500 gpm	1	EA	$65,000.00	$78,000	$97,500
	Hydrogeological Testing Program & Report	1	LS	$55,000.00	$66,000	$82,500
	Water Supply System Piping and Accessories	1	LS	$100,000.00	$120,000	$150,000
	Intake Structure and Screen			*Subtotal*	*$0*	*$0*
	New Intake Structure	0	EA	$400,000.00	$0	$0
	Intake Screen	0	LS	$100,000.00	$0	$0
	Water Supply Piping and Accessories	0	LF	$85.00	$0	$0
	Drumfilter			*Subtotal*	*$303,600*	*$379,500*
	Sump and Foundation	175	SF	$85.00	$17,850	$22,313
	Building	175	SF	$175.00	$36,750	$45,938
	Drum Microscreen	2	EA	$60,000.00	$144,000	$180,000
	Plumbing	1	LS	$35,000.00	$42,000	$52,500
	Electrical	1	LS	$20,000.00	$24,000	$30,000
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV System			*Subtotal*	*$228,300*	*$285,375*
	UV Channel and Lamp Package	2	PK	$65,000.00	$156,000	$195,000
	UV Building/Found	275	SF	$150.00	$49,500	$61,875
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$11,000.00	$13,200	$16,500
	Aeration/Degassing System			*Subtotal*	*$102,000*	*$127,500*
	Primary Headtank & Aeration/Degassing System	1	EA	$85,000.00	$102,000	$127,500
A2	**Oxygenation System**				**$224,400**	**$280,500**
	Bulk LOX Tank, Vaporizer, Port. Tank Fill System	1	LS	$70,000.00	$84,000	$105,000
	Fence	200	LF	$20.00	$4,800	$6,000
	Concrete Pad & Bollards	1	LS	$11,000.00	$13,200	$16,500
	Buried Copper Oxygen Distribution to Units	1	LS	$60,000.00	$72,000	$90,000
	Oxygen Electrical	1	LS	$3,000.00	$3,600	$4,500
	Oxygen Dissolving for Rearing Units	12	EA	$2,500.00	$36,000	$45,000
	Oxygen Flow Meter Station (raceways)	12	LS	$750.00	$10,800	$13,500

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
B.	**Fish Rearing Units**					
B1	**Production Grow-Out Systems (Circular Units)**				**$1,965,120**	**$2,456,400**
	Pre-Engineered, Insulated Building with foundation & slab	12,300	SF	$65.00	$959,400	$1,199,250
	Concrete Aprons	4	EA	$3,250.00	$15,600	$19,500
	Building HVAC Systems	12,300	SF	$8.00	$118,080	$147,600
	Service and Distribution	12,300	SF	$0.75	$11,070	$13,838
	Building Power	12,300	SF	$1.75	$25,830	$32,288
	Lighting	12,300	SF	$5.25	$77,490	$96,863
	Aquaculture Electrical Equipment	12,300	SF	$1.25	$18,450	$23,063
	20' dia. SS Culture Tank with Foundation & Floor	12	EA	$18,000.00	$259,200	$324,000
	Water Supply, Drainage, & Oxygen Piping, Fitting, & Valves	12	EA	$30,000.00	$432,000	$540,000
	Feed & Storage Areas HVAC Systems	1	LS	$40,000.00	$48,000	$60,000
B2	**Egg Incubation and Early Rearing**				**$582,120**	**$727,650**
	Egg Incubation and Early Rearing Building	1,540	SF	$315.00	$582,120	$727,650
B3	**Broodstock Facility**				**$655,500**	**$819,375**
	Broodstock Bldg. 150' x 75' (10 6' x100' Raceways)	2,875	SF	$190.00	$655,500	$819,375
B4	**Isolation/Quarantine Building**				**$265,570**	**$331,963**
	Isolation Bldg.	1,165	SF	$190.00	$265,570	$331,963
C.	**Buildings**					
C1	**Hatchery Building**				**$204,930**	**$256,163**
	New Hatchery Building - Office Space	1,035	SF	$165.00	$204,930	$256,163
C2	**Vehicle/Chemical Storage Building**				**$228,000**	**$285,000**
	New Storage Building (40'x50')	2,000	SF	$95.00	$228,000	$285,000
C3	**Residences**				**$594,000**	**$742,500**
	New Residence	3	EA	$165,000.00	$594,000	$742,500
D.	**Site**					
D1	**Land Acquisition and Site Work**				**$675,300**	**$844,125**
	Land Acquisition	10.3	AC	$6,500.00	$79,950	$99,938
	Site Clearing	10.3	AC	$2,000.00	$24,600	$30,750
	General Earthwork for Hatchery Complex	1	LS	$75,000.00	$90,000	$112,500
	General Sitework	1	LS	$250,000.00	$300,000	$375,000
	Erosion Control	20	AC	$2,500.00	$60,000	$75,000
	Seeding	7	AC	$1,250.00	$10,500	$13,125
	Landscaping	7	AC	$3,000.00	$25,200	$31,500
	Natural Gas Connection and Distribution (if available)	1	LS	$35,000.00	$42,000	$52,500
	Stormwater Management System	10.3	AC	$3,500.00	$43,050	$53,813
D2	**Paved Access to State or Local Highways**				**$294,000**	**$367,500**
	Bituminous Paved Road	1	LS	$190,000.00	$228,000	$285,000
	Gravel Roads	1	LS	$55,000.00	$66,000	$82,500

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
D3	**Security Fence**				**$36,000**	**$45,000**
	Site Fencing	1,500	LF	$20.00	$36,000	$45,000
D4	**Domestic Water**				**$30,000**	**$37,500**
	Domestic Water Supply	1	LS	$25,000.00	$30,000	$37,500
D5	**Domestic Wastewater**				**$123,000**	**$153,750**
	Domestic Wastewater System	1	LS	$50,000.00	$60,000	$75,000
D6	**Disinfection Station**				**$31,500**	**$39,375**
	Truck Disinfection Station	1	LS	$15,000.00	$18,000	$22,500
	Roadway Aggregate	250	SY	$15.00	$4,500	$5,625
	Electrical	1	LS	$2,500.00	$3,000	$3,750
	Detention Tank	1	LS	$5,000.00	$6,000	$7,500

E.	**Aquaculture Wastewater**					
E1	**Effluent Treatment**				**$1,019,100**	**$1,273,875**
	Microscreen System			*Subtotal*	*$264,600*	*$330,750*
	Sump and Foundation	175	SF	$85.00	$17,850	$22,313
	Building	175	SF	$175.00	$36,750	$45,938
	Drum Microscreen	2	EA	$60,000.00	$144,000	$180,000
	Plumbing	1	LS	$35,000.00	$42,000	$52,500
	Electrical	1	LS	$20,000.00	$24,000	$30,000
	Clarifier System			*Subtotal*	*$312,000*	*$390,000*
	Rectangular Clarifier	1	EA	$260,000.00	$312,000	$390,000
	Sludge Storage System			*Subtotal*	*$216,000*	*$270,000*
	Sludge Storage Tank and Pump System	1	EA	$180,000.00	$216,000	$270,000
	WW Piping			*Subtotal*	*$226,500*	*$283,125*
	WW Piping	1,750	LF	$85.00	$178,500	$223,125
	WW Sitework	1	LS	$40,000.00	$48,000	$60,000
E2	**Effluent Monitoring**				**$38,400**	**$48,000**
	Automated Flow Measurement Equipment	1	LS	$25,000.00	$30,000	$37,500
	Portable Composite Sampler	1	LS	$5,000.00	$6,000	$7,500
	Electrical	1	LS	$2,000.00	$2,400	$3,000

F.	**Electrical and HVAC**					
F1	**Electrical Service**				**$204,000**	**$255,000**
	Primary Power to Complex	1	LS	$150,000.00	$180,000	$225,000
	Security Lighting	8	EA	$2,500.00	$24,000	$30,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
F2	**Emergency Power**				**$130,800**	**$163,500**
	Emergency Generator: 100-200kW	1	LS	$75,000.00	$90,000	$112,500
	Automatic Transfer Switch	1	LS	$20,000.00	$24,000	$30,000
	Fuel Tank	1	LS	$14,000.00	$16,800	$21,000
F3	**Instrumentation and Alarm System**				**$210,000**	**$262,500**
	Instrumentation, Alarm System & Communication	1	LS	$175,000.00	$210,000	$262,500
G.	**Visitor Education/Interpretation**					
G1	**Hatchery Building - Displays**				**$60,000**	**$75,000**
	Display Materials by IF&W	1	LS	$50,000.00	$60,000	$75,000

Tier 2 - New Facility Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost		**$15,755,000**	**$19,692,000**
New Facility Features			
Hatchery Supply and Treatment	A1	$1,928,000	$2,410,000
Oxygenation System	A2	$353,000	$441,000
Production Grow-Out Systems (Circular Units)	B1	$4,793,000	$5,991,000
Egg Incubation and Early Rearing	B2	$1,429,000	$1,786,000
Broodstock Facility	B3	$1,556,000	$1,944,000
Isolation/Quarantine Building	B4	$664,000	$830,000
Hatchery Building	C1	$477,000	$596,000
Vehicle/Chemical Storage Building	C2	$456,000	$570,000
Residences	C3	$594,000	$743,000
Land Acquisition and Site Work	D1	$1,173,000	$1,466,000
Paved Access to State or Local Highways	D2	$79,000	$98,000
Security Fence	D3	$42,000	$53,000
Domestic Water	D4	$30,000	$38,000
Domestic Wastewater	D5	$123,000	$154,000
Disinfection Station	D6	$32,000	$40,000
Effluent Treatment	E1	$1,197,000	$1,496,000
Effluent Monitoring	E2	$39,000	$48,000
Electrical Service	F1	$258,000	$323,000
Emergency Power	F2	$172,000	$215,000
Instrumentation and Alarm System	F3	$300,000	$375,000
Hatchery Building - Displays	G1	$60,000	$75,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 6 for further discussion and recommendations regarding contingencies.

Project: Maine Hatchery Studies
Phase: PER | Hatchery: New Facility - Tier 3
By: Team | Date: 1/25/2016

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
	See Report for detailed explanation of fees & contingencies					
A.	**Aquaculture Water Supply**					
A1	**Hatchery Supply and Treatment**				**$1,927,800**	**$2,409,750**
	Well Supply			*Subtotal*	*$390,000*	*$487,500*
	Well Water Supply System, 2,000 gpm (1 wells/ 1 back up)	2	EA	$100,000.00	$240,000	$300,000
	Hydrogeological Testing Program & Report	1	LS	$40,000.00	$48,000	$60,000
	Water Supply System Piping and Accessories	1	LS	$85,000.00	$102,000	$127,500
	Intake Structure and Screen			*Subtotal*	*$612,000*	*$765,000*
	New Intake Structure	1	EA	$275,000.00	$330,000	$412,500
	Intake Screen	1	LS	$85,000.00	$102,000	$127,500
	Water Supply Piping and Accessories	2,000	LF	$75.00	$180,000	$225,000
	Drumfilter			*Subtotal*	*$438,600*	*$548,250*
	Sump and Foundation	300	SF	$85.00	$30,600	$38,250
	Building	300	SF	$175.00	$63,000	$78,750
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV System			*Subtotal*	*$367,200*	*$459,000*
	UV Channel and Lamp Package	3	PK	$75,000.00	$270,000	$337,500
	UV Building/Found	400	SF	$150.00	$72,000	$90,000
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$13,000.00	$15,600	$19,500
	Aeration/Degassing System			*Subtotal*	*$120,000*	*$150,000*
	Primary Headtank & Aeration/Degassing System	1	EA	$100,000.00	$120,000	$150,000
A2	**Oxygenation System**				**$352,800**	**$441,000**
	Bulk LOX Tank, Vaporizer, Port. Tank Fill System	1	LS	$85,000.00	$102,000	$127,500
	Fence	200	LF	$20.00	$4,800	$6,000
	Concrete Pad & Bollards	1	LS	$11,000.00	$13,200	$16,500
	Buried Copper Oxygen Distribution to Units	1	LS	$85,000.00	$102,000	$127,500
	Oxygen Electrical	1	LS	$5,000.00	$6,000	$7,500
	Oxygen Dissolving for Rearing Units	32	EA	$2,500.00	$96,000	$120,000
	Oxygen Flow Meter Station (raceways)	32	LS	$750.00	$28,800	$36,000
B.	**Fish Rearing Units**					
B1	**Production Grow-Out Systems (Circular Units)**				**$4,792,320**	**$5,990,400**
	Pre-Engineered, Insulated Building with foundation & slab	30,800	SF	$60.00	$2,217,600	$2,772,000
	Concrete Aprons	8	EA	$3,250.00	$31,200	$39,000

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
	Building HVAC Systems	30,800	SF	$8.00	$295,680	$369,600
	Service and Distribution	30,800	SF	$0.75	$27,720	$34,650
	Building Power	30,800	SF	$1.75	$64,680	$80,850
	Lighting	30,800	SF	$5.25	$194,040	$242,550
	Aquaculture Electrical Equipment	30,800	SF	$1.25	$46,200	$57,750
	20' dia. SS Culture Tank with Foundation & Floor	32	EA	$18,000.00	$691,200	$864,000
	Water Supply, Drainage, & Oxygen Piping, Fitting, & Valves	32	EA	$30,000.00	$1,152,000	$1,440,000
	Feed & Storage Areas HVAC Systems	1	LS	$60,000.00	$72,000	$90,000
B2	**Egg Incubation and Early Rearing**				**$1,428,480**	**$1,785,600**
	Egg Incubation and Early Rearing Building	3,840	SF	$310.00	$1,428,480	$1,785,600
B3	**Broodstock Facility**				**$1,555,200**	**$1,944,000**
	Broodstock Bldg. 150' x 75' (20, 6' x50' Raceways)	7,200	SF	$180.00	$1,555,200	$1,944,000
B4	**Isolation/Quarantine Building**				**$663,933**	**$829,916**
	Isolation Bldg.	2,912	SF	$190.00	$663,933	$829,916

C.	**Buildings**					
C1	**Hatchery Building**				**$476,160**	**$595,200**
	New Hatchery Building - Office Space	2,560	SF	$155.00	$476,160	$595,200
C2	**Vehicle/Chemical Storage Building**				**$456,000**	**$570,000**
	New Storage Building (80'x50')	4,000	SF	$95.00	$456,000	$570,000
C3	**Residences**				**$594,000**	**$742,500**
	New Residence	3	EA	$165,000.00	$594,000	$742,500

D.	**Site**					
D1	**Land Acquisition and Site Work**				**$1,172,400**	**$1,465,500**
	Land Acquisition	26	AC	$6,500.00	$202,800	$253,500
	Site Clearing	26	AC	$2,000.00	$62,400	$78,000
	General Earthwork for Hatchery Complex	1	LS	$100,000.00	$120,000	$150,000
	General Sitework	1	LS	$375,000.00	$450,000	$562,500
	Erosion Control	45	AC	$2,500.00	$135,000	$168,750
	Seeding	10	AC	$1,250.00	$15,000	$18,750
	Landscaping	10	AC	$3,000.00	$36,000	$45,000
	Natural Gas Connection and Distribution (if available)	1	LS	$35,000.00	$42,000	$52,500
	Stormwater Management System	26	AC	$3,500.00	$109,200	$136,500
D2	**Paved Access to State or Local Highways**				**$78,240**	**$97,800**
	Bituminous Paved Road	1	LS	$200.00	$240	$300
	Gravel Roads	1	LS	$65,000.00	$78,000	$97,500
D3	**Security Fence**				**$42,000**	**$52,500**
	Site Fencing	1,750	LF	$20.00	$42,000	$52,500

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
D4	**Domestic Water**				**$30,000**	**$37,500**
	Domestic Water Supply	1	LS	$25,000.00	$30,000	$37,500
D5	**Domestic Wastewater**				**$123,000**	**$153,750**
	Domestic Wastewater System	1	LS	$50,000.00	$60,000	$75,000
D6	**Disinfection Station**				**$31,500**	**$39,375**
	Truck Disinfection Station	1	LS	$15,000.00	$18,000	$22,500
	Roadway Aggregate	250	SY	$15.00	$4,500	$5,625
	Electrical	1	LS	$2,500.00	$3,000	$3,750
	Detention Tank	1	LS	$5,000.00	$6,000	$7,500

E.	**Aquaculture Wastewater**					
E1	**Effluent Treatment**				**$1,196,100**	**$1,495,125**
	Microscreen System			*Subtotal*	*$399,600*	*$499,500*
	Sump and Foundation	300	SF	$85.00	$30,600	$38,250
	Building	300	SF	$175.00	$63,000	$78,750
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Clarifier System			*Subtotal*	*$330,000*	*$412,500*
	Rectangular Clarifier	1	EA	$275,000.00	$330,000	$412,500
	Sludge Storage System			*Subtotal*	*$240,000*	*$300,000*
	Sludge Storage Tank and Pump System	1	EA	$200,000.00	$240,000	$300,000
	WW Piping			*Subtotal*	*$226,500*	*$283,125*
	WW Piping	1,750	LF	$85.00	$178,500	$223,125
	WW Sitework	1	LS	$40,000.00	$48,000	$60,000
E2	**Effluent Monitoring**				**$38,400**	**$48,000**
	Automated Flow Measurement Equipment	1	LS	$25,000.00	$30,000	$37,500
	Portable Composite Sampler	1	LS	$5,000.00	$6,000	$7,500
	Electrical	1	LS	$2,000.00	$2,400	$3,000

F.	**Electrical and HVAC**					
F1	**Electrical Service**				**$258,000**	**$322,500**
	Primary Power to Complex	1	LS	$185,000.00	$222,000	$277,500
	Security Lighting	12	EA	$2,500.00	$36,000	$45,000
F2	**Emergency Power**				**$171,600**	**$214,500**
	Emergency Generator: 200-400kW	1	LS	$90,000.00	$108,000	$135,000
	Automatic Transfer Switch	1	LS	$35,000.00	$42,000	$52,500
	Fuel Tank	1	LS	$18,000.00	$21,600	$27,000
F3	**Instrumentation and Alarm System**				**$300,000**	**$375,000**

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Instrumentation, Alarm System & Communication	1	LS	$250,000.00	$300,000	$375,000
G.	**Visitor Education/Interpretation**					
G1	**Hatchery Building - Displays**				**$60,000**	**$75,000**
	Display Materials by IF&W	1	LS	$50,000.00	$60,000	$75,000

Tier 3 - New Facility Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost		**$22,302,000**	**$27,877,000**
New Facility Features			
Hatchery Supply and Treatment	A1	$2,420,000	$3,025,000
Oxygenation System	A2	$452,000	$564,000
Production Grow-Out Systems (Circular Units)	B1	$7,304,000	$9,129,000
Egg Incubation and Early Rearing	B2	$2,160,000	$2,700,000
Broodstock Facility	B3	$2,363,000	$2,954,000
Isolation/Quarantine Building	B4	$956,000	$1,195,000
Hatchery Building	C1	$720,000	$900,000
Vehicle/Chemical Storage Building	C2	$456,000	$570,000
Residences	C3	$594,000	$743,000
Land Acquisition and Site Work	D1	$1,610,000	$2,012,000
Paved Access to State or Local Highways	D2	$390,000	$488,000
Security Fence	D3	$48,000	$60,000
Domestic Water	D4	$30,000	$38,000
Domestic Wastewater	D5	$123,000	$154,000
Disinfection Station	D6	$32,000	$40,000
Effluent Treatment	E1	$1,534,000	$1,917,000
Effluent Monitoring	E2	$39,000	$48,000
Electrical Service	F1	$345,000	$432,000
Emergency Power	F2	$216,000	$270,000
Instrumentation and Alarm System	F3	$450,000	$563,000
Hatchery Building - Displays	G1	$60,000	$75,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 6 for further discussion and recommendations regarding contingencies.

Project:	Maine Hatchery Studies
Phase: PER	**Hatchery:** New Facility - Tier 2
By: Team	**Date:** 1/25/2016

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
				See Report for detailed explanation of fees & contingencies		
A.	**Aquaculture Water Supply**					
A1	**Hatchery Supply and Treatment**				**$2,419,800**	**$3,024,750**
	Well Supply			*Subtotal*	*$390,000*	*$487,500*
	Well Water Supply System, 2,000 gpm (1 wells/ 1 back up)	2	EA	$100,000.00	$240,000	$300,000
	Hydrogeological Testing Program & Report	1	LS	$40,000.00	$48,000	$60,000
	Water Supply System Piping and Accessories	1	LS	$85,000.00	$102,000	$127,500
	Intake Structure and Screen			*Subtotal*	*$804,000*	*$1,005,000*
	New Intake Structure	1	EA	$400,000.00	$480,000	$600,000
	Intake Screen	1	LS	$100,000.00	$120,000	$150,000
	Water Supply Piping and Accessories	2,000	LF	$85.00	$204,000	$255,000
	Drumfilter			*Subtotal*	*$595,800*	*$744,750*
	Sump and Foundation	400	SF	$85.00	$40,800	$51,000
	Building	400	SF	$175.00	$84,000	$105,000
	Drum Microscreen	4	EA	$65,000.00	$312,000	$390,000
	Plumbing	1	LS	$65,000.00	$78,000	$97,500
	Electrical	1	LS	$35,000.00	$42,000	$52,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV System			*Subtotal*	*$480,000*	*$600,000*
	UV Channel and Lamp Package	4	PK	$75,000.00	$360,000	$450,000
	UV Building/Found	500	SF	$150.00	$90,000	$112,500
	UV Electrical	1	LS	$10,000.00	$12,000	$15,000
	UV Plumbing	1	LS	$15,000.00	$18,000	$22,500
	Aeration/Degassing System			*Subtotal*	*$150,000*	*$187,500*
	Primary Headtank & Aeration/Degassing System	1	EA	$125,000.00	$150,000	$187,500
A2	**Oxygenation System**				**$451,200**	**$564,000**
	Bulk LOX Tank, Vaporizer, Port. Tank Fill System	1	LS	$100,000.00	$120,000	$150,000
	Fence	200	LF	$20.00	$4,800	$6,000
	Concrete Pad & Bollards	1	LS	$11,000.00	$13,200	$16,500
	Buried Copper Oxygen Distribution to Units	1	LS	$100,000.00	$120,000	$150,000
	Oxygen Electrical	1	LS	$5,000.00	$6,000	$7,500
	Oxygen Dissolving for Rearing Units	48	EA	$2,500.00	$144,000	$180,000
	Oxygen Flow Meter Station (raceways)	48	LS	$750.00	$43,200	$54,000
B.	**Fish Rearing Units**					
B1	**Production Grow-Out Systems (Circular Units)**				**$7,303,200**	**$9,129,000**
	Pre-Engineered, Insulated Building with foundation & slab	48,000	SF	$60.00	$3,456,000	$4,320,000
	Concrete Aprons	8	EA	$3,250.00	$31,200	$39,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Building HVAC Systems	48,000	SF	$8.00	$460,800	$576,000
	Service and Distribution	48,000	SF	$0.75	$43,200	$54,000
	Building Power	48,000	SF	$1.75	$100,800	$126,000
	Lighting	48,000	SF	$5.25	$302,400	$378,000
	Aquaculture Electrical Equipment	48,000	SF	$1.25	$72,000	$90,000
	20' dia. SS Culture Tank with Foundation & Floor	48	EA	$18,000.00	$1,036,800	$1,296,000
	Water Supply, Drainage, & Oxygen Piping, Fitting, & Valves	48	EA	$30,000.00	$1,728,000	$2,160,000
	Feed & Storage Areas HVAC Systems	1	LS	$60,000.00	$72,000	$90,000
B2	**Egg Incubation and Early Rearing**				**$2,160,000**	**$2,700,000**
	Egg Incubation and Early Rearing Building	6,000	SF	$300.00	$2,160,000	$2,700,000
B3	**Broodstock Facility**				**$2,362,500**	**$2,953,125**
	Broodstock Bldg. 150' x 75' (20, 6' x50' Raceways)	11,250	SF	$175.00	$2,362,500	$2,953,125
B4	**Isolation/Quarantine Building**				**$955,500**	**$1,194,375**
	Isolation Bldg. 65' x 70' (4, 8' x50' Raceways)	4,550	SF	$175.00	$955,500	$1,194,375

C.	**Buildings**					
C1	**Hatchery Building**				**$720,000**	**$900,000**
	New Hatchery Building - Office Space	4,000	SF	$150.00	$720,000	$900,000
C2	**Vehicle/Chemical Storage Building**				**$456,000**	**$570,000**
	New Storage Building (80'x50')	4,000	SF	$95.00	$456,000	$570,000
C3	**Residences**				**$594,000**	**$742,500**
	New Residence	3	EA	$165,000.00	$594,000	$742,500

D.	**Site**					
D1	**Land Acquisition and Site Work**				**$1,609,500**	**$2,011,875**
	Land Acquisition	40	AC	$6,500.00	$312,000	$390,000
	Site Clearing	40	AC	$2,000.00	$96,000	$120,000
	General Earthwork for Hatchery Complex	1	LS	$125,000.00	$150,000	$187,500
	General Sitework	1	LS	$500,000.00	$600,000	$750,000
	Erosion Control	55	AC	$2,500.00	$165,000	$206,250
	Seeding	15	AC	$1,250.00	$22,500	$28,125
	Landscaping	15	AC	$3,000.00	$54,000	$67,500
	Natural Gas Connection and Distribution (if available)	1	LS	$35,000.00	$42,000	$52,500
	Stormwater Management System	40	AC	$3,500.00	$168,000	$210,000
D2	**Paved Access to State or Local Highways**				**$390,000**	**$487,500**
	Bituminous Paved Road	1	LS	$250,000.00	$300,000	$375,000
	Gravel Roads	1	LS	$75,000.00	$90,000	$112,500
D3	**Security Fence**				**$48,000**	**$60,000**
	Site Fencing	2,000	LF	$20.00	$48,000	$60,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
D4	**Domestic Water**				**$30,000**	**$37,500**
	Domestic Water Supply	1	LS	$25,000.00	$30,000	$37,500
D5	**Domestic Wastewater**				**$123,000**	**$153,750**
	Domestic Wastewater System	1	LS	$50,000.00	$60,000	$75,000
D6	**Disinfection Station**				**$31,500**	**$39,375**
	Truck Disinfection Station	1	LS	$15,000.00	$18,000	$22,500
	Roadway Aggregate	250	SY	$15.00	$4,500	$5,625
	Electrical	1	LS	$2,500.00	$3,000	$3,750
	Detention Tank	1	LS	$5,000.00	$6,000	$7,500

E.	**Aquaculture Wastewater**					
E1	**Effluent Treatment**				**$1,533,300**	**$1,916,625**
	Microscreen System			*Subtotal*	*$634,800*	*$793,500*
	Sump and Foundation	400	SF	$85.00	$40,800	$51,000
	Building	400	SF	$175.00	$84,000	$105,000
	Drum Microscreen	5	EA	$65,000.00	$390,000	$487,500
	Plumbing	1	LS	$65,000.00	$78,000	$97,500
	Electrical	1	LS	$35,000.00	$42,000	$52,500
	Clarifier System			*Subtotal*	*$360,000*	*$450,000*
	Rectangular Clarifier	1	EA	$300,000.00	$360,000	$450,000
	Sludge Storage System			*Subtotal*	*$300,000*	*$375,000*
	Sludge Storage Tank and Pump System	1	EA	$250,000.00	$300,000	$375,000
	WW Piping			*Subtotal*	*$238,500*	*$298,125*
	WW Piping	1,750	LF	$85.00	$178,500	$223,125
	WW Sitework	1	LS	$50,000.00	$60,000	$75,000
E2	**Effluent Monitoring**				**$38,400**	**$48,000**
	Automated Flow Measurement Equipment	1	LS	$25,000.00	$30,000	$37,500
	Portable Composite Sampler	1	LS	$5,000.00	$6,000	$7,500
	Electrical	1	LS	$2,000.00	$2,400	$3,000

F.	**Electrical and HVAC**					
F1	**Electrical Service**				**$345,000**	**$431,250**
	Primary Power to Complex	1	LS	$250,000.00	$300,000	$375,000
	Security Lighting	15	EA	$2,500.00	$45,000	$56,250
F2	**Emergency Power**				**$216,000**	**$270,000**
	Emergency Generator: 400-600 kW	1	LS	$110,000.00	$132,000	$165,000
	Automatic Transfer Switch	1	LS	$50,000.00	$60,000	$75,000
	Fuel Tank	1	LS	$20,000.00	$24,000	$30,000
F3	**Instrumentation and Alarm System**				**$450,000**	**$562,500**

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Instrumentation, Alarm System & Communication	1	LS	$375,000.00	$450,000	$562,500
G.	**Visitor Education/Interpretation**					
G1	**Hatchery Building - Displays**				**$60,000**	**$75,000**
	Display Materials by IF&W	1	LS	$50,000.00	$60,000	$75,000

Tier 4 - New Facility Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost		**$72,481,500**	**$90,600,250**
New Facility Features			
Hatchery Supply and Treatment	A1	$7,865,000	$9,831,250
Oxygenation System	A2	$1,469,000	$1,833,000
Production Grow-Out Systems (Circular Units)	B1	$23,738,000	$29,669,250
Egg Incubation and Early Rearing	B2	$7,020,000	$8,775,000
Broodstock Facility	B3	$7,679,750	$9,600,500
Isolation/Quarantine Building	B4	$3,107,000	$3,883,750
Hatchery Building	C1	$2,340,000	$2,925,000
Vehicle/Chemical Storage Building	C2	$1,482,000	$1,852,500
Residences	C3	$1,930,500	$2,414,750
Land Acquisition and Site Work	D1	$5,232,500	$6,539,000
Paved Access to State or Local Highways	D2	$1,267,500	$1,586,000
Security Fence	D3	$156,000	$195,000
Domestic Water	D4	$97,500	$123,500
Domestic Wastewater	D5	$399,750	$500,500
Disinfection Station	D6	$104,000	$130,000
Effluent Treatment	E1	$4,985,500	$6,230,250
Effluent Monitoring	E2	$126,750	$156,000
Electrical Service	F1	$1,121,250	$1,404,000
Emergency Power	F2	$702,000	$877,500
Instrumentation and Alarm System	F3	$1,462,500	$1,829,750
Hatchery Building - Displays	G1	$195,000	$243,750

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 6 for further discussion and recommendations regarding contingencies.

Note: Tier 4 costs were projected by multiplying Tier 3 costs by 3.25.

Casco SFH Option 1 Intake Renovation Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost with Optional Additions		**$1,713,000**	**$2,141,000**
New Facility Features with Optional Additions		**$943,000**	**$1,178,000**
Construction Operations Cost	1	$190,000	$237,000
Site Prep	2	$33,000	$41,000
Excavation Earthwork and Demolition	3	$93,000	$116,000
Pipe and Valving	4	$572,000	$715,000
Concrete	5	$3,000	$4,000
Miscellaneous Fabrications	6	$52,000	$65,000
Optional Intake Screen	7	$21,000	$27,000
Optional Water Treatment Replacement	8	$749,000	$936,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 7 for further discussion and recommendations regarding contingencies.

Project: Maine Hatchery Studies
Phase: PER **Hatchery:** Casco SFH Intake Option 1
By: Team **Date:** 1/25/2016

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
	See Report for detailed explanation of fees & contingencies					
	Casco SFH Intake Renovation					
1	**Construction Operations Cost**				**$189,412**	**$236,765**
	Construction Management Team	3	MO	$8,333.33	$30,000	$37,500
	Mobilization of Equipment,	1	LS	$78,562.00	$94,274	$117,843
	Demobilization of Equipment,	1	LS	$39,281.00	$47,137	$58,922
	Special equipment adder for Barges.	1	LS	$15,000.00	$18,000	$22,500
2	**Site Prep**				**$32,550**	**$40,688**
	Clearing			*Subtotal*	*$27,600*	*$34,500*
	Site Erosion Control	1	LS	$15,000.00	$18,000	$22,500
	Clear and Grub	2	AC	$4,000.00	$9,600	$12,000
	Cofferdam				*$4,950*	*$6,188*
	U/S Cofferdam - excavate and level upstream, remove muck	1	LS	$1,500.00	$1,800	$2,250
	U/S Cofferdam - Gravel Fill	5	CY	$65.00	$390	$488
	U/S Cofferdam - Sandbag	1	LS	$1,800.00	$2,160	$2,700
	U/S Cofferdam - Removal	1	LS	$500.00	$600	$750
3	**Excavation Earthwork and Demolition**				**$92,664**	**$115,830**
	Earth			*Subtotal*	*$48,264*	*$60,330*
	Excav for pipe, spoil to side	6,844	CY	$5.00	$41,064	$51,330
	Dispose excess offsite	400	CY	$15.00	$7,200	$9,000
	Dam Demolition			*Subtotal*	*$12,240*	*$15,300*
	Demo section of Dam, assuming no flange in place	1	LS	$10,200.00	$12,240	$15,300
	Site Grading			*Subtotal*	*$11,760*	*$14,700*
	Loam and Seed	2	AC	$2,900.00	$6,960	$8,700
	Remove E&S	1	LS	$4,000.00	$4,800	$6,000
	Site Work			*Subtotal*	*$20,400*	*$25,500*
	Detailed Site survey and location of existing pipeline, utilities OH a	1	LS	$9,000.00	$10,800	$13,500
	Geotechnical exploration of cut/cover section, samples, lab	1	LS	$8,000.00	$9,600	$12,000
4	**Pipe and Valving**				**$571,636**	**$714,545**
	Pipe Grading			*Subtotal*	*$117,522*	*$146,903*
	Bedding	227	CY	$50.00	$13,620	$17,025
	Structural Fill	227	CY	$50.00	$13,620	$17,025
	Common fill	6,844	CY	$10.00	$82,128	$102,660
	Offsite Spoil	453	CY	$15.00	$8,154	$10,193

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Pipe			*Subtotal*	*$421,735*	*$527,169*
	16 inch DIP Push on Burried	592	LF	$80.93	$57,493	$71,866
	16 DIP Restrained joint lengths	108	LF	$112.33	$14,558	$18,197
	18" HDPE SDR11 welded, anchored, barge work	1,950	LF	$140.00	$327,600	$409,500
	Elbows, 45 degree	1	EA	$1,756.00	$2,107	$2,634
	Elbow 90 degree	1	EA	$2,140.00	$2,568	$3,210
	Wye	1	LS	$4,508.00	$5,410	$6,762
	DIP to HDPE connectors	2	LS	$5,000.00	$12,000	$15,000
	Valves			*Subtotal*	*$32,378*	*$40,473*
	16 inch eccentric plug valve	2	EA	$12,962.00	$31,109	$38,886
	Tax and shipping FOB site	1	LS	$1,058.00	$1,270	$1,587
5	**Concrete**				**$2,880**	**$3,600**
	Dam, concrete fill in slot	4	CY	$600.00	$2,880	$3,600
	(if flange is not provided in Town of Casco Design)					
6	**Miscellaneous Fabrications**				**$51,600**	**$64,500**
	New Intake Tower, Local Fabrication	1	LS	$8,000.00	$9,600	$12,000
	Diver installation	1	LS	$25,000.00	$30,000	$37,500
	Modifications to existing tower (upgrade anchor, etc.)	1	LS	$10,000.00	$12,000	$15,000
7	**Optional Intake Screen**				**$21,000**	**$26,250**
	Intake Screen (T-Screen)	1	LS	$15,000.00	$18,000	$22,500
	Diver installation	1	LS	$2,500.00	$3,000	$3,750
8	**Optional Water Treatment Replacement**				**$748,200**	**$935,250**
	Microscreen Replacement			*Subtotal*	*$375,000*	*$468,750*
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Plumbing Modifications	1	LS	$25,000.00	$30,000	$37,500
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV Replacement			*Subtotal*	*$319,200*	*$399,000*
	UV Channel and Lamp Package	3	PK	$75,000.00	$270,000	$337,500
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$13,000.00	$15,600	$19,500
	Plumbing Modifications	1	LS	$20,000.00	$24,000	$30,000
	Building Modifications			*Subtotal*	*$54,000*	*$67,500*
	Roof Removal and replacement	1	LS	$15,000.00	$18,000	$22,500
	General Building Renovation	1	LS	$10,000.00	$12,000	$15,000
	Strucural Modifications for Retrofit	1	LS	$20,000.00	$24,000	$30,000

Casco SFH Option 2Intake Renovation Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost with Optional Additions		**$2,048,000**	**$2,562,000**
New Facility Features with Optional Additions		**$1,278,000**	**$1,599,000**
Construction Operations Cost	1	$237,000	$297,000
Site Prep	2	$28,000	$35,000
Excavation Earthwork and Demolition	3	$93,000	$116,000
Pipe and Valving	4	$865,000	$1,082,000
Concrete	5	$3,000	$4,000
Miscellaneous Fabrications	6	$52,000	$65,000
Optional Intake Screen	7	$21,000	$27,000
Optional Water Treatment Replacement	8	$749,000	$936,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 7 for further discussion and recommendations regarding contingencies.

Project: Maine Hatchery Studies
Phase: PER **Hatchery:** Casco SFH Intake Option 2
By: Team **Date:** 1/25/2016

Detailed Opinions of Probable Cost

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
					See Report for detailed explanation of fees & contingencies	
	Casco SFH Intake Renovation					
1	**Construction Operations Cost**				**$236,932**	**$296,165**
	Construction Management Team	3	MO	$8,333.33	$30,000	$37,500
	Mobilization of Equipment,	1	LS	$104,962.00	$125,954	$157,443
	Demobilization of Equipment,	1	LS	$52,481.00	$62,977	$78,722
	Special equipment adder for Barges.	1	LS	$15,000.00	$18,000	$22,500
2	**Site Prep**				**$27,750**	**$34,688**
	Clearing			*Subtotal*	*$22,800*	*$28,500*
	Site Erosion Control	1	LS	$15,000.00	$18,000	$22,500
	Clear and Grub	2	AC	$2,000.00	$4,800	$6,000
	Cofferdam				*$4,950*	*$6,188*
	U/S Cofferdam - excavate and level upstream, remove muck	1	LS	$1,500.00	$1,800	$2,250
	U/S Cofferdam - Gravel Fill	5	CY	$65.00	$390	$488
	U/S Cofferdam - Sandbag	1	LS	$1,800.00	$2,160	$2,700
	U/S Cofferdam - Removal	1	LS	$500.00	$600	$750
3	**Excavation Earthwork and Demolition**				**$92,664**	**$115,830**
	Earth			*Subtotal*	*$48,264*	*$60,330*
	Excav for pipe, spoil to side	6,844	CY	$5.00	$41,064	$51,330
	Dispose excess offsite	400	CY	$15.00	$7,200	$9,000
	Dam Demolition			*Subtotal*	*$12,240*	*$15,300*
	Demo section of Dam, assuming no flange in place	1	LS	$10,200.00	$12,240	$15,300
	Site Grading			*Subtotal*	*$11,760*	*$14,700*
	Loam and Seed	2	AC	$2,900.00	$6,960	$8,700
	Remove E&S	1	LS	$4,000.00	$4,800	$6,000
	Site Work			*Subtotal*	*$20,400*	*$25,500*
	Detailed Site survey and location of existing pipeline, utilities OH a	1	LS	$9,000.00	$10,800	$13,500
	Geotechnical exploration of cut/cover section, samples, lab	1	LS	$8,000.00	$9,600	$12,000
4	**Pipe and Valving**				**$864,958**	**$1,081,198**
	Pipe Grading			*Subtotal*	*$234,984*	*$293,730*
	Bedding	227	CY	$50.00	$13,620	$17,025
	Structural Fill	227	CY	$50.00	$13,620	$17,025
	Common fill	6,844	CY	$10.00	$82,128	$102,660
	Offsite Spoil	453	CY	$15.00	$8,154	$10,193
	Double for replacing the AC piping	1	LS	$97,885.00	$117,462	$146,828

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Pipe			*Subtotal*	*$602,396*	*$752,995*
	16 inch DIP Push on Burried	968	LF	$80.93	$94,008	$117,510
	16 DIP Restrained joint lengths	216	LF	$112.33	$29,116	$36,395
	18" HDPE SDR11 welded, anchored, barge work	1,950	LF	$140.00	$327,600	$409,500
	AC Pipe Replacement	1	LS	$102,601.00	$123,121	$153,902
	Elbows, 45 degree	4	EA	$1,756.00	$8,429	$10,536
	Elbow 90 degree	1	EA	$2,140.00	$2,568	$3,210
	Wye	1	LS	$4,508.00	$5,410	$6,762
	DIP to HDPE connectors	2	LS	$5,060.00	$12,144	$15,180
	Valves			*Subtotal*	*$27,578*	*$34,473*
	16 inch eccentric plug valve	2	EA	$10,962.00	$26,309	$32,886
	Tax and shipping FOB site	1	LS	$1,058.00	$1,270	$1,587
5	**Concrete**				**$2,880**	**$3,600**
	Dam, concrete fill in slot	4	CY	$600.00	$2,880	$3,600
	(if flange is not provided in Town of Casco Design)					
6	**Miscellaneous Fabrications**				**$51,600**	**$64,500**
	New Intake Tower, Local Fabrication	1	LS	$8,000.00	$9,600	$12,000
	Diver installation	1	LS	$25,000.00	$30,000	$37,500
	Modifications to existing tower (upgrade anchor, etc.)	1	LS	$10,000.00	$12,000	$15,000
7	**Optional Intake Screen**				**$21,000**	**$26,250**
	Intake Screen (T-Screen)	1	LS	$15,000.00	$18,000	$22,500
	Diver installation	1	LS	$2,500.00	$3,000	$3,750
8	**Optional Water Treatment Replacement**				**$748,200**	**$935,250**
	Microscreen Replacement			*Subtotal*	*$375,000*	*$468,750*
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Plumbing Modifications	1	LS	$25,000.00	$30,000	$37,500
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV Replacement			*Subtotal*	*$319,200*	*$399,000*
	UV Channel and Lamp Package	3	PK	$75,000.00	$270,000	$337,500
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$13,000.00	$15,600	$19,500
	Plumbing Modifications	1	LS	$20,000.00	$24,000	$30,000
	Building Modifications			*Subtotal*	*$54,000*	*$67,500*
	Roof Removal and replacement	1	LS	$15,000.00	$18,000	$22,500
	General Building Renovation	1	LS	$10,000.00	$12,000	$15,000
	Strucural Modifications for Retrofit	1	LS	$20,000.00	$24,000	$30,000

Grand Lake Stream SFH Option 1 Intake Renovation
Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost with Optional Additions		**$5,654,000**	**$7,067,000**
New Facility Features with Optional Additions		**$4,047,000**	**$5,057,000**
Construction Operations Cost	1	$677,000	$846,000
Site Prep	2	$13,000	$16,000
Excavation Earthwork and Demolition	3	$223,000	$278,000
Pipe and Valving	4	$3,107,000	$3,883,000
Concrete	5	$3,000	$4,000
Miscellaneous Fabrications	6	$24,000	$30,000
Optional Intake Screen	7	$21,000	$27,000
Optional Water Treatment Replacement	8	$749,000	$936,000
Optional Added Tanks	9	$837,000	$1,047,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 7 for further discussion and recommendations regarding contingencies.

Project: Maine Hatchery Studies
Phase: PER **Hatchery:** GLS SFH Intake Option 1
By: Team **Date:** 1/25/2016

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
	See Report for detailed explanation of fees & contingencies					
	Grand Lake Stream SFH Intake Renovation					
1	**Construction Operations Cost**				**$676,377**	**$845,472**
	Construction Management Team	3.5	MO	$8,333.33	$35,000	$43,750
	Mobilization of Equipment,	1	LS	$339,654.00	$407,585	$509,481
	Demobilization of Equipment,	1	LS	$169,827.00	$203,792	$254,741
	Special equipment adder for Barges.	1	LS	$25,000.00	$30,000	$37,500
2	**Site Prep**				**$12,504**	**$15,630**
	Clearing			*Subtotal*	*$7,200*	*$9,000*
	Site Erosion Control (only need near hatchery and at public beach	1	LS	$5,000.00	$6,000	$7,500
	Clear and Grub along upstream end of canal for trench to road, sa	0.5	AC	$2,000.00	$1,200	$1,500
	Cofferdam				*$5,304*	*$6,630*
	Cofferdam - prepare grading	1	LS	$500.00	$600	$750
	Cofferdam - Sandbag	1	LS	$1,960.00	$2,352	$2,940
	Cofferdam - Removal	1	LS	$960.00	$1,152	$1,440
	Cofferdam - Water	1	LS	$1,000.00	$1,200	$1,500
3	**Excavation Earthwork and Demolition**				**$222,145**	**$277,682**
	Earth			*Subtotal*	*$92,400*	*$115,500*
	Shallow excavation building up to road	270	CY	$5.00	$1,620	$2,025
	Bedding, structural fill	72	CY	$15.00	$1,296	$1,620
	Offsite disposal	72	CY	$25.00	$2,160	$2,700
	Mucking along dewatered canal, excavator, truck laborer, offsite	3	Day	$5,560.00	$20,016	$25,020
	Canal Cut to beach, including trenchbox,	2,000	CY	$20.00	$48,000	$60,000
	Canal Cut Structural Bedding Fill	174	CY	$25.00	$5,220	$6,525
	Offsite spoil disposal	174	CY	$15.00	$3,132	$3,915
	Backfill common borrow.	1,826	CY	$5.00	$10,956	$13,695
	Pavement			*Subtotal*	*$86,125*	*$107,657*
	4 inch pavement rehab	1,111	SY	$61.00	$81,325	$101,657
	Haul adder, 20 miles	1	LS	$4,000.00	$4,800	$6,000
	Dam Demolition			*Subtotal*	*$18,720*	*$23,400*
	Demo section of Canal Dam for pipe	4	CY	$3,900.00	$18,720	$23,400
	Site Grading			*Subtotal*	*$3,300*	*$4,125*
	Loam and Seed	0.5	AC	$1,500.00	$900	$1,125
	Remove E&S	1	LS	$2,000.00	$2,400	$3,000
	Site Work			*Subtotal*	*$21,600*	*$27,000*
	Detailed Site survey and location of existing pipeline, utilities OH a	1	LS	$10,000.00	$12,000	$15,000
	Geotechnical exploration of cut/cover section, samples, lab	1	LS	$8,000.00	$9,600	$12,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
4	**Pipe and Valving**				**$3,106,262**	**$3,882,827**
	Pipe			*Subtotal*	*$3,017,802*	*$3,772,253*
	24 inch DIP Push on Burried	1,284	LF	$120.54	$185,728	$232,160
	24 inch HDPE, SDR-11, Welded on barge, chute launch	10,710	LF	$212.46	$2,730,536	$3,413,170
	24 inch DIP Restrained joints	216	LF	$171.71	$44,507	$55,634
	Elbows, 45 degree	4	EA	$2,622.00	$12,586	$15,732
	Elbow 90 degree	1	EA	$3,718.00	$4,462	$5,577
	Wye	1	EA	$11,210.00	$13,452	$16,815
	Additional labor for placement through road culvert	1	LS	$2,000.00	$2,400	$3,000
	Demo piping upstream of the new headbox	1	LS	$6,000.00	$7,200	$9,000
	New 24 to 10 "T" to bypass at new headbox	1	EA	$14,110.00	$16,932	$21,165
	Valves			*Subtotal*	*$64,459*	*$80,574*
	24 inch eccentric plug valve	2	EA	$17,443.00	$41,863	$52,329
	Tax and shipping	1	LS	$1,387.00	$1,664	$2,081
	New 24" ecentric plug valve at new Headbox	1	EA	$17,443.00	$20,932	$26,165
	Fittings			*Subtotal*	*$24,000*	*$30,000*
	HDPE to DIP joint	2	EA	$5,000.00	$12,000	$15,000
	Couplings to existing pipe	2	LS	$1,500.00	$3,600	$4,500
	couplings new 24" pipe upstream of headbox	1	LS	$7,000.00	$8,400	$10,500
5	**Concrete**				**$2,880**	**$3,600**
	Dam, concrete fill in slot	4	CY	$600.00	$2,880	$3,600
	(if flange is not provided in Town of Casco Design)					
6	**Miscellaneous Fabrications**				**$24,000**	**$30,000**
	Intake Screen (coarse rack 3-inch opening)	1	LS	$10,000.00	$12,000	$15,000
	Diver installation	1	LS	$10,000.00	$12,000	$15,000
7	**Optional Intake Screen**				**$21,000**	**$26,250**
	Intake Screen (T-Screen)	1	LS	$15,000.00	$18,000	$22,500
	Diver installation	1	LS	$2,500.00	$3,000	$3,750
8	**Optional Water Treatment Replacement**				**$748,200**	**$935,250**
	Microscreen Replacement			*Subtotal*	*$375,000*	*$468,750*
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Plumbing Modifications	1	LS	$25,000.00	$30,000	$37,500
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV Replacement			*Subtotal*	*$319,200*	*$399,000*
	UV Channel and Lamp Package	3	PK	$75,000.00	$270,000	$337,500
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$13,000.00	$15,600	$19,500
	Plumbing Modifications	1	LS	$20,000.00	$24,000	$30,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Building Modifications			*Subtotal*	*$54,000*	*$67,500*
	Roof Removal and replacement	1	LS	$15,000.00	$18,000	$22,500
	General Building Renovation	1	LS	$10,000.00	$12,000	$15,000
	Strucural Modifications for Retrofit	1	LS	$20,000.00	$24,000	$30,000
9	**Optional Added Tanks**				**$837,000**	**$1,046,250**
	Pre-Engineered, Insulated Building with foundation & slab	5,500	SF	$65.00	$429,000	$536,250
	Concrete Aprons	2	EA	$3,250.00	$7,800	$9,750
	Building HVAC Systems	5,500	SF	$8.00	$52,800	$66,000
	Service and Distribution	5,500	SF	$0.75	$4,950	$6,188
	Building Power	5,500	SF	$1.75	$11,550	$14,438
	Lighting	5,500	SF	$5.25	$34,650	$43,313
	Aquaculture Electrical Equipment	5,500	SF	$1.25	$8,250	$10,313
	20' dia. SS Culture Tank with Foundation & Floor	5	EA	$18,000.00	$108,000	$135,000
	Water Supply, Drainage, & Oxygen Piping, Fitting, & Valves	5	EA	$30,000.00	$180,000	$225,000

Grand Lake Stream SFH Option 2 Intake Renovation
Summary Opinions of Probable Cost

ITEM	DRAWING I.D. #	ROUNDED CONST COST[a]	ROUNDED TOTAL COST[a]
Total Cost with Optional Additions		**$4,397,000**	**$5,496,000**
New Facility Features with Optional Additions		**$2,790,000**	**$3,486,000**
Construction Operations Cost	1	$465,000	$581,000
Site Prep	2	$13,000	$16,000
Excavation Earthwork and Demolition	3	$223,000	$278,000
Pipe and Valving	4	$2,062,000	$2,577,000
Concrete	5	$3,000	$4,000
Miscellaneous Fabrications	6	$24,000	$30,000
Optional Intake Screen	7	$21,000	$27,000
Optional Water Treatment Replacement	8	$749,000	$936,000
Optional Added Tanks	9	$837,000	$1,047,000

[a] Rounded Construction Costs include 20% Contingency: General Conditions (5%) ; Estimating (15%). Rounded Total Costs (or Costs needed to Budget) also include 25% Contingency: Planning & Design (8%); Construction Phase Engineering (7%); and State Construction (10%, Bidding and Change Order). [Total * (1.15+.05) * (1.10 + 0.08 + 0.07)]

Costs do **NOT** include: Design Reimbursables (Variable); State Agency Administrative Fee; or escalation beyond 2016 Construction. See Section 7 for further discussion and recommendations regarding contingencies.

Project: Maine Hatchery Studies
Phase: PER **Hatchery:** GLS SFH Intake Option 2
By: Team **Date:** 1/25/2016

Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
	Detailed Opinions of Probable Cost					
	See Report for detailed explanation of fees & contingencies					
	Grand Lake Stream SFH Intake Renovation					
1	**Construction Operations Cost**				**$464,371**	**$580,464**
	Construction Management Team	2	MO	$8,333.33	$20,000	$25,000
	Mobilization of Equipment,	1	LS	$230,206.00	$276,247	$345,309
	Demobilization of Equipment,	1	LS	$115,103.00	$138,124	$172,655
	Special equipment adder for Barges.	1	LS	$25,000.00	$30,000	$37,500
2	**Site Prep**				**$12,504**	**$15,630**
	Clearing			*Subtotal*	*$7,200*	*$9,000*
	Site Erosion Control (only need near hatchery and at public beach	1	LS	$5,000.00	$6,000	$7,500
	Clear and Grub along upstream end of canal for trench to road, sa	0.5	AC	$2,000.00	$1,200	$1,500
	Cofferdam				*$5,304*	*$6,630*
	Cofferdam - prepare grading	1	LS	$500.00	$600	$750
	Cofferdam - Sandbag	1	LS	$1,960.00	$2,352	$2,940
	Cofferdam - Removal	1	LS	$960.00	$1,152	$1,440
	Cofferdam - Water	1	LS	$1,000.00	$1,200	$1,500
3	**Excavation Earthwork and Demolition**				**$222,373**	**$277,967**
	Earth			*Subtotal*	*$92,628*	*$115,785*
	Shallow excavation building up to road	270	CY	$5.00	$1,620	$2,025
	Bedding, structural fill	98	CY	$15.00	$1,764	$2,205
	Offsite disposal	32	CY	$50.00	$1,920	$2,400
	Mucking along dewatered canal, excavator, truck laborer, offsite	3	Day	$5,560.00	$20,016	$25,020
	Canal Cut to beach, including trenchbox,	2,000	CY	$20.00	$48,000	$60,000
	Canal Cut Structural Bedding Fill	174	CY	$25.00	$5,220	$6,525
	Offsite spoil disposal	174	CY	$15.00	$3,132	$3,915
	Backfill common borrow.	1,826	CY	$5.00	$10,956	$13,695
	Pavement			*Subtotal*	*$86,125*	*$107,657*
	4 inch pavement rehab	1,111	SY	$61.00	$81,325	$101,657
	Haul adder, 20 miles	1	LS	$4,000.00	$4,800	$6,000
	Dam Demolition			*Subtotal*	*$18,720*	*$23,400*
	Demo section of Canal Dam for pipe	4	CY	$3,900.00	$18,720	$23,400
	Site Grading			*Subtotal*	*$3,300*	*$4,125*
	Loam and Seed	0.5	AC	$1,500.00	$900	$1,125
	Remove E&S	1	LS	$2,000.00	$2,400	$3,000
	Site Work			*Subtotal*	*$21,600*	*$27,000*
	Detailed Site survey and location of existing pipeline, utilities OH a	1	LS	$10,000.00	$12,000	$15,000
	Geotechnical exploration of cut/cover section, samples, lab	1	LS	$8,000.00	$9,600	$12,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
4	**Pipe and Valving**				**$2,061,339**	**$2,576,674**
	Pipe			*Subtotal*	*$2,002,212*	*$2,502,765*
	24 inch DIP Push on Burried	1,284	LF	$124.04	$191,121	$238,901
	24 inch HDPE, SDR-11, Welded on barge, chute launch	5,150	LF	$282.22	$1,744,120	$2,180,150
	24 inch DIP Restrained joints	216	LF	$171.21	$44,378	$55,472
	Elbows, 45 degree	4	EA	$2,394.00	$11,491	$14,364
	Elbow 90 degree	1	EA	$2,970.00	$3,564	$4,455
	Wye	1	EA	$6,282.00	$7,538	$9,423
	Valves			*Subtotal*	*$43,528*	*$54,410*
	24 inch eccentric plug valve	2	EA	$17,443.00	$41,863	$52,329
	Tax and shipping	1	LS	$1,387.00	$1,664	$2,081
	Fittings			*Subtotal*	*$15,600*	*$19,500*
	HDPE to DIP joint	2	EA	$5,000.00	$12,000	$15,000
	Couplings to existing pipe	2	LS	$1,500.00	$3,600	$4,500
5	**Concrete**				**$2,880**	**$3,600**
	Dam, concrete fill in slot	4	CY	$600.00	$2,880	$3,600
	(if flange is not provided in Town of Casco Design)					
6	**Miscellaneous Fabrications**				**$24,000**	**$30,000**
	Intake Screen (coarse rack 3-inch opening)	1	LS	$10,000.00	$12,000	$15,000
	Diver installation	1	LS	$10,000.00	$12,000	$15,000
7	**Optional Intake Screen**				**$21,000**	**$26,250**
	Intake Screen (T-Screen)	1	LS	$15,000.00	$18,000	$22,500
	Diver installation	1	LS	$2,500.00	$3,000	$3,750
8	**Optional Water Treatment Replacement**				**$748,200**	**$935,250**
	Microscreen Replacement			*Subtotal*	*$375,000*	*$468,750*
	Drum Microscreen	3	EA	$60,000.00	$216,000	$270,000
	Plumbing	1	LS	$50,000.00	$60,000	$75,000
	Plumbing Modifications	1	LS	$25,000.00	$30,000	$37,500
	Electrical	1	LS	$25,000.00	$30,000	$37,500
	Piping to Effluent Treatment	500	LF	$65.00	$39,000	$48,750
	UV Replacement			*Subtotal*	*$319,200*	*$399,000*
	UV Channel and Lamp Package	3	PK	$75,000.00	$270,000	$337,500
	UV Electrical	1	LS	$8,000.00	$9,600	$12,000
	UV Plumbing	1	LS	$13,000.00	$15,600	$19,500
	Plumbing Modifications	1	LS	$20,000.00	$24,000	$30,000
	Building Modifications			*Subtotal*	*$54,000*	*$67,500*
	Roof Removal and replacement	1	LS	$15,000.00	$18,000	$22,500
	General Building Renovation	1	LS	$10,000.00	$12,000	$15,000
	Strucural Modifications for Retrofit	1	LS	$20,000.00	$24,000	$30,000

Detailed Opinions of Probable Cost						
Dwg. I.D.#	ITEM	NO. UNITS	UNIT MEAS.	COST PER UNIT	SUBTOTAL +20% GC/EST	TOTAL COST +25% CONT.
9	**Optional Added Tanks**				**$837,000**	**$1,046,250**
	Pre-Engineered, Insulated Building with foundation & slab	5,500	SF	$65.00	$429,000	$536,250
	Concrete Aprons	2	EA	$3,250.00	$7,800	$9,750
	Building HVAC Systems	5,500	SF	$8.00	$52,800	$66,000
	Service and Distribution	5,500	SF	$0.75	$4,950	$6,188
	Building Power	5,500	SF	$1.75	$11,550	$14,438
	Lighting	5,500	SF	$5.25	$34,650	$43,313
	Aquaculture Electrical Equipment	5,500	SF	$1.25	$8,250	$10,313
	20' dia. SS Culture Tank with Foundation & Floor	5	EA	$18,000.00	$108,000	$135,000
	Water Supply, Drainage, & Oxygen Piping, Fitting, & Valves	5	EA	$30,000.00	$180,000	$225,000

APPENDIX

C

Fish Production Data

Maine New Facility Example - 39% Brook Trout Production Increase

Maine Brook Trout 39% Increase

Version 2 - Prepared Jan 25, 2016

New Facility

Date	Event	Location	Avg. Temp. (F)	Degree Days for Period	Growth Length (inches)	Growth Fish per Pound	Monthly Survival	Number of Fish On Hand	Fish Weight Start of Month (lbs.)	Number Transferred or Stocked	Pounds Transferred or Stocked	Percent Weight Gain	Density Index (lb/cf/in)	Density (lbs/ft^3)	Req'd Space (cu ft)	%BWFeed	Daily Feed lbs.	Monthly Feed lbs.	Req'd Tanks	Req'd Volume ft^3	Volume Available ft^3	Flow Required gpm	Water Source
1-Nov-14	Egg Take	Hatchery	48																				Ground
1-Dec-14		Incubators	45																				Ground
1-Jan-15		Incubators	35.6					300,000															Ground
1-Feb-15	First Feeding	Combi-Tanks	44	372	1.0	2,387.0	86.0%	258,000	108	0	0		0.30	1.28	351	13.0%			1	85	170	24	Ground
1-Mar-15		Combi-Tanks	44	336	1.4	916.2	84.0%	216,720	237	0	0	161%	0.30	0.42	558	9.4%	22.3	625	7	558	170	158	Ground
1-Apr-15		Combi-Tanks	44	372	1.8	414.6	95.0%	205,884	497	0	0	121%	0.30	0.55	899	7.2%	36.0	1,115	11	899	170	255	Ground
1-May-15	Transfer & Fry Stock	Combi-Tanks	44	360	2.3	225.7	90.0%	185,296	821	0	0	84%	0.30	0.68	1,214	5.9%	48.6	1,457	14	1,214	170	344	Ground
1-Jun-15		Circulars	55	698	3.1	90.6	89.5%	165,840	1,831	0	0	149%	0.20	0.61	2,994	8.2%	149.7	4,642	3	2,994	35,564	370	Ground/Surface
1-Jul-15		Circulars	60	853	4.0	39.3	89.0%	164,913	4,195	0	0	130%	0.20	0.81	5,195	7.8%	328.4	9,851	6	5,195	35,564	643	Ground/Surface
1-Aug-15		Circulars	58	804	5.0	21.2	88.5%	163,987	7,739	0	0	86%	0.20	0.99	7,800	5.8%	449.3	13,929	9	7,800	35,564	965	Ground/Surface
1-Sep-15		Circulars	57	764	5.8	13.0	88.0%	163,060	12,551	0	0	63%	0.20	1.17	10,747	4.7%	589.0	18,258	12	10,747	35,564	1,330	Ground/Surface
1-Oct-15		Circulars	55	702	6.6	8.8	87.5%	162,134	18,401	0	0	47%	0.25	1.66	11,074	3.9%	719.9	21,597	12	11,074	35,564	1,370	Ground/Surface
1-Nov-15	Stock FF	Circulars	48	485	7.2	6.4	87.0%	156,957	24,384	4,250	660	27%	0.25	1.80	13,538	2.4%	589.0	18,258	15	13,538	35,564	1,675	Ground/Surface
1-Dec-15		Circulars	45	378	7.6	5.4	86.5%	156,031	28,895	0	0	19%	0.25	1.91	15,131	1.8%	529.6	15,888	17	15,131	35,564	1,872	Ground/Surface
1-Jan-16		Circulars	36	112	7.8	5.1	86.0%	159,354	31,022	0	0	5%	0.25	1.94	15,976	0.5%	159.8	4,953	18	15,976	35,564	1,977	Ground/Surface
1-Feb-16		Circulars	36	112	7.9	5.1	85.5%	154,178	30,156	0	0	5%	0.25	1.97	15,278	0.5%	152.8	4,736	17	15,278	35,564	1,890	Ground/Surface
1-Mar-16		Circulars	36	125	8.0	4.8	85.0%	153,251	31,644	0	0	6%	0.25	2.01	15,745	0.6%	189.0	5,480	18	15,745	35,564	1,948	Ground/Surface
1-Apr-16		Circulars	39	223	8.3	4.4	84.5%	152,325	34,561	0	0	10%	0.25	2.07	16,664	1.0%	333.3	10,333	19	16,664	35,564	2,062	Ground/Surface
1-May-16	Stock SY	Circulars	46	432	8.8	3.7	84.0%	118,733	32,073	32,665	8,824	19%	0.25	2.20	14,591	1.8%	583.7	17,510	16	14,591	35,564	1,805	Ground/Surface
1-Jun-16		Circulars	55	698	9.6	2.5	83.5%	117,807	46,983	0	0	30%	0.25	2.40	19,588	2.6%	1,224.4	37,955	22	19,588	35,564	2,423	Ground/Surface
1-Jul-16		Circulars	60	853	10.6	1.9	83.0%	116,880	62,419	0	0	34%	0.25	2.64	23,610	3.0%	1,865.3	55,960	27	23,610	35,564	2,921	Ground/Surface
1-Aug-16		Circulars	58	804	11.5	1.5	82.5%	115,954	79,607	0	0	29%	0.25	2.87	27,693	2.5%	1,994.1	61,816	31	27,693	35,564	3,426	Ground/Surface
1-Sep-16		Circulars	57	764	12.4	1.2	82.0%	115,027	98,494	0	0	25%	0.25	3.09	31,831	2.2%	2,180.6	67,598	36	31,831	35,564	3,938	Ground/Surface
1-Oct-16	Stock FY	Circulars	55	702	13.2	1.0	81.5%	114,101	118,081	109,630	113,455	21%	0.28	3.69	31,987	2.0%	2,328.8	69,865	36	31,987	35,564	3,957	Ground/Surface
Total Stocked										146,545	122,938												
1-Nov-16	Adult	Circulars	45	403	13.6	0.9	80.0%	1,691	1,943			13%	0.20	1.10	712	1.1%	20.6	637	1.98	104	35,564	218	Ground/Surface
Total Produced										148,236	124,881												

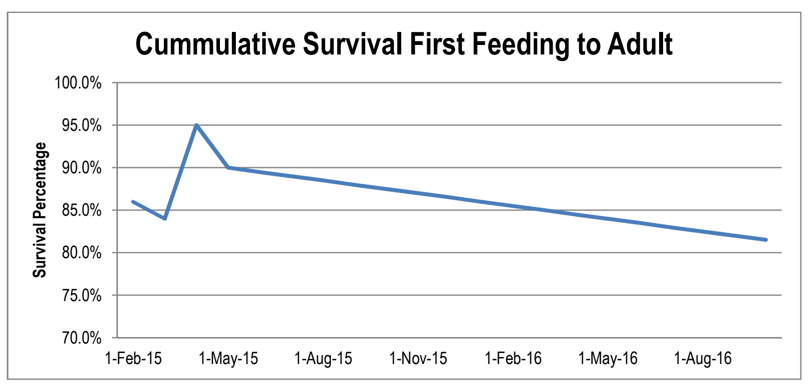
Adult Space

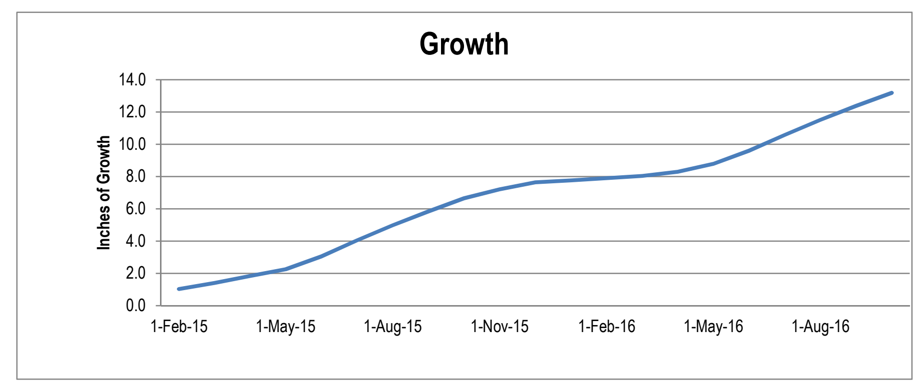
Species	Number[1]	Cubic Feet/ Adult	Space Required (cf)	Flow Required (gpm)
Required	1,010	10	10,100	505
Available	1,691		21,000	

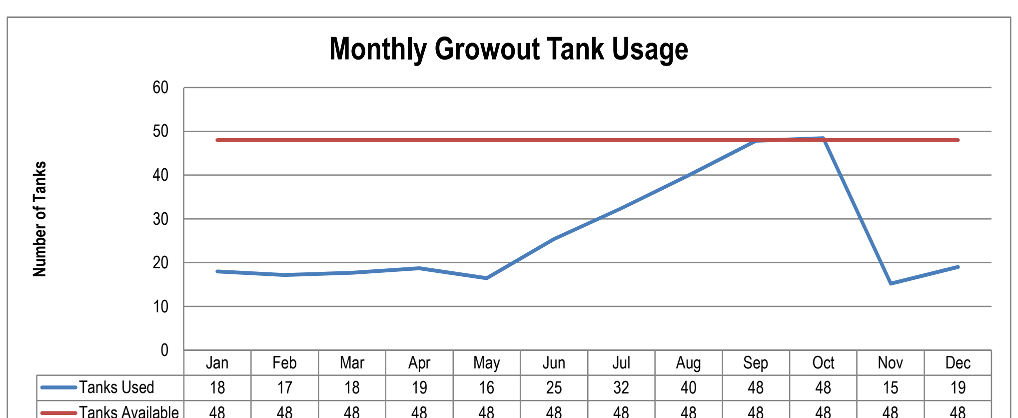
[1]Assumes an 50:50 sex ratio and incorporates a 15% prespawning mortality

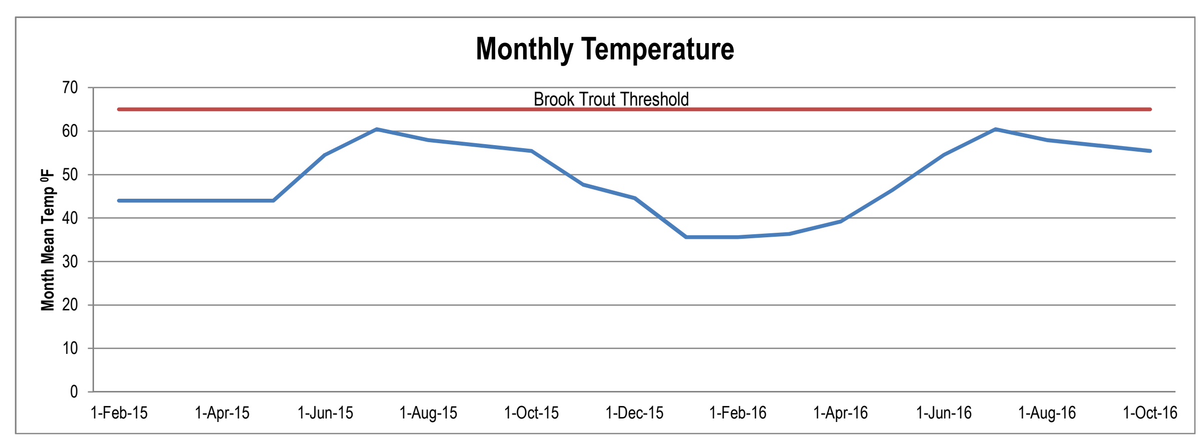
Egg Requirements

Species	Fecundity	Surv. to 1st feed	Egg Requirement	# Females	Eggs/oz	Number of Qts.	Qts./Jar	Jars Needed
Brook Trout	700	50.0%	300,000	429	324	30	3	10









Maine New Facility Example - 39% Brook Trout Production Increase

Grand Lake Stream Tank Addition

Version 2 - Prepared Jan 25, 2016

GLS Brook Trout

Date	Event	Location	Avg. Temp. (F)	Degree Days for Period	Growth Length (inches)	Growth Fish per Pound	Monthly Survival	Number of Fish On Hand	Fish Weight Start of Month (lbs.)	Number Transferred or Stocked	Pounds Transferred or Stocked	Percent Weight Gain	Density Index (lb/cf/in)	Density (lbs/ft^3)	Req'd Space (cu ft)	%BWFeed	Daily Feed lbs.	Monthly Feed lbs.	Req'd Tanks	Req'd Volume ft^3	Volume Available ft^3	Flow Required gpm	Water Source
1-Nov-14	Egg Take	Hatchery	48																				Ground
1-Dec-14		Incubators	45																				Ground
1-Jan-15		Incubators	35.6					35,000															Ground
1-Feb-15	First Feeding	Combi-Tanks	44	372	1.0	2,387.0	86.0%	30,100	13	0	0		0.30	0.15	41	13.0%			1	85	170	24	Ground
1-Mar-15		Combi-Tanks	44	336	1.4	916.2	84.0%	25,284	28	0	0	161%	0.30	0.42	65	9.4%	2.6	73	1	65	170	18	Ground
1-Apr-15		Combi-Tanks	44	372	1.8	414.6	95.0%	24,020	58	0	0	121%	0.30	0.55	105	7.2%	4.2	130	1	105	170	30	Ground
1-May-15	Transfer & Fry Stock	Combi-Tanks	44	360	2.3	225.7	90.0%	21,618	96	0	0	84%	0.30	0.68	142	5.9%	5.7	170	2	142	170	40	Ground
1-Jun-15		Circulars	55	698	3.1	90.6	89.5%	19,348	214	0	0	149%	0.20	0.61	349	8.2%	17.5	542	0	349	35,564	43	Ground/Surface
1-Jul-15		Circulars	60	853	4.0	39.3	89.0%	19,240	489	0	0	130%	0.20	0.81	606	7.8%	38.3	1,149	1	606	35,564	75	Ground/Surface
1-Aug-15		Circulars	58	804	5.0	21.2	88.5%	19,132	903	0	0	86%	0.20	0.99	910	5.8%	52.4	1,625	1	910	35,564	113	Ground/Surface
1-Sep-15		Circulars	57	764	5.8	13.0	88.0%	19,024	1,464	0	0	63%	0.25	1.46	1,003	4.7%	68.7	2,130	1	1,003	35,564	124	Ground/Surface
1-Oct-15		Circulars	55	702	6.6	8.8	87.5%	18,916	2,147	0	0	47%	0.28	1.86	1,154	3.9%	84.0	2,520	1	1,154	35,564	143	Ground/Surface
1-Nov-15	Stock FF	Circulars	48	485	7.2	6.4	87.0%	18,283	2,840	525	82	27%	0.25	1.80	1,577	2.4%	68.6	2,127	2	1,577	35,564	195	Ground/Surface
1-Dec-15		Circulars	45	378	7.6	5.4	86.5%	18,174	3,366	0	0	19%	0.25	1.91	1,762	1.8%	61.7	1,851	2	1,762	35,564	218	Ground/Surface
1-Jan-16		Circulars	36	112	7.8	5.1	86.0%	18,591	3,619	0	0	5%	0.25	1.94	1,864	0.5%	18.6	578	2	1,864	35,564	231	Ground/Surface
1-Feb-16		Circulars	36	112	7.9	5.1	85.5%	17,958	3,512	0	0	5%	0.25	1.97	1,779	0.5%	17.8	552	2	1,779	35,564	220	Ground/Surface
1-Mar-16		Circulars	36	125	8.0	4.8	85.0%	17,850	3,686	0	0	6%	0.25	2.01	1,834	0.6%	22.0	638	2	1,834	35,564	227	Ground/Surface
1-Apr-16		Circulars	39	223	8.3	4.4	84.5%	17,742	4,026	0	0	10%	0.25	2.07	1,941	1.0%	38.8	1,204	2	1,941	35,564	240	Ground/Surface
1-May-16	Stock SY	Circulars	46	432	8.8	3.7	84.0%	13,784	3,723	3,850	1,040	19%	0.25	2.20	1,694	1.8%	67.8	2,033	2	1,694	35,564	210	Ground/Surface
1-Jun-16		Circulars	55	698	9.6	2.5	83.5%	13,676	5,454	0	0	30%	0.25	2.40	2,274	2.6%	142.1	4,406	3	2,274	35,564	281	Ground/Surface
1-Jul-16		Circulars	60	853	10.6	1.9	83.0%	13,568	7,246	0	0	34%	0.25	2.64	2,741	3.0%	216.5	6,496	3	2,741	35,564	339	Ground/Surface
1-Aug-16		Circulars	58	804	11.5	1.5	82.5%	13,460	9,241	0	0	29%	0.25	2.87	3,215	2.5%	231.5	7,175	4	3,215	35,564	398	Ground/Surface
1-Sep-16		Circulars	57	764	12.4	1.2	82.0%	13,352	11,433	0	0	25%	0.25	3.09	3,695	2.2%	253.1	7,846	4	3,695	35,564	457	Ground/Surface
1-Oct-16	Stock FY	Circulars	55	702	13.2	1.0	81.5%	13,244	13,706	13,125	13,583	21%	0.28	3.69	3,713	2.0%	270.3	8,109	4	3,713	35,564	459	Ground/Surface
Total Stocked										17,500	14,704												
Total Produced										17,500	14,704												

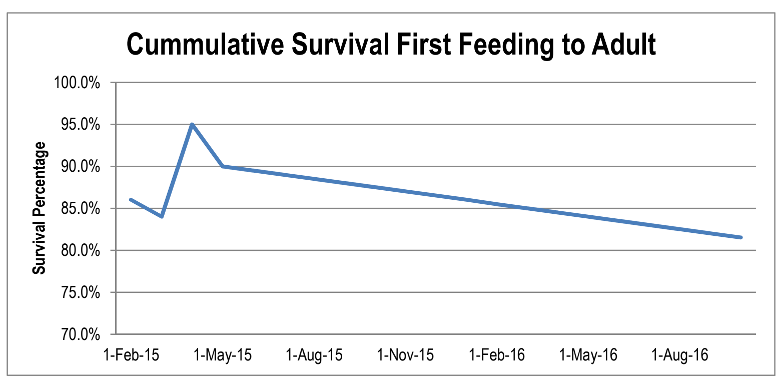
Adult Space

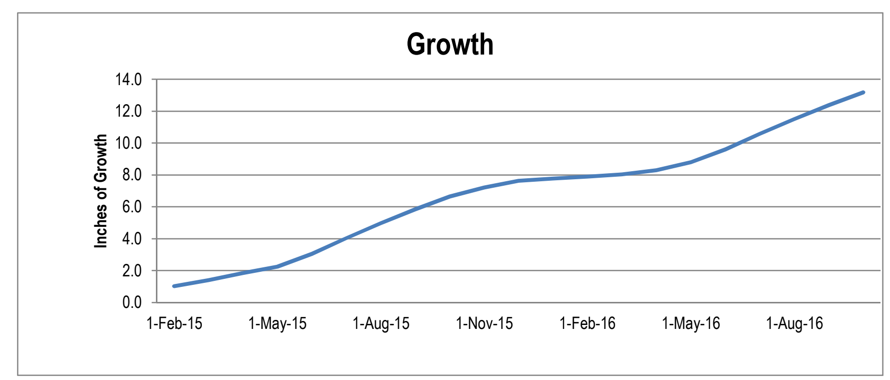
Species	Number [1]	Cubic Feet/ Adult	Space Required (cf)	Flow Required (gpm)
Required	118	10	1,180	59
Available	119		21,000	

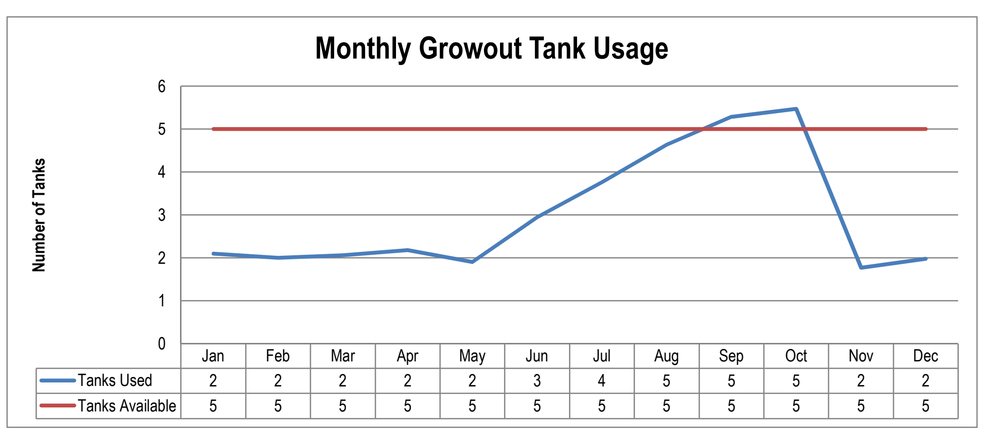
[1]Assumes an 50:50 sex ratio and incorporates a 15% prespawning mortality

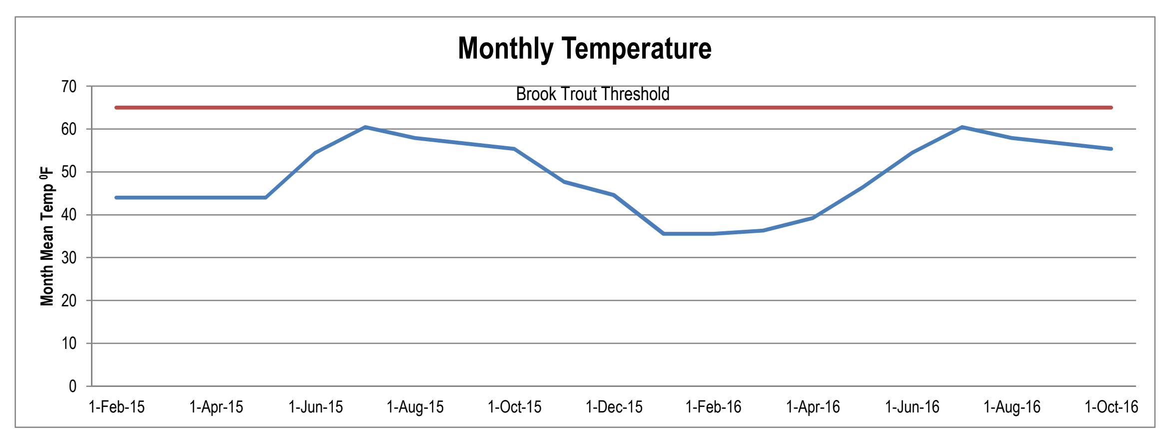
Egg Requirements

Species	Fecundity	Surv. to 1st feed	Egg Requirement	# Females	Eggs/oz	Number of Qts.	Qts./Jar	Jars Needed
Brook Trout	700	50.0%	35,000	50	324	3	3	1







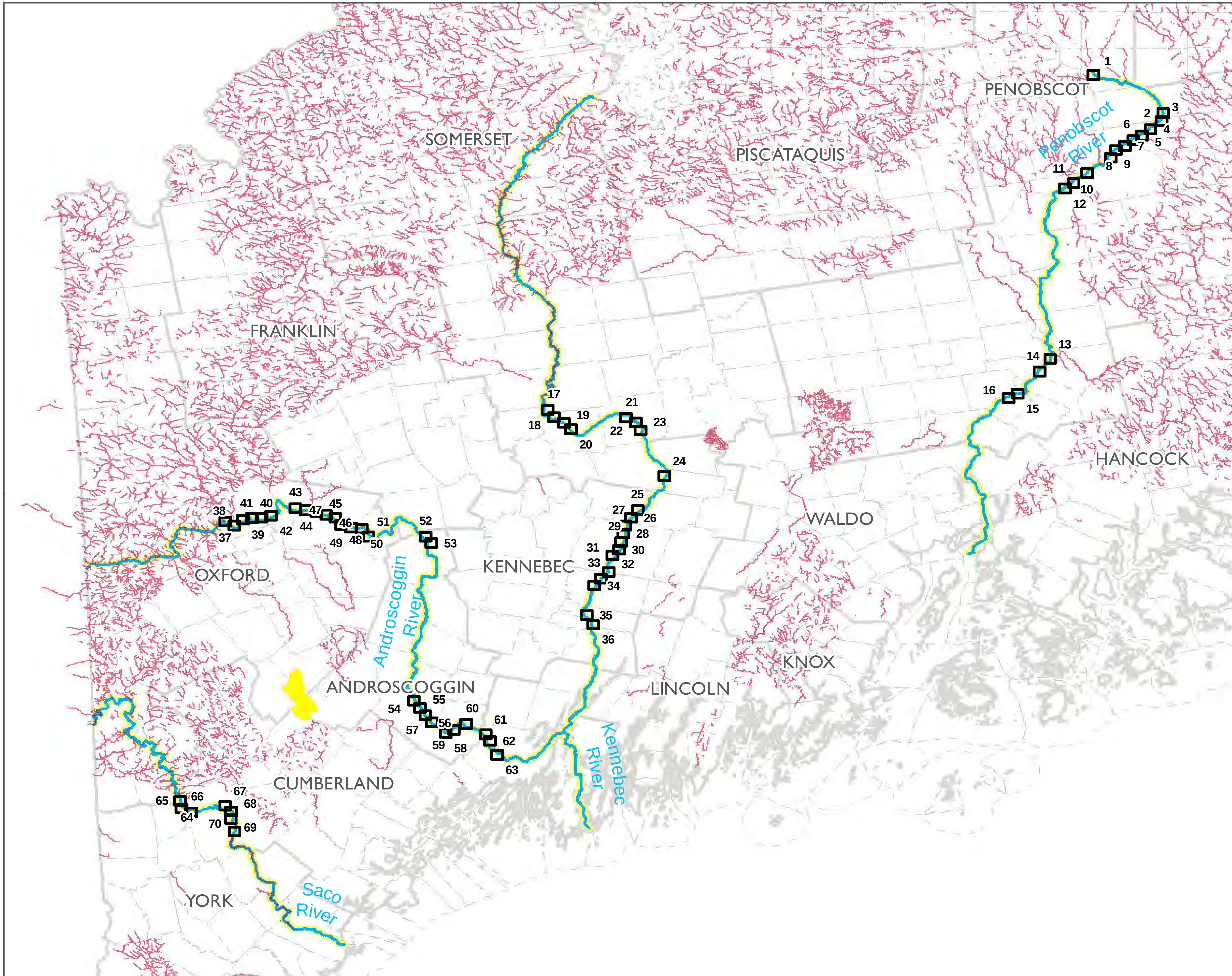


APPENDIX

D

GIS Mapping Records

The following pages highlight a very small subset of printed pages corresponding to the GIS screening for potential hatchery locations. Data that was generated was provided to IF&W electronically as layers for use within Google Earth. This printed subset was intended to show an example of what each search area included and should not be construed as the selected locations.



LEGEND

- Map Page
- 0.5 Mile Buffer Search Area
- Major River
- County Boundary
- DEP Water Classification A Streams
- DEP Water Classification A

FISH HATCHERY SITING POTENTAL LOCATIONS FEBRUARY 2016

N

0 5 10
MILES

HDR

INDEX

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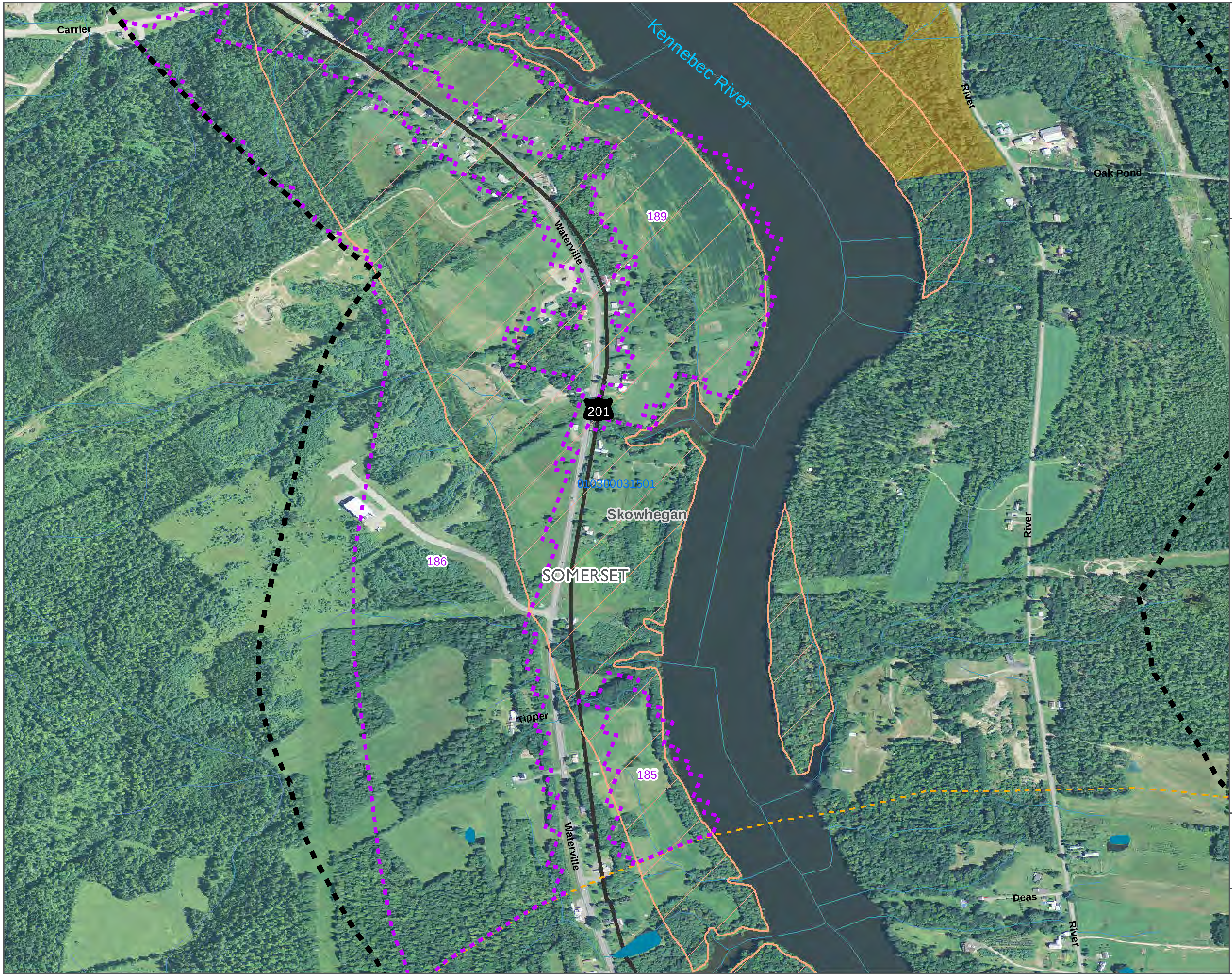

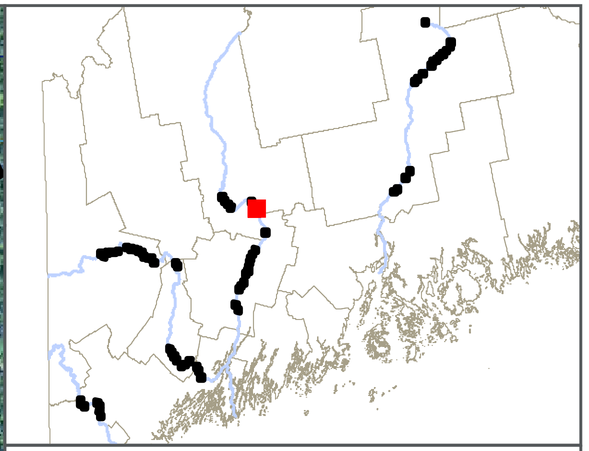

- Potential Siting Locations
- 0.5 Mile Buffer Search Area
- DEP Water Classification A Streams
- DEP Water Classification A Waterbodies

Aquifer Yield Expected (constructed well)

- 10-50 GPM
- >50 GPM
- Public Drinking Water (Surface Supply Watersheds)

Flood Zone

- A
- AE
- AH; AO
- D; X
- UNDES
- VE
- X500
- Conservation Lands
- Salmon Habitat Area
- Streams
- Waterbodies
- NWI Wetlands
- Watershed Boundary (HUC 12)
- Interstate Highway
- US Highway
- State Highway
- County Boundary
- Town Boundary

FISH HATCHERY SITING POTENTAL LOCATIONS FEBURARY 2016

N

0 500 1,000
FEET

HDR

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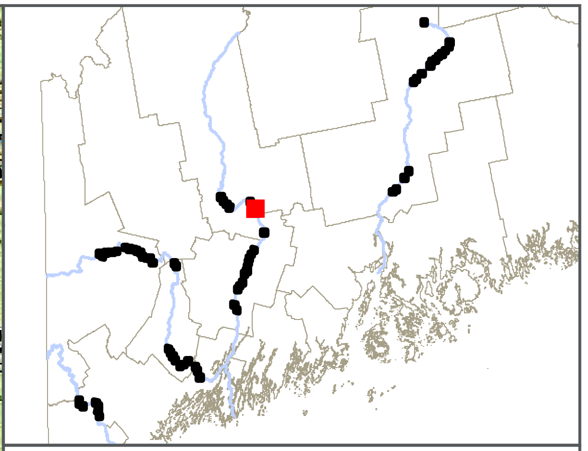

Potential Siting Locations
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DEP Water Classification A Streams
DEP Water Classification A Waterbodies

Aquifer Yield Expected (constructed well)

10-50 GPM
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State Highway
County Boundary
Town Boundary

FISH HATCHERY SITING POTENTAL LOCATIONS FEBURARY 2016

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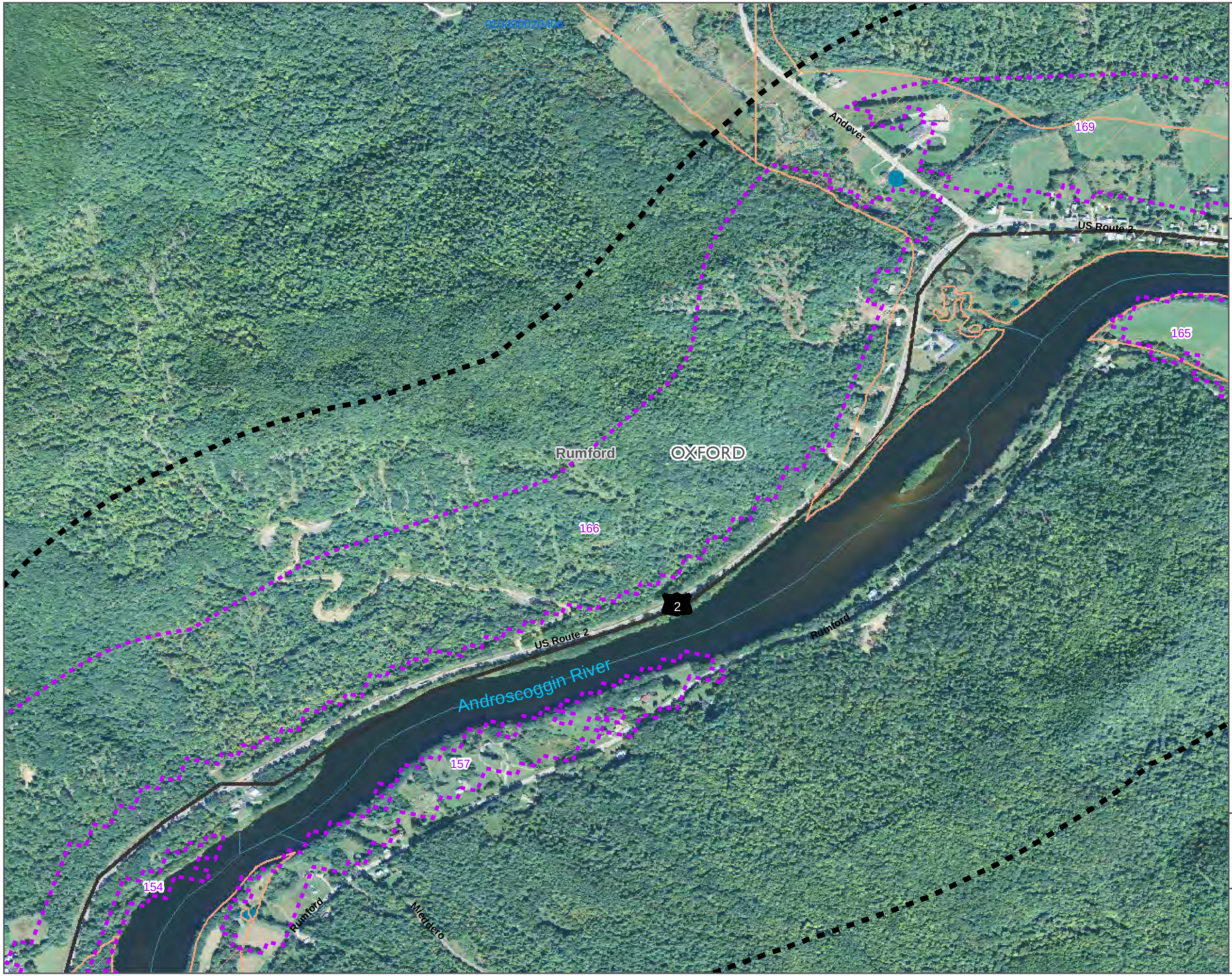

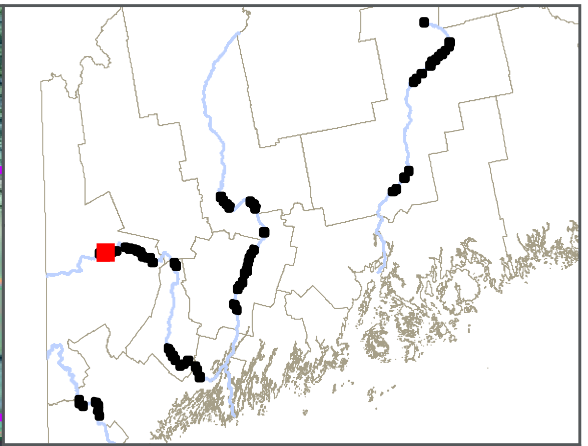

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FISH HATCHERY SITING POTENTAL LOCATIONS FEBURARY 2016

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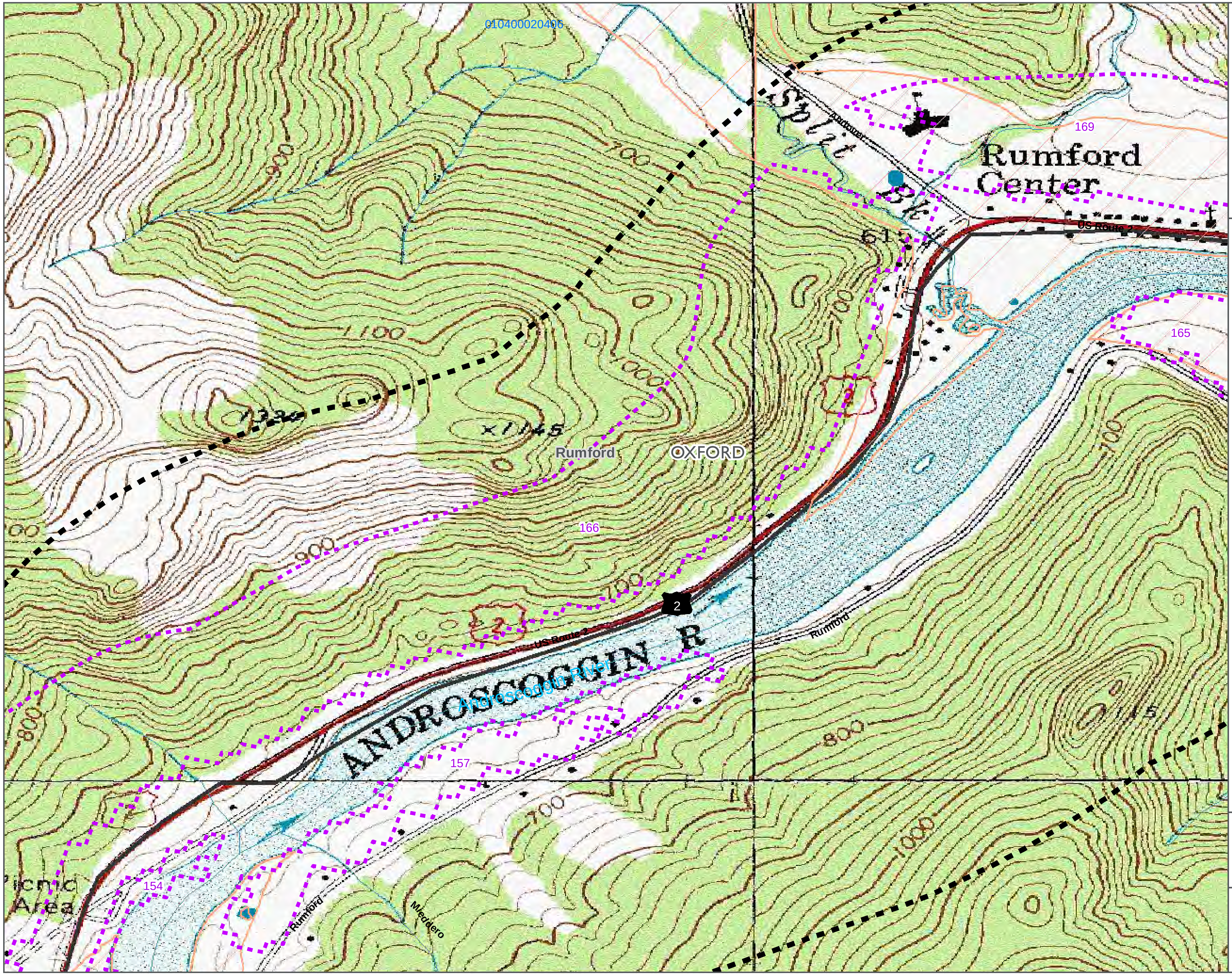

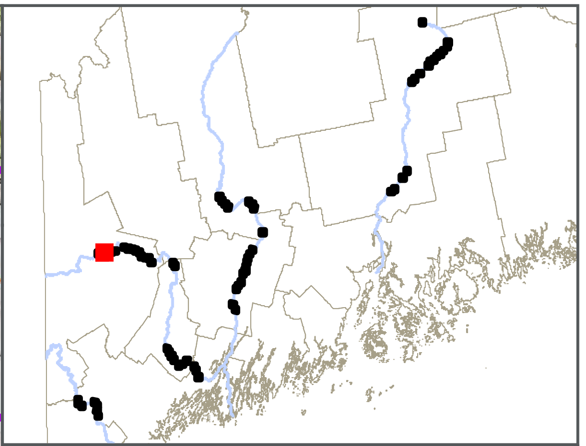

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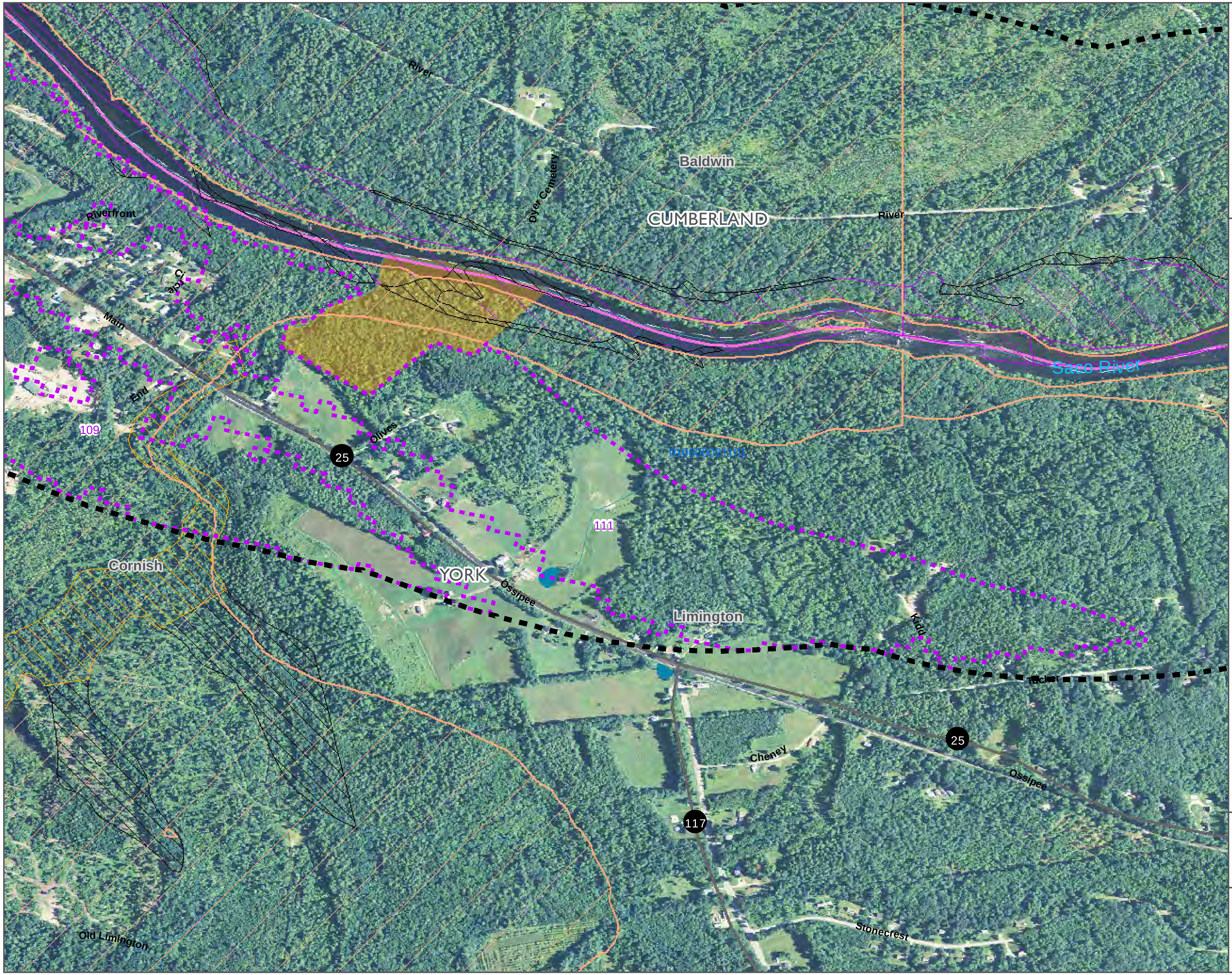

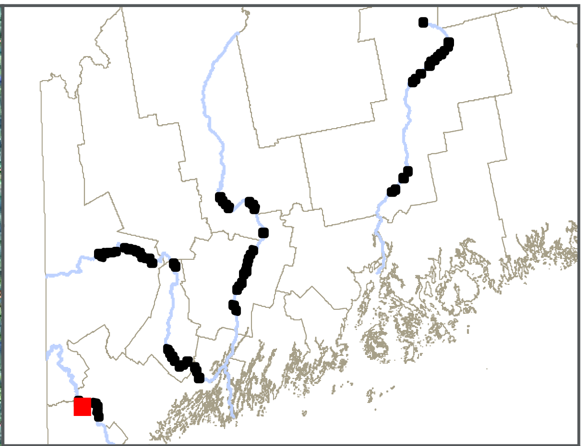

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N

0 500 1,000
FEET

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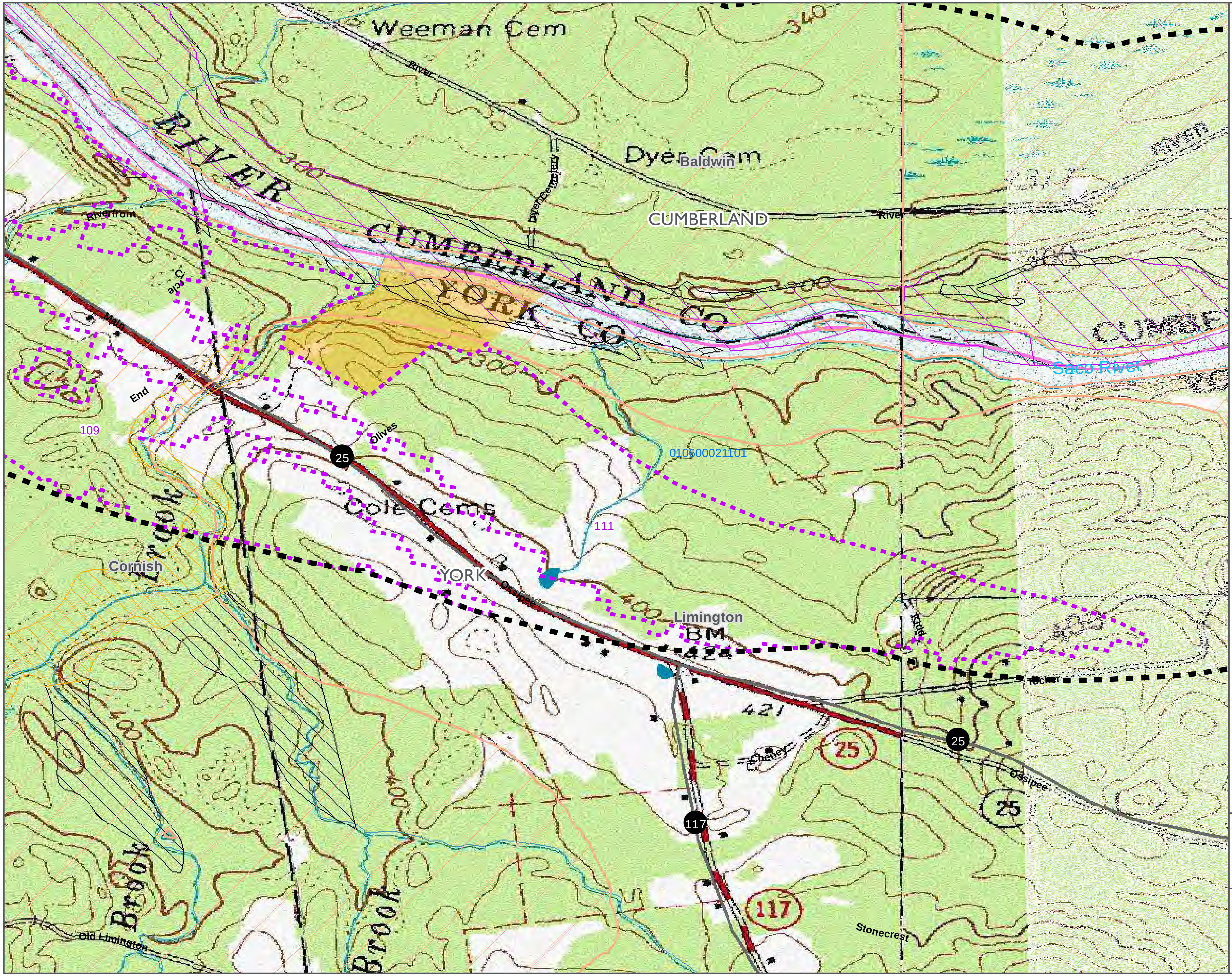

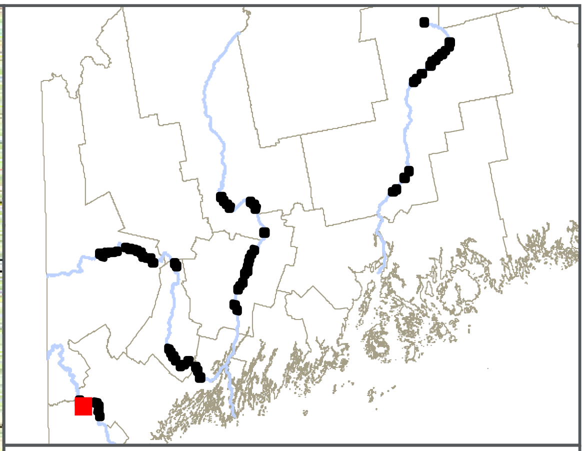

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FISH HATCHERY SITING POTENTAL LOCATIONS FEBURARY 2016

0 500 1,000 FEET

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APPENDIX

E

Effluent Data and DEP Communication

Casco State Fish Hatchery
DMR SUMMARY

2015 - 005A Discharge

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January	2.6	17350	17350			<47.1	<242	<2	<2	<47.1	<242	<2	<2	7.1	0.013	
February	2.6	25413	25413			<47.1	<242	<2	<2	<47.1	<242	<2	<2	16.8	0.014	
March	2.6	30046	30046			<47.1	<242	<2	<2	<47.1	<242	<2	<2	28	0.015	
April	2.6	36950	36950			<47.1	<242	<2	<2	<47.1	<242	<2	<2	52.4	0.033	
May	2.6	33621	33621			<47.1	<242	<2	<2	<47.1	<242	<2	<2	72.6	0.027	
June	2.6	31446	31446			<47.1	<242	<2	<2	<47.1	<242	<2	<2	95.1	0.030	7.9
July	2.6	32556	32556			<47.1	<242	<2	<2	<47.1	<242	<2	<2	124	**0.039**	8.1
August	2.6	36542	36542			<47.1	<242	<2	<2	<47.1	<242	<2	<2	168.6	**0.06**	7.6
September	2.6	37699	37699			<47.1	<242	<2	<2	<47.1	<242	<2	<2	189.2	0.028	7.7
October	2.6	38618	38618			<47.1	<242	<2	<2	<47.1	<242	<2	<2	211.3	0.03	
November																
December																
LIMITS	**2.90**	**Report**	**Report**	**-**	**-**	**47.1**	**242**	**6**	**10**	**47.1**	**242**	**6**	**10**	**274.5**	**0.035**	**7.5**

BOLD = Exceedence
NODI9 = Monitoring Not Required
NODIC = No Discharge

2015 - 006A Discharge (Hatchery Bldg)

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January	0.017	Eggs	Eggs			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.026	0.006	
February	0.017	Eggs	Eggs			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.041	0.005	
March	0.017	Eggs	Eggs			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.065	0.006	
April	0.017	Sac Fry	Sac Fry			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.1	0.008	
May	0.017	Sac Fry	Sac Fry			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.155	0.013	
June	0.017	Fry	Fry			<.9	<4.3	<2	<2	<.9	<4.3	<2	<2	0.184	0.007	7.7
July		Shutdown														
August		Shutdown														
September		Shutdown														
October		Shutdown														
November																
December																
LIMITS	**0.052**	**Report**	**Report**	**7.3**	**45.0**	**0.9**	**4.3**	**6**	**10**	**0.9**	**4.3**	**6**	**10**	**5.5**	**0.035**	**7.5**

BOLD = Exceedence
NODI9 = Monitoring Not Required
NODIC = No Discharge

DRY MILLS
DMR SUMMARY SHEET

2014

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Monthly Avg mg / L	Daily Min mg / L
January	1.17	19,475	19,624	61.6	12.5	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
February	1.17	21,302	22,980	NODI-9	NODI-9	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
March	1.17	22,574	22,980	43.4	8.8	<20	<20	<2	<2	**37**	37	3.8	3.8	NODI-9	NODI-9	NODI-9
April	1.18	22,591	23,013	NODI-9	NODI-9	<20	<20	<2	<2	30	30	3	3	NODI-9	NODI-9	NODI-9
May	1.18	19,020	23,013	NODI-9	NODI-9	<20	<20	<2	<2	27	27	2.7	2.7	NODI-9	NODI-9	NODI-9
June	1.18	14,535	15,026	NODI-9	NODI-9	<20	<20	<2	<2	28	28	2.8	2.8	**0.46**	**0.047**	10.2
July	1.18	16,772	19,500	NODI-9	NODI-9	<20	<20	<2	<2	20	21	2.1	2.1	0.43	**0.044**	10.1
August	1.18	23,808	28,116	50.6	10.26	<20	<20	<2	<2	30	30	3.1	3.1	**0.46**	**0.047**	10.1
September	1.18	31,073	34,029	79.9	16.2	<20	<20	<2	<2	ne	ne	ne	ne	**0.51**	**0.052**	10.2
October	1.18	26,251	34,029	NODI-9	NODI-9	<20	<20	<2	<2	<20	21	<2.1	2.1	NODI-9	NODI-9	NODI-9
November	1.18	17,083	18,473	8.5	1.72	<20	<20	<2	<2	20	20	2	2	NODI-9	NODI-9	NODI-9
December	1.18	17,001	18,308	66	13.38	<20	<20	<2	<2	29	29	2.9	2.9	NODI-9	NODI-9	NODI-9
LIMITS	***1.92***	**Report**	**Report**	***91.3***	***45.0***	***32***	***160***	***6***	***10***	***32***	***160***	***6***	***10***	***0.44***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required

2015

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Monthly Avg mg / L	Daily Min mg / L
January	1.18	19,475	20,642	NODI-9	NODI-9	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
February	1.18	22,202	23,762	NODI-9	NODI-9	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
March	1.18	26,497	29,231	NODI-9	NODI-9	21	21	2.1	2.1	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
April	1.18	28,023	29,231	NODI-9	NODI-9	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
May	1.18	21,985	26,814	66.2	13.43	<20	<20	<2	<2	<20	<20	<2	<2	NODI-9	NODI-9	NODI-9
June	1.18	17,265	17,374	2.9	0.59	22	22	2.2	2.2	<20	<20	<2	<2	**0.5**	**0.051**	10.3
July	1.18	20,563	23,751	NODI-9	NODI-9	<20	<20	<2	<2	<20	<20	<2	<2	**0.46**	**0.049**	10.2
August	1.18	26,882	30,013	NODI-9	NODI-9	<20	<20	<2	<2	26	29	2.6	2.9	**0.5**	**0.051**	10.1
September	1.18	33,059	36,104	63.9	13.1	<20	<20	<2	<2	<20	<20	<2	<2	**0.56**	**0.057**	9.9
October	1.18	29,201	36,104	NODI-9	NODI-9	<20	<20	<2	<2	NE	NE	NE	NE	NODI-9	NODI-9	NODI-9
November																
December																
LIMITS	***1.92***	**Report**	**Report**	***91.3***	***45.0***	***32***	***160***	***6***	***10***	***32***	***160***	***6***	***10***	***0.44***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required

Embden Rearing Station
DMR SUMMARY

2014

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg	Daily Max Lbs / Day	Monthly Avg	Daily Max mg / L	Monthly Avg	Daily Max Lbs / Day	Monthly Avg	Daily Max mg / L	Monthly Avg	Monthly Avg	Daily Min mg / L
January	4.84	48317	50576	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
February	4.84	52243	53930	N9	N9	<81	<81	<2.0	<2.0	129	129	3.2	3.2			
March	4.84	56846	59784	N9	N9	<81	<81	<2.0	<2.0	190	190	4.7	4.7			
April	4.84	60874	61987	N9	N9	<81	<81	<2.0	<2.0	101	101	2.5	2.5			
May	4.28	47422	61987	N9	N9	<71	<71	<2.0	<2.0	125	125	3.5	3.5			
June	4.28	26841	32874	N9	N9	71	71	2	2	<71	<71	<2.0	<2.0	1.3	**0.037**	11
July	4.5	26120	31432	N9	N9	<75	<75	<2.0	<2.0	<75	<75	<2.0	<2.0	**1.6**	**0.044**	9.5
August	4.84	39525	48312	N9	N9	109	109	2.7	2.7	93	93	2.3	2.3	**2.7**	**0.067**	9.2
September	4.84	56369	64446	N9	N9	93	93	2.3	2.3	<81	<81	<2.0	<2.0	**3.6**	**0.089**	9.8
October	4.53	47397	64446	N9	N9	181	181	4.8	4.8	151	151	4	4			
November	4.31	31921	33523	N9	N9	<72	<72	<2.0	<2.0	<72	<72	<2.0	<2.0			
December	4.84	35342	37174	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
LIMITS	***5.00***	**Report**	**Report**	***150.0***	***45.0***	***250***	***417***	***6***	***10***	***250***	***417***	***6***	***10***	***1.5***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required
NODIC = No Discharge

2015

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg	Daily Max Lbs / Day	Monthly Avg	Daily Max mg / L	Monthly Avg	Daily Max Lbs / Day	Monthly Avg	Daily Max mg / L	Monthly Avg	Monthly Avg	Daily Min mg / L
January	4.84	39108	41057	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
February	4.84	43205	45370	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
March	4.84	47811	50270	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
April	4.84	51010	51769	N9	N9	<81	<81	<2.0	<2.0	<81	<81	<2.0	<2.0			
May	4.81	40446	51769	N9	N9	<80	<80	<2.0	<2.0	NH	NH	NH	NH			
June	4.73	24789	29139	N9	N9	<79	<79	<2.0	<2.0	NH	NH	NH	NH	1.3	0.034	10.4
July	4.73	26355	32270	N9	N9	<79	<79	<2.0	<2.0	<79	<79	<2.0	<2.0	**2.5**	**0.064**	9.9
August	4.84	43205	54157	N9	N9	85	85	2.1	2.1	<81	<81	<2.0	<2.0	**3.5**	**0.086**	9.5
September	4.84	62573	71012	N9	N9	113	113	2.8	2.8	<81	<81	<2.0	<2.0	**4.6**	**0.115**	8.8
October	4.76	56077	71012	N9	N9	<80	<80	<2.0	<2.0	<80	<80	<2.0	<2.0			
November																
December																
LIMITS	**5.00**	**Report**	**Report**	***150.0***	***45.0***	***250***	***417***	***6***	***10***	***250***	***417***	***6***	***10***	***1.5***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required
NODIC = No Discharge

Enfield Hatchery
EXCEEDENCES ON CURRENT DISCHARGE LICENSE

2015 - 005A Discharge

	Flow	BOD				TSS				TP		Fish on Hand		Formalin 1Hr		Formalin 24Hr		D.O.
Month	Monthly Avg MGD	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs /Day	Monthly Avg mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Daily Max Lbs / Day	Daily Max mg / L	Daily Min mg / L
January	4.89	<79.2	<81.6	<2	<2	<79.2	<81.6	<2	<2	NODI 9	NODI 9	30,267	31,342	NODI 9	NODI 9	NODI 9	NODI 9	NODI 9
February	4.92	<79.2	<82.1	<2	<2	<79.2	<82.1	<2	<2	NODI 9	NODI 9	32,652	33,961	NODI 8	NODI 8	NODI 9	NODI 9	NODI 9
March	4.94	<79.2	<82.4	<2	<2	<79.2	<82.1	<2	<2	NODI 9	NODI 9	34,684	35,406	NODI 9	NODI 9	NODI 9	NODI 9	NODI 9
April	4.94	<79.2	<82.4	<2	<2	<79.2	<82.4	<2	<2	NODI 9	NODI 9	36,297	37,187	NODI 9	NODI 9	NODI 9	NODI 9	NODI 9
May	4.87	<79.2	<81.2	<2	<2	NODI H	NODI H	NODI H	NODI H	NODI 9	NODI 9	27,389	37,187	NODI 9	NODI 9	NODI 9	NODI 9	NODI 9
June	4.12	<68.1	<68.1	<2	<2	NODI H	NODI H	NODI H	NODI H	1.05	0.031	19,439	21,287	51.1	33.09	NODI 9	NODI 9	8.63
July	4.68	<79.2	<79.6	<2	<2	<79.2	<79.6	<2	<2	0.56	0.014	25,092	28,897	NODI 9	NODI 9	NODI 9	NODI 9	8
August	4.56	<79.2	<79.7	<2	<2	<79.2	<79.7	<2	<2	0.762	0.02	36,849	44,801	NODI 9	NODI 9	NODI 9	NODI 9	7.53
September	4.21	77.2	77.2	2.2	2.2	<70.2	<70.2	<2	<2	1.44	0.041	49,511	54,220	NODI 9	NODI 9	NODI 9	NODI 9	7.93
October	4.48	<74.7	<74.7	<2	<2	<74.7	<74.7	<2	<2	NODI 9	NODI 9	44,425	54,220	51.1	29.87	NODI 9	NODI 9	NODI 9
November										NODI 9	NODI 9							NODI 9
December										NODI 9	NODI 9							NODI 9
LIMITS	**5.00**	**79.2**	**402**	**6**	**10**	**79.2**	**402**	**6**	**10**	**1.85**	**0.041**	**Report**	**Report**	**103.6**	**47.0**	**103.6**	**26.0**	**7.5**

BOLD = Exceedence
NODI 9 = Monitoring Not Required
NODI C = No Discharge
NODI H = No Data Indicated / Invalid Test

Maine Pollutant Discharge Elimination System (MEPDES) #ME0001104
Maine Waste Discharge License (WDL) # W-002032-6F-E-R
License Date: 5 December 2011

Governor Hill Hatchery
DMR SUMMARY

2014

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Monthly Avg mg / L	Daily Min mg / L
January	1.2	16056	16813	nodic	nodic	10	10	1	1	4	4	0.4	0.4	nodi-9	nodi-9	nodi-9
February	1.2	17858	18894	nodic	nodic	6	6	0.6	0.6	12	12	1.2	1.2	nodi-9	nodi-9	nodi-9
March	1.2	20837	22780	nodic	nodic	4	4	0.4	0.4	8	8	0.8	0.8	nodi-9	nodi-9	nodi-9
April	1.2	23301	23462	nodic	nodic	11	11	1.1	1.1	12	12	1.2	1.2	nodi-9	nodi-9	nodi-9
May	1.2	19425	23461	nodic	nodic	11	11	1.1	1.1	12	12	1.2	1.2	nodi-9	nodi-9	nodi-9
June	1.2	14763	15349	nodic	nodic	8	8	0.8	0.8	13	13	1.3	1.3	**0.475**	**0.048**	10
July	1.2	16971	18483	37	8	8	8	0.8	0.8	7	7	0.7	0.7	**0.45**	**0.045**	9.9
August	1.2	20394	22640	37	8	10	10	1	1	7	7	0.7	0.7	**0.445**	**0.045**	10.3
September	1.2	23691	24742	nodic	nodic	11	11	1.1	1.1	5	5	0.5	0.5	**0.475**	**0.048**	10.5
October	1.2	20047	24742	5	1.2	9	9	0.9	0.9	7	7	0.7	0.7	nodi-9	nodi-9	nodi-9
November	1.2	12413	15035	5	1.2	6	6	0.6	0.6	1	1	0.1	0.1	nodi-9	nodi-9	nodi-9
December	1.2	10295	10798	2	0.5	6	6	0.6	0.6	<17	<100	<2	<2	nodi-9	nodi-9	nodi-9
LIMITS	***1.20***	**Report**	**Report**	***95.0***	***45.0***	***17***	***100***	***6***	***10***	***17***	***100***	***6***	***10***	***0.24***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required TSS over in Nov/Dec due to Ducks in Pond.
NODIC = No Discharge

2015

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	**Flow MGD**	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Dailymax mg/l	Monthly Avg Lbs / Day	Monthly Avg mg / L	Daily Min mg / L
January	1.2	11552	12307	nodic	nodic	7	7	0.7	0.7	<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
February	1.2	13167	14027	nodic	nodic	7	7	0.7	0.7	<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
March	1.2	15240	16466	nodic	nodic	6	6	0.6	0.6	<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
April	1.2	17380	18284	37	8					<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
May	1.2	13191	18282	nodic	nodic					<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
June	1.2	8618	9136	nodic	nodic					<17	<100	<2	<2	**0.42**	0.048	9.4
July	1.2	10585	12035	37	8					<17	<100	<2	<2	**0.435**	0.046	9.7
August	1.2	13636	15237	nodic	nodic					<17	<100	<2	<2	**0.335**	0.034	10
September	1.2	17679	20111	nodic	nodic					<17	<100	<2	<2	**0.37**	0.037	10.2
October	1.2	15448	20084	nodic	nodic					<17	<100	<2	<2	Nodi-9	Nodi-9	Nodi-9
November	1.2													Nodi-9	Nodi-9	Nodi-9
December	1.2													Nodi-9	Nodi-9	Nodi-9
LIMITS	***1.20***	**Report**	**Report**	***95.0***	***Report***	~~17~~	~~100~~	~~6~~	~~10~~	***17***	***100***	***6***	***10***	***0.24***	***Report***	***7.5***

BOLD = Exceedence New License 3/20/15
NODI9 = Monitoring Not Required
NODIC = No Discharge

Grand Lake Stream Hatchery
DMR SUMMARY

2014

Month	Flow	Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
		Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January	2.02	12079	12294	6.1	0.03	<34	<34	<2	<2	<34	<34	<2	<2	7.6	0.020	14.2
February	2.02	12857	13419	3.1	0.01	<34	<34	<2	<2	<34	<34	<2	<2	17.8	0.020	13.8
March	2.02	13805	14191			<34	<34	<2	<2	<34	<34	<2	<2	28.8	0.020	13.2
April	2.02	14773	15355			<34	<34	<2	<2	<34	<34	<2	<2	37.9	0.020	12
May	2.02	11277	15355			<34	<34	<2	<2	<34	<34	<2	<2	54.1	0.031	11
June	2.02	4602	7198			<34	<34	<2	<2	<34	<34	<2	<2	66.1	0.023	9.6
Jly	1.72	2954	3901			<34	<34	<2	<2	<34	<34	<2	<2	75.7	0.022	8
August	1.72	5141	6380							<29	<29	<2	<2	85	0.021	8
September	1.72	8514	10647							39	39	2.7	2.7	117.7	0.074	8
October	2.02	10268	10647							<34	<34	<2	<2	133.9	0.031	8.5
November	2.02	9088	9888	4.7						<34	<34	<2	<2	142.3	0.016	13
December	2.02	7779	8288	6.1						<34	<34	<2	<2	149.1	0.013	13
LIMITS	***2.90***	**Report**	**Report**	***54.8***	***72.0***	***48***	***242***	***6***	***10***	***48***	***242***	***6***	***10***	***504***	***0.140***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required
NODIC = No discharge.

2015

Month	Flow	Fish on Hand		Formalin		BOD				TSS				TP		D.O.
		Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Monthly Avg Lbs / Day	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January	2.02	7738	7779	6.13						<34	<34	<2	<2	6.5	0.013	14.2
February	2.02	7645	7697	3.1						<34	<34	<2	<2	9.4	0.006	13.8
March	2.02	7985	8377							<34	<34	<2	<2	14.4	0.010	13.2
April	2.02	8445	8512							<34	<34	<2	<2	20.7	0.012	12.4
May	2.02	5497	8512											34	0.026	11.4
June	1.94	2738	2995							<34	<34	<2	<2	50.8	0.034	10
Jly	1.72	3796	5196							<34	<34	<2	<2	70.1	0.039	8
August	1.8	6291	7385							<29	<29	<2	<2	85.6	0.035	7.8
September	2.02	9053	10721							<34	<34	<2	<2	112.6	0.052	7.6
October	2.02	9789	10721							<34	<34	<2	<2	134.8	0.043	8.2
November																
December																
LIMITS	***2.90***	**Report**	**Report**	***54.8***	***Report***	~~***48***~~	~~***242***~~	~~***6***~~	~~***10***~~	***48***	***242***	***6***	***10***	***504***	***Report***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring Not Required **New License 8/6/14**
NODIC = No discharge.

May 2015 TSS sample failed at the HETL, took additional sample in July 2015.

New Gloucester Hatchery
DMR SUMMARY

2014

Month	Flow MGD	Fish on Hand Monthly Avg Lbs / Day	Fish on Hand Daily Max Lbs / Day	Formalin 1-hr Daily Max Lbs / Day	Formalin 1-hr Daily Max mg / L	BOD Monthly Avg Lbs / Day	BOD Daily Max Lbs / Day	BOD Monthly Avg mg / L	BOD Daily Max mg / L	TSS Monthly Avg Lbs / Day	TSS Daily Max Lbs / Day	TSS Monthly Avg mg / L	TSS Daily Max mg / L	TP Monthly Avg Lbs / Day	TP Monthly Avg mg / L	D.O. Daily Min mg / L
January	4.36	17091	17091	N9	N9	<50	<250	<2	<2	<50	<250	<2	<2	NODI9	NODI9	NODI9
February	2.32	19487	20245	N9	N9	45	45	<2	<2	41	45	<2	<2	NODI9	NODI9	NODI9
March	2.66	20439	20439	N9	N9	45	45	<2	<2	45	45	<2	<2	NODI9	NODI9	NODI9
April	6.5	23151	24585	N9	N9	<50	<50	<2	<2	105	113	<2	<2	NODI9	NODI9	NODI9
May	6.25	18599	18599	N9	N9	<50	<50	<2	<2	**174**	174	3.8	3.8	NODI9	NODI9	NODI9
June	3.43	14523	15408	N9	N9	<50	<250	<2	<2	**103**	103	3.2	3.2	**1.27**	**0.050**	9.8
July	3.41	19580	20691	N9	N9	43	43	2.1	2.1	<50	<250	<2	<2	**0.84**	**0.040**	8.9
August	4.04	25830	27122	N9	N9	**84**	84	2	2	**293**	**293**	**7**	7	**1.72**	**0.050**	9
September	2.42	30123	30976	N9	N9	<50	<250	<2	<2	<50	<250	<2	<2	**1.47**	**0.050**	9.1
October	2.51	30995	30995	N9	N9	36	36	<2	<2	40	40	2.2	2.2	NODI9	NODI9	NODI9
November	2.19	15456	15456	N9	N9	41	41	2.3	2.3	<50	<250	<2	<2	NODI9	NODI9	NODI9
December	2.79	17558	17558	N9	N9	38	38	<2	<2	**95**	95	5	5	NODI9	NODI9	NODI9
LIMITS	*Report*	*Report*	*Report*	***18.3***	***45.0***	***50***	***250***	***6***	***10***	***50***	***250***	***6***	***10***	***0.77***	***0.035***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring is conditional/not required this monitoring period.
NODIC = No discharge.
New license effective 6 Nov 2014

2015

Month	Flow MGD	Fish on Hand Monthly Avg Lbs / Day	Fish on Hand Daily Max Lbs / Day	Formalin Daily Max Lbs / Day	Formalin Monthly Avg Lbs / Day	BOD Monthly Avg Lbs / Day	BOD Daily Max Lbs / Day	BOD Monthly Avg mg / L	BOD Daily Max mg / L	TSS Monthly Avg Lbs / Day	TSS Daily Max Lbs / Day	TSS Monthly Avg mg / L	TSS Daily Max mg / L	TP Monthly Avg Lbs / Day	TP Monthly Avg .mg / L	D.O. Daily Min mg / L
January	3.328	18110	18110	N9	N9	NODI9	NODI9	NODI9	NODI9	<50	<250	<2	<2	NODI9	NODI9	NODI9
February	2.593	18488	18488	2.475		NODI9	NODI9	NODI9	NODI9	42	42	<2	<2	NODI9	NODI9	NODI9
March	2.527	19101	19101	2.476		NODI9	NODI9	NODI9	NODI9	<50	<250	<2	<2	NODI9	NODI9	NODI9
April	6.262	26127	26127	N9	N9	NODI9	NODI9	NODI9	NODI9	<50	60	<2	<2	NODI9	NODI9	NODI9
May	4.192	21231	21231	N9	N9	NODI9	NODI9	NODI9	NODI9	92	92	2.6	2.6	NODI9	NODI9	NODI9
June	3.102	14668	15757	N9	N9	NODI9	NODI9	NODI9	NODI9	**560**	**560**	**16**	**16**	**1.30**	0.05	10
July	2.313	19462	20809	N9	N9	NODI9	NODI9	NODI9	NODI9	46	62	2.3	2.6	0.59	0.03	8.6
August	1.719	24087	24558	N9	N9	NODI9	NODI9	NODI9	NODI9	46	46	3	3	0.63	0.04	8.3
September	1.919	26917	28392	N9	N9	NODI9	NODI9	NODI9	NODI9	<50	<250	<2	<2	0.50	0.04	8.6
October	2.545	25297	25297	0.675		NODI9	NODI9	NODI9	NODI9	41	41	2.2	2.2	NODI9	NODI9	NODI9
November						NODI9	NODI9	NODI9	NODI9							
December						NODI9	NODI9	NODI9	NODI9							
LIMITS	*Report*	*Report*	*Report*	***18.3***	***Report***	~~***50***~~	~~***250***~~	~~***6***~~	~~***10***~~	***50***	***250***	***6***	***10***	***0.77***	***Report***	***7.5***

BOLD = Exceedence
NODI9 = Monitoring is conditional/not required this monitoring period. **New License 11/7/14**
NODIC = No discharge.
NOTE:

HETL RESULTS: TSS 16 mg/L J and "TSS result is approximate because oven temperature range exceeded 104+/- 1 *C" per HETL. WARNING: 00530 - SOLIDS, TOTAL SUSPENDED : 1 - EFFLUENT GROSS VALUE, Con Avg column, has exceeded maximum permit limit of 6 (16) for Con Avg column. WARNING: 00530 - SOLIDS, TOTAL SUSPENDED : 1 - EFFLUENT GROSS VALUE, Con Max column, has exceeded maximum permit limit of 10 (16) for Con Max column. Spoke with Fred Gallant on 7 Jul 15 and he suggested we use code (NH) as this was caused by a HETL equipment failure. Also, suggested retest for TSS in mid-July. Therefore no TSS violation however 560 and 16 values recorded above for reference.

Palermo Rearing Station
DMR SUMMARY

2015 - 005A Discharge

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	Flow MGD	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January	1.78	16938	16938			<30	<30	<2	<2	<30	<30	<2	<2	11.7	0.025	13.1
February	1.78	17496	17496			<30	<30	<2	<2	<30	<30	<2	<2	16.9	0.0125	12.1
March	1.78	18579	18641			<30	<30	<2	<2	<30	<30	<2	<2	22.7	0.0125	11.2
April	1.78	20543	20763			<30	<30	<2	<2	<30	<30	<2	<2	29.6	0.0155	11.7
May	1.91	15769	17809			<31	<31	<2	<2	<31	<31	<2	<2	39.7	0.0205	10.9
June	2.39	12815	14411	38	42	<40	<40	<2	<2	<40	<40	<2	<2	63.6	0.04	9.4
July	2.39	20344	21249	38	42	<40	<40	<2	<2	<40	<40	<2	<2	95.3	**0.0513**	9
August	2.39	29622	32004	38	42	<40	<40	<2	<2	<40	<40	<2	<2	126.2	**0.05**	8.7
September	2.39	37020	39747			<40	<40	<2	<2	<40	<40	<2	<2	148	0.0365	8.7
October	2.39	34779	38669			<40	<40	<2	<2	<40	<40	<2	<2	164.7	0.027	9.9
November																
December																
LIMITS	**4.75**	**Report**	**Report**	**41.0**	**49.0**	**238**	**396**	**6**	**10**	**65**	**396**	**6**	**10**	**197**	**0.049**	**7.5**

BOLD = Exceedence
NODI9 = Monitoring Not Required

2015 - 006A Emergency Bypass

		Fish on Hand		Formalin 1-hr		BOD				TSS				TP		D.O.
Month	Flow MGD	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Daily Max Lbs / Day	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Monthly Avg Lbs / Day	Daily Max Lbs / Day	Monthly Avg mg / L	Daily Max mg / L	Maximum Lbs / Year	Monthly Avg mg / L	Daily Min mg / L
January																
February																
March																
April																
May																
June																
July																
August																
September																
October																
November																
December																
LIMITS	**4.75**	**Report**	**Report**	**0.0**	**45.0**	**238**	**396**	**6**	**10**	**65**	**396**	**6**	**10**	**197**	**0.049**	**7.5**

BOLD = Exceedence
NODI9 = Monitoring Not Required

November 16, 2015

Michael Brown, Director, MDIFW Fisheries Division
Michael.brown@maine.gov

Todd Langevin, MDIFW Hatcheries Superintendent
Todd.Langevin@maine.gov

RE: Legislative Resolve L.D. 1202

Dear Michael and Todd,

This letter follows Maine Department of Inland Fisheries and Wildlife's (MDIFW) inquiry regarding Legislative Resolve L.D. 1202 and the feasibility of 1) expanding its Grand Lake Stream or Enfield hatcheries; and 2) a new fish hatchery in Oxford, Maine. Maine Department of Environmental Protection (DEP) staff (Brian Kavanah, Michael Kuhns, Leon Tsomides, Phillip Garwood, and Bill Hinkel) met with you on September 8, 2015 to discuss. MDIFW specifically asked to discuss the possibility of expanding production at the Grand Lake Stream and Enfield Fish Hatcheries.

Grand Lake Stream Fish Hatchery Analysis

1. Receiving water
   - Discharge to Grand Lake Stream, Class A 38 M.R.S.A. § 467(13)(B)(1)
   - Grand Lake Stream is a tributary to Big Lake, Class GPA 38 M.R.S.A. § 467(13)(A)(2)
   - Big Lake is a tributary to St. Croix River, Class A 38 M.R.S.A. § 467(13)(A)(1)
   - 2012 305(b) Report listed as Category 2: insufficient information on full attainment
   - 2011 macroinvertebrate data conclude Class A aquatic life standards are met below hatchery discharge
   - Woodland Pulp owns and operates the dam at Grand Lake Stream outlet in accordance with a FERC license
   - Modified acute dilution is 6.7:1

2. <u>Statutory requirements and restrictions</u>
    - Direct discharges to Class A waters licensed after January 1, 1986 are permitted only if the effluent will be equal to or better than the existing water quality of the receiving waters. Prior to issuing a discharge license, the department shall require the applicant to objectively demonstrate to the department's satisfaction that the discharge is necessary and that there are no other reasonable alternatives available. Discharges into waters of this classification licensed prior to January 1, 1986 are allowed to continue only until practical alternatives exist. 38 M.R.S.A. § 465(2)(C)

    - Based on the Department’s January 24, 1996 letter to MDIFW, in lieu of the “equal to or better” standard for those existing licensed discharges, the Department will apply the more stringent of 1) the previous discharge license effluent limits; 2) newly calculated BPT or water quality based effluent limits; or 3) past demonstrated effluent performance.

    - All new discharges of pollutants or increases in pollutants in a permitted facility's existing discharge that will not comply with existing permit limitations must meet all Class A standards and be equal to or better than the existing water quality of the receiving waters pursuant to 06-096 CMR 586.

3. <u>Pollutants</u>
    - Permit limit, Discharge Flow: 2.9 MGD
    - Discharge Flow, long-term average: 1.9 MGD
    - Estimated necessary flow limit to expand: 4.0 MGD
    - Effluent phosphorous, long-term average: 50 ppb
    - Background phosphorous, West Grand Lake: 5 ppb
    - Permit limit TSS, average: 48 lbs./day
    - Effluent TSS loading, long-term average: 33 lbs./day
    - Effluent TSS concentration, long-term average: 2 mg/L

4. <u>Conclusions</u>
    Although flow alone is not considered a pollutant and an increase in the flow limit could be approved, the corresponding increase in pollutant loading, namely TSS and phosphorous, can only be approved if the effluent quality is equal to or better than receiving water quality.

    At the September 8th meeting, there was general consensus that it would not be practicable to treat hatchery wastewater to meet the equal to or better than standard. Even discharging TSS at the 2 mg/L reporting limit, the calculated mass loading to the stream would be higher than the current permit limit of 48 lbs./day. For example: (4.0 MGD)(2 mg/L TSS)(8.34 lbs/gal) = 67 lbs/day. In addition, it does not appear that the discharge would meet the 06-096 CMR 586 criterion for plant nutrients, which requires the effluent to be better than the seasonal median and will not cause the aquatic life to be other than as naturally occurs.

The Class A water quality standards effectively restrict MDIFW to the current waste discharge permit conditions established for that facility.

Enfield Fish Hatchery Analysis

1. Receiving water
   - Discharge to Cold Stream, Class A 38 M.R.S.A. § 467(7)(E)(2)(i)
   - Cold Stream is tributary to Passadumkeag River, Class AA 38 M.R.S.A. § 467(7)(F)(6)(a)
   - Passadumkeag River is tributary to Penobscot River, Class B 38 M.R.S.A. § 467(7)(A)(5)
   - Cold Stream upgraded from Class B to Class A in 1990
   - 2012 305(b) Report listed as Category 4-B non-attainment for aquatic life (may be updated in final 2014 report based on recent macroinvertebrate data)
   - 2011 macroinvertebrate data conclude Class A aquatic life standards are met below hatchery discharge
   - MDIFW owns the dam at Cold Stream Pond outlet, but no water level order or minimum flow requirements are in effect
   - Modified acute dilution is 1.04:1

2. Statutory requirements and restrictions
   - All of the statutory requirements and restrictions discussed for Grand Lake Stream apply to this discharge to Class A waters.

3. Pollutants
   - Permit limit, Discharge Flow: 5.0 MGD
   - Discharge Flow, long-term average: 4.6 MGD
   - Estimated necessary flow limit to expand: Not discussed
   - Permit limit, phosphorous: 41 ppb
   - Effluent phosphorous, long-term average 30 ppb
   - Background phosphorous, Cold Stream Pond: 5 ppb
   - Permit limit TSS, average: 79.2 lbs./day
   - Effluent TSS, long-term average: 77 lbs./day
   - Effluent TSS, long-term average: 2 mg/L

4. <u>Conclusions</u>
Enfield is operating very close to their current TSS permit limits at the current production level. With effluent quality of 2 mg/L TSS, any increase in production at Enfield that will not comply with existing permit limitations would constitute a new discharge subject to the "equal to or better than" water quality standard. At the September 8th meeting, there was general consensus that it would not be practicable to treat hatchery wastewater to meet the equal to or better than standard and that the facility is already very close to its permit limits. In addition, it does not appear that the discharge would meet the 06-096 CMR 586 criterion for plant nutrients, which requires the effluent to be better than the seasonal median and will not cause the aquatic life to be other than as naturally occurs.

The Class A water quality standards effectively restrict MDIFW to the current waste discharge permit conditions established for that facility.

Thompson Lake Outlet Stream Analysis

Subsequent to the September 8th meeting, MDIFW inquired as to the possibility of a new hatchery discharge to the outlet of Thompson Lake in Oxford, Maine.

1. <u>Receiving water</u>
   - Discharge to Thompson Lake Outlet Stream, Class C 38 M.R.S.A. § 467(1)(B)(2)(a)
   - Thompson Lake Outlet Stream is tributary to the Little Androscoggin River, Class C. 38 M.R.S.A. § 467(1)(B)(1)(b)
   - Thompson Lake outlet dam is owned by the Town of Oxford and generally managed by the Thompson Lake Dam Committee.
   - Robinson Manufacturing previously owned and operated the dam and had an agreement to pass a minimum flow of 25 cfs from the lake to the stream.
   - 2012 305(b) Report does not address Thompson Lake Outlet Stream. The stream quickly converges with the Little Androscoggin River, which is listed as Category 2: insufficient information on full attainment.
   - 2003 macroinvertebrate data conclude Class C aquatic life standards are met below the former Robinson Manufacturing outfall point in Thompson Lake Outlet Stream.
   - DEA stated that the stream is an enriched system with a high temperature regime (27 degrees C in August).

2. Statutory requirements and restrictions
    - Designated Uses. Class C waters must be of such quality that they are suitable for the designated uses of drinking water after treatment, fishing; agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power recreation, and as habitat for aquatic life.
    - Water Quality Criteria. The dissolved oxygen content of Class C water may be not less than 5 parts per million or 60% of saturation, whichever is higher, except that in identified salmonid spawning areas where water quality is sufficient to ensure spawning, egg incubation and survival of early life stages, that water quality sufficient for these purposes must be maintained. In order to provide additional protection for the growth of indigenous fish, the dissolved oxygen may not be less than 6.5 parts per million as a 30-day average based upon a temperature of 24 degrees centigrade or the ambient temperature of the water body, whichever is less.
    - Discharges to Class C waters may cause some changes to aquatic life, except that the receiving waters must be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community.
    - Antidegradation Policy. State waters are protected by the State's antidegradation policy which provides that certain existing in-stream water uses and the level of water quality necessary to protect those existing uses must be maintained and protected. 38 M.R.S.A. § 464(4)(F).

      In any case where the new or increased discharge will consume 20% or more of the remaining assimilative capacity for dissolved oxygen or other water quality parameter, the resulting lowering of water quality will be determined to be significant. Where the DEP determines that a new or increased discharge will result in a significant lowering of existing water quality, the DEP will then determine whether the lowering of water quality is necessary to achieve important economic or social benefits to the State.

3. Pollutants
    - Robinson Manufacturing Co. previously operated a woolen mill with a discharge to Thompson Lake Outlet Stream. The facility is now closed and the discharge was terminated. Permit limits for relevant pollutants regulated in Robinson's permit are summarized for comparison purposes.

- Discharge Flow: 0.50 MGD
- Permit limit, phosphorous: Report Only
- Effluent phosphorous, long-term average 1,150 ppb
- Background phosphorous, Thompson Lake: 6 ppb
- TSS, average: 400 lbs./day and 96 mg/L
- BOD, average: 290 lbs./day and 70 mg/L

4. Phosphorous Reasonable Potential

USEPA's Quality Criteria for Water 1986 (Gold Book) puts forth an in-stream phosphorus concentration goal of less than 0.100 mg/L in streams or other flowing waters not discharging directly to lakes or impoundments, to prevent nuisance algal growth. The DEP's draft ambient water quality criterion for Class C waters is 0.033 mg/L for phosphorus.

For purposes of estimating whether a new facility would have a reasonable potential to exceed the phosphorous standards, the DEP assumed the following for a hypothetical hatchery at this location:

- Discharge flow: 5.0 MGD
- Effluent phosphorous, long-term average: 30 ppb
- Background phosphorous, Thompson Lake: 6 ppb
- Dilution based on 7Q10 of 25 cfs: 4.2:1

Chronic: 7Q10 = 25 cfs $\Rightarrow \dfrac{(25\text{ cfs})(0.6464) + 5.0\text{ MGD}}{5.0\text{ MGD}} = 4.2{:}1$

Using the following calculation and criteria, the hypothetical new fish hatchery does not have a reasonable potential to exceed either the USEPA's Total P Ambient Water Quality Goal of 0.100 mg/L (100 ug/L) for phosphorus for rivers and streams not feeding lakes, or the Department's draft ambient water quality criteria of 0.033 mg/L for phosphorus:

Reasonable Potential Analysis

$$Cr = \frac{QeCe + QsCs}{Qr}$$

Qe = effluent flow	=	5.0 MGD
Ce = effluent pollutant concentration	=	0.030 mg/L
Qs = 7Q10 flow of receiving water	=	16.2 MGD
Cs = upstream concentration	=	0.006 mg/L
Qr = receiving water flow (5.0 MGD + 16.2 MGD)	=	23.2 MGD
Cr = receiving water concentration		

$$Cr = \frac{(5.0 \text{ MGD} \times 0.030 \text{ mg/L}) + (16.2 \text{ MGD} \times 0.006 \text{ mg/L})}{23.2 \text{ MGD}} = 0.011 \text{ mg/L}$$

Cr = 0.011 mg/L < 0.100 mg/L **No Reasonable Potential**
Cr = 0.011 mg/L < 0.033 mg/L **No Reasonable Potential**

It is noted that the results of the RP analysis will change based on actual design criteria (*i.e.*, discharge flow and consequent dilution) and actual effluent P concentration for a proposed facility that are different from the assumptions used in this example.

5. Conclusions

The effluent limitations established in Robinson's 2003 MEPDES permit can be used to characterize pollutant loading to the segment of the stream into which MDIFW is considering a new hatchery discharge. The phosphorous and TSS loading from a properly operated and maintained fish hatchery are anticipated to be considerably lower than the loadings from the former Robinson mill. In 2003, macroinvertebrate data concluded that the stream was meeting Class C standards below the former Robinson discharge.

In terms of assimilative capacity, designated uses, and the numeric water quality standards that must be achieved to ensure those existing uses are maintained and protected, Thompson Lake Outlet Stream appears to be a reasonable candidate for MDIFW to consider as the site of a new discharge. It should be noted, however, that depending on the size of the facility and effluent flow rate, the assumed 4.2:1 dilution could reduce significantly, and this would affect all water quality-based effluent limitations regulated in the permit.

If MDIFW intends to pursue this site for a potential new discharge, DEP suggests that:

- MDIFW contact the Thompson Lake Dam Committee to obtain any formal agreements regarding minimum flow from Thompson Lake to the Outlet Stream;
- MDIFW prepare a plan describing the type of facility and wastewater treatment system proposed, the estimated discharge flow, the estimated concentration and mass of TSS, BOD and phosphorous, outfall information, and any other relevant information for DEP consideration and antidegradation analysis; and
- Investigate title, right or interest (TRI) in all of the property necessary to operate the facility to ensure MDIFW has TRI to make application for a waste discharge permit.

With additional information, DEP can model the discharge to fulfill its obligation to ensure the antidegradation provisions of the water quality laws are met and to notify MDIFW of any potential water quality concerns with the proposed discharge. MDIFW should meet prior to filing an application to discuss process.

Don’t hesitate to contact me if DEP can be of further assistance on this matter.

Respectfully,

Bill Hinkel
Division of Water Quality Management
Bureau of Water Quality
bill.hinkel@maine.gov
ph: 207.485.2281

ec: Brian Kavanah, MDEP
Gregg Wood, MDEP

APPENDIX

F

IF&W Why We Stock

Maine's Fish Stocking Program: What It's All About

We receive lots of questions regarding fish stocking in Maine. Why do we stock? Why don't we stock more? What species do we stock and why? Why do we stock varying sizes and ages of fish? The next few paragraphs will attempt to answer some of these questions.

Maine stocks well over a million fish each year. Most of these fish are six inches or larger when released into the wild. The Maine Department of Inland Fisheries and Wildlife's (IFW) fish culture program consists of growing various species of trout and landlocked salmon. We are currently raising brook trout, brown trout, lake trout (togue), landlocked salmon, splake (a brook trout/lake trout hybrid), and rainbow trout.

We stock fish to provide fishing opportunities for anglers that would not otherwise be available. Many of the state's nearly 6,000 lakes and ponds and almost 32,000 miles of rivers and streams present some type of angling opportunity, as well as management challenges.

Fish stocking 100 years ago was done with little knowledge of the habitat requirements for a given species and with little understanding of the complexities of lake and river ecosystems. In the early 1950's, fishery biologists began to study these ecosystems to gain an understanding of how they operated in order to make informed decisions for future management. As more information was gathered, management recommendations resulted in a variety of stocking changes. In many situations the species to be stocked was changed - for example, at one time Maine stocked four species of Pacific salmon! In other instances changes were made in the size of fish stocked. Millions of tiny fry were once planted in many waters with large populations of predatory fish, resulting in few returns to anglers. In addition, many stockings - especially in brooks and streams - were stopped completely because we learned that natural reproduction could produce more than enough fish to support a fishery for wild fish.

IFW's fish stocking programs fall into four categories: introductory stocking, maintenance stocking, experimental stocking, and put and take stocking. Introductory, maintenance, and experimental stockings fall into a broad category of "biological" stocking programs. Waters selected for these programs have been assessed and have habitat, water quality and forage suitable to allow a stocked fish to survive and grow to legal size; that is, a minimum legal length limit and/or a lower bag limit may be applied to allow the stocked fish to use the lake's food supply to survive and grow to older ages before harvest. These programs are often referred to as "put-grow-take" stockings.

Of these three types of programs, the introductory one is the smallest. In an introductory program we consider all habitat conditions to be suitable, including sufficient spawning and nursery areas for the species being stocked. After a few years, stocking can usually be discontinued and the fishery will maintain itself through natural reproduction. In fact, several of our wild brook trout and togue populations have established self-sustaining populations with only a single stocking.

The largest part of Maine's fish stocking program is considered a “maintenance” program, where routine, continuous stockings (on various time tables) are made to supplement an insufficient amount of natural reproduction, or many cases, to substitute where there is a complete lack of natural reproduction. The lack of natural reproduction is generally a result of no suitable spawning and nursery habitat, but it can also be related to the presence of large numbers of predator or competitor fish, such as bass, pickerel, or perch.

We often get the question: Do stocked fish spawn? Yes, indeed they would spawn very nicely if there were suitable habitat conditions for successful spawning and rearing of young fish. Many Maine's waters have great habitat for growth and survival of adult or sub-adult fish, but lack spawning and nursery areas, so our maintenance stocking program must continue if good sport fisheries are to be sustained.

The last of our three “biological” stocking programs is experimental. Experimental stocking is used in special situations to help us predict the success of a new program where complex biological interactions occur. Fish may be stocked on a trial basis, and once information is gathered, the program may be changed, continued, or stopped entirely, depending on the results of the stocking. Recent examples of experimental programs include stocking of brown trout in certain tidal rivers, tests of new strains of brown trout, trial stockings of rainbow trout in several waters in central and southern Maine, and plantings of lake whitefish in several northern Maine lakes.

An important “non-biological” program we employ is called “put and take” stocking, which consists of stocking legal-sized fish into waters where they are expected to be caught and harvested within a short time. These waters generally do not provide the right conditions to hold trout over the entire year. For example, the water may become too warm in the summer, or too low, or there may be very heavy fishing pressure, such as waters near urban areas.

Put and take stocking provides a short-term fishery that must be maintained by continuous stocking during periods when habitat conditions are suitable. Most of this program is conducted in high population areas where angler access is good and other opportunities for trout fishing may not exist. Spring stocking of some brooks in York and Cumberland Counties is one example. Another more recent put and take program that has proven very popular is the stocking of large fall-yearling trout (typically brook trout) late in the year. These fish are highly catchable by open water anglers during the fall months, by ice anglers in the winter, and in some cases by spring anglers at ice-out. These fish are attractive because of their size (usually 12-15 inches long when stocked), their bright fall colorations, and because they are relatively easy for even novice anglers to catch. However, stocking these large fall yearlings into more waters is limited because our hatchery space is also limited during the second summer these fish need to be cultured. Finally, it’s important to realize that programs such as this are not considered for waters that already produce adequate numbers of wild fish.

All "biological" stocking programs are done with the benefit of considerable field data, public input, and thought by our Regional Fisheries Biologists. Many years ago

Department biologists established a set of guidelines for our stocking programs. These guidelines include recommendations on species to be stocked, size of fish at stocking, and numbers to be stocked. Species, size, and numbers are based on the available habitat for each species, the degree of competition from other fish species, and available forage (feed).

To give our biological stocking programs the best chance of success, fish quality goals (size and condition of fish at a particular age) are established for all species and strains grown in our hatchery system. Department Fish Culturists strive to meet these goals so that good survival occurs after stocking, which assures the greatest returns to anglers. They take great pride in the products they stock and are continually finding ways to improve them.

IFW has eight hatcheries and rearing stations. Hatcheries are just that - where fish are hatched and also raised. A rearing station is where some fish are moved to and grown out after hatching. These eight facilities are located on sites that have proven to be conducive to the production of certain species of coldwater fish. Most of them are fed by surface water, while others receive their water supply from springs and underground wells.

Fish production schedules are planned at least two years in advance to assure the number and size of a particular species or strain are available to meet the needs of anglers. Exactly what species are produced by a particular facility is governed by the need for specific species, strain and size of the fish, the suitability of a facility for certain species, and the geographic need for a specific species.

Another "special" program is the stocking of many of our larger, "retired" hatchery brood stock. Brood stock are the parents that produce the fry, fingerlings, and yearlings that IFW stocks throughout the year. They are no longer needed for the brood stock program so they are released into the wild for anglers to catch. Retired brood fish generally range in age from three to five years old, although togue can be held as viable brood fish for as much as a decade. These old-timers give anglers the opportunity to catch a trophy size fish. Brown trout and brook trout typically measure from 16 to 20 inches long and togue can be up to 30 inches long when released as retired brood stock.

And of course, you may wonder just how all these fish get into over 800 lakes, rivers, streams and ponds? There isn't one process used for all them. It depends on the geographic location of the water body, and its accessibility. Some are stocked by running a hose from a hatchery truck to the water, while some are moved to ponds by a bucket that is filled at the truck. We use airplanes to bring fish to remote ponds where travel by truck is not feasible, and in some areas, we backpack them in as fry in a specially made pack frame designed to carry very small fish. The stocking of many waters also includes the boating of fish to various sections of a water body to spread the fish out and reduce attacks on them by predators such as larger fish or birds.

Hopefully this has given you an overview of IFW's stocking programs. If you are looking for a list of what bodies of water we stock or want to follow our daily updated stocking report throughout the season, check us out online at www.mefishwildlife.com.

APPENDIX

G

IF&W Fish Quality Report

MAINE DEPARTMENT OF INLAND FISHERIES & WILDLIFE
HATCHERY DIVISION

FISH QUALITY REPORT

INTRODUCTION

The semi-annual MDIF&W fish quality inspection was developed in 1977 by fish pathologist, Peter Walker, from a similar quality assessment tool developed by Canadian fisheries biologists (Frantsi, Ritter et al. 1972). At the time, fishery managers and culturists were increasingly concerned with the condition of the fins of hatchery produced salmonids. Quality assessment became one tool to quantify the fin and body conditions of salmonids reared in the state hatchery system. Over the past thirty-plus years, the quality of Maine fish has been monitored and recorded for internal departmental quality assessment of the fish stocked in the public waters of the State. Improvements to the health and rearing conditions (e.g., decreased rearing density, light exposure, fright responses, nutrition, feeding regimes, species, strains, and age) of fish have resulted in corresponding improvements in fish quality. This report is available to department personnel, and the public. This year data was collected by hatchery and Fish Health Laboratory personnel. The report is printed from Microsoft® spreadsheet program Excel®. A paper copy or .pdf of this report can be obtained from the Maine Department of Inland Fisheries and Wildlife Fish Health Laboratory. We hope you find this report informative and useful.

GOALS

MDIFW Fish Quality Size Goals & Guidelines

Species	Age Class	Mean Length (mm)	Length Range (mm)		Mean Weight (g)	Weight Range (g)		Condition Factor	Mean Length (inches)	No. Per Lb
			(-Std.Dev)	(+Std.Dev)		(-Std.Dev)	(+Std.Dev)			
Rainbow Trout	FF	178	157	199	56	51	61	1.00E-05	7	8.0
Rainbow Trout	SY	305	278	332	312	294	330	1.10E-05	12	1.5
Rainbow Trout	FY	355	319	391	492	453	531	1.10E-05	14	0.9
Splake	FF	178	153	203	56	51	62	1.00E-05	7	8.0
Splake	SY	254	226	282	164	155	172	1.00E-05	10	2.8
Splake	FY	330	299	361	395	360	430	1.10E-05	13	1.1
Lake Trout	FF	140	130	150	27	25	30	1.00E-05	5 1/2	16.5
Lake Trout	SY	180	168	192	58	53	64	1.00E-05	7	7.8
Lake Trout	FY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Landlocked Salmon	FF	120	107	133	17	15	19	1.00E-05	4 1/2	26.3
Landlocked Salmon	SY	215	200	230	105	95	116	1.06E-05	8 1/2	4.3
Landlocked Salmon	FY	355	337	373	474	444	504	1.06E-05	14	1.0
Brown Trout	FF	178	166	190	56	51	62	1.00E-05	7	8.0
Brown Trout	SY	230	210	250	150	141	158	1.23E-05	9	3.0
Brown Trout	FY	305	277	333	301	276	325	1.06E-05	12	1.5
Brook Trout	FF	178	164	192	60	54	66	1.07E-05	7	7.5
Brook Trout	AFF	230	215	245	140	126	154	1.15E-05	9	3.2
Brook Trout	SY	254	236	272	180	162	198	1.10E-05	10	2.5
Brook Trout	FY	330	309	351	449	404	494	1.25E-05	13	1.0

* Goals last updated prior to 2010 stocking

KEY TO CODES USED IN FISH QUALITY REPORTS			
	Acronym	**Description**	**Goal**
Snout	Blank	Normal	100%
	E	Elongated	
	I	Injured	
	S	Shortened	
	O	Other *(describe)*.	
Jaw	Blank	Normal	100%
	I	Injured	
	D	Deformed	
	O	Other (*describe*).	
Mouth	Blank	Normal	100%
	A	Abnormal	
Eyes	Blank	Normal	100%
	E1/E2	Exophthalmia (pop eyed)	
	H1/H2	Hemorrhagic	
	M1/M2	Missing eye	
	C1/C2	Cloudiness in or on eye	
	U1/U2	Ulcers on cornea	
	O	Other (*describe*).	
Operculum	Blank	Normal	100%
	A1/A2	Abridged (not covering gill filaments).	
	M1/M2	Missing	
Thymus	Blank	Normal	100%
	P	Pale	
	I	Inflamed (swollen)	
Gills	Blank	Normal	100%
	F1/F2	Frayed	
	C1/C2	Clubbed	
	H1/H2	Hyperplasia (swollen)	
	P1/P2	Pale	
Body Condition	Blank	Normal	100%
	H	Humpback/Pumpkinseed shaped	
	S	Scoliosis (curved backbone)	
	C	Deformed caudal peduncle	
	P	Pot bellied	
	T	Tumor	
	W	Wound	
	V	Vent injured	
	O	Other (*describe*).	
Color	Blank	Normal	75%
	P	Pale	
	D	Dark	
	+	Brilliant coloration	25%
	O	Other (*describe*).	
Scales	Blank	Normal	100%
	M	Missing *(estimate %)*	
	O	Other (*describe*).	
Symmetry	Blank	Normal	100%
	A	Abnormal *(describe)*.	
Fin Conditions	0	Normal fin condition	100%
	1	Distal portion of fin injured or missing	
	2	Distal 2/3 portion of fin injured or missing.	
	3	Entire fin injured or missing.	
	P, M, F	Partial fin clip; Missing fin clip, Frayed fin	

Frantsi, C., J. A. Ritter, et al. (1972). A method used to describe the quality of Atlantic salmon (*Salmo salar)* smolts released from hatcheries in Nova Scotia and New Brunswick. Halifax, Nova Scotia, Resource Development Branch, Fisheries Service, Department of the Environment of Canada**:** 24.

APPENDIX

H

Commission Report

2002

Final Report of the Commission to Study the Needs and Opportunities Associated with the Production of Salmonid Sport Fish in Maine

Maine State Legislature

Office of Policy and Legal Analysis

Executive Summary and Recommendations

The Commission to Study the Needs and Opportunities Associated with the Production of Salmonid Sport Fish in Maine ("Commission"), established in 1999, was directed by the legislature to assess and evaluate recreational salmonid fish production facilities in the State, set salmonid production goals at state-owned fish production facilities over the next 15 to 20 year planning horizon and ensure that these facilities comply with discharge license standards within three years. The Commission was required to complete its work and report its findings and recommendations to the Joint Standing Committee on Inland Fisheries and Wildlife by October 31, 2002.

To complete its mission the Commission met 15 times between September 1999 and November 2002 and worked extensively with the Department of Inland Fisheries and Wildlife ("Department"), the Department's engineering consultant FishPro Consulting Engineers & Scientists[1] ("FishPro"), and Maine's Department of Environmental Protection ("DEP"). As a result of this work, the Commission issued two interim reports dated December 2000 and December 2001, outlining the Commission progress and continuing work plans that culminated in this report.[2]

Recreational sport fishing is not only an important part of Maine's outdoor heritage, it is an important part of Maine's economic vitality. According to the most recent study by the University of Maine, in 1996 alone, recreational fishing activities in Maine generated $292.7 million in total economic activity that resulted in $13.5 million in sales taxes and supported 5230 full and part time jobs that paid more than $5.7 million in state income taxes that year.[3] Despite the significance recreational fishing activities play in Maine's economy, the Commission found there is increasing evidence that the State's recreational salmonid fisheries no longer meet the expectations of many anglers. In addition, other New England states and Canada are heavily competing for the attention of these anglers and may be drawing anglers away from the State.[4] The Commission found that Maine's fish production facilities form the backbone of the sport fishing industry in Maine and if Maine hopes to successfully compete on a national and international level for angler dollars, these facilities must be upgraded and maintained to produce significantly more salmonid fish. Maine's nine State-owned fish production facilities, in total, have been in

[1] The Department contracted with FishPro on April 13, 2001 to conduct a comprehensive engineering study of the State's fish production facilities including effluent issues and to work with and provide technical support to the Commission.
[2] These reports are available for review at the Maine State Law Library in the State House in Augusta, Maine.
[3] Michael Teisl and Kevin J. Boyle. Economic impact of hunting and inland fishing and wildlife-associated recreation in Maine. Rep #479, Maine Agricultural and Forestry Experiment Station, University of Maine, Orono. November 1998.
[4] See Appendix A for fishing license sales data provided by the Department showing static fishing license sales over the past 8 years.

operation for the equivalent of 500 production years and have an average age of 58 years.[5] Over the past 40 years, these facilities have produced nearly 60 million fish that were stocked in over 700 lakes and 100 streams statewide. In its 2000 interim report, the Commission also found that while some upgrades to these facilities have been implemented since the first facility was constructed in 1857 (Grand Lake Stream), inadequate funding has kept maintenance and enhancement projects well below desirable levels.[6] Because many components of the fish production facilities are reaching the end of their useful service life, nearly all of the State's aging facilities require significant capital improvements just to meet effluent license requirements and maintain current fish production levels. The passage of the November 2002, $7 million bond referendum (Private & Special Law 2001, chapter 35) for renovations and upgrades to the State's fish production facilities, will be a first step towards achieving critical capital improvements and improving Maine's recreational salmonid fisheries.

In its 2001 interim report, the Commission found that opportunities for significantly increasing the stocking of salmonid fish are present throughout the State and proposed that the Department increase salmonid production over the next 15 to 20 years to approximately 865,000 pounds per year, including the development of a trophy fish program to provide anglers with more opportunities for catching trophy size fish. However, based on FishPro's cost estimates for implementing the proposed increase, the Commission has revised that recommendation to exclude the trophy fish program.

In addition to addressing the maintenance and upgrade of Maine's fish production facilities, the Commission worked closely with DEP, the Department and FishPro to identify problem areas regarding effluent discharges at the facilities and to develop recommendations to ensure that these facilities comply with discharge license standards within three years. The Commission concluded that a significant portion of the $7 million bond money should go towards upgrading the effluent treatment systems of fish production facilities identified by DEP as having receiving waters[7] in non-attainment while the remainder of those funds should be used to enhance production at the Embden facility. These upgrades and enhancements will allow fish production facilities to simultaneously address current discharge licenses issues and increase fish production levels.

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[5] Data provided in the Commission's 2000 interim report. Maine's nine fish production facilities are Casco, Dry Mills, Embden, Enfield, Governor Hill, Grand Lake Stream, Palermo, Philips and New Gloucester. A map showing the location of these facilities is attached as Appendix B. A tenth facility located at Deblois was closed in the early 1980's for financial reasons and was subsequently placed under a long-term lease to a private aquaculture firm for the production of Atlantic salmon smolts. That leased will expire in 2004 and the Department, at the recommendation of the Commission, is actively seeking a buyer for this facility.

[6] The Adopt-a-Hatchery Program was established to help alleviate chronic funding shortages facing the State's fish production facilities. While the generous efforts of adoptees under this program have provided much needed funding, this program is not designed to provide the financial resources needed to implement large-scale capital improvements recommended in this report.

[7] For this report, "receiving waters," means water bodies that wastewater is discharged into by fish production facilities.

It is particularly important to note that although recreational fishing activities in Maine generate nearly $300 million in statewide economic benefits, the facilities themselves operate on an annual budget that is directly related to the revenues generated from the sale of resident and nonresident fishing licenses.[8] To the extent that the fish production facilities support such a broad based economic benefits to the State, the Commission feels that it is appropriate to consider broader based revenue sources to fund the needed improvements at those facilities.

The Commission presents the following unanimous and majority findings and recommendations.[9]

Unanimous Finding #1 The Commission unanimously finds, based on data provided by the Department and by FishPro in its 2002 Final Comprehensive Statewide Fish Hatchery System Engineering Study, ("FishPro Study Report"),[10] that the facility resources needed to establish a trophy fish program with production levels recommended by the Commission in its December 2001 interim report are extensive and not economically feasible.

- **Unanimous Recommendation** The Commission unanimously recommends that the Department should not establish a trophy fish program and should continue to use retired brood stock as a source for stocking trophy size fish. The Commission further recommends that a portion of the fish poundage allotted for trophy fish in its December 2001 interim report, be reallocated to increase two-year-old and spring yearling production for brook trout, landlocked salmon and rainbow trout as indicated in Table I attached as Appendix C of this report.

Unanimous Finding #2: The Commission unanimously finds that the Commission's proposed increase in fish production as stated in its 2001 interim report should be

[8] Although the revenues from fishing licenses are not technically "dedicated" for fish production facilities, Article 9, section 22 of the Maine Constitution requires that the Department revenue annual appropriations that are at least equal to the revenues collected by the Department during a fiscal year.
[9] Members present and voting on these findings and recommendations on October 23, 2002 were Senator Woodcock, Senator Martin, Honorable Leo Kieffer, Representative Bryant, Representative Honey, Harold Brown, Ken Elowe (DIFW), Bill Gilzinis (Trout Unlimited), Richard Neal, Gary Picard (private hatchery), Urban Pierce (private hatchery), George Smith (Sportsman Alliance of Maine), Steve Wilson (DIFW). Representative Mathews was present and voted on Findings and Recommendations 8 and 11. Evelyn Sawyer (private hatchery) was present and voted on Findings and Recommendations 1-7, 9 and10. Richard Solman (private hatchery) was not present and did not vote on the Findings and Recommendations.
[10] A copy of this report is available for review at the Maine State Law Library in the State House in Augusta, Maine

modified to incorporate Finding #1 and to incorporate corrected weight estimates for various age classes of fish as indicated in Appendix C, Table 1 of this report.[11]

- **Unanimous Recommendation:** The Commission unanimously recommends that its 2001 proposed increase in total fish production of 865,748 pounds/year be adjusted to as shown in Appendix C, Table 1 to 865,077 pounds/year. The Commission further unanimously recommends that the Department review its present state-wide distribution of stocked fish and adjust fish allocations within the State to better reflect the amount of appropriate coldwater habitat. The Department's fish allocation adjustments should not include stocking fish over wild salmonid populations in waters not previously stocked.

Unanimous Finding #3: The Commission unanimously finds, based on reports from the Department and the results of the 1999 Open Water Survey[12], that brook trout, landlocked salmon and rainbow trout are species most heavily sought after by anglers and are species that have the most potential for expanding stocking opportunities in waters stocked by the Department. The Commission further unanimously finds that splake and whitefish are not heavily sought after by most anglers.

- **Unanimous recommendation:** The Commission unanimously recommends that the species mix for the 865,077 pounds in total fish production include 700,609 pounds of brook trout, 16,457 pounds of landlocked salmon, 60,125 pounds of rainbow trout, 77,622 pounds of brown trout, and 4,664 pounds of lake trout as shown in Table 1 and Figure 2 attached as Appendix C of this report. The Commission also unanimously recommends that brown trout production not be increased from current levels.

- **Majority recommendation:** The Commission unanimously agrees that current splake production should be dramatically reduced, however, a majority of Commission members (9) recommended that existing splake production be reduced from 2000 levels of 9,517 pounds/year to 5,600 pounds/year while a minority of the Commission recommended the complete removal of the splake stocking program.

Unanimous Finding #4: The Commission unanimously finds that a new fish production facility will be needed to meet the Commission's fish production goals.

- **Unanimous Recommendation:** The Commission unanimously recommends that the Department seek funds from the legislature or other sources, to acquire or construct a new fish production facility in the State. The Commission further

[11] Because FishPro's Study Report was not finalized before this report was printed, weight estimates used for this report may vary slightly from those reported in FishPro's published Study Report.
[12] A brief summary of the 1999 open water fishing survey is attached as Appendix D.

recommends that the Department look at the acquisition or construction of a limited-discharge fish production facility.[13]

Unanimous finding #5: The Commission finds based on data provided by the Department and data in the FishPro Study Report, that operating and maintenance costs associated with fish production facilities will increase as a result of implementing the Commission's increased fish production goals and that additional funding to cover these costs is essential to maintaining the facilities production capabilities.

- **Unanimous recommendation:** The Commission recommends that the Department and the joint standing committee of jurisdiction over fish and wildlife matters seek funding sources to support additional operating and maintenance cost associated with the increase in fish production needed to restore Maine's salmonid fisheries.

Unanimous Finding # 6: The Commission finds, based on review of data provided in the FishPro Study Report, that current wastewater discharge permit levels for fish production facilities in Maine mandates excessive compliance costs to these facilities.

- **Unanimous recommendation:** The Commission recommends that the Department and DEP review the wastewater discharge permit levels of fish production facilities located within the State every two years in order to reduce compliance costs by identifying cost reducing alternatives for effluent treatment.

Unanimous Finding #7: The Commission finds that its recommended fish production goals must be implemented as expeditiously as possible to address angler's perception that Maine's recreational salmonid fisheries are in decline. The Commission further finds based on data provided in Figure II-6 (Project Implementation Timeline for $7.0 Million Bond Bill Projects) and Figure II-7 (10-year Full Project Implementation Timeline and Plan) of the FishPro Study Report, that with adequate funding, the implementation of the Commission's fish production goals can be completed within ten years.[14]

- **Unanimous recommendation:** The Commission recommends that upgrades to fish production facilities as provided in Table II-14[15] of the FishPro Study Report be completed prior to November 2005 as shown on Figure II-6. The Commission further recommends that as additional funds become available, the implementation of facility upgrades and the acquisition or construction of a new fish production facility as described in the FishPro Study Report and shown in Table II-14 and Figure II-7, be completed within 10 years in order to expeditiously increase license

[13] A "limited –discharge" facility means a facility that is nearly self contained and discharges low volumes of effluent.
[14] Figure II-6 and Figure II-7 from FishPro's Study Report are attached as Appendix E and F respectively.
[15] Table II-14 from FishPro's Study Report is attached as Appendix G.

sales and boost Maine's sagging economy. While the Commission recommends the Department begin the process of obtaining a new facility after the implementation of upgrades shown on Table II-4, the Department should not supplant efforts to increase fish production through other measures including the continued upgrade of existing facilities.

Unanimous Finding #8: The Commission strongly agrees that it is critical to Maine's recreational salmonid fisheries and to Maine's economy that the Commission's recommendations are attained in the timeframe provided in Figure II-7 of the FishPro Study Report. The Commission finds that a qualified group authorized by the legislature to provide oversight to the Department during the initial implementation of the Commission's recommendations is necessary to address unexpected circumstances and avoid costly delays. The Commission further finds that it is uniquely qualified to provide this oversight function.

- **Unanimous recommendation:** The Commission recommends that the Commission be reestablished for two years and its 2002 membership be reinstated to provide oversight and guidance to the Department during the initial implementation of the Commission's recommendations.

Majority Finding #9: (10 in favor, 3 opposed and 2 abstained) A majority of the Commission finds based on data provided in DEP's September 12, 2002 report ("DEP [16] and data provided in the FishPro Study Report, that the Casco, Embden, Enfield and Palermo facilities will require immediate upgrades to existing effluent treatment systems to help these facilities' conform to the requirements of their current discharge licenses. A majority of the Commission further finds that wastewater improvements and "low-cost" methods, including application of best management practices of effluent treatment as identified by DEP, DIFW and FishPro, are necessary to help those facilities comply with license requirements. Additionally, a majority of the Commission finds that implementing dissolved oxygen improvements at many of the fish production facilities will both improve effluent water quality and allow for some increase in fish production consistent with current discharge license requirements.

- **Majority recommendation:** (10 in favor, 3 opposed and 2 abstained) A majority of the Commission recommends that the Department upgrade the wastewater discharge systems at Casco, Embden, Enfield and Palermo in accordance with the purposes of the effluent improvements provided in the Table II-14 of the FishPro Study Report. Additionally, a majority of the Commission recommends that dissolved oxygen management improvements be implemented at the Casco, Dry Mills, Embden, Enfield, Governor Hill, and Palermo as shown in Table II-14 of the FishPro Study Report.

[16] DEP's September 12, 2002 report is attached as Appendix H.

Majority Finding #10: (10 in favor, 2 opposed and 3 abstaining) A majority of the Commission finds that funding from the November 2002, $7 million bond referendum is sufficient to implement the recommendations under Finding #9 as reflected in Table II-14 of the FishPro Study Report.

- **Majority Recommendation:** (10 in favor, 2 opposed and 3 abstaining) The Commission recommends that funds from the $7 million bond be used to implement the recommendation under Finding #9 as provided in Table II-14 of the FishPro Study Report or should circumstances require, allocate those funds as needed to achieve the purposes reflected in that table.

Majority Finding #11: (14 in favor and 1 opposed) A majority of the Commission finds, based on data presented in the FishPro Study Report and in particular survey results presented in that report, that privatization of fish production could be an important component in meeting the Commission's fish production goals.

- **Majority Recommendation:** (14 in favor and 1 opposed) A majority of the Commission recommends that the Department seek contracts with private fish production facilities to supply egg, fry or fish needed to achieve the Commission's fish production goals that cannot be produced by State-owned facilities.

Establishment and Duties

The Commission was created by Resolves of 1999, chapter 82 and extended by Public Law of 2001, chapter 462.[17] As enacted, Resolves of 1999, chapter 82, created a 13 member Commission to study the salmonid fish culture facilities in Maine. Public Law 2001, chapter 462 increased the Commission's membership to 16.[18] Additionally, Public Law 2001, chapter 462 directed the Commission to set production goals for the number, size and species mix of recreational sport fish to be stocked within the State over the next 15 to 20 year planning horizon. Public Law 2001, chapter 462 also required the Commission to make recommendations on how to meet the State's future sport fish production and management needs in the most cost-effective manner that may include upgrades to existing facilities, closure of non-economic facilities, building new facilities or the purchasing of fish from privately owned fish production facilities. Finally, Public Law 2001, chapter 462 established a non-lapsing fish hatchery maintenance fund, a non-lapsing fund, in the Department to be used by the commissioner to fund engineering designs for the Embden Hatchery and for the maintenance, repair and capital improvements of other fish hatcheries and feeding stations owned by the State.[19]

Study process and prior findings and recommendations

The Commission met 15 times over a four-year period starting September 28, 1999 and ending on October 23, 2002.[20] The Commission held its first six meetings between September 28, 1999 and December 5, 2000. During those meetings the Commission undertook a comprehensive review of the current condition of the fish production facilities and the current levels and type of fish production at those facilities. In conducting that review, the Commission organized itself into three subcommittees focusing on discharge issues, fish management issues and oversight of FishPro. Those subcommittees each held several meetings to discuss topics related to their area of inquiry. During its first six meetings, the Commission and its subcommittees completed the following substantive tasks:

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[17] Enacted during the 1st Regular Session of the 119th Legislature with an effective date of June 17, 1999. Resolves of 1999, c. 82, is derived from LD 986, Resolve, Establishing a Commission to Study the Feasibility of Reestablishing a Brook Trout and Landlocked Salmon Hatchery in Northern Maine, sponsored by Senator Kieffer of Aroostook. A copy of the Resolve, chapter 82 and Public Law 462 are attached as Appendix I.

[18] A list of Commission members is attached as Appendix J.

[19] The 119th Legislature appropriated $500,000 to the Department of Inland Fisheries and Wildlife under Part HHH-1 of Public Laws of 1999, chapter 731, and Public Law 462 placed unexpended funds appropriated by the 119th Legislature into the fish hatchery maintenance fund.

[20] In Brewer on 9/28/99, in Skowhegan on 10/15/99, in Augusta on 2/16/00, 3/8/00, 6/19/00,12/5/00, 6/20/01, 7/20/01, 8/1/01, 10/ 6/01, 10/26/01, 1/16/02, 3/27/02, 9/16/02, 10/23/02.

1). Worked with the Department, DEP, private fish hatchery owners and members of the public during the development and final issuance of waste discharge licenses for the nine state-owned fish hatcheries.[21] The Commission worked with those agencies for over a year to obtain those licenses. Prior to the issuance of these licenses in July 2000, the fish production facilities were operating under licenses last issued in 1983;

2). The Commission in conjunction with the Department and FishPro completed a thorough preliminary strategic fish production facility planning and engineering study which characterizes and documents the condition of those facilities and identifies the needs at each facility as well as possible improvements. FishPro also completed a thorough review of the effluent discharge standards contained in the discharge licenses and identified compliance issues and provided guidance to the Commission with respect to what cost effective wastewater treatment options that are available to the State to meet those effluent discharge standards within the three year compliance window; and

3). Began work to determine the future sport fish management needs and to assess how those needs will be met in the most cost effective manner.

In its December 2000 interim report, the Commission made the following findings and recommendations:

Finding 1. That legislative policy guidance to the Department is essential over the next two years to establish long term fish production and distribution goals, ensure a high quality and economically viable recreational sport fishery in the state and provide for reliable, efficient and cost effective fish production systems.

Recommendation. Reauthorize the Commission for an additional two years to complete its assigned tasks and to accomplish the following tasks:

- Continue to work with the Department and FishPro in evaluating the effluent characteristics of fish hatcheries, including private fish hatcheries, with the purpose of ensuring that the State fish hatcheries will be able to comply with licensed effluent discharge standards within three years and to obtain information relevant to discussions of discharge license standards for unlicensed private fish hatcheries;

- Set statewide production goals for the number, size and species mix of recreational sport fish over a 10 to 20 year planning horizon. Although Commission as a whole has not made a recommendation on production goals, some members of the Commission feel that a reasonable goal would be to

[21] Final discharge licenses were issued by DEP on July 25, 2000.

increase annual production by 5 million fish in the next 10 years with an additional 3 million fish in the following 5 years; and

- Determine how to meet those production goals in the most cost effective manner by evaluating all production options, including investing in cost effective upgrades to existing state owned facilities to produce more fish, closing non-economic state owned facilities, purchasing fish from privately owned hatcheries and building new capacity in other locations. The assessment of other locations will include a statewide search for new locations that meet specific requirements.

Finding 2. The 119th Legislature appropriated $500,000 to the Department for engineering analysis and assessment of state owned fish hatcheries in Part HHHH-1 of Public Laws of 1999, chapter 731.

Recommendation. Unexpended balances appropriated to the Department under Part HHH-1 of Public Laws of 1999, chapter 731 should be allowed to carry forward into Fiscal Year 2002.

Public Law 2001, chapter 426, reauthorized the Commission for an additional two years. The Commission held five meetings between June 20, 2001 and October 26, 2001.[22] Over this time period, the Commission undertook a comprehensive review of the Department's current stocking efforts and identified potential needs for new and enhanced stocking of salmonids within the State. In conducting that review, the Commission invited Department regional biologists representing each of the State's seven regions to provide the Commission with detailed information about the region's stocking program and to identify any future stocking opportunities. Reports provided by regional biologists are attached to the Commission's 2001 interim report. As a result of this review, the Department provided the Commission with a report establishing baseline numbers for increased stocking of salmonids in each region.

The Commission, after a thorough review and analysis of the data provided by the Department, directed FishPro to provide the Commission with cost estimates for increasing the State's fish production from its current level of nearly 260,000 pounds of fish per year to nearly 866,000 pounds of fish per year phased in over the next 15 to 20 years.[23] Cost estimates were to include options for the upgrade of existing facilities, acquisition or construction of a new facility and the privatization of fish production in whole or in part. Detailed analysis of increased production options and costs can be found in the FishPro Study Report.

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[22] Public Law 462 authorized the Commission to meet a total of four times per year for two years, however, the Commission requested and received permission from the presiding officers to hold a fifth meeting in 2001.

[23] One member of the Commission supported an increase in fish production of approximately 1.1 million pounds of fish per year.

During these five meetings, the Commission completed the following substantive tasks:

1) Established a six member subcommittee to study the possibility of constructing a new fish hatchery to meet fish stocking needs.[24] The subcommittee under the policy supervision of the Commission, worked with the Department and FishPro to identify potential new fish production facility locations.[25] The subcommittee identified 3 localities that met baseline requirements for citing a new fish hatchery and the Department and FishPro have made initial site visits to all three locations.[26]

2) Monitored the progress of the Department, FishPro, and the DEP in finding a long-term solution to effluent issues facing the State's fish hatcheries.

3) Endorsed the Department's and FishPro's recommendation that the Department purchase nine composite water samplers to improve effluent sampling at the State's fish production facilities. The Department currently has the samplers in use.

In its December 2001 interim report, the Commission made the following findings and recommendations:

<u>Finding 1:.</u> That salmonid recreational fishing in Maine is generally not meeting the expectations of Maine anglers and that increased stocking in all regions of the State is needed to meet angler expectations and to maintain Maine's national status as a salmonid-sport-fishing vacation destination.

<u>Recommendation</u>. Pending the completion of the cost estimates, the Department should increase its salmonid production from nearly 260,000 pounds of fish per year to 865,748 pounds of fish per year over the next 10 to 15 years.

<u>Finding 2:</u> Anglers strongly desire the opportunity to fish in waters that contain trophy size fish.

<u>Recommendation.</u> The Department develop a trophy fish stocking program that will allow the Department to include trophy size fish each time it stocks a particular body of water. The Department should strive to ensure that at least 1% of each stocking event is comprised of trophy size fish.

<u>Finding 3:</u> The Deblois Fish Hatchery is not economically viable as a state owned fish hatchery.

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[24] Subcommittee members are Senator Leo Kieffer, Representative Bruce Bryant, Gary Picard, Steve Wilson, Bill Gilzinus and Urban Pierce.
[25] The Commission solicited public input from numerous interested groups and received 4 responses.
[26] A locality near Washburn was visited on October 25, 2001 and localities near the Saco River and Rumford Point in Androscoggin County were visited on October 27, 2001.

Recommendation. The Commission recommends that the Deblois fish production facility be sold with proceeds going into the fish hatchery maintenance fund.

The Commission held its final four meetings between January 30, 2002 and October 23, 2002.[27] During that time frame the Commission continued to work with the Department and FishPro to establish the feasibility and cost implications for the Commission's 2001 recommendations. In FishPro's Draft Final Supplement of August 2002, FishPro stated that increases in production in the range of 25% to 850% of present Department levels are theoretically possible if infrastructure improvements identified by FishPro and presented in the FishPro Study Report in Table II-2 through Table II-12 were implemented. Those improvements included upgrades to all nine facilities, the acquisition or construction of a new facility and limited purchase of fish from commercial producers[28] at an estimated cost of $42 million over the next 22 years.[29]

On October 12, 2002, the Commission met with DEP to review and discuss DEP's September 12, 2002 report on its evaluation of the State's fish production facilities. After a lengthy briefing by DEP followed by an intense discussion among all parties at the meeting, the Commission directed FishPro to modify its cost estimates and timelines to reflect those discussions.[30]

Background on fish production in Maine

Since the late 19th century, Maine has been actively involved in the management of fisheries in its thousands of lakes, ponds, rivers, and streams. These efforts have focused on the protection of native self-sustaining populations, as well as the establishment and maintenance of other non-native species throughout the state. Large and smallmouth bass, for example, were introduced to the waters throughout the southern half of the state and today represent a major self-sustaining sport fishery. Other species, such as landlocked salmon, brook trout, brown trout, lake trout and splake, are currently raised in State-owned hatcheries and stocked in over 700 waters throughout the state. Species such as bass, pickerel, perch and other

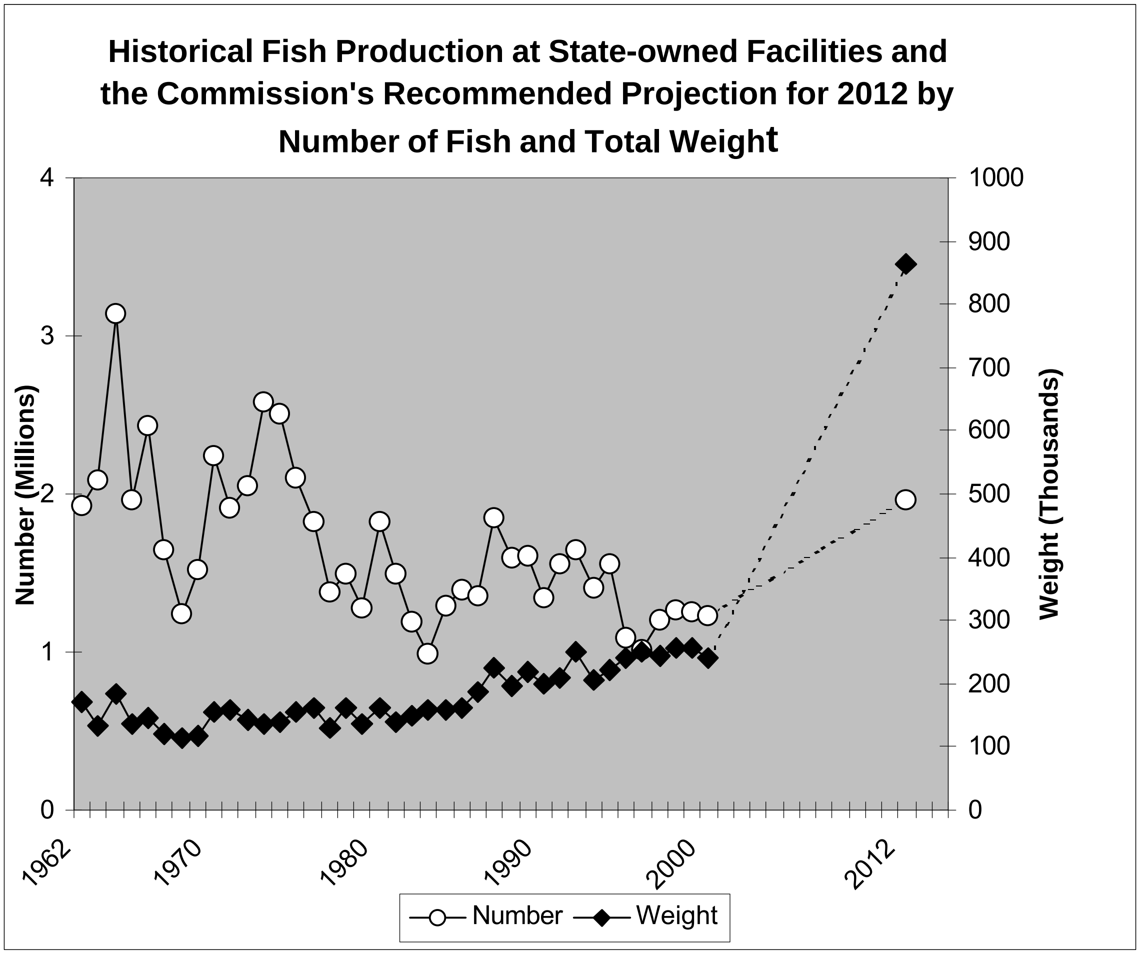
[27] Meetings were held in Augusta on 1/30/02, 3/27/02, 9/13/02 and 10/23/02.
[28] FishPro conducted a survey of private aquaculture facilities to determine the interest and capability of those facilities to meet the State's fish production needs. Based on survey responses, FishPro reported that private facilities could contribute 8.9% of the number and 6.5% of the pounds of species currently produced by the Department. A copy of the survey and a more detailed analysis of the privatization option can be found in FishPro's Final Report.
[29] In that report FishPro stated that the proposed trophy fish program would not be feasible because it would require the holding of 3 to 4 concurrent year classes of fish at a trout biomass of over 500,000 pounds per year. To accommodate the proposed trophy program would require a large investment of facility space and resources making the trophy program excessively costly. FishPro also noted that no other state currently produces trophy fish in quantities proposed by the Commission
[30] See DEP's September 12, 2002 report, FishPro's Study Report and the section in this report dealing with effluent issues for additional information.

"warm water" species are perpetuated by natural reproduction, so no stocking program for these species is considered necessary.

The production of fish from State-owned facilities play a vital role in the maintenance of the salmonid angling opportunities that are highly valued by Maine anglers and thousands of others who visit our State to enjoy its outdoor heritage. According to the Department, over 60 percent of the state's landlocked salmon waters have inadequate spawning habitat and are maintained by stocking. For example, only about four natural populations of landlocked salmon existed historically within the state. Now there are over 200 lake salmon fisheries statewide.

In recent years, greater reliance has been placed on size, health, and genetic makeup of the Department's fish stock to maximize survival in the wild. Although the number of fish stocked has been declining over the years, the size of fish stocked has been steadily increasing. As shown in Figure 1, the overall average weight of fish raised in Maine's fish production facilities has increased approximately 41% since 1962 and is currently at the greatest average weight ever produced by the State. With the implementation of the Commission's recommendations, the weight of fish produced by the Department will increase 409% from 1962 levels by 2012. Interestingly, the number of fish produced over this same period of time will increase only by 2%.

Figure 1



Dotted line represents increase in fish production over the next 10 years expected to result from the implementation of the Commission's recommendations.

Aging fish production infrastructure

The nine facilities currently operated by the State were initially constructed between 1857 (Grand Lake Stream) and 1958 (Enfield). In total, these nine hatcheries have been operation for the overall equivalent of 500 production years and have an average age of 58 years. According to the Department's consultant, many components of those facilities are reaching the end of their useful service life.

In 1987, the Department assessed the status of these facilities in a comprehensive manner, and updated a plan to address a variety of maintenance needs. Although some of these needs have been addressed since that time, inadequate funds have kept maintenance and enhancement projects at less then desired levels. Raceway renovations were completed at several facilities (Grand Lake Stream, Palermo, Governor Hill, and Dry Mills), and production increased at

Dry Mills by increasing water supplies and reclaiming previously unused raceways. Recent renovations to the water supply dam, construction of a new hatchery facility, and development of underground well water supplies have greatly enhanced the operation of the New Gloucester facility. At Governor Hill, new sources of well water have been located that will allow a significant expansion in both brood rearing and fry production, while also allowing for a modest increase in fish for stocking. In addition, voluntary assistance from some or the larger paper companies, through an "Adopt-A-Hatchery" program, is providing technical support and assistance needed to address many ongoing maintenance needs at each facility. All of the nine facilities have been adopted and will be benefiting from significant corporate/employee contributions resulting in major improvements. The Department is also committing significant resources (up to $250,000 annually over the next few years) to support this effort.

During the 1990's, considerable effort was spent on two initiatives to fund improvements at state hatcheries. The first attempt was in 1994 when the Legislature approved a $10 million bond referendum that, if passed by the voters, would have funded improvements and expansions of state fish hatcheries.[31] That referendum failed to receive a majority vote in the general election of November 1994.[32] A second fish hatchery bond issue for $5 million was contemplated two years later in 1996. At that time, the Department's proposal was to use funds from a bond issue to incorporate new fish rearing technology into the existing facilities, expand and protect their water supplies and upgrade effluent treatment facilities to meet new discharge requirements associated with expanded production. That proposal was withdrawn before going before the voters; however, because of the lack of a detailed long-range plan upon which the use of such funds could be based.

In November 2002, voters passed a $24.1million bond package referendum that included $7 million to make renovations and enhance wastewater treatment at the Department's fish production facilities. That bond money will be provided to the department in periodic allotments, as needed to carryout the purposes of the bond.

Effluent issues at fish production facilities

The primary sources of waste matter in discharge waters from fish production facilities are unconsumed feed and the by-products or wastes produced by fish. The amount of waste produced by a fish depends on the mass of the fish and the amount of food utilized by the fish. Therefore, the water quality impacts are in direct proportion to the amount of fish food introduced into the system. Detailed analysis of fish production effluents are presented in the Fish Hatchery Effluent Study, FishPro, November 2000,[33] and in the FishPro Study Report.

[31] Private and Special 993, chapter 90 (LD 1756).
[32] That referendum was supported by 238,092 voters (48.9%) and rejected by 249,142 voters (51.1%).
[33] A copy of this report is available for review at the Maine State Law Library in the State House in Augusta, Maine

Maine has had a water classification system since the 1950's. This classification system establishes water quality goals for the State and is used to direct the State in the management of its surface waters, protect the quality of those waters for their intended management purposes, and where standards are not achieved, direct the State to enhance the quality to achieve those purposes. The classification standards establish designated uses, related characteristics of those uses, and criteria necessary to protect the uses, and specific conditions for certain activities such as the discharge of wastewater.

All surface waters in Maine have been classified by the legislature and once a classification assignment is made, and the uses and criteria are achieved, that achievement is protected by the antidegradation provisions of the water quality statute (36 MRSA § 464(4)(F)). Thus, the law provides a mechanism for the State to continually move forward in the improvement and protection of water quality. While downgrades to classification have been made, it is infrequent and is limited to situations where existing conditions do not afford the possibility to achieve the higher class.

The State has four classes for freshwater rivers, three classes for marine and estuarine waters, and one class for lakes and ponds. DEP views the classification systems as more representative of a hierarchy of risk rather than an indicator of water use or quality. The risk to the water body is the possibility of a breakdown of the ecosystem and loss of use due to either natural or human-caused events. Classes AA, GPA and SA involve little risk since activities such as waste discharge and impoundment are prohibited in these waters. Class A waters allow impoundments and very restricted discharges, so the risk of degradation while quite small, does increase since there is some small human intervention in the maintenance of the ecosystem. Classes B and SB have fewer restrictions on activities but still maintain high water quality criteria. Finally, Classes C and SC have the least restrictions on use and lower water quality criteria. Classes C and SC waters are still good quality, but the margin for error before significant degradation might occur in these waters in the event of an additional stress being introduced (such as a spill or a drought) is the least.

The reclassification of waters of the State is governed by 38 MRSA §§ 464(2), 464(2-A) and 464(3). This statute requires DEP to conduct water quality studies, and the Board of Environmental Protection to hold hearings and propose changes to the water classification system to the Legislature for final approval. This is to be conducted from time to time, but at least every three years. The last reclassification resulted in changes enacted in 1999 and a classification review may be done in 2003.

Three of the state-owned fish production facilities' receiving waters are Class A waters and six are Class B waters. DEP is mandated with ensuring that facility discharges do not cause non-attainment of these receiving waters classification. In assessing the attainment status of receiving waters, DEP conducts monitoring and observations to determine the condition of those criteria.

On July 25, 2000, DEP issued 5-year waste discharge licenses to the nine state-owned fish production facilities. The licenses established technology based and receiving water quality based discharge limits and monitoring requirements for biological oxygen demands, total suspended sediment and total phosphorous. Those licenses impose monthly and yearly effluent limits on phosphorus, suspended solids and dissolved oxygen, although each of the licenses includes a provision allowing the facilities three years to comply with the effluent limits. At the request of the Commission, the Department contracted with FishPro to conduct an effluent study of those fish production facilities to determine how the discharge characteristics compared to the effluent limits in the discharge licenses, whether or not compliance was achievable within the 3 year compliance window and, if compliance could not be guaranteed, what effluent treatment options were available to the hatcheries that would allow them to meet their discharge limits when those limits take effect in 2003. That analysis was completed in December 2000 and presented to the Commission on December 5, 2000.[34]

FishPro's analysis indicated that five of the fish production facilities were in compliance with all their numeric effluent limits in the discharge licenses. Those facilities are Casco, Embden, Grand Lake Stream and New Gloucester. Effluent from three other hatcheries, Dry Mills, Governor Hill and Phillips, may not have met the license limits for phosphorus and dissolved oxygen at the time of the FishPro's analysis, and were potentially at risk of being in noncompliance with their discharge license in 2003 unless some steps were taken to further treat the effluent from those facilities. It was unclear if the Palermo facility was meeting its phosphorus limits at the time FishPro conducted its analysis because of technical concerns about how the phosphorus license limit was initially calculated for this facility.

As a result of this analysis, the Commission endorsed recommendations by FishPro, and the Department to meet with the DEP to discuss the discharge license to address the Palermo phosphorus limit and the limits applicable to rearing unit cleaning. The Commission also encouraged the Department to undertake immediate measures to implement improved solids recovery and management of existing treatment basins at the three fish production facilities that may have been operating above limits established in their discharge permits. Additionally, the Commission encouraged the Department to give a high priority to improvements of solids collection and disposal systems at facilities with solids recovery systems and to evaluate the costs of constructing effluent treatment systems at those fish production facilities without solids recovery systems. Furthermore, the Commission recommended that the Department purchase nine composite water samplers to monitor effluent levels at the State's nine fish production facilities. As of the date of this report, the Department in conjunction with FishPro and DEP has implemented or begun to implement these recommendations.

In 2002, DEP analyzed the condition of the receiving waters for the nine-state-owned fish production facilities and discharge data collected by the Department for these facilities to reevaluate the 2000 license limits. DEP conducted monitoring for aquatic macro-invertebrates

[34] A copy this report is available for review at the Maine State Law Library in the State House in Augusta, Maine.

in fish production facilities' receiving waters and made specific observations of conditions impacting class attainment such as the presence of certain types of fungus and algae[35].

In its 2002 report, DEP maintains that the effluent limits for biological oxygen demand, total suspended solids and phosphorous as set in 2000 for the State's fish production facilities permits are appropriate, except DEP agreed that the phosphorous limit for Palermo should be revised to make it less restrictive. DEP found that the receiving waters for Dry Mills, New Gloucester, Governor Hill and Phillips fish production facilities are currently meeting or exceeding their assigned classes for micro-invertebrates. DEP tentatively identified the receiving waters for Enfield and Grand Lake Stream fish production facilities as not meeting their assigned classifications for macro-invertebrates but stated that this may be due to adjacent lake effects on rock baskets used to sample aquatic insect faunas, and that the receiving water for these facilities may actually attain their classifications. DEP identified the receiving waters for Casco, Embden and Palermo as not meeting the classification for micro-invertebrates.

In its report to the Commission, DEP stressed that receiving waters currently in non-attainment of classification standards must be brought into attainment and that any facility expansion must produce better quality effluent than current effluent for any receiving water currently in non-attainment. In addition to compliance with current license limits, facility upgrades must address receiving water class attainment issues such as discharges into Class A waters,[36] dissolved oxygen, the presence of fungus and excess algae, and macro-invertebrate impacts. DEP also recommended the Department exhaust any low cost options including best management practices, elimination of non-treated effluent discharges and regular cleaning of sediment basins to see how receiving waters respond before implementing larger scale upgrades to treatment systems.

As a result of DEP's report, the Commission directed FishPro to design wastewater effluent treatment recommendations that include best management practices to ensure the State's fish production facilities comply with discharge license requirements. As indicated in Table II-14 of the FishPro Study Report, Casco, Embden, Enfield and Palermo fish production facilities should be fitted with Tier I and Tier II wastewater treatment system improvements. Additionally, dissolved oxygen management should be implemented at all but three facilities which will help maintain dissolved oxygen levels and increase the ability of fish to metabolize feed more efficiently. Because discharge license compliance also includes factors such as

[35] DEP uses macro-invertebrates as indicators because changes to macro-invertebrate communities are typically caused by factors that are likely to affect the entire receiving water ecosystem. Excessive algae or fungus can also indicate elevated levels of certain pollutants.

[36] In order to protect Maine's Class A waters, 38 MRSA 465.2(C) states that new or expanded discharges into Class A waters are permitted only if, in addition to satisfying all the requirements of the article, the discharged effluent will be equal to or better than the existing water quality of the receiving water. This includes demonstrating that the proposed expansion is necessary and that there are no reasonable alternatives available.

insect community health, fungus and algae conditions, future effluent analysis by DEP may require additional upgrades to effluent treatment systems in order to attain class assignments.

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