

Report of the New Hampshire Fish Hatchery Advisory Committee

July 21, 2021



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Appendices

Appendix A – Powder Mill State Fish Hatchery BMPP updates 2019-2021

Appendix B – Request for Qualifications to conduct a feasibility study for modernization of the Department’s Powder Mill Fish Hatchery

Appendix C -- Water Use – 2020 – all hatcheries

Appendix D – Tiered Treatment Approach



All fish photos courtesy of Steve Anger, North Country Angler -- www.northcountryangler.com

Background

Fish Hatchery Advisory Committee

The purpose of the committee is to advise the Executive Director on different options and methods for meeting the Environmental Protection Agencies (EPA) National Pollution Discharge Elimination System (NPDES) permit requirements at the Powder Mill Fish Hatchery in New Durham, New Hampshire (NH). The committee will make its final report to the Executive Director on or before July 21, 2021.

Hatchery Advisory Committee Members:

- Ted Diers – DES
- Dennis Greene – DES
- Dave Poole – Guide’s Association
- Steve Angers – NH Trout Unlimited/Retail Stores
- Rebecca Elwood (resigned June 11, 2021) – HDR Inc., Bow, NH
- Rep. Raymond Howard – Alton, NH
- Christopher Hodgdon – Merrimack County NHFG Commissioner
- Eric Stohl, Chair & Coos County NHFG Commissioner
- Tim Buzinski – NH Fish and Game
- Matt Pehrson – NH Fish and Game

Meetings

Meetings took place on the following dates –

- April 5, 2021 -- EPA presentation on permit requirements
 - April 12, 2021 – Trout management practices in NH
 - April 19, 2021 -- PMFH practices and situation
 - April 26, 2021 – Hatchery effluent treatment technical presentation
 - May 3, 2021 – Field tour of Powder Mill Fish Hatchery
 - May 10, 2021 – Platt River Fish Hatchery presentation, MI DNR
 - May 17, 2021 – Hatchery system costs and revenue
 - May 24, 2021 – Subcommittee meetings
 - June 7, 2021 – Report Review
 - June 14, 2021- Subcommittee report out
 - June 21, 2021- Report Review
 - June 28, 2021- Report Review
 - July 12, 2021- Report Review
 - July 19, 2021 – Final Report Review
 - July 21, 2021 -- Report vote/Presentation to Director
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Recommendation summary

Below is a summary of the goals and strategies identified and agreed upon by the Hatchery Advisory Committee to rectify the conditions at Powder Mill State Fish Hatchery regarding water quality compliance and broader system goals. The rationale for these recommendations is explained in detail throughout the document.

- The Hatchery Advisory Committee recommends that the Department maintain current fish production levels at Powder Mill while seeking resources to expand production to meet growing angler demand. (Section a)
- The Committee recommends that the Department develop and institute marketing and sales strategies designed to reduce license renewal churn (Section a.3).
- The Committee recommends that the Department assess the suitability of using a portion of the Powder Mill Hatchery as a public education and angling promotion resource (Section a.5).
- The Powder Mill Fish Hatchery is an integral part of the hatchery system. The other hatcheries in the system are also at or near capacity so the ability to move fish from PMFH to other facilities is limited. (Section b.1)
- The Committee recommends that the Department seek resources and partnerships to expand its ability to conduct angler surveys for the purpose of expanding its understanding of angler preferences and resource utilization (Section b.3).
- The Committee recommends that the Department assess angler interest in and willingness to fund through license sales additional high quality angling opportunities (Section b.4).
- The Committee recommends that the Department pursue tactics and opportunities to improve genetic integrity and quality of hatchery product to increase angler satisfaction, system efficiency and license revenue (Section b.5).
- Opportunities for multi-state regionalization and privatization do not currently exist to take pressure off of PMFH, and a great deal more study would be needed to determine if options could be created (Section c.2).
- The Committee recommends that the Department consider evaluating the potential for modernization at the other fish hatcheries in the system (Section f.3).
- Adding modern wastewater treatment technology to the existing structure of the PMFH, which is at or beyond its service life, would not be cost effective. Modernization of the fish hatchery structure itself is considered to be the key to the consistent treatment of the effluent to meet permit limits, due to more efficient solids capture and reduced water volume (Section g.1).
- The Committee recommends that the Department utilize a tiered approach, beginning with low-cost interim mitigation measures, then moving forward with the RFQ process to identify the correct mix of modernization and treatment technologies as needed to meet the effluent limits and desired fish populations. (Section g.2 and Appendix D)
- Additional data should be gathered about the potential for production expansion at other hatcheries in the state to offset short-term decreases at PMFH during construction (Section f.4).
- The Committee recommends that the Department pursue funding within the state's Capital Budget to fund in whole or in part the improvements necessary to sustain and expand operations at Powder Mill Hatchery.
- The Committee recommends that the Department pursue funding from any available federal sources including those provided to the state for water quality and economic development projects.

a) Fisheries and Angling in New Hampshire

a.1 Trends

- **200,000 anglers fish NH waters annually generating on average more than \$6M in license sales.**
- **Interest in fishing spiked during 2020 with nearly 35% of occasional anglers wanting to fish more.**

Angling popularity in NH when measured by license sales and revenue has enjoyed steady and sustained growth since the 2015 fee increase temporarily reduced the number of units sold. The most recent data presented to the Hatchery Advisory Committee (the Committee) by the Department shows that NH Fish and Game consistently sells more than 151,700 resident and non-resident freshwater licenses annually, generating approximately \$6.29M in total annual revenue. Only those aged 16 and older and seniors born after 1947 are required to hold a license so the actual number of anglers fishing in NH is much higher. Numbers spiked in 2020 due to the Covid pandemic, license sales were just under 183,000, generating \$11.6M.

The 2021 Special Report on Fishing across the nation, issued by the *Recreational Boating & Fishing Foundation* and the *Outdoor Foundation* (2021 report) found that 27% of children between the ages of 6-14 and 14.1% of seniors aged 65 and above fish. Census data shows that New Hampshire has approximately 139,000 minors in the 6-14 age cohort. Based on the 2021 report estimates, as many as 33,500 people are fishing in NH. Additionally, using estimates from the 2021 report as many as 22,500 NH seniors in the 69 and up age cohort are enjoying fishing in NH.

When considering both licensed anglers and those outside the required criteria to hold a license bracket, it is likely that over 200,000 anglers fish NH waterways annually of which 75% or approximately 150,000 are NH residents. Based on this data, angling, by NH residents, is one of the most participated in recreational activities across all age groups.

Additionally, substantial opportunities exist to grow the angling community as 13% of non-angling respondents to the 2021 report identified themselves as “interested” in trying fishing, up 30% from 2010. Further, among those who are anglers 33.9% identified as an “occasional participant, would like to fish more”. The Covid-19 pandemic offered insight into this potential for increase as 2020 saw major increases across all license types. Many of those interested non-anglers used the Covid-19 pandemic as an opportunity to try fishing. The potential to attract and retain new anglers to fishing is high.

a.2 Role of fishing in the recreational economy

- **Angling is a key element of the recreation experience, supporting NH’s tourism economy.**
- **More than 30% of anglers consider fishing to be their most important recreational activity.**

Angling is a key element of New Hampshire’s recreation experience. According to the 2021 report, 79% of respondents stated that they enjoyed fishing along with other traditional outdoor recreation activities (Camping 40%, Bicycling 30%, Hiking 28%, Running 26%, and Hunting 22%). The 2021 report identified these activities as “cross over activities”, which are activities that anglers preferred when not fishing. New Hampshire’s recreational resources are well situated to offer anglers access to all of these in-demand crossover activities, offering anglers the opportunity to engage in multiple desired experiences concurrently.

When compared to other recreational activities by their relative importance angling ranked extremely high. In the 2016 Responsive Management report, developed for NH Fish and Game, when asked to rate the importance of recreational fishing to them relative to other activities (on a scale of 0-10) 31% of respondents rated angling a 10 with a mean of 7.56. For many NH residents and visitors fishing opportunities are central to their recreational experience.

a.3 Economic Impact to the State and Department

- **Angling in total contributes \$338M to the NH economy.**
- **New Hampshire's hatchery program directly contributes an estimated \$100M in annual spending and \$150M in economic activity.**
- **License revenue rose 77% in 2020 with the largest increase among state residents.**
- **Investment in fisheries infrastructure is key to sustaining license revenue, which in turn sustains Department operations.**

Recreational fishing in NH was estimated by the American Sportfishing Association to contribute over \$338M to the NH economy in 2018 with direct spending of \$209M by anglers.

While the portion of this economic activity fairly attributed to angling opportunities supported by the Hatchery Program is surely smaller, the 2016 Responsive Management report offers useful information on how to assign this economic activity. When asked which fish species they preferred, all three trout species ranked very high just behind black bass among open water anglers and ahead of all other species among hard water anglers. Vermont's more comprehensive *2020 Vermont Angler Survey Report* provides a useful window into how common Coldwater fishing is in the neighboring state of NH.

While not available from NH data, Vermont's survey data narrowed in on where angling occurred and for which species. In VT's streams and rivers 66.3% of resident and 38.5% of non-resident license holders had fished for trout and in streams and rivers while 47.9% of resident and 33.8% of non-resident license holders had fished for trout and salmon in lakes and ponds. While VT's data doesn't suggest that these anglers only fished for Coldwater species the data shows that very large percentages of anglers target trout and salmon all of which are supported by the hatchery program. Based on the data contained in the 2016 NH report and the 2020 VT report, it is reasonable to conclude that at least 50% of the angling and economic activity in NH can be attributed to trout and salmon fishing and in turn the Department's hatchery program.

NH Fish and Game Department fishing license sales saw significant increases in 2020 in almost every category with the exception of the over 68 (free) licenses (Table 2). This never seen before uptick in sales is likely a response to the increase in people's free time from unemployment due to the COVID-19 pandemic of 2020. Resident fishing license sales (season licenses) were up more than 29% over 2019 while non-resident season license sales increased 22%. Overall, fishing license revenues increased over 77%! In many license categories, total license sales have now exceeded pre-fee increase levels. The numbers in this table reflect actual fishing license sales, not necessarily the total number of anglers in New Hampshire. The license numbers and revenues in this table include the sales of Fishing Licenses and Combination Hunting and Fishing Licenses (including Senior Licenses) but does not include restricted revenues such as the Fisheries Habitat Fees or Lifetime License fee revenues.

Table 2. Total fishing license sales 2011-2020.

License Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% chg 2019-2020
Resident Fishing	69,956	71,901	72,808	75,410	75,015	68,142	66,412	65,505	67,818	87,804	29.5%
Resident Hunting & Fishing	23,485	24,123	25,015	24,995	24,798	25,763	25,997	25,982	26,219	26,351	0.5%
Resident 1-Day Fishing	2,743	2,502	2,665	2,665	2,528	3,696	4,044	3,843	4,346	4,369	0.5%
Senior Fishing ¹	--	--	--	--	--	396	1,219	811	2,829	3,996	41.3%
Senior Hunting and Fishing ¹	--	--	--	--	--	391	1,219	1,706	2,332	2,996	28.5%
Over 68 Resident Fishing ²	1,565	1,748	1,809	1,835	2,407	1,745	969	709	561	494	-11.9%
Over 68 Resident Hunting & Fishing ²	1,226	1,249	1,200	1,224	1,620	784	350	270	250	192	-23.2%
Resident Lifetime Hunting and Fishing	79	68	93	119	702	642	696	775	821	1,014	23.5%
Resident Lifetime Fishing	42	40	62	69	110	71	77	101	102	120	17.6%
Non-resident Fishing	18,862	19,250	19,233	20,301	20,840	19,200	19,327	19,266	19,709	24,075	22.2%
Non-resident Hunting & Fishing	1,208	1,249	1,308	1,341	1,428	1,480	1,505	1,564	1,631	1,774	8.8%
Non-resident 1-Day Fishing	8,631	8,913	9,084	8,969	9,132	9,562	9,782	9,753	10,306	10,518	2.1%
Non-resident 3-Day Fishing	9,781	10,075	9,680	10,287	10,211	10,831	10,839	10,908	11,425	11,102	-2.8%
Non-resident 7-Day Fishing	6,937	7,182	7,149	6,975	7,375	7,977	7,994	7,998	8,064	8,086	0.3%
Total	144,515	148,300	150,106	154,190	156,166	150,680	150,430	149,191	156,413	182,891	16.9%
Total unrestricted revenues	\$5,089,136	\$5,224,347	\$5,293,028	\$5,445,614	\$5,475,740	\$6,377,542	\$6,270,038	\$6,258,132	\$6,553,589	\$11,614,376	77.2%

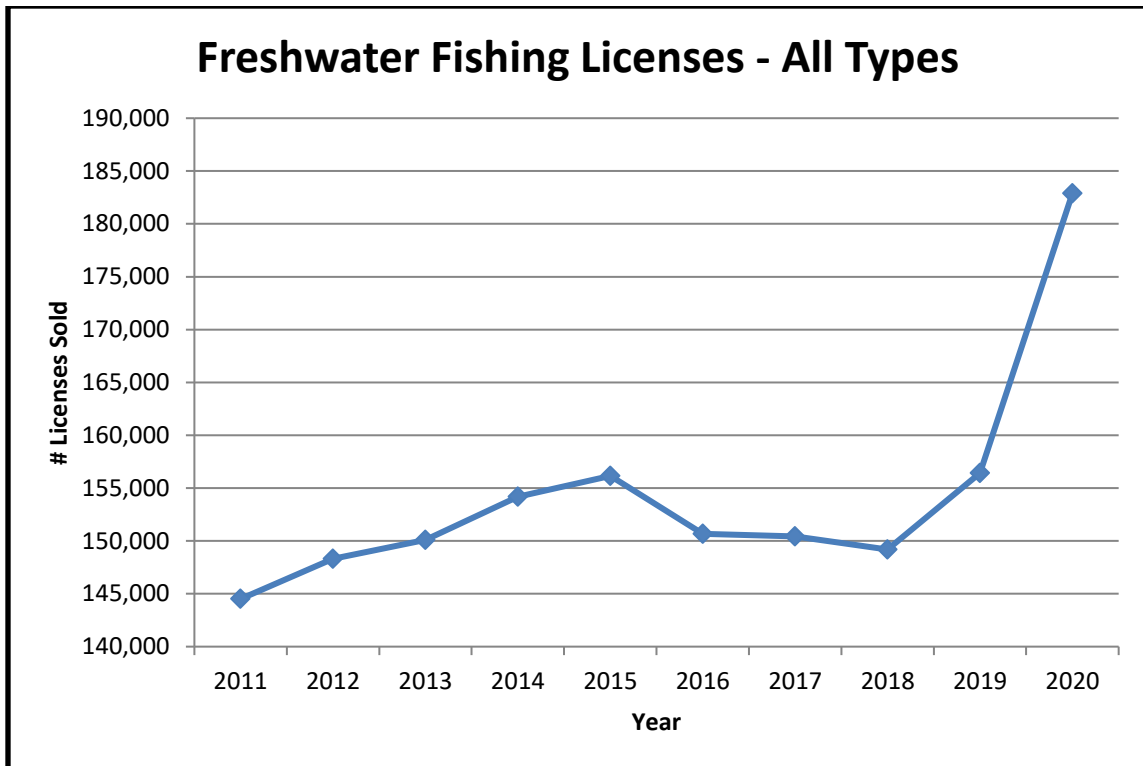


Figure 1. Fishing license sales data, all types combined, 2011-2020

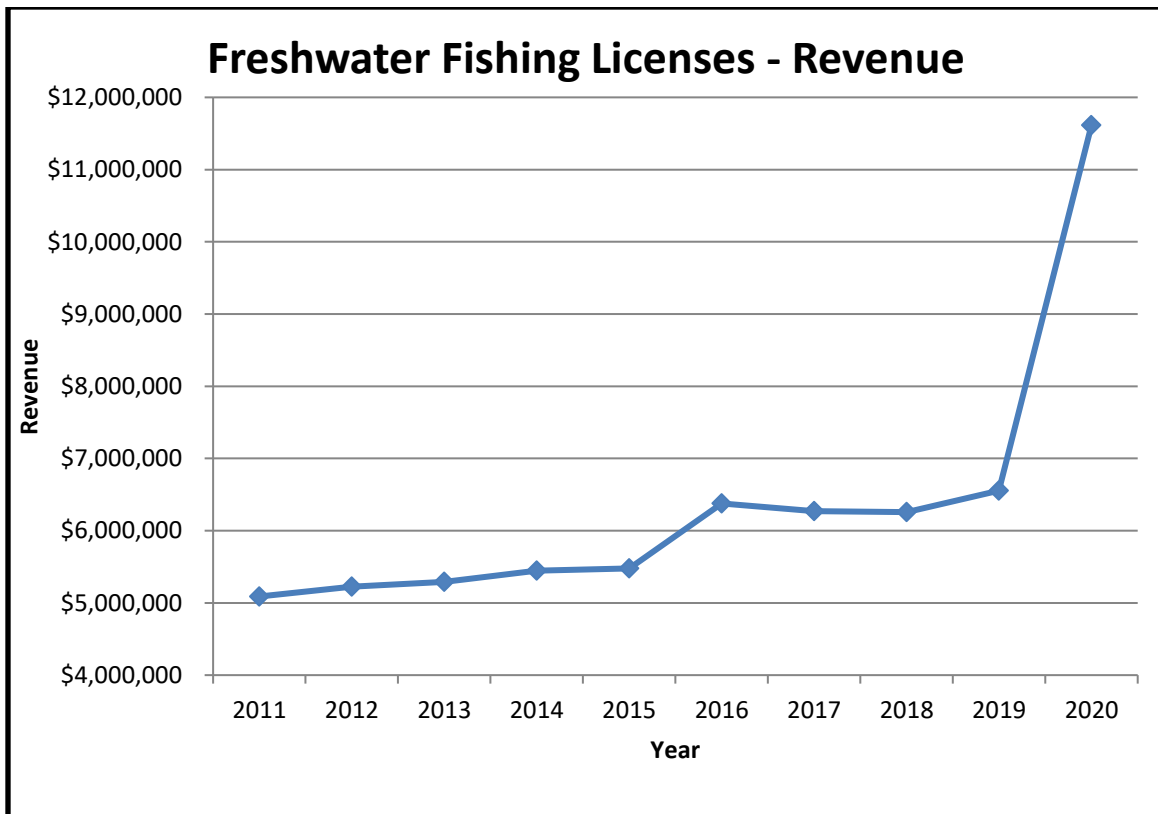


Figure 2. Fishing license sales revenues, all types combined, 2011-2020.

a.4 Economic impact warrants capital investment in Hatchery System

New Hampshire's hatchery program is estimated to contribute \$150M to the state's economy annually. It is well established that angling is a key component to the overall NH recreational and tourism economy. Further, among the more than 200,000 anglers who ply NH waters annually almost a third rank angling as a 10 on a scale of 0-10 when asked how important angling was as a recreational activity. This significant component to the NH tourism and recreation economy cannot be sustained without investment in hatchery infrastructure.

a.5 Growing the next generation of anglers

- **24.18% of youth nationally between ages 6-12 participate in fishing activities.**
- **35.5M adolescents ages 13-17 participated, a 28% increase from 2019**
- **Fly-Fishing in particular is attractive to first time anglers**
- **Powder Mill Hatchery is ideally situated in NH to serve as a public education and outreach resource.**

Each year millions of new and returning anglers discover the joys of fishing, the 2021 Report showed a record increase in the number of people fishing in 2020. This is the highest number of anglers reported since the record keeping began in 2007. Anglers that began fishing prior to age 12 still make up the majority of those anglers still fishing today (88%), highlighting the importance of introducing fishing to children as a metric to grow anglers in the future. Fostering youth "Let's Go Fishing" Programs and other children's events are critical to the future of angling across the country.

Anglers are motivated to try fishing for a variety of reasons including encouragement from friends and family, nostalgia, a desire to connect with the outdoors and a return to childhood experiences. Once introduced to fishing many cite the camaraderie, challenge, and excitement as key motivating factors to continue fishing. Fly-Fishing a predominately cold water pursuit has an especially high percentage of first-time participants. In 2020, 18% of all fly-fishing participants, or 1.4 million people, were new to the activity. Female first-timers made up a significant 20% of all female fly-fishing participants.

The Committee discussed the merits of incorporating public outreach and education into planned infrastructure improvements, such outreach is central to the NH Fish and Game mission. Powder Mill Hatchery is centrally located in the heart of the Lakes Region and accessible to hundreds of thousands of visitors the state welcomes annually. The property and its buildings, once improved, could be a valuable resource to educate the public on a variety of NH habitats and the flora and fauna that call them home.

b) Hatchery and Stocking Program

b.1 Overview of Powder Mill Hatchery's role in the system

- **Powder Mill Hatchery is central to NHFGD's ability to sustain its stocking program**
- **Due in large part to the abundant water supply, Powder Mill's operating costs are lower than other state hatcheries**

During the 2019 stocking year, according to Department data, Powder Mill Hatchery accounted for 26.5% of the fish production in the entire system, and in 2018, it accounted for 33% of system production. It is the largest contributor of one-year old Brook Trout and Rainbow Trout, and produces on average 360,900 trout and salmon. While the Department continues to pursue opportunities for increased efficiencies at all the state hatcheries, the committee found no evidence to suggest that the Department can meet the needs/desires of the angling community without contribution by Powder Mill.

Powder Mill's unique access to abundant cold water from Merrymeeting Lake is also unique, making this hatchery location ideal and irreplaceable. All of the other hatcheries in New Hampshire have combined water sources-either pond, spring and/or well. Further, access to this abundant gravity fed water supply contributes to the Powder Mill Hatchery being highly economical to operate, for example Powder Mill's utility costs are less than 20% of those at the Milford Hatchery.

b.2 Stocking Trends and Innovations

- **Continued increase interest in wild Brook Trout**
- **Interest in reallocation to areas experiencing higher angling pressure or creating new and expanded opportunity.**
- **NH's geology necessitates a robust stocking program**

Interest in angling for wild Brook Trout continues to grow since the inception of the Wild Trout Management Program back in 1996. NH is uniquely positioned to take advantage of this trend. Many streams throughout the state have self-sustaining populations of wild brook trout. This work is underscored by a regional study, completed in partnership with the Department, which provides a much clearer understanding of brook trout's required habitat and their status, and has resulted in many habitat restoration projects statewide.

Some of these streams have been or continue to be stocked with hatchery brook trout. There are many reasons that this process negatively impacts wild trout, most of which is the competition between and duplication of brook trout stocks and the over taxing of the stream forage and spawning habitats. Reallocating trout from the most productive habitats with the highest potential for successful natural reproduction to those areas that receive a lot of angler pressure will provide a longer potential opportunity for satisfaction at high-use waterbodies. This reallocation to improve use began in 2019. Changes and evaluations continue to be made annually. The committee also discussed the option for a "Fall Stocking Program", utilizing these fish in high demand waters that remain cool enough to stock in the fall, providing a late season option. The dramatic increase in anglers due to the pandemic has taxed several waterbodies throughout the state and reallocation may mitigate for the added pressure.

The Committee recognizes that historically NH has stocked far more fish on a per license holder basis than neighboring states, in many years double the quantity. This apparent abundance is attributable to NH's lack of high quality habitat and high angler expectations. Our streams, rivers and lakes lack the potential to grow wild trout at the same rate, size and quality as our neighboring states and angler expectations to catch larger fish and/or more fish remains high.

The geology of NH, the Granite State, is not conducive to stream populations that attain trout sizes that are available in the neighboring states. NH lacks calcium, an important mineral that contributes to the exoskeleton of macroinvertebrates. In other words, insects at their larval/nymphal stages are smaller than other states that have calcium in their landscapes. Smaller food equals smaller fish. Department data suggest that the average catchable wild stream trout in NH is 3.6 inches in size, not the "trophy" brook trout that many resident and non-resident anglers would be seeking.

Hatcheries provide trout in sizes that meet angler expectations immediately upon stocking. NH lakes and ponds are conducive to growing larger trout. Some ponds in NH support larger than averaged sized self-sustaining brook trout, others support stocked hatchery fish at various ages, and some grow small hatchery fish into larger catchable sized ones.

b.3 Angler preferences and expectations

- **Stocking is extremely popular among anglers, 92% of respondents to the 2016 report support stocking**
- **More than half of all respondents are satisfied with the amount of stocking and size of stocked fish.**
- **There is support for policies which increase quantity and quality of the fishery.**

Department data on angler preference shows that there is broad support for the stocking program with 9 in 10 supporting stocking. As the program is currently managed, trout anglers are generally open to more restrictive regulation of the fishery resource. Management regulations such as, *special length limits* and *catch and release* both have about half of trout anglers supporting their use (52% and 50%, respectively), and *reduced bag limits* as a special regulation has 44% supporting it. While angler motivation for supporting these regulations was not measured it is reasonable to conclude that support is due to the belief that they would lead to greater quality and quantity of the resource. These sentiments in turn support policies and initiatives which place a priority on preservation and investment in the department's hatchery system.

Satisfaction among Coldwater anglers is highest among those who fish remote ponds (76%). Stocked Brook Trout and Rainbow trout outperform wild Brook Trout by approximately 10% at 62%, 61% and 52% respectively, while only Brown Trout and Landlocked Salmon enjoy satisfaction rates below the median for all fish species. Among those that were unsatisfied, the reasons given for all species tended to be related to angler opportunity with *Low Catch Rates* and *Not Enough Angling Opportunities Near My Home* being most cited.

b.4 Revenue Enhancement Opportunities

- **Angler interest supports exploring new licensure programs in turn supported by hatchery program innovations.**

The Committee discussed a number of innovations to the stocking program which the Department could implement to increase angler interest and license revenue. For example, a fall Catch and Release, Artificial-Lure-Only (ALO) stamp backed by fall stocking, a Blue-Ribbon Trout Stamp program supported by increased stocking in designated areas and a White Mountain National Forest Stamp for access to the areas' wild trout streams, could bring enhanced revenue to the hatchery program.

There is precedent for some of these ideas both within NH and elsewhere as the Department had a fly fishing only season that started the day after Labor Day and ran until October 15 before the season became open to all anglers. In an online poll conducted by the North Country Angler (October 2019), 93% of the 1600 respondent said that they were willing to pay \$20 for a Fall ALO, Catch and Release Season Stamp. The Advisory Committee acknowledges the challenges the Department may face with acquiring stamps but feels it is worthy of consideration given the interest.

The White Mountain National Forest has been recognized as the last bastion for steam bred brook trout in the Northeast. With a reduction of stocking in self-sustaining populations, of which many are in the WMNF, the potential for a WMNF wild trout stamp of \$10 should be researched. The State of Virginia has a program in the Smokey Mountain National Forest that could be emulated.

b.5 Stocking Program Innovations

- **More efficient allocation of hatchery resources could improve angler satisfaction and better sustain wild stocks.**
- **Efforts to introduce wild genetics strains and improve egg availability can improve efficiency**

In addition to new stocking programs which could lead to enhanced revenue, reallocation of stocked fish from smaller headwater streams and streams with self-sustaining populations of wild fish could improve angler satisfaction. Current stocking regimen places smaller numbers of fish in “every road crossing”. Some of these streams have self-sustaining populations of trout or receive little angler interest. By identifying these locations and reallocating fish to those streams that receive intense fishing pressure, an increase in angler satisfaction is likely. In addition, streams with self-sustaining populations will meet the demands of anglers seeking wild fish. By promoting the increased stocking of high traffic rivers and ponds and the increase in the availability of wild fish, NH can encourage more anglers to participate.

Remote ponds are NH's best habitats for growing brook trout in excess of sixteen inches. The current stocking of Rome strain brook trout in remote trout ponds has met with mixed results. The State of New York, developers of the Rome strain, recently stopped stocking this strain in the Adirondack remote trout ponds due to lack of expected performance. The hatchery program should continue to identify locations locally and regionally which could supply viable gametes to introgress into the existing Brook Trout Brood Program. Such efforts could lead to enhanced fish quality as well as improve angler opportunities within the Remote Pond Program. The Committee also recognizes the challenges in raising wild fish and understands there may be increased costs in this strategy. Similar to efforts to improve Brook Trout genetics, continued focus on identifying and securing a high quality and dependable source of Rainbow Trout eggs is desirable as it would increase hatchery production and operations efficiency, reduce loss and improve product quality and return.

c) Fisheries related opportunities and challenges

c.1 Coldwater fisheries sustainability

- **NH's geology and trout habitat is unique in the northeast**
- **The State's historic forest products industries and continued development impact and fragment habitat.**
- **Stocking provides alternatives elsewhere and relieves pressure on fragile wild populations**

Like most of New England, New Hampshire suffers from a legacy of intensive timber cutting. Deforestation associated sedimentation and channelization for log drives degraded stream habitat and depleted many brook trout populations. Regional biologists ranked road sedimentation as the number one threat to Brook Trout in NH. Road construction and poorly maintained roads can increase sedimentation and impair water quality. Nonnative fish, particularly Rainbow Trout, were ranked as the second and third most widespread disturbances to Brook Trout statewide. Smallmouth Bass pose a specific threat to lake and large river populations of native Brook Trout in this state. Acid deposition impacts are most severe in the southern portion of the White Mountain National Forest and west of Concord and Manchester. In addition, poorly designed road culverts and dams fragment Brook Trout habitat and restrict fish movement. State agencies have been working closely with fish habitat biologists to ensure that best design practices minimize the impact of road crossings on Brook Trout. In addition, habitat restoration work is ongoing in impacted areas to restore vegetation and instream habitat damaged by historical logging and log drives. Stream temperatures have also been increasing with less alleviating rain events occurring throughout the state.

New Hampshire's geologic, history of land use and current level of development demand stocking of fish to direct angling pressure away from vulnerable wild trout populations. Trout stocking reports are published on the internet on a weekly basis. Many anglers monitor this information in order to pursue larger, easier to catch hatchery trout, while others still target wild smaller stocks. Stocking larger fish in larger streams and ponds makes most anglers happy and will give wild trout a better chance to reach larger sizes driven by their habitat. This is especially important in lakes and ponds where trout have to possibility to reach trophy size.

c.2 Regionalization and Privatization

The committee discussed and considered the merits of seeking stocking services from the private sector and pursuing a multi-state regional approach to Hatchery services. While an exhaustive review of the merits and defects of these concepts was beyond the scope of the Committee's work, initial data gathering does not suggest privatization or regionalization will address the near-term challenges presented by the Powder Mill Hatchery NPDES permit. The Committee's limited discussion on these issues highlighted several areas of concern including that no private producers of scale exist currently meet demand and that any such producer would be subject to the same permit considerations as the Department. Further, regionalization does not currently have consensus support among other states and many risks and operational challenges are created when very large, centralized fish production facilities are contemplated.

d) Powder Mill Fish Hatchery – Current Operations and Interim Mitigation Measures

d.1 History and conditions

The Facility is located at the headwaters of the Merrymeeting River at the Merrymeeting Lake Dam on Merrymeeting Road in New Durham, NH. Water flows from Merrymeeting Lake at a rate of 3,700 to 4,500 gallons per minute (gpm). Water use averaged about 5MGD for 2019. Influent can be sterilized with ultraviolet radiation prior to use at the hatchery, although ultraviolet system is not currently in use. The hatchery complex consists of a Hatchery House, multiple raceway units, three Show Ponds, four Woods Ponds, four Bass Ponds and 24 Circular Tanks. PMSFH produces Brook Trout, Rainbow Trout, and Brown Trout for fisheries management of selected water bodies located primarily in the central part of the state (referred to as Regions 2 & 3, or Conservation Law District 2, 3, 5, and 6). The total annual production levels at the Facility are about 65,000 lbs of Brook Trout, 97,000 lbs of Rainbow Trout, and 33,000 lbs of Brown Trout. The combined annual production target results in a potential cumulative harvestable weight of about 141,000 pounds for stocking. In 2019, the production target was 90,863 pounds. They met this target using 101,615 pounds of feed, which results in a pounds of feed conversion ratio of 1.12. In the past, the facility provided landlocked salmon; however, salmon production was moved to Nashua National Fish Hatchery and New Hampton Hatchery to provide interim reductions in pollutant loads and to determine if a larger product could be attained.

Culture water is withdrawn from Merrymeeting Lake to a centralized distribution box where it flows to either the hatchery house and Raceways E, F, and G (west of the river) and discharges from Outfall 001; or to Raceways A, B, C, or D (east of the river) and through the woods ponds or to the circular rearing tanks, and discharges from Outfall 002.

The facility was built in 1947. The site previously hosted a powder mill and hydropower facility. The facility is showing its age. The upstream concrete raceway, Raceway A, presents significant concrete damages such as spalling, surface delamination and cracks. As such, only three of the ten available banks are currently in use. The granite canal is an open channel that transfers flow from the show ponds to the wood ponds and does not serve for rearing purposes or for showing purposes. It requires intensive labor to clean out the leaves from the surrounding trees that clog the channel; during the fall season, cleaning is required multiple times a day. The facility currently owns and operates two portable vacuuming systems that are used to collect solids from the raceways and from the circular tanks. The show ponds, wood ponds and bass ponds are very difficult to vacuum. Vacuumed solids are then transferred to the solids treatment tanks, wood chip bags, and subsequently transported offsite.

d.2 BMPs and improvements made

The hatchery employs various solids management practices. The first step is managing the amount of feed. The hatchery hand feeds fish and adjusts feeding rates based on reference guidelines, specific conditions at the hatchery, and daily inspections of fish rearing containers after feeding. In addition to feed management, the hatchery follows specific solids collection and cleaning procedures to reduce the discharge of solids. When in use, raceways are cleaned weekly, which decreases to once every two weeks during winter; the 24 circular ponds are cleaned once every two weeks. Cleaning involves brushing fish retaining screens/plates and removing solids from the settling area at the end of each raceway or outlet of the circular tanks (“quiescent zone”) with a vacuum pump. Solids are transported to the three new wastewater storage ponds. Solids from the wastewater storage ponds are typically disposed of on land for agricultural purposes. The ten rearing tanks (5-foot diameter) and the 48 vertical egg incubation trays in the hatchery building are cleaned daily when in use. A number of improvements have been made over the past two years in order to reduce phosphorus effluent. These actions are summarized below and described in detail in Appendix A.

In 2019, the hatchery changed its solids management system. Three of the circular tanks at the downstream end of the fish hatchery are now used for solids management. Tanks 1 and 3 provide preliminary treatment (solids collection and clarifying). Water enters Tank 1 or Tank 3 via the fresh water inlet and vacuum tank discharge. The fresh water inlet moves the water column in a circular motion towards the center of the tank passing through media that is seeded with bacterial culture for nitrates removal. Duckweed cultured on the surface provides additional nutrient removal. Water enters Tank 2 and is mixed with more fresh water from existing supply inlet pipe to slowly move the water in a circular motion towards the effluent of Tank 2 located in the center of the tank. Wastewater gently passes through the tank that contains microalgae culture.

Overflow water leaving Tank 2 flows through a 3-inch pipe into several “dirt bags” dewatering sediment control devices. These dirt bags are designed to filter out any particulate matter coming from the primary and secondary treatment tanks. The bags are laid on 8-10 inches of wood chips which treat the water for nitrogen removal.

In 2020, the major new BMP was the addition of lime. Four Hatch House tanks have been designated for addition of powdered lime to buffer the pH in the discharge. These tanks allow for a slow release of buffered water into the rearing ponds that will add alkalinity to the water, and bring the water to a more neutral pH. This practice has had a major new benefit on helping solids to settle out and appears to have reduced phosphorus levels in the effluent from Outfall 001.

In 2021, the fish hatchery has been working on a number of additional measures, including:

- Discontinue rearing fish in the last raceway in E series, G Series and F series, and retrofit those three raceways to be used as solids setting areas.
- Secure footings for dam boards to be placed as baffles in the last raceway of each series to augment settling efficiency.
- Removal of legacy sediment deposits in the rearing ponds.
- Retrofit parts of the existing infrastructure to increase the stations treatment efficiency of solids via rapid removal, isolated capture and detention time reduction within the rearing environment.
- Converting Show Pond #1 into an isolated waste collection area.
- Re-piping of flow from the Woods Ponds to allow for additional sedimentation prior to release from Outfall 002.

d3. Efficiencies can be further realized through predation mitigation

Physically separating trout from predators by building a permanent enclosure will significantly improve the efficiency of Powder Mill Hatchery. Experience at NH hatcheries has shown that predators can account for losses of as much as 25%, even after the installation of netting and other non-permanent protective coverings. Losses have averaged 12%-13% at Powder Mill Hatchery. Loss prevention strategies offers the dual benefit of offering an increase in fish available to meet stocking goals while reducing waste produced and hatchery rearing expenses for trout ultimately consumed by predators.

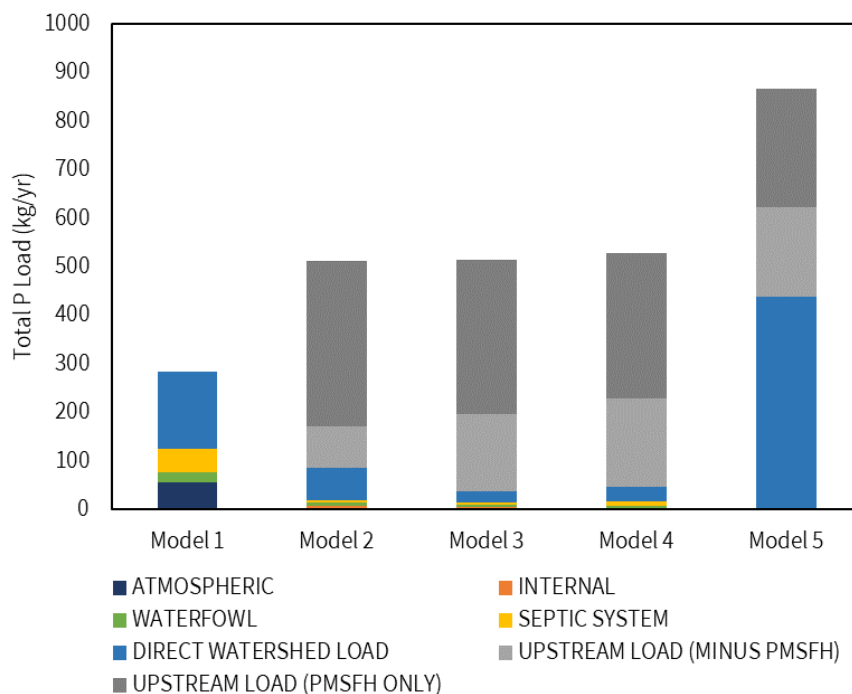
e) Water quality effluent limits and current data

e.1 Description of background data and rationale for permit

A local group was established called the Cyanobacteria Mitigation Steering Committee. This group had many meetings about the impacts on the three impoundments downstream, Marsh Pond, Jones Pond and Downing Pond. They ultimately funded, using a combination of local and private contributions, a lake loading model and a watershed based plan. The plan found that the water quality in each of the impoundments was degraded. Below is a graph from the plan that show the total phosphorus in each of the ponds.

SITE	Median	Mean	Min	Max	n
TP-EPILIMNION (PPB)					
MERRYMEETING LAKE-2 OWLS HEAD	3.3	3.8	2.3	7.3	30
MERRYMEETING LAKE-3 EAST END	3.5	3.9	2.6	9.0	30
MERRYMEETING LAKE-DEEP SPOT	3.8	4.0	2.6	6.8	30
MARSH POND - 2 DEEP	43.1	44.2	30.7	65.1	7
JONES POND SITE 3 - DEEP	26.7	28.6	22.3	35.8	5
DOWNING POND SITE 8 - DEEP	25.2	25.8	19.4	34.3	8

The model showed that PMFSH is the largest single source of TP to the system



Source: MERRYMEETING RIVER & LAKE LOADING RESPONSE MODEL REPORT, 2019, FB Consulting.

Based on a variety of sources, including the model created by the Committee and various DES approaches, EPA chose to make the instream target for TP 12 ug/l. The primary source of TP to all of the ponds is the hatchery (Marsh Pond – 67%,

Jones Pond – 62% and Downing Pond – 57%). Given that PMFH has essentially no dilution (the entire flow of the Merrymeeting River moves through the facility), the 12 ug/l TP became the effluent limit.

e.2 Load and concentration limits

In general, the new permit carried forward limits most of the limits in the previous permit for items such as monitoring and narrative requirements. The major changes in the new permit included:

- Established a TSS daily maximum benchmark of 10 mg/L
- Established water quality-based limits for Total Phosphorus
 - Average monthly limit of 12 µg/L at each outfall
 - Total combined load limit of 227 lbs/year and 19 lbs/month
- Established ambient monitoring requirements (May 1 –Oct 31)
 - Total Phosphorus; Total Nitrogen; Chlorophyll-a; Secchi Disk Transparency

e.3 Effluent data

Total Phosphorus data

<i>Historic data – 2018 - 2019</i>	<i>Outfall 1</i>	<i>Outfall 2</i>
	<i>AVG of CONC (Ug/L)</i>	<i>AVG of CONC (Ug/L)</i>
<i>DEC-FEB</i>	<i>27.5</i>	<i>54.1</i>
<i>MAR-MAY</i>	<i>17.3</i>	<i>43.9</i>
<i>JUN-AUG</i>	<i>42.7</i>	<i>38.6</i>
<i>SEPT-NOV</i>	<i>43.8</i>	<i>63.2</i>

Current Data

<i>2021</i>	<i>Outfall 1</i>	<i>Outfall 2</i>	<i>Total</i>
	<i>MO AVG of CONC Ug/L</i>	<i>MO AVG of CONC Ug/L</i>	<i>Load TOTAL Lbs/month</i>
<i>1/31/21</i>	<i>7.25</i>	<i>12.25</i>	<i>16.15</i>
<i>2/28/21</i>	<i>15.25</i>	<i>16.75</i>	<i>20.16</i>
<i>3/31/21</i>	<i>12.5</i>	<i>14.5</i>	<i>18.91</i>
<i>4/30/21</i>	<i>14.6</i>	<i>17.8</i>	<i>20.89</i>
<i>5/31/21</i>	<i>3</i>	<i>21.5</i>	<i>20.82</i>
<i>6/30/21</i>	<i>13.25</i>	<i>17.75</i>	<i>15.9</i>

f) Hatchery system limitations and challenges

Through presentations from experts in fish hatcheries and in subsequent meetings with other states in New England, the committee discovered that it is very possible that the NPDES permit for the Powder Mill Fish Hatchery has the most stringent total phosphorus effluent limit in the country. What makes it so challenging is that it includes both a concentration and load limit.

f.1 Load and concentration

Many hatchery effluent permits around the country and in New England have load limits. In general, these limits focus on total phosphorus and limit the facility to a mass load over a certain period of time, typically a month or year. This is generally considered to be a more flexible way to impose restrictions because it allows for fluctuations over the course of the time period. A concentration limit, on the other hand, allows for fewer fluctuations because a day or week of higher loads may violate the contraction limit. In the case of PMFH, EPA imposed both a load and concentration limit on each of the two outfalls. This was done because essentially all of the flow Merrymeeting lake moves through the fish hatchery. This means that that there is no dilution. Given frequency of cyanobacteria blooms and low dissolved oxygen events immediately downstream in the three ponds between PMFH and Alton Bay, concentration is an important fact. Normally hatchery effluent would be diluted by the flow of the receiving water, so the concentration is lowered by that receiving water.

f.2 Water sources and discharge issues

The fish hatcheries around the state were located where they are to take advantage of cold, clear water. (See Appendix C – 2020 water withdrawals for the hatchery system). PMFH is no exception. The water quality of Merrymeeting Lake is very good, and is available as such a quantity, that the location is nearly ideal for growing fish. However, given the shallow impoundment just downstream (Marsh Pond), it is not an ideal location for the discharge of phosphorus.

f.3 Capacity and age of system

The entire hatchery system is at or near capacity. Below is a chart that breaks down the overall production of the system by facility.

Facilities	Percentage of system by weight of fish produced (2018)
Berlin State Fish Hatchery/Twin Mountain	25%
Milford State Fish Hatchery	18%
New Hampton State Fish Hatchery	19%
Powder Mill State Fish Hatchery	33%
Warren State Fish Hatchery	5%

Again, the major challenges at each of these facilities are access to clean, cold water and the ability to discharge waste. It is not clear precisely how much a decrease in production at PMFH could be absorbed by other facilities, but it appears to be very limited. In addition, the other fish hatcheries recently received General Permit coverage by EPA for their discharges. That general permit includes requirements for monitoring. Additional restrictions in phosphorus effluent may occur in the next permit at some facilities depending on the results of monitoring and evaluation. Therefore, increasing the discharges at those facilities may be counterproductive.

f.4 Major challenges

The major challenges facing the Powder Mill Fish Hatchery and, to a lesser extent, the other facilities in the system include:

- Maintaining current level of overall fish stocking
- Resuspension of waste
- Age of facility
- Access to clean water
- Regulatory effluent limitations



g) Potential approaches to meet effluent limits

Potential approaches for complying with conditions of the PMFH NPDES permit must also address PMFH fish production needs to satisfy NHFG statewide fish stocking goals. This section presents a possible tiered implementation approach involving interim mitigation measures for phosphorus control, PMFH modernization, wastewater treatment and waste solids handling.

g.1 Role of modernization

PMFH is an aging facility with site infrastructure that has exceeded intended service life. Given that the facility serves a vital role for statewide fish production, PMFH modernization should be strongly considered. Hatchery modernization would provide the following key benefits:

- Allow NHFG to satisfy statewide fish production needs more reliably.
- Facilitate regulatory compliance through:
 - reduction of water use for fish rearing
 - reduction of wastewater volume
 - improved fish feed waste solids capture
- Reduce cost of wastewater treatment and waste solids handling/disposal.
- Covering the facility with a roof will greatly reduce predation, allows for greater fish yield for stocking. Current estimated fish loss due to predation is 12 to 13%.

Accordingly, PMFH modernization is key component of an integrated fish production and regulatory compliance strategy.

g.2 Tiered approach

Appendix D presents a possible tiered approach for regulatory compliance involving up to four implementation tiers:

- **Tier 1 – Interim Mitigation Measures** - – This tier is currently in progress and involves construction of select facility improvements to reduce phosphorus loadings to the Merrymeeting River. Tier 1 is funded through the current NHFG operating budget. Interim mitigation measures are discussed in Section d.2.
- **Tier 2 – PMFH Modernization** – Construction of modern, covered fish rearing tankage, support systems and site improvements. Estimated Tier 2 capital cost range is \$5 to \$6M. Staffing needs would not likely increase above current PMFH levels.
- **Tier 3 – Wastewater Treatment System** – Construction of new wastewater treatment, solids handling and support systems to meet NPDES permit requirements. Estimated Tier 3 capital cost range is \$5 to \$7M (not including Tier 2 costs). Facility operating costs and staffing needs are higher than Tier 2.
- **Tier 4 - Advanced Wastewater Treatment** – Construction of advanced wastewater treatment systems to meet NPDES permit requirements at significantly higher fish production (than current levels). Estimated Tier 4 capital cost range is \$8 to \$11M (not including Tier 2 and Tier 3 costs). Facility operating costs and staffing needs are significantly higher than Tier 2 and Tier 3.

It is envisioned that each implementation tier would build upon the previous tiers. Not all tiers and scope items listed in Appendix D may be needed or desired depending on the following factors:

- 1) Target level of fish production for PMFH. Implementation of hatchery modernization and wastewater treatment schemes will potentially allow for increasing fish production (progressing from Tier 2 to Tier 4).
- 2) Wastewater treatment and solids handling requirements identified by a detailed engineering evaluation (currently planned for 2021-22). See Section g.3 for details.
- 3) Required level of redundancy for critical fish production and treatment systems.
- 4) Funding availability for capital projects.
- 5) Staffing needs and limitations.
- 6) Operating costs (power, equipment maintenance/repair, chemicals).

g.3 Study and Plan Needs

In June 2021 NHFG issued a Request for Qualifications (RFQ) from expert consulting firms to conduct a feasibility study for modernization of the PMFH, including upgrade of fish production operations and wastewater treatment facilities. It is anticipated that the study will be complete in late 2022. Study findings will help inform the decision making process for the recommended tiered implementation approach. The RFQ can be found in Appendix B.

g.4 Timeframes

These estimated timeframes are based on experience with other sectors and industries and attempt to tie into the NPDES permit requirements. Based on the results of each task (and available resources), this timeline may change.

2021 Q3 – Expert consultant selected and contracted.

2021 Q3 – Tier 1 interim mitigation measures implementation complete.

2022 Q4 – 12-month assessment of Tier 1 interim mitigation measures effectiveness.

2022 Q4 – Engineering study complete, includes piloting of selected technologies.

2023 Q4 – If needed, complete design and bidding of PMFH facility upgrades

2024 Q2 – If needed, initiate construction of PMFH upgrades.

2026 Q2 – Substantial completion of construction, and initiation of new system operations.

2026 Q4 – Full compliance with NPDES permit conditions at full target fish production.



NH Fish and Game: Powder Mill State Fish Hatchery Interim Mitigation Measures updates 2019-2021

By: Matthew Pehrson
Hatchery Biologist

2019 Interim Mitigation Measures Update

Production Reduction

Landlocked Atlantic Salmon have historically been raised at Powder Mill State Fish Hatchery. Beginning in 2019, salmon production has been moved to Nashua National Fish Hatchery for the foreseeable future.

Waste Management

Tank dynamics

Purpose of Linked Circular Tank System-

- Tank 1 & 3-To be used as solids collector, clarifier preliminary nutrient treatment (Living tank)
- Tank 2- To be used as secondary nutrient treatment and secondary clarifier
- After “secondary treatment” over flow water to be discharged to final treatment

Tank Descriptions (Waste Collection & Treatment)

Tank 1 & 3 Preliminary Treatment (preliminary nutrient treatment, solids collector and clarifier)

Hatchery Cleaning water from the vacuum tank is discharged into tank 1 or 3. Water then settles and passes through the tank and flows through a 3” PVC pipe line that brings the waste into the Tank 2. Solids settle towards the center of the tank 1 & 3 by circular flow created by a vertical stand pipe fresh water inlet located on the outside edge of tank 1 & 3. This water dynamic pattern acts as a containment barrier. An aerator is placed above the settling area to provide an upward current and add aeration to prevent solids from going anaerobic.

Tank 1 & 3 will contain seeded media to promote preliminary nutrient removal. Plant species such as duckweed will also be seeded in the tank to further nutrient removal of the wastewater. Duckweed will also cover the surface of the water and minimize sunlight which will deter algae growth and further promote good bacterial growth. Aeration will be added throughout the tank to increase DO content of the water utilizing air stones.

Tank 2 Primary Treatment (secondary clarifier and nutrient treatment)

Wastewater from the effluent of Tank 1 & 3 enters Tank 2 from the newly installed over flow outlet located on the outside walls of tank 2. A micro algal culture will be suspended by silt screen and in the first 20 cm of tank 2 this will provide additional phosphorous and nitrate removal, this will also provide additional solids collection. Water will then flow through an upwelling sand filter in the center of the pool before exiting the tank to the wood chip system (see below).

Tank Descriptions (Water Flow Direction)

Tank 1 & 3 Preliminary Treatment (solids collector and clarifier)

Water enters Tank 1 or Tank 3 via the fresh water inlet and vacuum tank discharge. The fresh water inlet moves the water column in a circular motion towards the center of the tank passing through media that is seeded with bacterial culture for nitrates removal. Duckweed cultured on the surface will also provide additional nutrient removal. A mix of wastewater and fresh water leaves Tank 1 out of the newly cut overflow outlet and flows through a new pipe line that connects Tank 1 & Tank 3 to Tank 2. The bottom plate is then removed so the settleable solids can be removed via a new vacuum line retrofitted onto the old effluent line to be land applied after being removed from Tank 1 & 3.

Tank 2 Primary Treatment (secondary clarifier and preliminary nutrient treatment)

Water enters Tank 2 and is mixed with more fresh water from existing supply inlet pipe to slowly move the water in a circular motion towards the effluent of Tank 2 located in the center of the tank. Wastewater gently passes through the tank that contains micro algae culture. Effluent water will travel through the new effluent line to a final junction box and flow over a weir board into the new pipeline to the final treatment wood chip system.

Final Treatment (Wood chip treatment system)

Overflow water leaving tank 2 will flow through a 3 inch pipe into several construction “dirt bags”. These dirt bags are designed to filter out any particulate matter coming from the primary and secondary treatment tanks. The bags will be laid on 8-10 inches of wood chips. Wood chips will treat the water for nitrogen removal. Treated water will leech into the ground below without entering the Merrymeeting River unless it happens through gravel filtration.

Solids Disposal: The current preferred option for disposal is removing of concentrated solids from the holding tanks using the center drain and dumping them at the discussed site/sand pit owned by the town of New Durham on an as needed basis. Another option is land application of our fish manure on local farmer’s hay fields, or crops, as part of the farmer’s nutrient management plan. (Estimated at 3 times per year, utilizing our NUHN INDUSTRIES LTD 600 gallon capacity tanks and vacuum pumping systems with spreader bar attachment for land application.). Note: Fish mortality is removed and properly disposed of on a regular basis.



2020 Interim Mitigation Measures Update

Rotating lime addition pH buffer tanks:

Four Hatch House tanks have been designated for addition of powdered lime to buffer the pH in the discharge. These tanks allow for a slow release of buffered water into the rearing ponds that will add alkalinity to the water, and bring the water to a more neutral pH.

The less fine particulates from the Hatch House tanks are then removed and used at the head of E-series where they are placed in a container to allow flow to dissolve the particulates over time and buffer the water in 001 discharge in a similar manner.

2021 Interim Mitigation Measures Update Plan

Outfall 001

New Development retrofit summary:

Discontinue rearing fish in the last raceway in E series, G Series and F series, and retrofit those three raceways to be used as solids setting areas. These areas will be baffled to increase efficiency of settling solids in a concentrated area before reaching the outfall 001 effluent.

New Development retrofit summary:

Drill channel iron or angle iron into the last raceway walls to secure a footing for dam boards to be placed as baffles in the last raceway of each series in the new development. This will bolster the settling efficiency of the already existent quiescent zones located at the end of each raceway for each series.

Outfall 002

Cleaning of rearing ponds with organic benthic structure summary:

Remove historic nutrients confined within the natural benthic structures of the rearing ponds i.e. (Show Ponds, Woods Ponds and Bass Ponds) from being re-suspended into the rearing water.

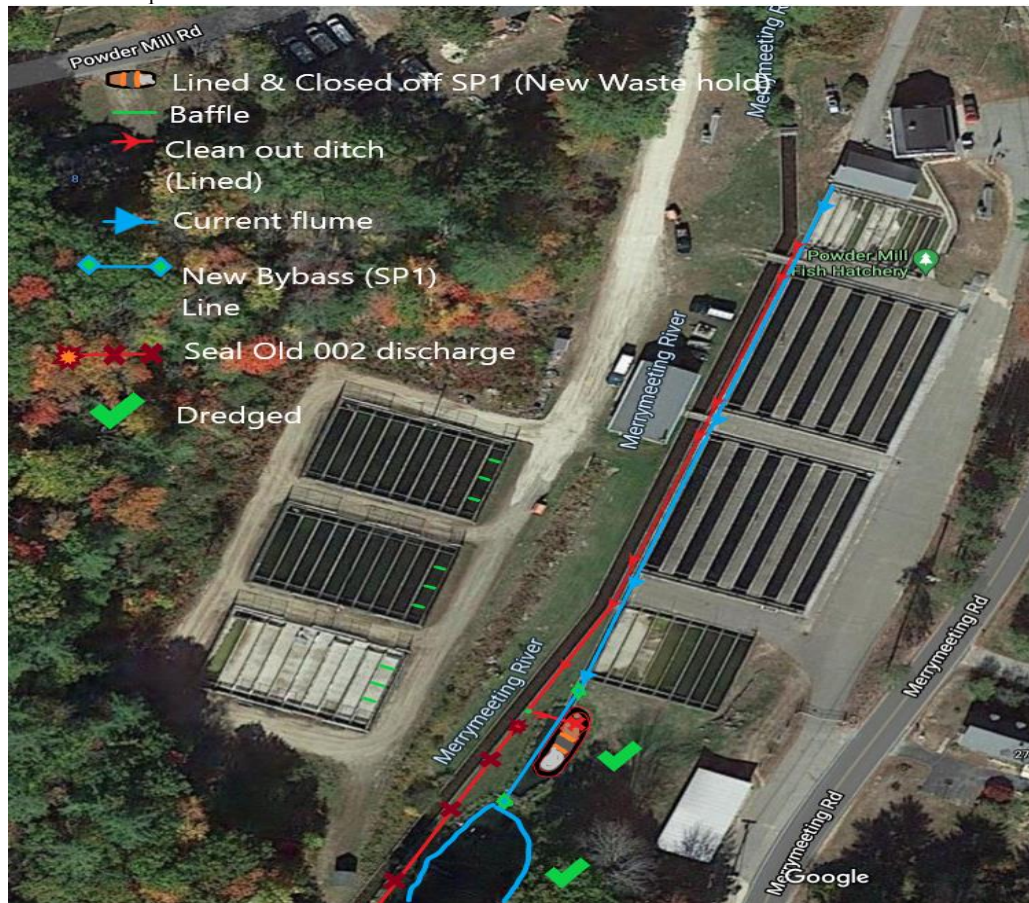
Cleaning of rearing ponds with organic benthic structure:

Using heavy equipment we will clean out the current natural rearing ponds (Show Ponds, Woods Ponds and Bass Ponds) by digging out a later to determined depth of bottom structure sediments. This will be done after all fish have been stocked out of the ponds and the rearing water has been decanted to allow for the benthic structure to dry. This will avoid a situation where sediments are re-suspended via agitation and inadvertently released out of the effluent. The removed benthic material will be transported and dumped at the town sand pit (the same place that Bass ponds 2 & 3's material was taken). This will remove historic nutrients confined within the natural benthic structures of the rearing ponds i.e. (Show Ponds, Woods Ponds and Bass Ponds) from being re-suspended into the rearing water.

Upper station Retrofit Summary (Hatch house, A series, B series and C series):

To retrofit parts of the existing infrastructure at the Powder Mill State Fish Hatchery to increase the stations treatment efficiency of solids via rapid removal, isolated capture and detention time

reduction within the rearing environment. This will aid the staff by allowing them to extract solids from the rearing water and isolating them in a closed system in half the amount of time it currently takes to remove solids and transport them to closed containment.



Upper Stations Retrofit (Hatch house, A series, B series and C series):

Tanking show pond #1 out of use for rearing space and convert it into an isolated waste collection area (no effluent). The pond will be lined with an impermeable pond liner to avoid and Pond line the old clean out flume for the Hatch house, A series, B series and C series with an impermeable pond liner all the way to the old effluent pipe. The old effluent waste line will be modified by sealing off at the end and tapping into the pipe and redirecting the pipe to empty into the isolated and seal show pond #1. The flume that funnels the rearing water coming from Hatch house, A series, B series and C series into show pond #1 will be dammed and re-piped to show pond #2 to by-pass the newly isolated and sealed show pond #1.

Being able to utilize the old clean out flume after piping it to an isolated show pond #1 is that it will allow for rapid removal of solids to an isolated area that can concentrate the waste into a smaller organized collection and extraction area. This will also allow for a faster removal of waste off the facility grounds to the town sand pit which is currently being used.

Show Ponds, Woods Ponds and Bass Ponds Summary:

The rearing water for most of the upper station flows ends up at the end of Woods pond #4 where it is goes into the main line that ends up at outfall 002. We will redirect the rearing water to Bass ponds 1 & 4 via a junction box to allow for increased solids settling efficiency. Then the water will flow

via a newly installed waterline to the already cleaned Bass ponds 2 & 3 for stabilization before flowing back into the current pipe being used which connects to outfall 002.



Request for Qualifications to conduct a feasibility study for modernization of the Department's Powder Mill Fish Hatchery



New Hampshire Fish and Game Department

11 Hazen Drive, Concord, NH 03301-6500
Headquarters: (603) 271-3421
Website: www.WildNH.com

TDD Access: Relay NH 1-800-735-2964

Email: info@wildlife.nh.gov

Scott R. Mason
Executive Director

Request for Qualifications (RFQ)

The New Hampshire Fish and Game Department (NHFGD) is seeking submittals from qualified consultants to conduct a feasibility study for modernization of the Department's Powder Mill Fish Hatchery, including upgrade of fish production operations and wastewater treatment facilities to achieve compliance with permit effluent limits. Qualifications must be received by NHFGD by June 25, 2021. Submittals shall be hand delivered or mailed to:

New Hampshire Fish and Game Department
11 Hazen Drive
Concord, NH 03301-6500

The submittal shall be in a sealed envelope clearly marked:

RFQ Submittal
Powder Mill Fish Hatchery Modernization

Each consultant will submit one (1) hard copy of all documents and one (1) PDF version on a USB storage device. No faxed, emailed, or other electronic submissions will be accepted. Questions shall be submitted at least 7 calendar days prior to proposal due date. Questions will be directed to Tim Buzinski, PE at Timothy.M.Buzinski@wildlife.nh.gov or (603) 271-1134.

NHFGD representatives will review and rank submittals based on qualifications, such as experience of the project team with similar projects, availability of assigned personnel, understanding of the project and client references. Top-ranked candidate firms will then be interviewed to discuss relevant experience and project approach. Interviews will be scheduled between July 7, 2021 and July 16, 2021. The most qualified firm based upon combined qualification package and interview scores will be selected and invited to develop a scope of services, fee schedule, and to negotiate a contract.

PROJECT BACKGROUND

The Powder Mill Fish Hatchery is located in close proximity to the outlet of Merrymeeting Lake in New Durham, NH as shown in Figure 1. The hatchery was constructed in 1947 and currently raises four fish species (brook trout, brown trout, rainbow trout) for distribution to rivers and lakes in NH.

A schematic of Powder Mill Fish Hatchery production operations is shown in Figure 2. The hatchery operates multiple rectangular fish culture raceways. The water supply for the hatchery is Merrymeeting Lake. Flow through the raceways and subsequent fish staging ponds is by gravity via two intake pipes in the lake.

Effluent from hatchery operations discharges from two outfalls to the Merrymeeting River. The discharges are subject to the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit NH0000710, which was recently reissued in January 2021. The permit contains stringent concentration based limits for phosphorus (12 µg/L). The hatchery NPDES permit can be viewed at <https://www3.epa.gov/region1/npdes/permits/2020/finalnh0000710permit.pdf>

NHFGD plans to conduct a feasibility study to evaluate management and treatment alternatives for complying with the NPDES permit. Given the age of the hatchery, the study will also focus on possible hatchery modernization approaches to improve fish rearing and solids management practices, and reduce the volume of wastewater requiring treatment. Following the feasibility study, NHFGD plans to select a preferred hatchery modernization alternative for final design and construction.

This project may be funded by a NH Department of Environmental Resources (NHDES) Clean Water State Revolving Fund (CWSRF) Wastewater and Stormwater Planning Loan and may be subject to the terms of that program. The CWSRF Wastewater and Stormwater Planning Guidance Document is attached to this RFQ for reference.



Figure 1: Powder Mill Fish Hatchery

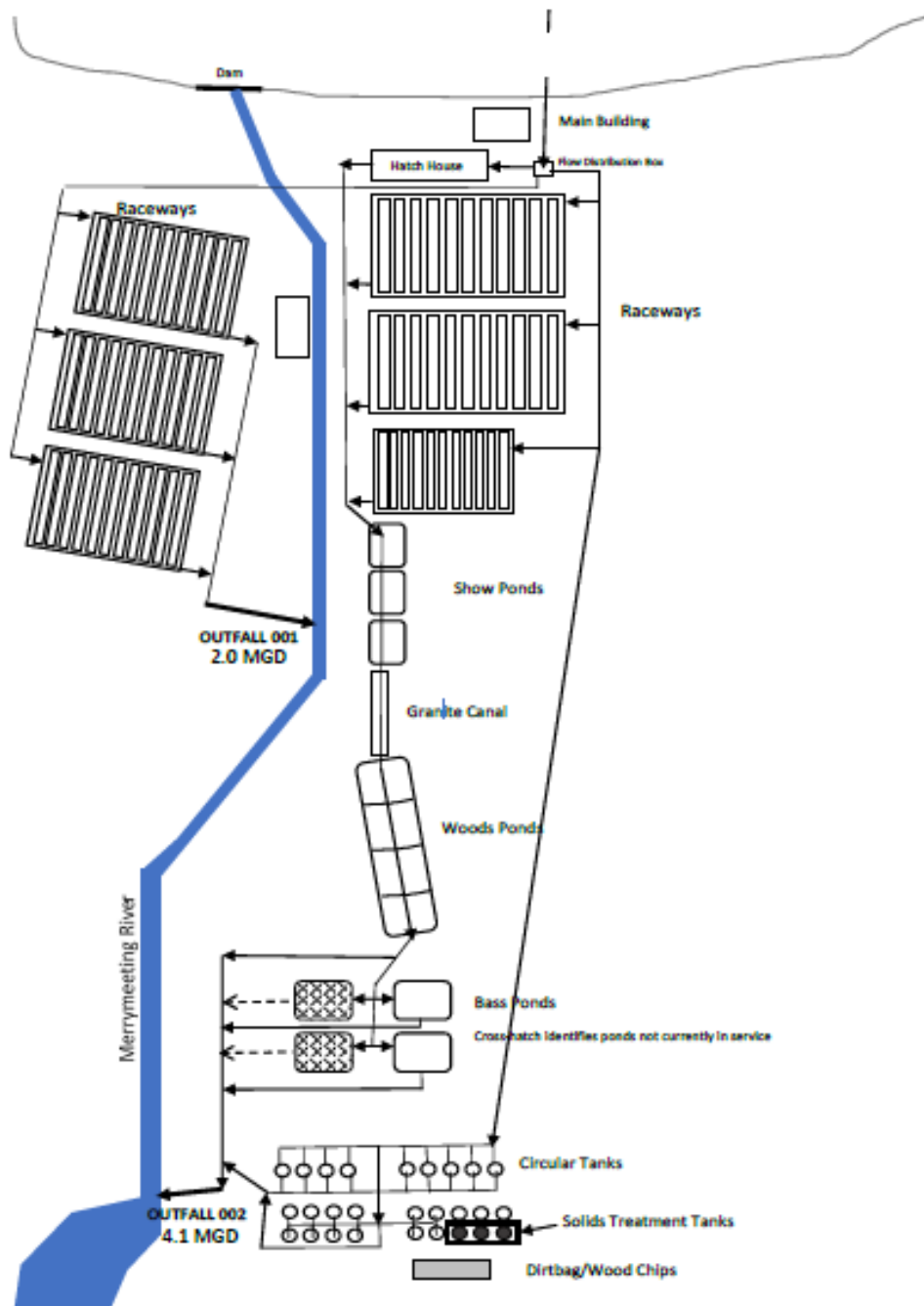


Figure 2 – Powder Mill Fish Hatchery Operations Schematic

PROJECT APPROACH AND ANTICIPATED SCOPE OF WORK

NHFGD envisions a study that evaluates holistic approaches to hatchery modernization, wastewater treatment, waste solids handling and NPDES permit compliance. The following is the anticipated scope of work for this project. This scope may be modified during discussions with the selected consultant.

Task 1 – Existing Data Collection and Review

Collect and review existing information to be used in the study including, but not limited to:

- Fish production data.
- Fish feed usage.
- Lime addition for pH buffering.
- Wastewater effluent data (flow, water quality, phosphorus concentrations/mass loads).
- NPDES permit conditions which may impact future fish production and wastewater treatment operations.
- Best Management Practices (BMP) Plan for total suspended solids (TSS) and phosphorus.
- New Hampshire Hatchery System Evaluation – Final Report July 2002
- Powder Mill Pipe Consolidation project plans and notes
- NHFGD Hatchery Advisory board report

Task 2 – Hatchery Modernization

Evaluate approaches and alternatives for hatchery modernization including but not limited to:

- Fish culture tank modernization to meet current and projected fish production needs.
- Improvement of existing BMP Plan to further reduce solids and phosphorus waste loads.
- Improvement of hatchery buildings, infrastructure and support systems to meet ADA and State Fire Marshal recommendations.
- Opportunities to recycle or reduce water usage.
- Improvement to the hatchery visitor center areas and show ponds

Task 3 – Source Water and Wastewater Effluent Characterization

Perform a characterization and analysis of hatchery source water and wastewater effluent to gain an understanding of the following factors that can affect potential wastewater treatment approaches:

- Basic water chemistry of hatchery source water and wastewater.
- Phosphorus speciation in source water and effluent
 - Solid fractions
 - Dissolved fractions (reactive and non-reactive)

Water quality characterization may be performed by a combination of modeling and laboratory analytical methods.

Task 4 – Wastewater Treatment and Solids Handling Technology Review

Evaluate candidate technologies for wastewater treatment and solids handling including but not limited to:

- Wastewater treatment
 - Chemical addition/precipitation
 - Clarification/sedimentation
 - Filtration
 - Advanced treatment (ion exchange, reverse osmosis)
- Fish culture train solids management
 - Solids collection/conveyance
 - Solids storage/concentration
 - Treatment of effluent streams from solids handling
 - Solids disposal

Task 5 – Pilot Testing

Conduct pilot testing of up to three (3) candidate treatment technologies to evaluate effectiveness in meeting NPDES permit requirements. Design and operation of the pilot system should address the following factors:

- Pilot systems should be operated continuously and cover critical operating periods that can affect performance (e.g., critical water temperatures, high fish feed application rates, etc).
- Pilot systems should run concurrently.
- Pilot test plan shall clearly identify the division of responsibilities between the selected consultant team and NHFGD staff, including:
 - Pilot system construction and start-up
 - Pilot system operation

- Monitoring, analytical testing and reporting

Consultant will evaluate pilot testing results and assess overall effectiveness of candidate technologies (i.e., effluent quality, operational reliability, operational complexity).

Task 6 – Development and Evaluation of Hatchery Upgrade Alternatives.

Development and evaluation of full-scale system alternatives (combination of hatchery modernization/wastewater treatment/solids handling schemes) for the Powder Mill Fish Hatchery including:

- Advantages/disadvantages of each system alternative.
- Cost evaluation (capital, operating, total present worth).
- Description of staffing and monitoring needs.
- Presentation of recommended system alternative.

Task 7 – Study Report

Prepare a final report documenting the study methods, results, and recommendations. The report will include a narrative description, exhibits, and documentation and calculations in support of findings and recommendations.

CWSRF Planning Loan Requirements

In addition to the above tasks, the following must also be included in the scope of work:

- A minimum of three (3) meetings that include NHFGD and NHDES attendance: kick-off, mid-point and wrap-up.
- Draft reports and documents will be provided to NHFGD and NHDES for review and comment.
- Final documents will be provided to NHFGD and NHDES in electronic form.
- Consultant shall prepare all CWSRF loan disbursement requests for submission to NHDES.

Hatchery Upgrade Design and Construction

Following completion of the feasibility study and report, NHFGD will select its preferred alternative for Hatchery upgrades. The consultant will submit a proposed scope of work for the design and construction administration services phase of this work. NHFGD anticipates to utilize the Department of Public works to execute most construction administration duties including bidding services.

PROJECT SCHEDULE

The project may begin as soon as final approval is received from NHDES & Governor and Executive Council anticipated to be no later than August 18, 2021. The feasibility study is scheduled to be completed by December 30, 2022.

SUBMITTAL REQUIREMENTS

Submittals should include:

- a qualification statement for the firm or team participating in the project;
- identification of the individuals responsible for managing the project and conducting specific project tasks, as well as their expected level of participation in the project tasks;
- an organization chart showing lines of communication and decision-making hierarchy;
- resumes for proposed project team members;
- description of similar fish hatchery evaluation projects;
- description of similar fish hatchery design and construction projects;
- a scope of services and elaboration on the scope outline provided above;
- a proposed schedule;
- A minimum of three (3) references for similar projects.

EVALUATION OF SUBMITTALS

Emphasis in evaluating submittals will be placed on the firm's qualifications and experience in projects similar to those which NHFGD anticipates undertaking. NHFGD will assign an evaluation team to review submittals with respect to the following evaluation criteria:

1. Similar firm experience (15%)
2. Similar experience of assigned personnel (20%)
3. Current workload/availability of assigned personnel (15%)
3. Quality of proposal (10%)
4. Understanding of project (20%)
5. Firm capability to design and implement preferred alternatives (10%)
6. Client references (10%)

SUBMITTAL INFORMATION

Submittals must comply with the following:

1. Address and Deadline

Sealed submittals shall be marked on the outside of the envelope:

RFQ Submittal
Powder Mill Fish Hatchery Modernization

and addressed to:

Tim Buzinski, PE
New Hampshire Fish and Game Department
11 Hazen Drive
Concord, NH 03301-6500

Submittals will be accepted until 4:00 p.m. on Friday, June 25, 2021. Faxed or emailed submittals will not be accepted.

2. Authorization

The submittal must be signed in ink by an authorized signer, or by an agent of the submitter legally qualified and acceptable to the proposer, and contain the printed names, titles, and business and post office address of both parties, if applicable.

3. Withdrawal of Submittals

A submitter will be permitted to withdraw their submittal unopened after it has been deposited if such request is received in writing prior to the specified time it is to be received.

4. Reservation of Rights

NHFGD reserves the right to reject any or all submittals, to waive technical or legal deficiencies, and to accept any submittal that it deems to be in the best interest of NHFGD. The submitter is solely responsible for the contents of their response to this request for qualifications.

END OF RFQ

Water Use – 2020 – all hatcheries

FACILITY	SOURCE NAME	January Monthly Average GPD	February Monthly Average GPD	March Monthly Average GPD	April Monthly Average GPD	May Monthly Average GPD	June Monthly Average GPD	July Monthly Average GPD	August Monthly Average GPD	September Monthly Average GPD	October Monthly Average GPD	November Monthly Average GPD	December Monthly Average GPD	max month	ratio to PMF H
BERLIN	GRAVEL WELLS CB	1,236,384	1,280,541	1,122,336	1,262,822	1,700,352	0	0	24,387	23,328	22,111	1,073,088	850,176	1,700,352	0.29
BERLIN	W BRANCH UPPER AMMONOOSUC	2,603,232	2,696,205	2,603,232	4,745,434	4,638,870	3,679,301	2,424,384	1,803,384	1,079,298	4,022,838	3,560,814	3,631,608	4,745,434	0.81
TWIN MTN	NATURAL FLOWING SPRINGS	712,735	775,797	689,211	728,105	815,931	964,612	773,280	605,623	542,411	522,783	616,255	689,112	964,612	0.16
MILFORD	WELL #4 RIVER WELL	1,440,000	1,491,429	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,491,429	0.25
MILFORD	WELL #1 FIELD WELL	288,000	298,286	288,000	288,000	0	0	0	0	0	288,000	288,000	288,000	298,286	0.05
BERLIN	COLD BROOK CB	0	0	0	0	0	1,835,136	1,399,680	28,038	1,469,664	48,709	0	0	1,835,136	0.31
BERLIN	POND NUMBER NINE BROOK WB	1,887,480	1,796,426	1,498,320	2,240,496	2,300,652	2,040,768	2,058,480	1,804,608	1,393,776	2,757,600	2,813,760	2,966,040	2,966,040	0.51
NEW HAMPTON	HATCHERY SPRINGS	867,240	751,410	841,140	1,106,856	1,198,530	1,404,810	1,330,128	1,277,028	1,189,080	656,827	663,120	441,072	1,404,810	0.24
NEW HAMPTON	DICKERMAN POND	1,864,944	1,572,390	1,983,150	2,123,352	1,983,348	1,708,470	916,128	327,420	1,135,440	1,362,384	1,674,990	1,579,104	2,123,352	0.36
POWDER MILL HATCHERY	MERRYMEETING LAKE	5,602,622	5,859,692	5,311,278	5,486,810	4,999,572	5,477,130	5,038,560	4,068,000	5,143,680	4,749,303	5,379,156	5,555,693	5,859,692	1.00
WARREN	BEDROCK WELL 1	144,000	149,143	144,000	144,000	144,000	144,000	144,000	144,000	144,000	144,000	144,000	144,000	149,143	0.03
WARREN	BEDROCK WELL 2	360,000	372,857	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	372,857	0.06
WARREN	BEDROCK WELL 3	720,000	745,714	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000	745,714	0.13
WARREN	POINT WELLS	360,000	372,857	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	372,857	0.06

Tiered Approach for PMFH Modernization and Regulatory Compliance

Appendix D - Tiered Approach for PMFH Modernization and Regulatory Compliance (Progressively Building Tiers)

Tier	Description	Possible Scope Items (Each tier progressively builds upon prior tiers)	Function/Benefits	Estimated PMFH Staffing Needs	Estimated Capital Cost Range (\$M) Per Tier	
					Low	High
1	Interim Mitigation Measures	1.1 - Fish pond dredging and waste disposal.	➤ Removal of sediment containing phosphorus.	Same as Current Staffing	Ongoing actions: Funded through current and past NHF&G annual operating budgets and current materials on inventory. (>\$10,000 plus materials on-site)	
		1.2 – Conversion of Show Pond 1 to dedicated waste storage.	➤ Improved capture of fish waste solids.			
		1.3 - Conversion of Bass Ponds to wastewater settling basin.	➤ Improved capture of fish waste solids.			
		1.4 - Conversion of select raceway tanks to settling tanks.	➤ Improved capture of fish waste solids.			
		1.5 – Lime addition optimization.	➤ Evaluation optimal lime addition rate for reduction of soluble phosphorus in wastewater.			
2	Fish Hatchery Modernization	2.1 – New circular fish culture tanks.	➤ Improved fish waste solids capture. ➤ 40 to 60 % wastewater reduction.	Same as Current Staffing	+5	+6
		2.2 – New structure to cover fish culture tanks.	➤ Reduced predation of fish (eliminating an estimated an average 12-13% fish loss).			
		2.3 – New operation buildings (possibly integrated with Item 2.2).	➤ Consolidated operations for increased efficiency of fish production operations.			
		2.4 – Roadway improvements	➤ Improved site access and traffic flow for site operations			
3	Wastewater Treatment and Waste Solids Processing Systems¹	3.1 – Wastewater filtration system.	➤ Improved capture of fish waste solids.	Current Staffing + 1-2 staff	+5	+7
		3.2 – Recirculating water system for fish culture tanks	➤ 70 to 80% wastewater reduction (including reduction realized in Item 2.1).			
		3.3 – Treatment facility building (possibly integrated with Item 2.2).	➤ Consolidation and protection of process mechanical equipment, electrical systems and control systems.			
		3.4 – Waste solids conveyance system.	➤ Pumping of waste solids from fish culture tanks and filtration systems to solids processing area. ➤ Reduced staff labor for solids removal.			
		3.5 – Waste solids drier.	➤ Concentration of waste solids to reduce volume for additional solids processing or disposal.			
		3.6 – Waste solids dewatering system	➤ Further concentration of waste solids (from Item 3.5) to reduce volume and cost of disposal.			
		3.7 – Automated lime addition feed system (continuation of Item 1.5).	➤ Efficient addition of lime to minimize chemical costs and staff labor.			
		3.8 – Site power system upgrade (possibly needed depending on Tier 2 and 3 scope).	➤ Provide power needs for new fish production and wastewater treatment, including emergency back-up power.			
4	Advanced Wastewater Treatment System^{1,2}	4.1 – Advanced filtration or membrane treatment system	➤ Removal of trace levels of soluble phosphorus compounds. ➤ Removal of fine particulates with phosphorus.	Current Staffing + 2-3 staff	+8	+11
		4.2 – Advanced treatment residuals handling	➤ Handling, processing and disposal of residuals generated from advanced treatment.			
Notes: 1) Required scope and cost of wastewater treatment will depend on results detailed engineering evaluation and pilot testing. Tier 3 and 4 treatment costs assume at least 40% water reduction achieved by hatchery modernization in Tier 2, resulting in average and peak wastewater flow rates of 2 and 4 mgd, respectively. 2) Advanced treatment cost estimates based on USEPA "Work Breakdown Structure-Based Cost Model for Reverse Osmosis/Nanofiltration Drinking Water Treatment" (2019).						
