

April Talon

From: Todd Selig
Sent: Monday, March 4, 2019 12:41 PM
To: mschidlovsky
Subject: *Re: A walk on the Mill Pond - an email from Mike Schidlovsky

Dear Mike,

Thank you very much for your email and for this good suggestion. I know some Councilors have done just what you suggest already. I'll share your correspondence with them for their information.

All my very best,

Todd

Todd I. Selig, Administrator
Town of Durham, NH
t: 603.868.5571 | m: 603.817.0720
a: 8 Newmarket Rd., Durham, NH 03824 USA
e: tselig@ci.durham.nh.us | w: www.ci.durham.nh.us

Everyone can tackle climate change. How can you reduce your carbon footprint?

From: mschidlovsky <mschidlovsky@comcast.net>
Date: Friday, March 1, 2019 at 7:52 PM
To: Todd Selig <tselig@ci.durham.nh.us>
Subject: A walk on the Mill Pond

Todd,

Hope all is well. Enjoyed your Friday newsletter again today.

With all the discussion about dam removal, this is an excellent time of year to walk the frozen Mill Pond to really understand the effect of possible dam removal. It is also fun to see all of the various wildlife footprints in the snow. Otter, bobcat deer, coyote and fox. Amazing. I recommend anyone who wants to debate the merits of dam removal or preservation take the walk and appreciate the scope of how dam removal will affect so much.

Thanks,

Mike Schidlovsky
Cell: 603-397-7987
Sent from my cell phone.

April Talon

From: Todd Selig
Sent: Monday, March 4, 2019 12:13 PM
To: nhgrantwriter@aol.com
Cc: mapunh@hotmail.com
Subject: Re: Mill Pond Dam - an email from Carolyn Singer and Mark Popecki

Dear Carolyn and Mark,

Thank you very much for your email concerning the Mill Pond Dam. We shall share it with the members of the Council for their review and information as well.

All my very best,

Todd

Todd I. Selig, Administrator
Town of Durham, NH
t: 603.868.5571 | m: 603.817.0720
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Everyone can tackle climate change. How can you reduce your carbon footprint?

From: Carolyn Singer <nhgrantwriter@aol.com>
Date: Monday, March 4, 2019 at 7:12 AM
To: Todd Selig <tselig@ci.durham.nh.us>
Cc: "mapunh@hotmail.com" <mapunh@hotmail.com>
Subject: Mill Pond Dam

Todd,

We support the CITIZENS of Durham deciding whether or not to preserve the Mill Pond dam. Please put it to a town vote.

Carolyn Singer and Mark Popecki
5 Woodridge Road
Durham

April Talon

From: Todd Selig
Sent: Monday, March 4, 2019 2:30 PM
Subject: *FW: More on the OR Dam from Citizens Exchange - letter from Diane Freedman

Dear Members of the Council,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
t: 603.868.5571 | m: 603.817.0720
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From: Citizens Exchange <CitizensExchange@comcast.net>

Date: Monday, March 4, 2019 at 2:25 PM

Subject: More on the OR Dam

There are some very strong reasons **NOT** to remove the Oyster River dam. Environmental uncertainty. Fiscal uncertainty. Loss of value to abutting landowners. Loss of value of residing in our town. Loss of beauty, history, health, recreation, open space, a powerful means of suppressing invasive plants and insects. Avoiding bad faith.

If the dam is removed, it could have many more environmental, cultural, health, recreational, aesthetic, and economic negative consequences, **including costs**, than anticipated. Keeping the dam may in the end have more benefits, in all of these important areas of our cultural and environmental lives.

We do not have enough information to know. Moving money budgeted to research keeping the dam (in the short term by contesting the state's recent re-designation or applying for a waiver so as not to have to go directly into dam-raising—that is dam-raising, not razing—mode) to a plan to remove the dam is getting ahead of ourselves.

Better the devil we know than the one we do not. Like the HDC, my pond and impoundment neighbors urge caution. Put money back towards securing a waiver. Find out what keeping the dam entails.

Find out what we know and do not know about dam removal and its aftermath. We do know (via [research that sums up current research!](#)) there is a profound lack of studies on the aftermath of dam removal! Notably in New Hampshire. **Importantly**, of the worldwide studies that do exist, less than ten percent pertain to low-gradient rivers like ours not to mention a dam in the center of town that provides as much culture, history, recreation, delight, and property taxes as ours may be said to do. Dam removal has been found wreak havoc and inevitably harm many downstream flora and fauna. It can harm communities, human and otherwise. It can hurt the economy. Prematurely planning dam removal can countermand a town's missions, hopes, history, and allure for visitors and residents, **undermine its long-term property-tax revenues**, lose community capital and that elusive sense of community we seek.

There are 25 tax-paying properties that will be directly affected by draining the Mill Pond. The total assessed value of those properties in 2018 was almost \$10 million dollars. The main reason abutters mention for purchasing and enjoying their properties is the location along and accessibility of the water. They sought all it represents in terms of beauty, exercise, recreation, contemplation. For years, the Town promised and planned to maintain the impoundment and the dam. There were to be weed mats and those turned at intervals. There was to be dredging with the help of the Army Reserves. There was to be a bicycle lane the length of rte 108 (to be begun if not completed by 2012, but there are plans for such going back 75 years in Town records some of us looked into back in the 1990s when we worked on one of our Town Master Plans, and I served on the Transportation subcommittee at the time).

Please realize that the dam is responsible for a vast, vibrant, breathtakingly beautiful span of water or ice and snow, a vast open space, not just the “Mill Pond.” Open space is what many in Town argue us to buy, bond, raise funds for. Rather than focus on how much it may cost to maintain the impoundment, focus on its current ready value as open space providing wildlife and citizenry access to contiguous public lands. How much to buy Wagon Hill, to mow it, curate it? How much to clear invasives from the Milne and Doe Farm parcels? Even the University cannot keep up with the areas it cleared for select species but intended to maintain against invasive plants.

Walk the impoundment upstream(s) from the Mill Pond while it is still frozen. See what a resource the entire impoundment is, even without any regular maintenance whatsoever! The water “naturally” stops or slows woody plants from gaining footholds (where you see impenetrable glossy-buckthorn thickets-becoming-woods there is not enough covering water). Mosquitoes are checked by species spawned in or drawn to ponds: dragonflies, swallows, frogs, bats, phoebes. The open volume of water dispels ticks and prevents deer lingering long. Ice in winter tamps down plants. Along our shores, however, landowners must labor to keep glossy buckthorn from preventing our access to the water—it grows so thickly as to be impassable on foot, on ski, on snowshoe. Equally bad is the Japanese knotweed growing now along Mill Pond Road. Give either of these species a chance and they will fill the open space.

If the dam goes away, there may never be free-flowing river as some imagine, certainly not the length or breadth of the current impounded area, and certainly not even where the river now comes in. There is too much fill and too much flow. And we will have lost species, recreation (skating, snowshoeing, skiing, walked; boating, swimming, fishing), the backyard gym, the sight for sore eyes, the community gathering place, the sense of community it generates, the subject of words and paint, some of the specifically Durham allure for property owners, friends, family, visitors, hotel guests, students, alumni. The Oyster River is low gradient. Upstream there are feeder streams but not enough flow collectively, too much mystery sediment, roadway and organic, stuff of old dumps. The aftermath will be muck and suck year round. Not solid ground. Plants will colonize aggressively without the weight of water: glossy buckthorn, Japanese knotweed, loosestrife, thorny canes, poison ivy—and attendant mosquitoes and ticks.

Those of us who can now access so much nature via boat or snow, without a car, will be marooned, with little room to roam before encountering busy 108. Crossing now brings (The proposed new footbridge will be a boon but won't replace the present joys and options for winter crossings along the entire length of the impoundment.)

Abutters, other Durham residents, students, visitors—and the prevailing animal life now present—have so much to lose, so much so as to make worthwhile at least to find out what it will cost and who will help to keep the dam, to tweak the current crop of invasives, do a least a little dredging. Even if the Town does not have the will or means to dredge, there may be ways to let some water through that removes sediment without dispatching posited problematic inorganic deposits that can harm oyster beds or other downstream flora or fauna. There are better ways of dealing with our dam and impoundment than removing both from its historic public uses and value.

Diane P. Freedman
Laurel Lane

April Talon

From: Todd Selig
Sent: Monday, March 4, 2019 6:02 PM
To: April Talon; Michael Lynch
Subject: FW: Presentation/ Mill Pond Dam

From: Todd Selig <tselig@ci.durham.nh.us>
Date: Monday, March 4, 2019 at 5:39 PM
To: Daphne Gowland <daphnegowland@yahoo.com>, Durham Town Council <council@ci.durham.nh.us>
Subject: Re: Presentation/ Mill Pond Dam

Dear Mrs. and Mr. Gowland,

Thank you very much for your email. The issues of preserving the dam and the Mill Pond have been discussed for many years and as such a good deal of information has been addressed/discussed in some way or another over that timeframe. The feasibility study approved recently by the Town Council would look at implications associated with dam removal, which represent a new line of inquiry. I would envision a feasibility study to take a year +/- to complete, followed by discussion concerning next steps.

Again, I know the Council will appreciate your feedback concerning this difficult and important issue on many levels.

All my very best,

Todd

Todd I. Selig, Administrator
Town of Durham, NH
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Everyone can tackle climate change. How can you reduce your carbon footprint?

From: Daphne Gowland <daphnegowland@yahoo.com>
Reply-To: Daphne Gowland <daphnegowland@yahoo.com>
Date: Monday, February 25, 2019 at 8:51 AM
To: Durham Town Council <council@ci.durham.nh.us>
Subject: Presentation/ Mill Pond Dam

Dear Council,

I think I speak for all of us in saying that we do appreciate your efforts and patience in the matter concerning the Mill Pond. I am not one to "write letters" but thought it was appropriate at this time.

I was disappointed in the (lack of) presentation about the dam (2/18/19). While knowledgeable, it seems that April Talon needs to prepare and do a clear presentation with graphics, visible data and photo's for the council and for the public to see. Her presentation did not give anyone clarity about any particular path.

She needs to present a decision tree with every clear option:

- best case
- worst case
- likely case
- also the future cost to all 3

Just an fyi...A professor from UNH had grad students all last summer (2018) go out on the pond to take samples. They left the canoe on our property. I spoke to the student recently and he said all the finding he processed showed the water was fine. I was surprised at this- I am happy to provide the grad students name as well as the professor.

Regarding what to do with the dam in it's current state I would also request the following addressed:

- a lot of silt has settled (I think) in that pond and removing the dam would create an environmental problem in the oyster river/bay. All of that sediment would wash downstream and cover spawning areas and shellfish/oysters.
- Would it be best to retain the area as a storm-water retention area?. There doesn't have to be a dam - It could just be turned into a berm with boulders and substrate that water would have to filter through before getting downstream.
- The pond could serve a value by receiving storm-water overflows and being improved to help infiltration of water into the ground.
- a bubbler/fountain of some sort to keep water generating in summer months.

Thank you,

Daphne and Chris Gowland
28 Newmarket Rd

Once again, thank you for your time and effort.
Daphne Gowland
28 Newmarket Road

April Talon

From: Todd Selig
Sent: Wednesday, March 20, 2019 4:29 PM
To: April Talon; Michael Lynch
Subject: FW: [POSSIBLE SPAM] Mill Dam removal
Attachments: Outlook-1495826534.png

Importance: Low

Dear April and Mike,

For your general information from Melissa Paly, the Great Bay Waterkeeper.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
t: 603.868.5571 | m: 603.817.0720
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From: Melissa Paly <mpaly@clf.org>
Date: Wednesday, March 20, 2019 at 1:04 PM
To: Todd Selig <tselig@ci.durham.nh.us>
Subject: [POSSIBLE SPAM] Mill Dam removal

Hi Todd -

Perhaps this RFP is a good fit for habitat restoration and fish passage related to Mill Dam removal?

<https://www.nfwf.org/newengland/Pages/2019rfp.aspx>

Best,
Melissa

Melissa Paly
Great Bay – Piscataqua Waterkeeper

Conservation Law Foundation

27 North Main Street
Concord, NH 03301

April Talon

From: Todd Selig
Sent: Friday, August 2, 2019 2:17 PM
To: England, Richard
Subject: Re: dam removal - following up with Richard England

Dear Richard,

Thank you for your email on this issue. I know the Town will consider these and other issues as part of future conversations surrounding the Mill Pond Dam. In the meantime, you can review the recent RFQ we sent out for an upcoming feasibility study that will focus on a variety of options, including removal, at https://www.ci.durham.nh.us/sites/default/files/fileattachments/public_works/page/54315/040919_oyster_river_dam_at_mill_pond_removal_feasibility_study_rfq_details.pdf.

Todd

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From: "England, Richard" <Richard.England@unh.edu>
Date: Friday, August 2, 2019 at 1:48 PM
To: Todd Selig <tselig@ci.durham.nh.us>
Subject: dam removal

Todd,

I can tell that the Town is leaning heavily in the direction of removing the Mill Pond dam. I hope that a proper benefit cost study has been or will be undertaken before taking this action. Have the Council members and your office considered that the abutters will have every right to petition for a reduction in assessed valuation because of the loss of an amenity? Do you have an estimate of how costly removal of toxic sludge from the exposed floor of the mill pond will be? Will there be any adverse impact on fish and wildlife from exposure of this sludge? These and other questions should be posed and answered before taking action to remove the dam.

Richard England
Foss Farm

April Talon

From: Todd Selig
Sent: Tuesday, January 21, 2020 12:02 PM
To: Nick Tulloh; April Talon
Subject: Re: Durham dam

Dear Nick,

Thank you very much for this feedback. April will share it with the feasibility team for their review and consideration. I hope you are having a nice winter season.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | m: 603.817.0720 | w: www.ci.durham.nh.us

Everyone can tackle climate change. How can you reduce your carbon footprint?

From: Nick Tulloh <nicktulloh@comcast.net>
Reply-To: Nick Tulloh <nicktulloh@comcast.net>
Date: Friday, January 17, 2020 at 10:21 AM
To: April Talon <atalon@ci.durham.nh.us>, Todd Selig <tselig@ci.durham.nh.us>
Subject: Durham dam

Ms. Talon,

I would like to make two suggestions regarding the dam issue;

1. The effects on the mooring field and usage of the boat ramp/docks from any "solution" should be examined.
2. The water level upstream should be lowered to the extent possible to illustrate what it would look like with no dam (the way Newmarket did).

Thank you,

Nick Tulloh
311 Newmarket Rd
Durham, NH 03824

April Talon

From: Freedman, Diane <Diane.Freedman@unh.edu>
Sent: Friday, May 15, 2020 4:03 PM
To: April Talon
Subject: More thoughts on the Oyster River Dam and its value to the community

Dear Todd, April, Councilors, and relevant others,

I am pleased to hear that positive reports from the State as to the classification of the Oyster River Dam at 108 (because of the release from liability the immediate neighbors of the dam site offer) have been received. That is a reason to draw a collective breath—as it would suggest that at least nothing need be done or decided in a hurry.

But I would like to put on the record (again, but louder :-), some of the myriad reasons my neighbors, pond users and enjoyers all, have for retaining the dam.

(Note that when/if I write “pond” I refer to the historic skating area adjacent to the Town park and Andrea Bodo and Daphne Gowan’s property but also the semi-navigable waters up stream to the backyard of the Schidlovsky family and the Meadows/MacDonald land)

-The dam itself is of historical significance and on the NH Registry of Historic Places, but so is the dam site itself, as there were dams by indigenous inhabitants before the present one, and even if the present one is refurbished or replaced, it is the fact of the dam—and the pond and the upriver beyond that has been central to Town (and UNH) history and memories.

-The pond/impoundment is a defacto park, beautiful to look upon and site of human-nature interaction and human recreation, without new land purchase, without foregoing taxes as the Town does upon purchasing park land or accepting a donation of it in the form of “current use.” Its wide expanse affords complex scenic views and a diverse ecosystem, not a monoculture or a wall or screen of glossy buckthorn and deciduous trees.

-The pond and beyond offers (free!) recreation good for public health: In seasons without freeze, the pond floats boats; in winter it hosts skaters, skiers, snowshoers, winter walkers, serving as a destination but also as a frozen bridge to and from the Foss Farm trails at the upper reaches and the MacDonald preserve in the middle and the Orchard Drive parcel as one moves down in the direction of small park near the end of Mill Pond Road.

-It performs due diligence at keeping back glossy buckthorn, Japanese knotweed, poison ivy, and other invasive plant species over its expanse, all plants global warning is posited to make more prevalent. Removal of the dam will make the battle against these invasives that much harder and way more costly.

-It also keeps down the threat of these species on contiguous landscapes, the three dozen or more abutters, and those farther away, too, those yards where birds and animals disseminate seeds. The fewer plants one place, the fewer in others, in other words. Thus the water and what it does makes for greater resident enjoyment of their space, public and private.

-It presents tremendous and historic biodiversity in plants, animals, birds, marine life, one that dominant invasives otherwise will foreclose. Green frogs, bull frogs, otters, muskrat, beaver, fox, cormorant, great blue heron, kingfisher, swallows, osprey, hawks, sunfish, bass, perch, painted turtles, red-eared sliders, snapping

turtles, ducks, wood ducks, geese, dragonflies (keeping mosquitoes in check, as do the swallows), and more (occasional coyote or bear) abound.

-Local experience with several Town properties tell us about the likely outcome as do the observations of those who have lived along the impoundment for decades (whatever outsiders may conclude—they have not lived HERE) . If the fullness of the pond and beyond goes away, the impoundment will grow glossy buckthorn, brambles, poison ivy, purple loosestrife, lose the open water that keeps off ticks and attracts the balance of creatures that keeps away the mosquitoes that attend the tidal parts of town and the deep woods. It will be a forest of glossy buckthorn impassable on foot by humans except in places cleared out (ask the owners of the Mill Pond Center property about their path along the pond edge or check out the island by the Olson home), harboring more ticks and mosquitoes than at present.

Some examples:

^Sadly, to so many of us it is clear from the evident difficulty the Town has keeping but a narrow strip of land along the Mill Road clear of Japanese knotweed. Let me be clear—the knotwood does not grow in the water but were the water braided with terrain, as will happen along the current impoundment with dam removal, it would likely grow on that.

^The Town is also challenged in the removal of (the Town's) Doe Farm's glossy buckthorn specifically, both precisely in the area used to grow a population of glossy buckthorn intended to be a model for eradication of it and in all other places where the Lamprey river does not flow or the pines do not dominate.

^(The university's) Foss Farm woods, too, is a failure in regards to removal or discouragement of non-invasives, as Environmental Conservation/Natural Resources students have reported. Where land was subject to timber harvest and clearing is especially impassable to walkers and skiers, filled with glossy buckthorn and berry brambles that the deer don't browse, despite a plan for browse areas (I do not speak about other species in areas therein they might consume).

-Anyone in town can see this fill in with undesireables even if they do not walk in the woods—just about anywhere roadway edges have been disrupted, as by the recent expansion of route 108, invasives (poison ivy, that invasive mustard-related plant) or simply nuisance vegetation thrives, and its removal/maintenance is likely under or not calculated in the cost of making such changes as the Town or the State have. *Maintenance of the aftermath of a removed dam, even just in the immediate pond area let alone the upstream “pond,” will likely be just as or more costly than dam and pond maintenance would be. *The possible loss of property-tax revenue through challenges to assessments, as the resource that drew residents here is diminished in the ways outlined, needs to be taken into account. And the simple unhappiness then with the property, location, Town.

-While removing dams has or is theorized to hold ecological efficacy in many places, the research is not in fact clear or strong on dam removal on small waterways or in New Hampshire. The Exeter dam removal is too new to see the results and the Exeter River is much more powerful than the span of Oyster River we are talking about in Durham. The research on dam removal decidedly not a positive when a river is low-gradient, like our river, and when the dam to be removed is a relatively low one, low because the flow behind it was never all that great as to require higher.

-Every one of my neighbors moved to their residences on or near Laurel Lane or Mill Pond Road because of what the pond and beyond offers them; it is what they are willing to bite the bullet and pay our high TAXES for even though we lack many other services our Town provides residents or other Towns provide theirs. The much Newmarket dam over the Lamprey River is far larger and more presumably expensive to maintain, but that Town recognized the social, aesthetic, economic, recreational, historic benefits and more of keeping it even with the much greater flow at its place along its river than ours would ever enjoy.

In closing, I urge that ALL aspects of life as we know it with a dam (including history, scenery, health, recreation, property impact, cultural and community life impact) and the urgings in all the testimony given by residents over the years (that should be in Town archives or film footage somewhere!) when possible removal of the dam has come up, be taken into account.

The current abutter view, as I have surveyed it, is to, first, keep the dam. Second, to make the dam a priority as needed if work on it is to be done rather than pursue its removal or the expense of pursuing such.

Diane P. Freedman

April Talon

From: Douglas Worthen <dougworthen@gmail.com>
Sent: Tuesday, June 2, 2020 1:32 PM
To: Michael Behrendt; April Talon
Subject: 14 Newmarket Rd re: Mill Pond Dam

Dear April,

Please present this email at the June 15th meeting:

Thank you for your letter of May 27, 2020. Yes, I am a “Stakeholder”, and the stakes for my property at 14 Newmarket Rd. are high indeed. My family has owned the Falls House since 1929. I have put over \$150,000 in improvements to the home, and lived in the house from 1978 to 2008. I would like to return here in my upcoming retirement.

My son grew up in this house. Now an avid hockey player, he was included in pickup hockey games with UNH students from the age of seven. For Durham residents, this was not unusual. Notably with less gender-bias, many of his friends also learned the game from the older college students. (Sadie Wright-Ward was among the children in this group. Her NCAA Hockey statistics can be found [here](#).) These informal interactions became mentorships that have shaped our residents’ lives. Canoeing and fishing have been a constant part of the view out the windows of my house. This body of water has sustained literally hundreds of years of recreational activity. The inestimable value of this social, aesthetic, and recreational activity should not be underestimated. Without the dam, the pond would disappear.

After nearly four hundred years, an entire ecosystem has developed both above and below the falls. The fish ladder on the north side of the dam has been highly effective, and New Hampshire Fish and Game have decades of data to verify this statement. At times the water has been drawn down so that the Mill Pond was revealed to be a fetid stream. It would not be a large enough body of water to sustain the black back herring that leave the brackish water to spawn in the fresh waters of the mill pond. These fish in turn feed birds and other wildlife in Great Bay.

The legal statute requiring documentation and protection of the archeological artifacts which are partially hidden by today’s Mill Pond would incur major expenses for the Town of Durham. Going back to the seventeenth century, there are artifacts that indicate that a dam was in place nearly one hundred years before Durham was incorporated as a town. An example of such an artifact is the stone retaining wall that extends hundreds of feet along my side of the pond, where the water runs deep. Photographs taken during pond drawdowns document historically significant evidence that would need to be preserved should the dam be removed. The legal ramifications that would ensue should the Town overlook even this single issue would be costly.

I am disappointed in the process by which the Town of Durham has gone about gathering information about this project. Rather than speaking to me directly, my tenants have been contacted about the project. Just before Thanksgiving, I was asked to keep one of my parking spots free so that the town could “have a truck back into the town park”. There was no mention of the huge and unsightly structure that was built in order to support the weight of the truck. Will that structure now be removed? It already covers important archeological evidence of the sawmill that was on my side of the dam. It is an eyesore.

As a college professor, I know that Zoom discussions dilute the interaction of meetings of over ten participants. Using this platform will disenfranchise those who are unfamiliar with it. There is no urgency for the Town to make these decisions now. I therefore suggest that the June 15th meeting be indefinitely postponed.

If there is to be a fair and honest discussion of this project, it will need to include fact-based and rational consideration of all the ramifications that disturbing the keystone of Historic District would cause. In the future, please communicate with me personally about issues that affect my property. I have read the proposals of the future of the dam online, but I am a "stakeholder" and an abutter of the Town's property, and your letter is a welcome but belated communication.

Dr. Douglas E Worthen

Associate Professor of Music History and Flute

dougworthen@gmail.com

worthen@siu.edu

Douglas Worthen

dougworthen@gmail.com

April Talon

From: Sullivan, Kevin <Kevin.Sullivan@wildlife.nh.gov>
Sent: Sunday, June 14, 2020 9:21 PM
To: April Talon; Dionne, Michael
Cc: Todd Selig; Richard Reine; Douglas Bullen
Subject: Re: dead fish at falls by oyster river dam at mill pond
Attachments: Mill pond rh stuck june 10 2020.mp4

Here is a video I took of them trying to get out last week, to show what i mean. I have other videos where one flips over, and some videos with the turtles waiting for them.

From: April Talon <atalon@ci.durham.nh.us>
Sent: Sunday, June 14, 2020 6:27:38 PM
To: Sullivan, Kevin; Dionne, Michael
Cc: Todd Selig; Richard Reine; Douglas Bullen
Subject: Re: dead fish at falls by oyster river dam at mill pond

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Thank you for the response. I will share this. Hope you both are well!

Get Outlook for iOS<[---

From: Sullivan, Kevin <Kevin.Sullivan@wildlife.nh.gov>
Sent: Sunday, June 14, 2020 5:59 PM
To: April Talon; Dionne, Michael
Subject: Re: dead fish at falls by oyster river dam at mill pond](https://urldefense.com/v3/__https://aka.ms/o0ukef__;!!Oai6dtTQULp8Sw!D7BQZA-AV47XDcaJwAb4uladbF-L8EKfabckKugWWq46cMNe_SV9_rZHRWjyL8VRfSr_fQjgWo4Q$></p></div><div data-bbox=)

Hi April,

I also talked to some people on site last weekend. Unfortunately not enough water goes over the Crest of the dam for the herring to get out of the impoundment. Some flip over and are able to get out alive, some flip up onto the spillway and get eaten by birds, some get eaten by the turtles that wait for them on the spillway, but a lot die and then the suction by the ladder attracts the dead ones that get stuck on the grate. We clean them off. Probably about 100 today, we had closer to 300 last weekend. It's unfortunate that probably 1,000 of the 4,000 ish fish that returned this year die before they can get out of the impoundment. I imagine as water conditions worsen over time in the impoundment it will continue. Another good reason to remove the dam to get back closer to a natural ecosystem.

Thanks,
Kevin

From: April Talon <atalon@ci.durham.nh.us>
Sent: Sunday, June 14, 2020 3:15:50 PM
To: Sullivan, Kevin; Dionne, Michael
Subject: Fwd: dead fish at falls by oyster river dam at mill pond

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FYI

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iOS<[---

From: April Talon <atalon@ci.durham.nh.us>](https://urldefense.com/v3/__https://aka.ms/o0ukef__;!!Oai6dtTQULp8Sw!HDcs_edb1NCGFTb8GeaX3MTudRoY6-CmKasZGdrNqkH_cASeF8rWOqSE4gu6LLDFkPrtPO-nk0M$></p></div><div data-bbox=)

Sent: Sunday, June 14, 2020 3:12:22 PM

To: Todd Selig <tselig@ci.durham.nh.us>; Michael Lynch <mlynch@ci.durham.nh.us>; Richard Reine <richreine@gmail.com>; Douglas Bullen <dbullen@ci.durham.nh.us>

Subject: Re: dead fish at falls by oyster river dam at mill pond

I will ask fish and game though

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From: April Talon <atalon@ci.durham.nh.us>](https://urldefense.com/v3/__https://aka.ms/o0ukef__;!!Oai6dtTQULp8Sw!HDcs_edb1NCGFTb8GeaX3MTudRoY6-CmKasZGdrNqkH_cASeF8rWOqSE4gu6LLDFkPrtPO-nk0M$></p></div><div data-bbox=)

Sent: Sunday, June 14, 2020 3:11:40 PM

To: Todd Selig <tselig@ci.durham.nh.us>; Michael Lynch <mlynch@ci.durham.nh.us>; Richard Reine <richreine@gmail.com>; Douglas Bullen <dbullen@ci.durham.nh.us>

Subject: Re: dead fish at falls by oyster river dam at mill pond

Had not noticed. When I was there Thursday we saw two turtles in the pond by the dam and the blue heron

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From: Todd Selig <tselig@ci.durham.nh.us>](https://urldefense.com/v3/__https://aka.ms/o0ukef__;!!Oai6dtTQULp8Sw!HDcs_edb1NCGFTb8GeaX3MTudRoY6-CmKasZGdrNqkH_cASeF8rWOqSE4gu6LLDFkPrtPO-nk0M$></p></div><div data-bbox=)

Sent: Sunday, June 14, 2020 1:44:31 PM

To: April Talon <atalon@ci.durham.nh.us>; Michael Lynch <mlynch@ci.durham.nh.us>; Richard Reine <richreine@gmail.com>; Douglas Bullen <dbullen@ci.durham.nh.us>

Subject: dead fish at falls by oyster river dam at mill pond

All,

Someone wrote to Loren asking why there are so many dead fish at the falls by the Three Chimneys. I don't know and have not had a chance to learn more. Have any of you noticed this?

Todd

Todd Selig

Durham, NH USA

Cell: 603.817.0720

Sent from my iPhone.

~~ Please pardon typographical errors.

April Talon

From: _____
Sent: Saturday, June 27, 2020 7:07 PM
To: April Talon
Subject: Thoughts about Mill Pond Dam

*Resident asked
to remain
anonymous*

Hi Ms. Talon,

This is _____ on _____ writing. I watched the presentation at the last town council meeting and am aware of the current state of the feasibility study recommendations. I have been thinking about the Mill Pond dam discussion and would like to share a few thoughts with you.

First, I completely agree with the opinion of the consultants, and the opinion that you have expressed at previous meetings, that doing nothing is a non-starter. This seems like a profoundly irresponsible option. My feeling from the town councils reaction at the meeting is that there is general agreement on this point: something will be done.

Next, my feeling, and my reading of the reaction of the council and the delivery from the consultant, is that rebuilding the dam completely to meet current requirements is also a non-starter. The cost is huge, the structure will no longer be historic in appearance, and the environmental concerns around fish migration and water quality are not resolved. This doesn't seem like any kind of a solution.

Next, the repair option that involves encasing the ribs seems silly when compared with the option to reinforce the whole structure by filling in the whole downstream side. I think the rib repair can be rejected based on cost and complexity when there is the other option that is cheaper, easier, and has better long term prospects.

This leaves the reinforcement option or removal as the remaining viable choices. Reinforcement saves the structure and it will still have something of its current appearance. I feel like this should satisfy those concerned with the historic structure preservation. It still does not address the environmental issues at all. This brings us to dredging.

The discussion on dredging scope, cost, and permitting was eye opening. Even if the permit is obtainable I can't see how the council could approve that much money for the project in this financial climate. I feel like the inevitable result of a decision to keep the dam is the continued degradation of the pond habitat and the death of the river herring population. The cost to remediate these issues is just too great and is reoccurring.

So this brings me to the conclusion that the responsible choice is dam removal. I say this knowing full-well that my property will likely be noticeably impacted by this decision. Nonetheless, I feel it is the right choice for the greater good of the town. That said, I can not stop thinking about the discussion from last winter regarding the old logging road/dam that blocks Hammel brook on the Newmarket side of Laurel lane.

I know you were resistant to including the removal of the Hammel Brook obstruction in this project. I want to challenge that and put forward the suggestion that this opportunity could be the missing piece that makes the removal of Mill Pond dam palatable. I don't know if the restoration of the Hammel Brook flow would significantly offset the reduction of the Mill Pond impoundment. If it could be shown that this would offset the loss, even in part, it could help to convince other impacted property holders to drop their opposition to the Mill Pond dam removal. It seemed from the discussion at the time that the project to remove the Hammel Brook obstruction would likely be relatively manageable and certainly smaller in scope than some of the other options on the table.

Now that we are at a point where the scope of options that the consultants will develop is likely to be significantly narrowed I would like to encourage you to add the option to remove the Hammel Brook obstruction to their work scope. The development of this option seems to have the potential to significantly offset some of the major points of

resistance. It would be a shame for the community to have to make such a difficult decision without having the full details of this possibility for improving and restoring this watershed.

Thanks for your consideration,

April Talon

From: Andrea Bodo <afbodo@comcast.net>
Sent: Friday, August 7, 2020 2:29 PM
To: Michael Behrendt; April Talon
Subject: Re: UNH Students Report of Oyster River Dam
Attachments: Oyster River Final Report.pdf

April,

Thank you for getting a copy of Prof Gress's student project to Michael. There was a color picture on a poster but I imagine that didn't get saved.

At the time, people in the NHDHR and I believe Peter Michaud felt that this was an interesting option because the dam would essentially look the same structurally on the exterior. Of course now, they have all moved on.

Andrea

On Aug 7, 2020, at 11:55 AM, Michael Behrendt <mbehrendt@ci.durham.nh.us> wrote:

To the HDC,

Here is the dam report by UNH students that was discussed last night. We will post this to the website under HDC – Historic Sites. The concrete arch solution recommended for reinforcing the dam is very interesting. That discussion starts on page 12.

Michael Behrendt

Durham Town Planner
Town of Durham
8 Newmarket Road
Durham, NH 03824
(603) 868-8064
www.ci.durham.nh.us

From: April Talon

Sent: Thursday, August 06, 2020 8:47 PM

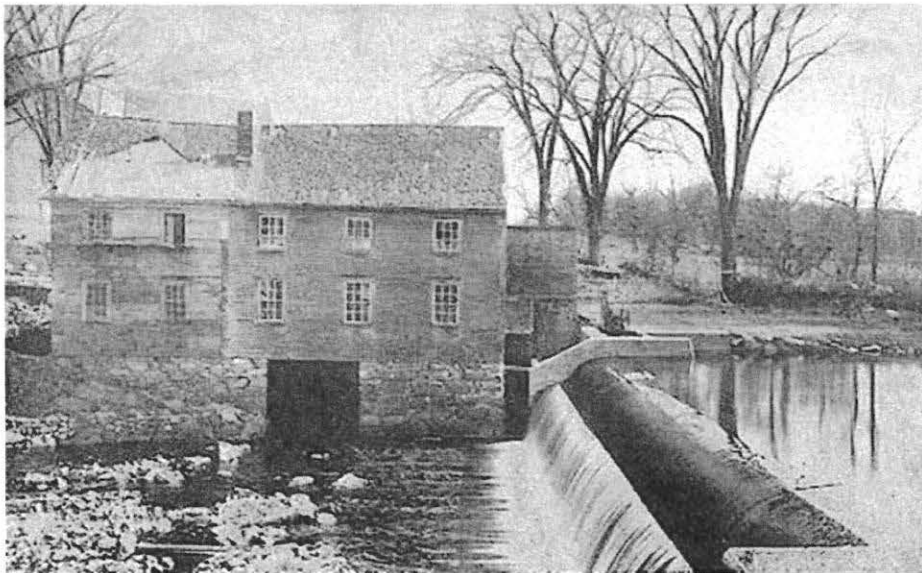
To: Michael Behrendt; external forward for acorow

Subject: UNH Students Report of Oyster River Dam

Report that was discussed tonight at meeting.

Oyster River Dam Restoration

Senior Project 2012



Project Manager: Brian Paula
Mathew Bogle
Neal Drake
Alexander Klink
Maxwell Murray

Advisor: Professor David Gress

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Abstract

The rehabilitation and implementation of a low head hydro-electric generator on the Oyster River Dam was the focus of the senior design project. The Oyster River Dam, which was first built in 1913, is experiencing some cracking on the upstream face of the spill way and the gate structure. Our goal when approaching this project was to implement a power generator and rehabilitate the structure without damaging the historical aspect. The dam is classified as an Ambursen dam and is the last remaining of its type in New Hampshire. An arch structure was determined to be the best method to reinforce the dam and strengthen the spill way, while keeping the structural integrity of an Ambursen dam intact. An Archimedes screw was also determined to be the best hydropower for the dam. This form of hydropower generation is popular in Europe, but is relatively new in the United States. With the implementation of this form of hydroelectric generation, the site will maintain its historical status and create an educational experience for students and town's people alike. Moreover, a hydrologic study was performed, and the peak monthly flows of the Oyster river were determined, providing information on how much hydroelectric power can be generated during a given time period.

Introduction

The Oyster River dam was built in 1913, however the site had functioning timber dams prior to its current structure for over 300 years. The town of Durham, like many small towns in the New England area, depended on hydro power to drive the construction industry and the economy. The Oyster River dam provided the means to facilitate the growth of Durham and the surrounding area. The dam is a symbol of innovation in early America and a historical piece of engineering, representative of hard work and ingenuity.

Preserving the historical aspect of the dam, while providing sufficient structural support, was the main goal when deciding on the structural rehabilitation aspect of the project. A concrete arch supporting each individual bay was selected as the best method to reinforce the spillway, while maintaining the historical structural integrity. Hydropower will be generated by an Archimedes Screw, a form of hydroelectric generation most common in Europe that will provide educational opportunities to UNH students as well as residents.

An evaluation of permitting required with the implementation of hydropower at the site was studied. Appropriate measures to register the dam as a functional hydro electric generator were taken into account along with environmental conditions that must be met. The applicability of the Federal Energy Regulatory Commission permit was contingent on the usage of power generated, which is outlined in the hydroelectric section of the report. A detailed evaluation of the watershed and the hydrologic conditions surrounding the dam was also met.

History

The Oyster River Dam was originally constructed in 1913. It was built to provide power to the Jenkins Mill that once stood there. It replaced one of the old timber dams that had been built on the Oyster River in the 1600's. The dam is at the center of the town of Durham and had a major influence on the industrial era of the local area. The river was a major trade route during the 1800's. Trade boats came all the way up from the Portsmouth harbor to Durham. Residents would come from surrounding towns to gather goods. There are many ties with the University as well. The dam was built in honor of Hamilton Smith, step father of Mrs. Edith Angela Congreve Onderdonk. She was very involved and generous to the University. The design engineer was Professor Charles Elbert Hewitt who was the first Head of Electrical Engineering at UNH and the builder was Daniel Chesley. The dam was built using the unique Ambursen design; there are eight walls that create nine empty bays that have a spillway structure over the top. The upstream side of the dam angles down into the riverbed and the downstream side has a hydrodynamic shaped lip that allows water to flow efficiently. The abutment on the south side, where the mill stood, has a gate structure with two openings which can be opened and closed to reduce head during flood events. In 1975, there was a rehabilitation of the dam. The repairs included patching cracks in the concrete and erosion control around the abutments. A fish ladder was also installed by the N.H. Fish and Game Department on the north abutment. The fish ladder allows fish to bypass the dam and move upriver.

Presently the dam is experiencing concrete cracking, spalling erosion and efflorescence. Exposed corroded reinforcing steel is exposed on the downstream face, inside the cells and on the right abutment. Foundation footings of the supporting walls are not in good condition and erosion around both abutments poses a threat.

Hydrology

Dam and Stream Gauge Locations:

The Oyster River Dam is located on the Oyster River 3 miles upstream from Great Bay. This location is also where NH Route 108 and the Oyster River intersect. Located upstream of the dam is Mill Pond. The data collection point used to analyze the dam is the USGS 01073000 stream gauge, located approximately 4 miles upstream of the dam where the Oyster River and Main Street (NH Route 155A) intersect.

Methods

USGS Stream Statistics:

USGS Stream stats program was used in order to obtain watershed characteristics of the dam and stream gauge that would be used in subsequent analysis for this report. Upon a watershed delineation of the dam the approximate area of the watershed is 20.37 square miles, 7.6% of which is covered in wetlands. The average slope of the stream over the course of the watershed is 15.2 feet per mile. For USGS 01073000 the basin characteristics were that the basin covered approximately 12.2 square miles and has a wetland area of 9.6%. In the case of this basin the average stream slope is approximately 17.9 feet per mile. Both of these watersheds have a mean average April precipitation of 4.16" and 4.18" respectively that are used for calculating the 100 year flood. To clarify the stream gauge being upstream from dam has a smaller watershed is within the watershed of the dam; however due to the characteristics of the watershed being specific to the geography alters the characteristics determined for the dam. The USGS historical data represents hydrologic conditions that pertain to a stream gauge, being represented by watershed characteristics. For calculations for the 100 year flood interval these differences must be taken into account during calculations and must be recorded.

Watershed Scaling:

Watershed scaling was used to approximate the stream flow of the water that is passing over the dam. In order to do this both watershed areas of the dam and stream gauge are needed which were determined above. Using the area of the stream gauge's watershed and the flow data gathered, the flows are divided by the area of the watershed giving a unit of flow per area, in this case cubic feet per second per square mile (cfs/m²). This gives a unit that is capable of being used to interpolate data to account for the fact that the dam is down stream and accumulates more water from the subsequently larger watershed area. As such, these values are then multiplied by the area of the dam giving the approximate flows that run over the dam. In the case of the Oyster River Dam and USGS 01073000, a watershed area ratio scalar of 1.67 was used to modify the data from USGS 01073000.

Indicators of Hydrologic Alteration (IHA):

Using the modified flow data the Indicators of Hydrologic Alteration (IHA) method of stream flow analysis was used to examine the stream flow. The program, IHA 7 was used to run the data analysis of the stream flow data from USGS 01073000. This analysis produced monthly average flow rates, minimum and maximum flows for 1, 3, 7, 30, 90 day periods, low/high pulse counts and durations, as well as the rise and fall rates of the river changes.

USGS/NHDOT Method:

Using watershed characteristics retrieved from the USGS Stream Stats this method the calculations can be conducted for different recurrence intervals. See appendix for calculations based on this method, also reference USGS article Estimation of Flood Discharges at Selected Recurrence Intervals for Streams in New Hampshire for calculation methodology.

Analysis Results

Stream Flow:

Utilization of the IHA program was primarily used to determine the average monthly flows that pass over the dam, however other useful information was garnered that would be helpful to understanding the stream flow regime at the dam's location. The overall average flow that passes over this dam throughout the year is approximately 20.1 cfs. For each individual month refer to Table 1. These values were used in calculations in reference to power generation for an Archimedes screw power generator.

Table 1: Power Generation

Parameter Group #1	Mean Guage	Coeff. of Var.	Mean Dam
October	8.668	1.289	14.47
November	18.57	0.7728	31.01
December	22.77	0.6308	38.02
January	19.12	0.6412	31.92
February	22.07	0.7096	36.85
March	48.38	0.4946	80.78
April	48.77	0.4869	81.43
May	25.63	0.673	42.79
June	13.39	0.9344	22.36
July	5.542	1.107	9.25
August	4.028	1.356	6.73
September	4.549	1.663	7.60

The minimum and maximum flows for the Oyster River at different time intervals in conjunction with high and low pulse information is important to understanding how the impoundment caused by the dam will react to extreme flow situations over periods of time. In defining the pulses which are flows that fall into the first and last quartiles of data when it is numerically ranked from lowest to highest. In this case the thresholds for high and low pulses are 88.68 cfs for high

pulses and 5.01 cfs for low pulses. On average these pulses occur 6.67 times for low pulses and 8.14 for high with average durations of 19.37 days and 4.30 days respectively¹.

100 Year Flood:

USGS Stream Stats was used to estimate the 100 year flow to be 1800 cfs, at a prediction error of 39%. It was determined that further analysis should be conducted. Based on calculations from the USGS/NHDOT method the 100 year flood flow for the Oyster River dam was estimated to be 1750.14 cfs. Based on the flow values the maximum flow that has occurred happened April 16th, 2007 with a flow of 1572.83 which is 87.37% of the USGS stream stats and 89.87% of the calculated value. These 100 year floods are most likely conservative. Due to this a bulletin 17B can be utilized to produce a lower flow for the 100 year flood however the conservative values are recommended.

Sources of Error

The methods used produces approximate flows that could possibly occur at the Oyster River dam. Two main sources of error that could change the results are as follows. First, is that the watershed scaling used, makes the assumption that due to the size of scale, these watersheds are affecting all watersheds. Since this assumption was made it neglects that any tributaries that enter the Oyster River after the stream gauge may have an adverse effect on the actual flow regime at the dam. The second source of error for these data is caused by a canal that was not completed during 1800's that was supposed to connect the Oyster and Lamprey rivers. Though it was not completed the low-lying area that resulted during extreme storms could cause water from the Lamprey to flow into the Oyster River, therefore increasing the actual flow.

Conclusion

Including the sources of error mentioned these approximate flows determined are within tolerable bounds for the use of the hydrologic analysis. These values were also used in the analysis of hydropower generation and are also acceptable for the use of that analysis as well. If further investigation is determined to be required for the 100 year flood upon further analysis a bulletin 17B utilizing the watershed scaling should be utilized. The recommendation of the 100 year flood value to be used is 1750 cfs for continuing the design of the structural rehabilitation of the dam.

¹ All IHA graphs and data in appendix

Hydropower

In addition to the proposed structural rehabilitation plans of the dam, a hydropower installation feasibility report has also been prepared. The initial capital costs as well as, the cost of labor, materials, equipment, and maintenance were assessed. The range of costs and benefits associated with the hydropower process and determination of the economic feasibility of installing hydropower was also assessed for the Oyster River Dam.

Several methods can be used to generate electricity using a river; many turbine designs are associated with these generation methods. The Oyster River Dam site has a low head and medium flow rate; a “reaction turbine” was determined to be most suited for use. This type of turbine draws energy from the pressure drop of a fully immersed water turbine. Specifically an Archimedean screw, or Hydrodynamic Screw, hydro generator was chosen. Although this turbine is not considered a traditional reaction turbine due to its partial immersion, it still draws energy from the pressure drop between the higher and lower water levels flowing over the dam, and will continue to work at low flows.

The Archimedean Screw generator was chosen for the following reasons. The flow rate vs. mechanical efficiency of the Archimedean Screw has an efficiency of 90% at maximum flow rates, and holds this level of efficiency to flow rates 50% the maximum flow. This quality gives the Archimedean screw a large advantage due to the varying flow rate levels experienced by the Oyster River Dam. When flows drop below half the maximum flow, the efficiency can be retained using a braking control system that controls the speed of the screw. The system is also robust due to its slow operational speed, which lowers maintenance costs. The generator also has environmental benefits such as being fish friendly because of the slow speed and wide blade placement; and that the open-air design oxygenates the downstream water. These benefits led to the decision to use the Archimedean Screw as hydroelectric generator on site.

Once the generator was selected, approximate yearly energy outputs were calculated. The equation used to calculate the potential power in a hydroelectric generator is:

$$P = HQg\eta$$

P = Power generated (kW) H = Head of dam (m) Q = Flow (m³/s)
g = Gravitational acceleration (9.81 m²/s) η = Generator efficiency

In this case the head differential of the dam is difficult to determine due to the downstream’s tidal nature. To compensate for this the generator was designed for the minimum net head of approximately 1.8 meters.

The flows were determined using data compiled and analyzed from USGS. The flow duration curve determined by the hydrologic analysis estimated an average flow over the dam to be about 0.77 m³/s.

Before the design of the generator, the use of the generated power was needed to be determined. It was decided that two scenarios were possible; the powering devices on site (such as pond aerators) or sale of generated energy to PSNH.

In the first scenario, the screw is only used to power devices on-site, such as lights illuminating the spillway or water aeration devices in the pond to increase the dissolved oxygen concentration in Mill Pond. A relatively small screw would be best suited to the situation. The advantages of the smaller screw are a lower capital cost in conjunction with a capacity to operate at lower flows than a larger screw. This allows the screw to operate longer at a higher capacity than a larger screw. A conservative flow rate of $0.7 \text{ m}^3/\text{s}$ was used to design the screw, which required a diameter of 1.2 meters in order to operate. This design supplies 1 kW of power approximately 75% of the year, and would cost about \$170,000 for purchase and installation.

The second scenario with potential revenue generation from the energy sold required an in-depth financial analysis to examine the feasibility of selling the energy. In this case conservative design flows could also be used to design a smaller screw and reduce initial capital costs; however a smaller screw generates less power and consequently less revenue. Therefore a small screw based on a conservative design flow was not utilized.

Several tradeoffs must be considered when sizing the screw to generate the most energy. Mechanical efficiency screw is approximately 85% when the flow through the screw is low compared to the designed flow rate, when the flow rate is below about 30% of the designed flow rate the efficiency does drop significantly. This means that a smaller design will be more efficient when the flow over the dam is low, where a larger screw may not be able to produce energy. Alternatively, when the flow is higher than the designed flow, a generator cannot utilize the flow optimally. This means that larger screws have the advantage at higher flows, because it uses most of that potential power. A balance must be found in order to produce the most energy throughout the year.

Using MATLAB, it was determined that the design flow which produces the most energy throughout the year is $2.5 \text{ m}^3/\text{s}$, which is higher than the average flow over the dam. This design flow does not producing power 30% of the year, due to flows that are too low. This would be an issue if designed to power a household or building, however because only overall sales due to energy generation are considered this is irrelevant. A screw with this design flow would be 1.75 meters in diameter.

The financial feasibility analysis for this screw required two values taken from the MATLAB program; the rated power (maximum power) of the generator, and the total energy generated throughout the year (kWh). Then several assumptions were made for a 40 year life span to include an economic inflation rate of 3%, an electricity inflation rate of 5%, a discount rate of 6%, and a rate of \$0.06 per kWh for selling energy to PSNH. Utilizing software that was programed should these values need to be altered the below computations can be easily recalculated.

For a copy of this programming code see appendix.

A 40 year Life Cycle Cost (LCC) analysis was run for the lifespan of the Archimedean screw. The initial capital cost of this screw would be \$242,130. From this the program utilized determined a negative LCC of \$184,412; meaning that over a 40 year period, the generator would accumulate net revenue of \$184,412. The Simple Payback period, in which the generator would pay itself off, would be 36 years. Using this information it can be derived that a larger screw may not be the best investment, but would eventually make the town a profit.

In order to verify that the values above are the most optimal trial and error of other design flows was conducted finding that a screw designed using a flow of 1.6 m³/s is the most cost efficient design. Over 40 years life cycle it was determined to have a negative LCC value of \$230,100. This is better than the original design utilizing a flow 2.5 m³/s financially because though the larger screw outputs more energy annually, it has a higher capital cost. The design flow of 1.6 m³/s has the optimum balance of capital cost and overall revenue over forty years.

If a combination scenario was analyzed, in which the Town powered a pond aerator while selling the remaining energy. This would provide revenue from the surplus energy sold, however because power must be used for the aerator, the profit margin from the previous analysis is reduced. It was found that although the capital cost of the aerator is insignificant compared to that of the screw, the reduced surplus energy significantly reduces the revenue of the generator over 40 years. If the LCC analysis from before was performed including one aerator, over 40 years a system with a design flow of 1.6 m³/s would profit \$5,745, while a system with a design flow of 0.7 m³/s costs \$19,700. This makes a combination scenario infeasible and a situation to be avoided.

After performing these feasibility analyses, it is clear that an Archimedean screw hydroelectric generator on the Oyster River Dam is a financial risk when trying to sell the energy. Though the larger generator would eventually produce a profit, the simple payback period is close to the end of the lifespan of the screw. If weighing the decision to sell, the Town should attempt to take certain measures to mitigate the disadvantages of the project.

First, the Town should attempt to enter into a private agreement with PSNH if they expressed interest to sell. The rate of electricity sold was fairly low in this estimate—if the Town could barter a rate higher than \$0.06 per kWh from PSNH energy sold, the revenue gained would be higher and would become more feasible. Additionally, financial incentives for those participating in renewable energy projects within New Hampshire exist. The Renewable Energy Grant given by the NH Public Utilities Commission, up to \$1,000,000, for new hydroelectric projects is one such example. If the Town were to secure a grant such as this, feasibility of the project would not be a problem.

Other benefits to installing this Archimedean screw at the Oyster River site exist. Archimedean screw generators are uncommon in the United States and could become an attraction to the town, drawing positive attention to both the generator and the history of the Oyster River Dam. In doing so it would also become an educational site for UNH and other students. Environmental selling points such as it's the fish-friendly nature and the incorporation of the water aerators to increase the dissolved oxygen concentrations in Mill Pond also exist. Due to all of the benefits listed instillation of this system should be further considered and investigated by the town.

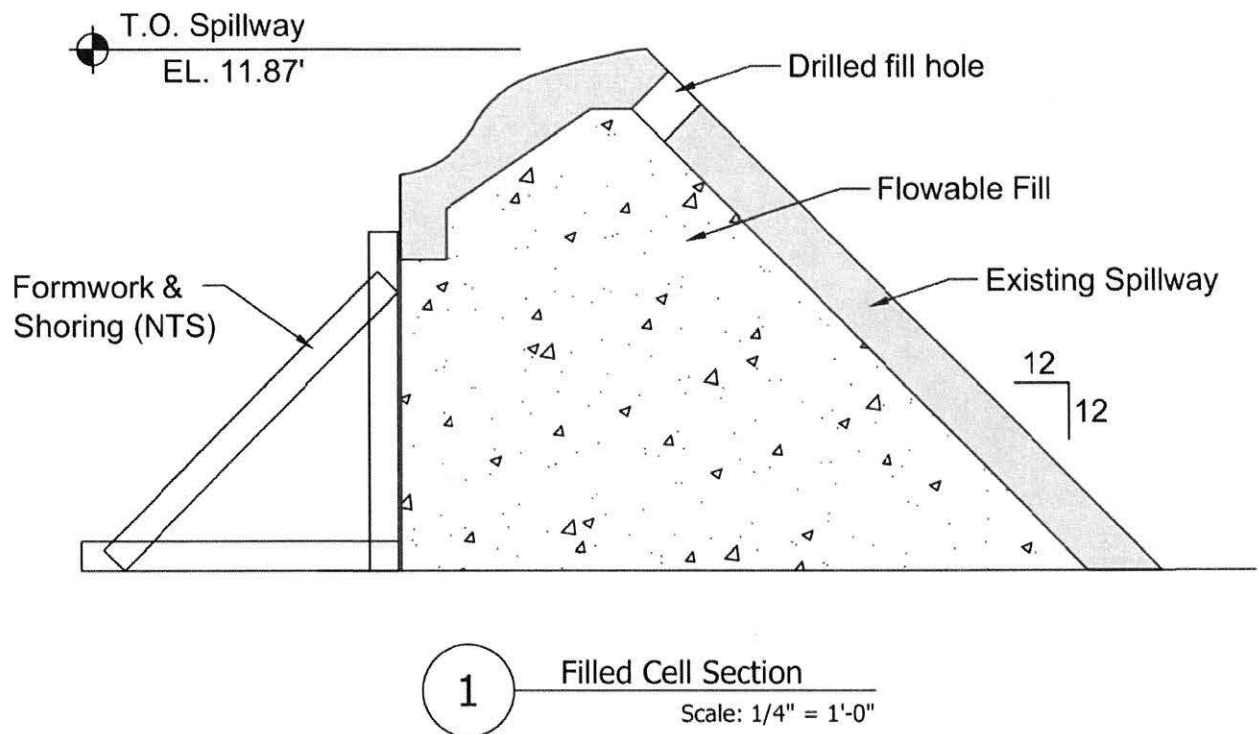
Structural Rehabilitation

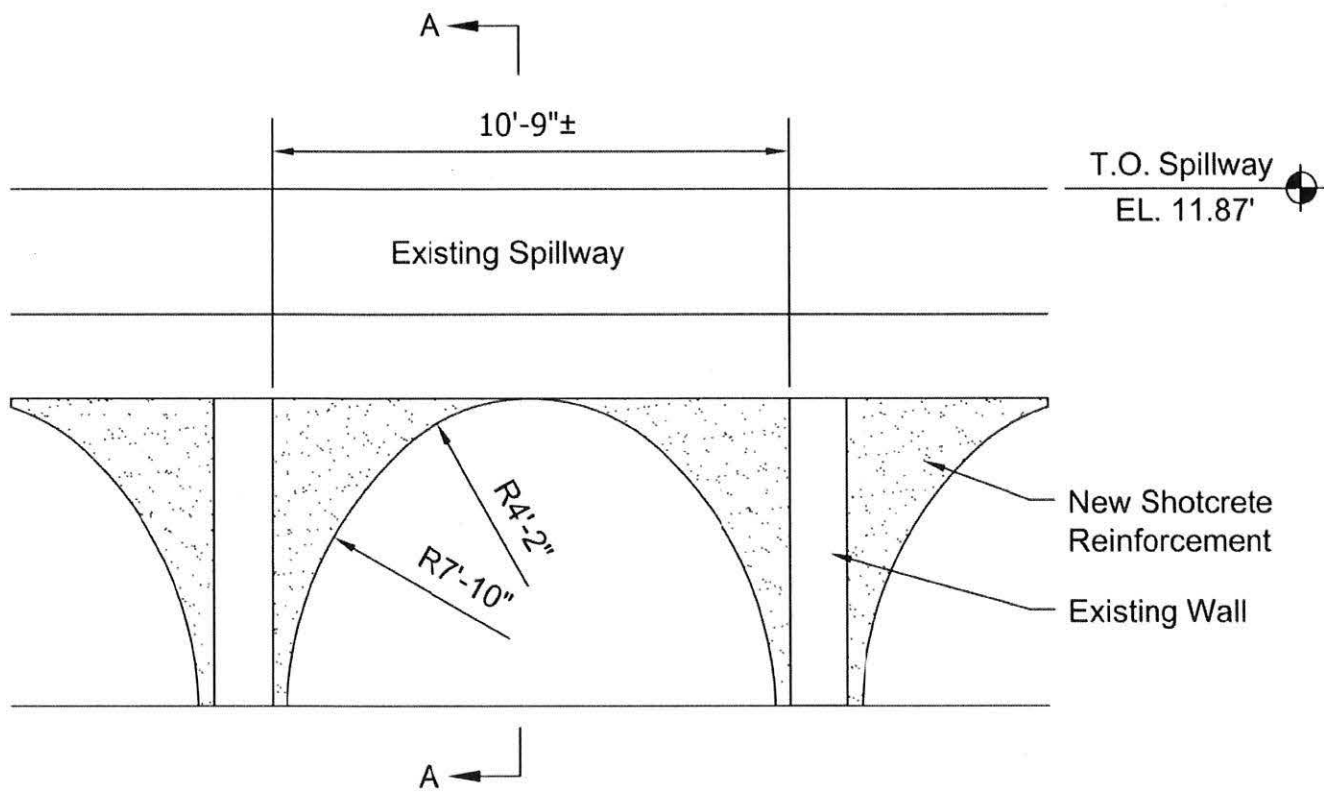
Structural rehabilitation of the Oyster River Dam was broken down into two areas of focus: the spillway and the gate structure. For reinforcing the spillway, there were three options up for consideration.

The first option was to reinforce with a topcoat over the existing spillway following surface preparation. This option requires the least amount of material with only 9 cubic yards required for a 2" topping coat. Surface preparation would be extensive to provide the best adhesion between the existing spillway and the new concrete. Delamination would be the biggest structural concern. Also, this new topcoat would raise the height of the dam. Concerns regarding the effect on abutters as well as 100 yr. flood overflow and permitting makes this course of action unfeasible.

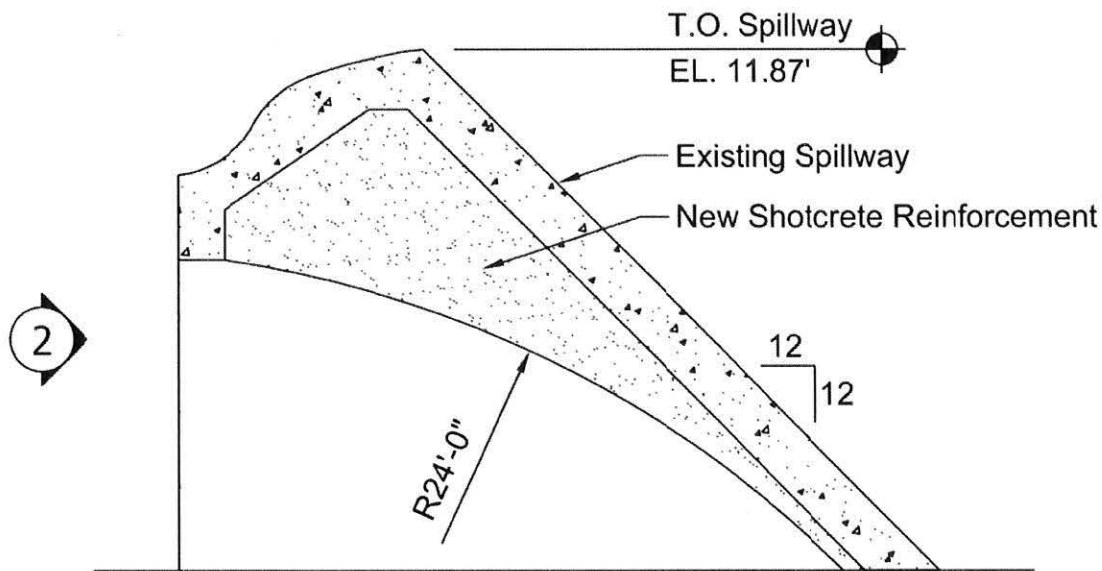
The second option was filling the bays under the spillway completely with concrete. This would be accomplished by blocking the front of the cell and pumping in flowable fill through a hole drilled in the back of the spillway (Figure 1). The volume of each cell averages 32 cubic yards (found using AutoCAD model), and so would require a total of 256 cubic yards of concrete to fill. This is the largest volume of material required of the three options. Filling the cells completely with concrete, though effective, would eliminate the rib and cell construction that is one of the defining features of an Ambursen Dam.

The third option was to construct an arch reinforcing structure in each bay underneath the spillway. The arch would be constructed using shotcrete over a steel reinforcing cage built into each cell. The arch formed would follow a dual-radius arch for aesthetics. (Figures 2 and 3). The volume of shotcrete required is approximately 16 cubic yards per cell, for a total required volume of 128 cubic yards.





2 Elevation
Scale: 1/4" = 1'-0"



3 Section A-A
Scale: 1/4" = 1'-0"

In order to pick an option for recommendation, a design matrix was used. Considerations included feasibility, effectiveness of structural reinforcement, affects to the dam’s aesthetics and cost of rehabilitation. The resulting matrix can be seen below in Table 2.

Table 2: Design Matrix

	Feasibility	Structural Reinforcement	Maintains Aesthetics	Cost	Total
New Top Coat on Spillway	1	2	3	2	8
Fill Bays w/ Concrete	3	3	1	1	8
Arch Reinforcement	3	3	3	3	12

- 1: Poor/Not Applicable
- 2: Fair
- 3: Good

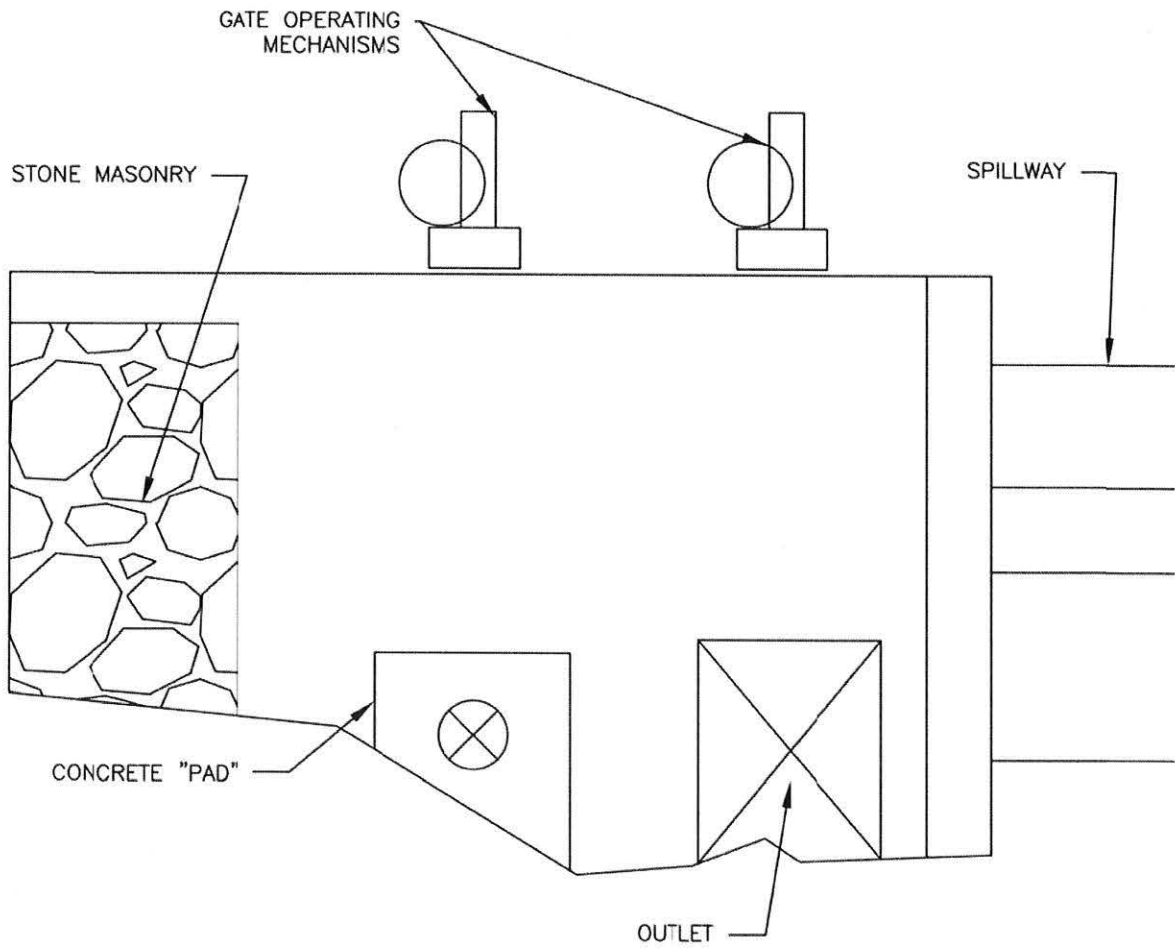
Thus, after considering all factors, it is recommended that the spillway be reinforced using the third option of an arch reinforcing structure.

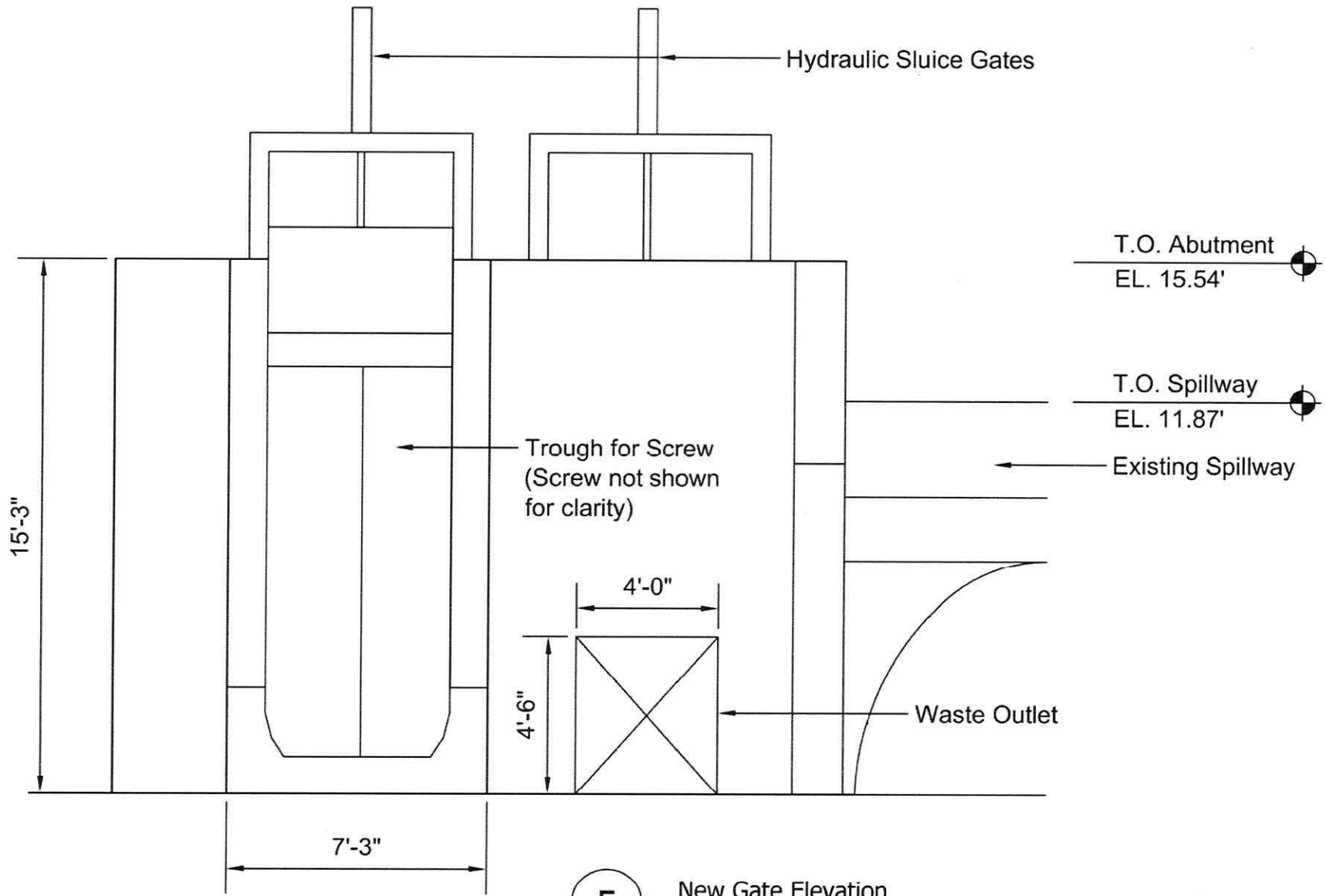
Gate Structure

The existing gate structure requires replacement. The existing gate structure houses two outlets, one 4ft wide by 4.5ft tall waste gate, and one 12 inch diameter corrugated metal pipe. These outlets are controlled using manually operated gates (Figure 4).

The new gate structure was designed to largely match the original, with the exception of a new trough added to house an Archimedean screw (Figure 5). In order to accommodate the flow from the 100yr flood, the right abutment/gate structure needed to be raised 1ft 10in. The outlet formed for the Archimedean screw will replace the pipe outlet in the existing gate structure. The supplemental waste outlet dimensions match the original. Two hydraulic sluice gates are used in place of the existing manual ones. One sluice gate is used to control the flow approaching the Archimedean screw generator, whereas the other one is used to operate the supplemental outlet.

The additional structure required to house the Archimedean screw will be constructed using steel reinforced cast in place concrete. The trough in which the screw sits is to be formed at a 22 degree angle from horizontal as required for the screw generator. This new structure will have a footprint of 7ft 2in wide by 32ft 3in long (Figure 6).

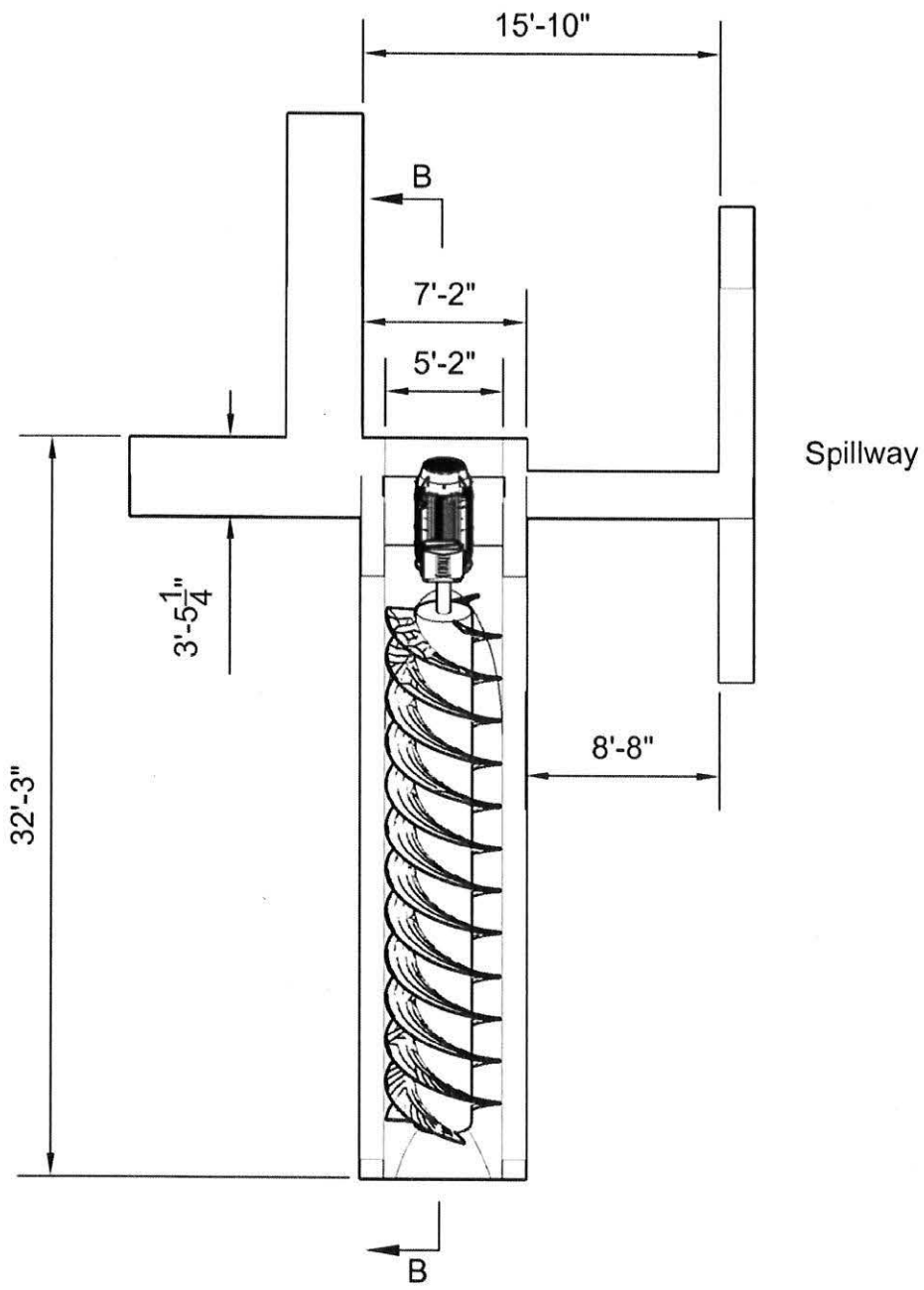




5

New Gate Elevation

Scale: 1/4" = 1'-0"



6 New Gate Plan
 Scale: 1/4" = 1'-0"

Installation method

When the oyster river dam was first constructed in 1913, construction workers diverted water through the middle of the construction site and built the dam from the sides to the middle. Once concrete was set, water was then diverted over the spillway and the middle of the dam was finished. This method can be modified using sandbags to divert water around each cell. However, using the shotcrete is a very fast process. Construction workers will be moving from cell to cell at a relatively fast pace, faster than water diversion could be modified. Because of this, construction on the spillway must be done at once. If all water is first diverted over the spillway so that the gate structure can be removed and a temporary channel (wood/metal) can be installed to handle all flow, the spillway can be dried and construction on all the cells can be done at one time. This process must be done at an extremely low flow so that the temporary channel can handle all water, such as during dry summer months. After the shotcrete is set, water can be redirected back over the spillway and then construction on the Archimedean screw and gate structure can commence.

Permitting

In order to implement the generation of electric power at the Oyster River Dam site, consultation with the Federal Energy Commission (FERC), is necessary. The commission regulates the interstate transmission of electricity, hydropower and natural gas and oil amongst other things. The Oyster River dam site and our goal to implement a low head, hydropower generator falls within the guidelines of the small/low impact hydropower program of FERC. This program is intended for small projects that result in minor environmental effects. Minor environmental effects is defined by FERC as little changes to water flow and unlikely to affect threatened or endangered species.

The first step for licensing is to obtain a preliminary permit. This permit can be used up to three years and it grants priority to study conditions of the dam and changes in hydrologic conditions. With this permit, submission of reports containing activities and dates is required. Along with the preliminary permit, FERC requires consultation with federal, state, interstate and non-governmental agencies prior to construction or rehabilitation of any dam site, in order to address any adverse ecologic or hydrologic impacts that may affect the surrounding area.

The site falls under the 5 Mega-Watt exemptions that FERC offers for non-federal, pre 2005 dams that generate 5MW or less. In order to obtain the exemption, mandatory federal and state fish and wildlife conditions must be met. This requires consultation with US fish and wildlife services, national marine fisheries services and state wildlife agencies. Each agency must determine the prevention and or loss to damages to resources. Along with this, a license adhering to the federal reservation conditions under section 4(e) of the FPA must be obtained along with a license adhering to fish way prescriptions under section 18 of the FPA, 16 U.S.C. § 811. FERC recommends using the traditional licensing process (TLP) when consulting with outside agencies in order to complete the required criteria for the exemption. Project boundaries must also be included in a report submitted to FERC, which includes all associated lands and facilities, such as the powerhouse, dam, impoundment, transmission line, and any lands that fulfill a project purpose (*e.g.*, recreation, resource protection, and access roads). Implementing statutes must be followed when filing for the 5MW exemption under the Public Utility Regulatory Policies Act. Prerequisites include addressing the safety of the dam by the commission, provided opportunity for consultation with council on environmental quality and EPA.

The New Hampshire Department of Environmental Services must also be contacted prior to the rehabilitation of the Oyster River Dam. The applicability of the NHDES dam permit applies to non-permitted existing dams and the repair and reconstruction of dams. An application to reconstruct a dam, including an application relative to emergency measures described in Env-Wr 401.02(a)(2), must be filed by the owner(s) of the dam. An application to register the dam must be filed by the property owner(s) on which the proposed dam is located. A filing fee of \$2,000 is also required along with the application. NHDES then inspects the site and structure to classify it as a low hazard structure, significant hazard or high hazard. Based on the classification, an annual registration fee is determined. This fee is aimed towards the protection and safety of residents downstream from the dam site if a failure were to happen. Once construction is approved, the project becomes contingent with the Wetlands Bureau.

Options for Controlling 100 Year Flood



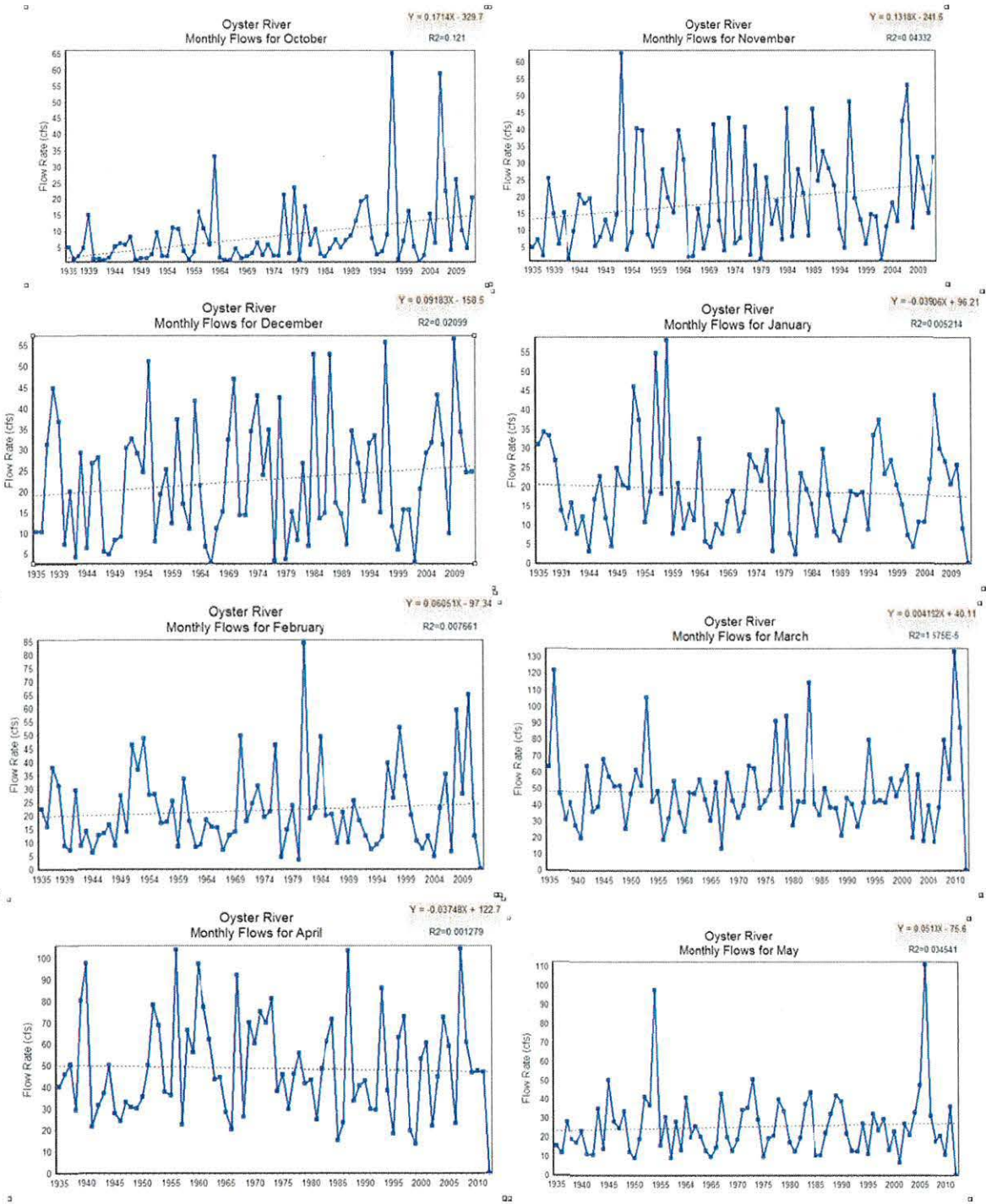
During the case of an extreme storm event, flooding occurs on the gate structure side of the dam and overflows into the adjacent yard. Necessary means must be considered to prevent flooding and to control and direct the river downstream without overflow. One option to consider would be to build an embankment or retaining wall. This is an advantageous method because the wall will only need to be 2 feet high and would be low in costs. Another option would be to install an underground drainage system, which would direct the excess water underground with the exit being on the downstream side of the dam. A more expensive option, but equally effective method to preventing flooding would be to install a hydraulic gate in the first bay of the dam. This could be achieved by removing the concrete spillway over the first bay and replacing it with a hydraulic gate. During the case of an extreme storm event, the gate would be able to open allowing for extra flow to move downstream, without overflowing into the adjacent property.

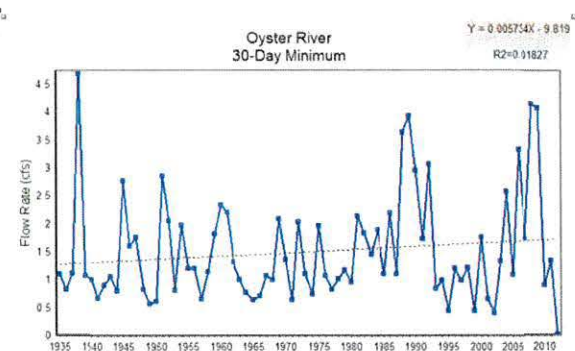
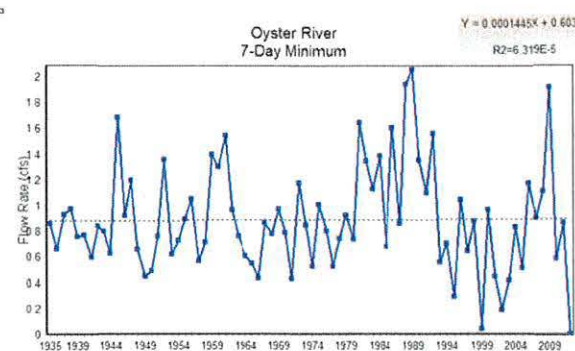
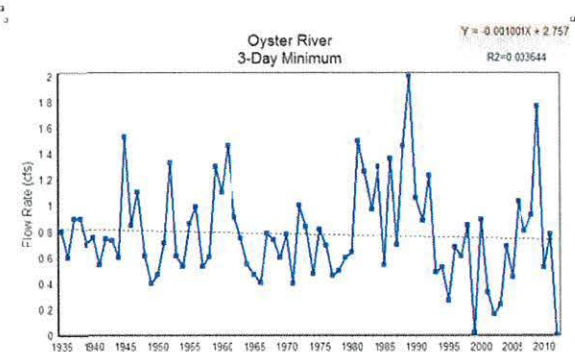
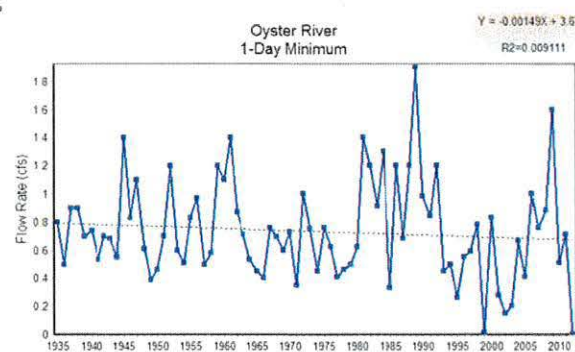
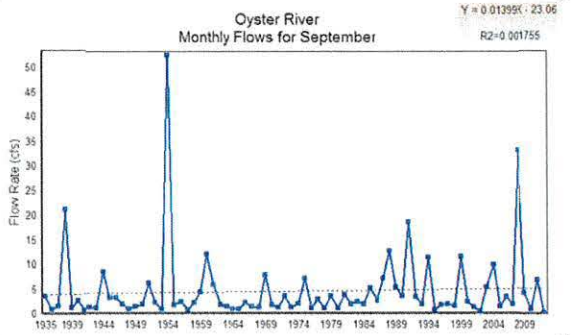
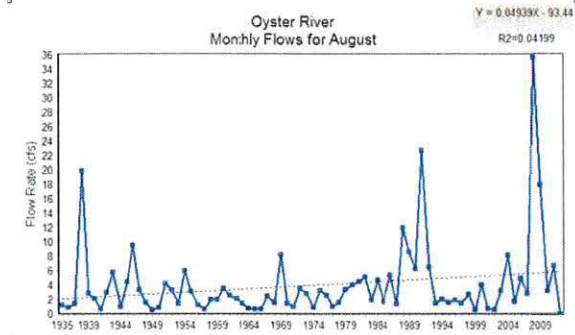
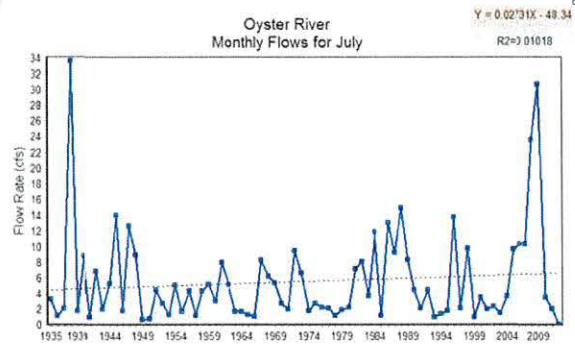
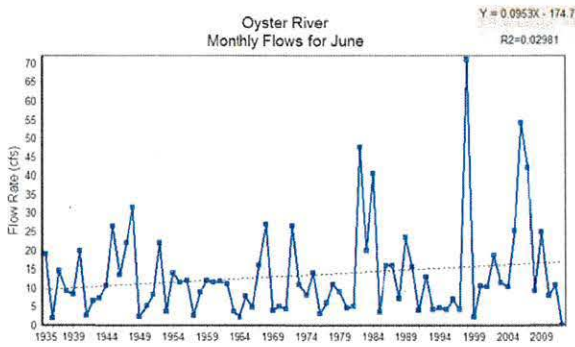
Conclusions and Recommendations

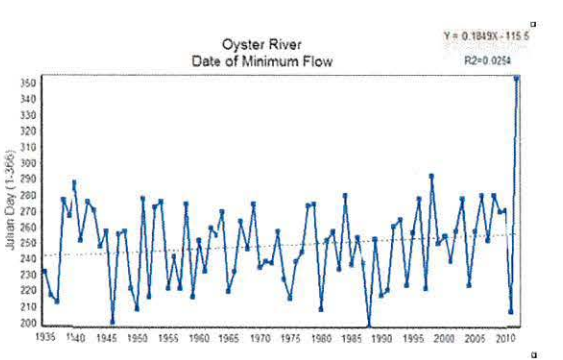
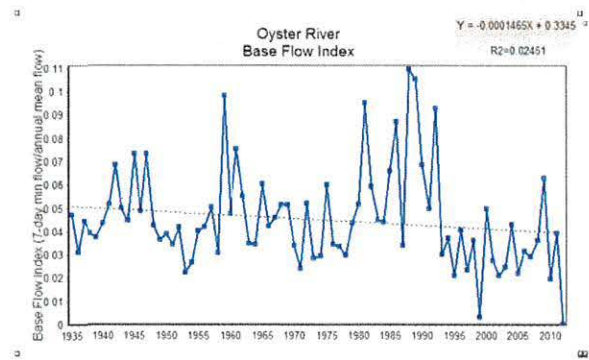
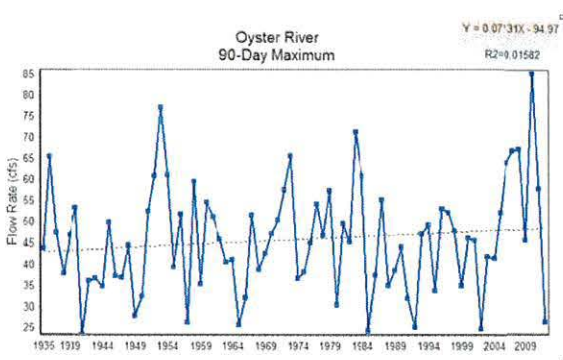
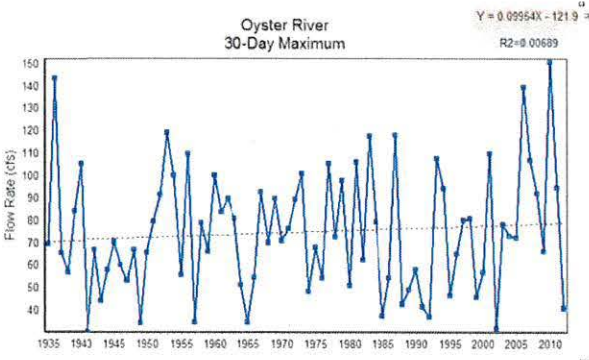
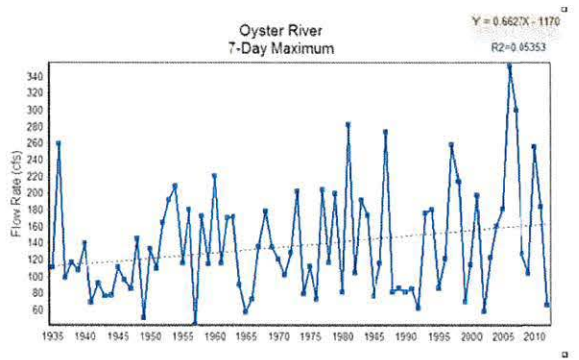
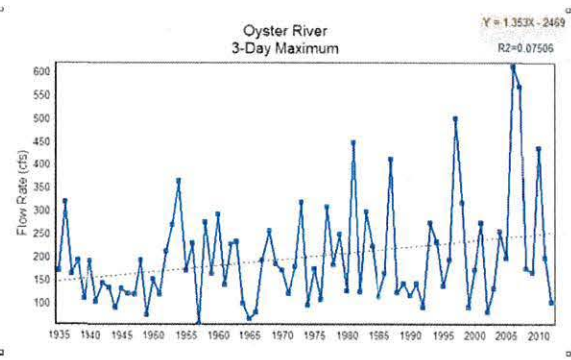
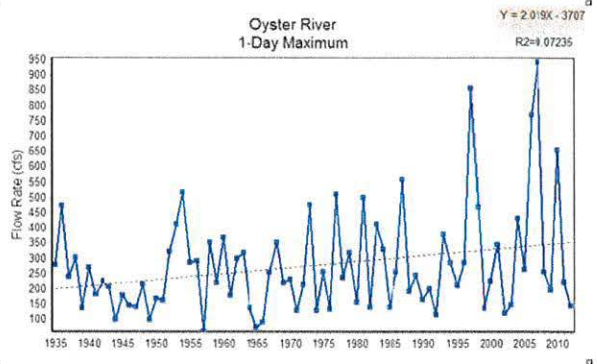
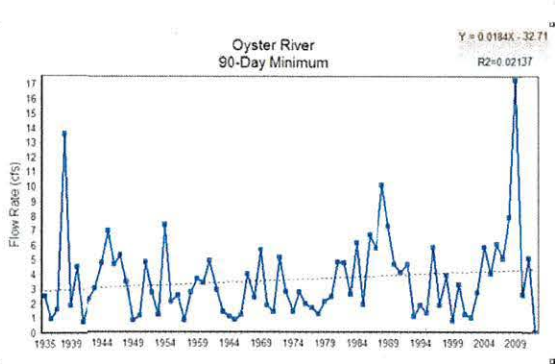
The Oyster River Dam is structurally deficient and the gate structure is structurally obsolete and must be replaced. Due to the concrete cracking on the underside of the spillway, a solution to reinforce the structure was necessary. In order to maintain the historical aspect of the structure, while adding structural support, it is recommended that an arch reinforcing structure be constructed under each bay. The arch would be constructed using shotcrete over a steel reinforcing cage and built into each cell. The arch formed would follow a dual-radius arch for aesthetics. (Figures 2 and 3). To implement this, it is recommended that the gate structure be taken out first, redirecting the flow away from the spillway. Upon completion of reinforcing the bays, the gate structure with the Archimedes screw will be installed, with flow being directed over the finished spillway. After completing a hydrologic analysis, and determining monthly average flows, it was concluded that the best option for the implementation of hydropower would be an Archimedes screw. This form of hydropower has relatively low maintenance costs, is environmentally friendly and is an efficient mechanical process. The Archimedes screw is not common in the United States and would provide an educational opportunity for UNH students as well as town's people. One method of conveying information to visitors would be to install a plaque or bulletin, detailed with images and text, explaining the historic significance of the dam, the rehabilitation process and also information on the Archimedes screw. With regards to power generation, it is recommended that the electricity be used on site for powering oxygen air diffusers within Mill pond and lighting the dam at night. Stephen Burns', the abutter to the site, owns the power rights and excess power could be redirected to his home. The Oyster River dam is a historic piece of engineering and ingenuity, representative of hard work and advances in technology in Durham and the surrounding area and should be preserved.

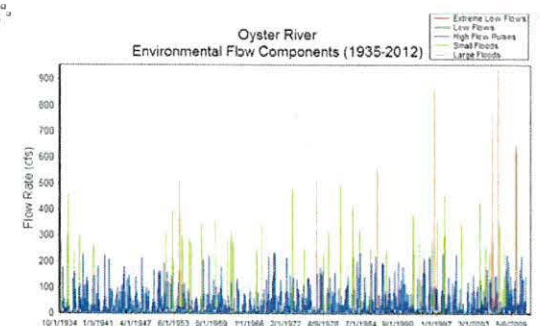
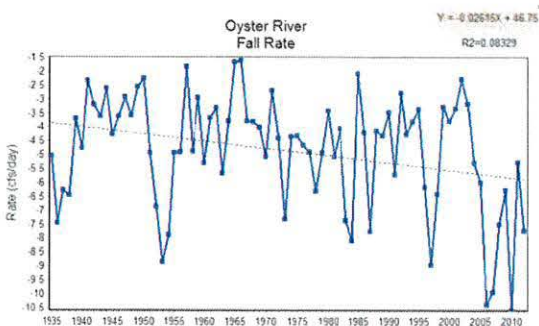
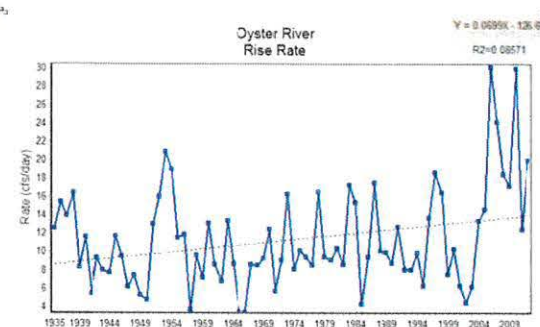
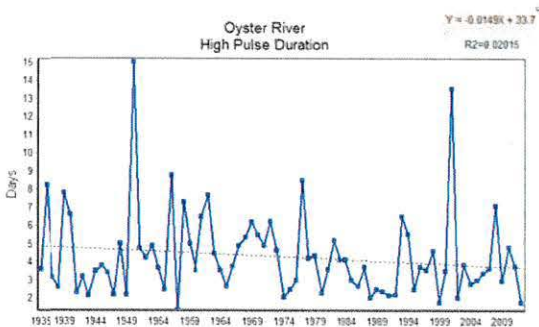
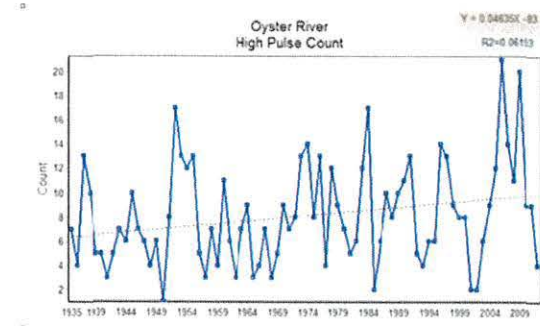
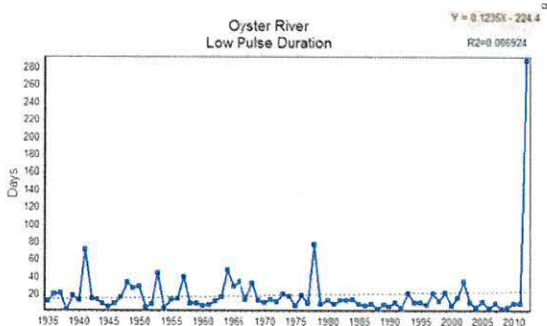
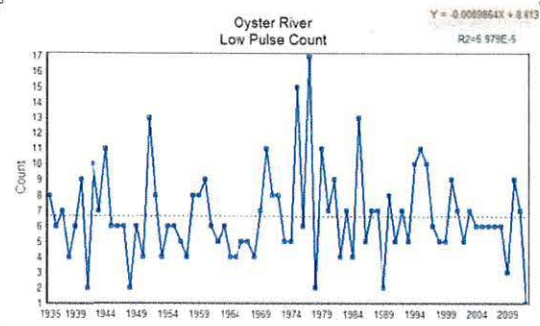
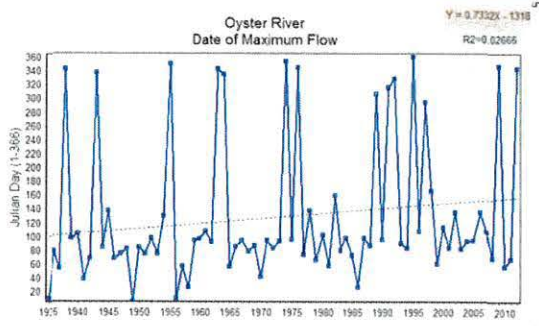
Appendix

A.) IHA Graphs for USGS 01073000









B.) IHA Analysis

Period of Analysis: 1935-2012 (78 years)	
Watershed area	1
Mean annual flow	20.1
Mean flow/area	20.1
Annual C. V.	1.64
Flow predictability	0.33
Constancy/predictability	0.48
% of floods in 60d period	0.37
Flood-free season	7

Parameter Group #1	Mean Gauge	Coeff. of Var.		Mean Dam
		Gauge	Dam	
October	8.668	1.289	14.47	
November	18.57	0.7728	31.01	
December	22.77	0.6308	38.02	
January	19.12	0.6412	31.92	
February	22.07	0.7096	36.85	
March	48.38	0.4946	80.78	
April	48.77	0.4869	81.43	
May	25.63	0.673	42.79	
June	13.39	0.9344	22.36	
July	5.542	1.107	9.25	
August	4.028	1.356	6.73	
September	4.549	1.663	7.60	

Parameter Group #2	Gauge Mean	Coeff. of Var.	Dam Mean
3-day minimum	0.7818	0.4806	1.31
7-day minimum	0.8886	0.4636	1.48
30-day minimum	1.497	0.642	2.50
90-day minimum	3.601	0.7921	6.01
1-day maximum	277.4	0.6131	463.17
3-day maximum	200.2	0.5587	334.27
7-day maximum	138.2	0.4695	230.75
30-day maximum	74.51	0.3647	124.41
90-day maximum	45.76	0.2808	76.40
Number of zero days	3.692	8.832	
Base flow index	0.04529	0.4683	0.08

Parameter Group #3		
Date of minimum	249.3	0.07183
Date of maximum	63.26	0.1451

Parameter Group #4	Gauge	Coeff. Of Var. Dam	
		Gauge	Dam
Low pulse count	6.67	0.4336	
Low pulse duration	19.37	1.737	
High pulse count	8.14	0.5184	
High pulse duration	4.30	0.5534	
Low Pulse Threshold	3		5.01
High Pulse Threshold	53.11		88.68

Parameter Group #5	Mean	Coeff. Of Var.
Rise rate	11.35	0.4767
Fall rate	-4.856	-0.4228
Number of reversals	100.4	0.1424

C.) Hand Calculations

USGS/NHDOT Estimation of Flood Discharge at Selected Recurrence Interval (100 year)

$$\text{Equation: } Q_{100} = 7.13 A^{0.867} P^{1.98} 10^{-0.0291(W)} S^{0.198}$$

Q_{100} = Estimated Flood Discharge

A = Drainage area of basin in square miles

P = Average April precipitation in inches

W = Percentage of basin covered in Wetlands

S = Average stream slope in ft/mile

$$\log_{10} Q_{100, W} = \frac{(N) \log_{10} Q_{100, S} + (E) \log_{10} Q_{100, (W)}}{N + E}$$

$Q_{100, W}$ = Weighted discharge for the 100 year interval at stream gage

$Q_{100, S}$ = Flood discharge for 100 year interval at stream gage

$Q_{100, (W)}$ = Flood discharge estimation for 100 year interval at gage

N = Number of years of stream gage at record

E = Equivalent years of record for site

$$SE_{pred} = \left[\hat{\sigma}^2 + x_i (X' \Lambda^{-1} X)^{-1} x_i' \right]^{1/2}$$

SE_{pred} = standard error prediction

$\hat{\sigma}^2$ = Model error variance (Table II is reference)

x_i = [1, $\log_{10}(A)$, $\log_{10}(P)$, W, $\log_{10}(S)$]

$X' \rightarrow X_{i-1}$ = Transverse of x_i

$(X' \Lambda X)^{-1}$ = Regression matrix for 100 year interval (Table II)

$$E = \frac{\hat{\sigma}^2 [1 + k_g g + 0.5 k_g^2 (1 + 0.75 g^2)]}{SE_{pred}^2}$$

E = Equivalent years of record

$\hat{\sigma}$ = Standard deviation of normal events based on drainage area

k_g = Log-Pearson type III frequency factor for 100 year interval

g = Skew used in computation with frequency curve (g = 0 for ungaged site)

$$S = e^{-(1.31 + 0.13 \log_2(A))}$$

$$m = \frac{\log_{10} (Q_{100, (W)} / Q_{100, S})}{\log_{10} (A_u / A_g)}$$

m = logarithmic slope between gage and site regressions

$Q_{100, (W)}$ = Estimated flood flow at ungaged site

$Q_{100, S}$ = Estimated flood flow at gage

A_u = Area at ungaged site

A_g = Area at gage

Equations continued:

$$c = m + \frac{\log_{10}(Q_{100y}/Q_{10y})}{\log_{10}(a)}$$

c = Slope of logarithmic line at coordinates

a = percentage of drainage area = 1.5 when $A_u > A_g$

$$Q_{100y} = Q_{10y} \left[\frac{A_u}{A_g} \right]^c$$

Q_{100y} : Flood discharge for 100 year flood at site.

Data Given:

Gauge	Site	Miscellaneous 100 year Discharge Data
A = 12.20 sq. mi.	A = 30.37 sq. mi.	$h_f = 2.326$ (Bulletin 17B)
P = 4.18	P = 4.16	$\bar{y} = 0.0235$ (Table 1)
W = 9.60%	W = 7.59%	$Q_{10} = 1200$ cfs
S = 17.90%/mi	S = 15.20%/mi	N = 70 years
		$a = 1.5$
		$(x^* \Delta x) = ?$ See Table 11
		$g = 0$

Calculations:

$$Q_{100y} = 7.13 (30.37 \text{ sq. mi.})^{0.867} (4.16)^{1.98} (10)^{-0.0235(9.60)} (15.20\% \text{ mi.})^{0.198}$$

$$Q_{100y} = 1798.91 \text{ cfs}$$

$$Q_{100y} = 7.13 (12.20 \text{ sq. mi.})^{0.867} (4.18)^{1.98} (10)^{-0.0235(9.60)} (17.90\% \text{ mi.})^{0.198}$$

$$Q_{100y} = 1069.34 \text{ cfs}$$

$$x_i = [1, \log_{10}(12.20 \text{ sq. mi.}), \log_{10}(4.18), 9.60, \log_{10}(17.90\% \text{ mi.})]$$

$$x_i = [1, 1.086, 0.621, 9.60, 1.253]$$

$$SE_{pred} = [0.0235 + [1, 1.086, 0.621, 9.60, 1.253]^T$$

$0.00575E^{-1}$	$-0.51227E^{-2}$	$-0.51248E^{-1}$	$-0.58711E^{-3}$	$-0.35517E^{-1}$
$-0.51667E^{-2}$	$0.13031E^{-2}$	$-0.13514E^{-2}$	$0.10560E^{-3}$	$0.19168E^{-2}$
$-0.50248E^{-1}$	$-0.243914E^{-3}$	0.10452	$-0.36357E^{-3}$	$-0.50145E^{-2}$
$-0.59817E^{-3}$	$0.10500E^{-2}$	$-0.3357E^{-2}$	$0.2923E^{-4}$	$0.28971E^{-3}$
$-0.10587E^{-1}$	$0.19168E^{-2}$	$-0.50476E^{-2}$	$0.28973E^{-3}$	$0.53550E^{-2}$
1	$1/2$			
1.086				
0.621				
9.60				
1.253				

$$SE_{pred} = 0.161$$

Calculations Continued:

$$s = e^{-0.131 + 0.134 \log_{10}(11,209 \text{ m}^2)}$$

$$s = 0.233$$

$$E = \frac{0.233^2 (1 + 6.5(2.326)(1 + 0.233)^{0.7})}{0.161^2}$$

$$E = 7.81 \text{ years}$$

$$Q_{new} = \frac{(72 \text{ years}) \log_{10}(1300 \text{ cfs}) + 7.81 \text{ years} \log_{10}(1069.34 \text{ cfs})}{72 \text{ years} + 7.81 \text{ years}}$$

$$Q_{new} = 1186.54 \text{ cfs}$$

$$m = \frac{\log_{10}(11798.91 \text{ cfs} / 1069.34 \text{ cfs})}{\log_{10}(20.37 \text{ sq mi} / 12.20 \text{ sq mi})}$$

$$m = 1.015$$

$$c = 1.015 + \frac{\log_{10}(1069.34 \text{ cfs} / 1186.54 \text{ cfs})}{\log_{10}(1.5)}$$

$$c = 0.758$$

$$Q_{new} = 1186.54 \text{ cfs} \left[\frac{20.37 \text{ sq mi}}{12.20 \text{ sq mi}} \right]^{0.758}$$

$$Q_{new} = 1756.14 \text{ cfs}$$

D) Mat LAB

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%           Oyster River Dam Flow Efficiency Calculations           %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
clear all;
close all;
%Gross head minus maximum tidal flux:
H = 1.8;
g = 9.81;

%Flow Duration curve from nearby gage:
GageDur = [1.61 1.25 .95 .79 .71 .65 .59 .57 .54 .51 .48 .42 .28 .23 .18 .15 .14 .12 .1];
%Use Watershed Scaling to find Flow Duration at dam, and subtract .15 cms
%for reserve flow:
UseableFlowDur = (1.71*GageDur)-.15; %1.71, new: 1.6 ish

%Hours per each time period from Flow Duration points (adds to 1 year):
SegmentHours = (365.25/length(UseableFlowDur))*24;

%Percentiles for F.D. Curve (x axis):
DamPerc = 5:5:95;
plot(DamPerc,UseableFlowDur);
xlabel('Percent of Time');
ylabel('Flow Rate Q (meters cubed per second)');
title('Flow Duration Curve for Oyster River Dam');

%Eff of gearbox, inverter (because using variable speed screw), etc:
eEff = 0.75;
%Mechanical Eff Curve for Screw for percent of design flow (0% to 100%):
EffPerc = 0:5:100;
mEff = [0 0 .2 .45 .65 .75 .8 .82 .83 .84 .85 .86 .87 .87 .875 .88 .88 .885 .89 .895 .9];
figure
plot(EffPerc,mEff);
xlabel('Percent of Design Flow');
ylabel('Mechanical Efficiency');
title('Archimedean Screw Mechanical Efficiency Curve');

%***** DESIGN FLOW RATE %*****
Qd = 1.6; %*****
%*****

TotEnergy = 0;
MaxPower = 0;
power(1:length(UseableFlowDur)) = zeros(1,length(UseableFlowDur));
energy(1:length(UseableFlowDur)) = zeros(1,length(UseableFlowDur));
SumEff = 0;
for i = 1:length(UseableFlowDur)
    %Ratio of flow rate to design flow:
    Qr = UseableFlowDur(i)/Qd;
    %If ratio is over Qd, sluice will automatically restrict flow
    %to prevent damage to equipment. Eff is also reduced (churning?):
    if Qr > 1
        %Eff reduced (bc of churning?) linearly if > 100%, zero at 500%:
        Eff = eEff*(1.125-(Qr*0.225));
        Q = Qd;
    else
        %Find the Mech Eff, multiply by Elec Eff for total Efficiency:
        percentile = ceil(Qr*21);
        Eff = eEff*mEff(percentile);
        Q = UseableFlowDur(i);
    end
    %Find average Eff:
    SumEff = SumEff+Eff;
    %Find output power and energy (during block of hours from year: whole
    %duration curve equals 1 year):
    power(i) = H*g*Q*Eff;
    energy(i) = power(i)*SegmentHours;
    %Find total energy in one year (using flow duration curve):
    TotEnergy = TotEnergy+energy(i);
end
```

```

%Find max power:
if power(i) > MaxPower
    MaxPower = power(i);
end
end
%Find Capacity Factor:
CapFactor = TotEnergy/(MaxPower*24*365.25);
%Find Average Overall Efficiency:
AveEff = SumEff/length(UseableFlowDur);

figure
plot(DamPerc,power)
xlabel('Percent of Time (Flow)');
ylabel('Minimum Power for Time Percentile (kW)');
title('Power (from Flow Duration Curve)');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%% Financial Analysis (Oyster R Dam Archimedean Screw) %%%
%%%           if Town sells power           %%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
close all;
clear all;

%LCC: Life Cycle Cost analysis: LCC = C + Mpw + Epw + Rpw + Spw
% Over amount of years:
years = 25; %Life cycle of screw?
%US general inflation rate:
r = 0.03;
%US discount rate:
d = 0.06;
%Amount of water aeration units (bubblers)?
a = 0;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Find C (Capital Cost): %%%%%%%%%
%Price per kW (in pounds, three years ago):
PricePer5kW = [5500 4250 3500 3200 2900 2700 2500 2400 2250 2200];
%Price per kW (in dollars, now):
PricePer5kW = PricePer5kW*1.6058*((1+r)^3);
%Power intervals (in kW):
PowerBracket = 5:5:50;
%Input maximum power of screw:
MaxPower = 29.5;%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Find screw cost:
if MaxPower > 50
    CScrew = MaxPower*PricePer5kW(10);
else
    CScrew = MaxPower*PricePer5kW(ceil(10*MaxPower/50));
end
%Find cost of bubblers:
CBub = a*2000;
%Assume cost of design, planning, permitting, installation, etc:
CAdditional = 100000;
%Find total capital cost C:
Cpw = CScrew+CBub+CAdditional;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Find Mpw (Present Worth of O&M): %%%%%%%%%
%From Idaho National Laboratory:
OandMperkWh = 0.007; % 1990-1994: 0.7 cents per kWh
%Current O&M cost:
OandMperkWh = OandMperkWh*((1+r)^20);
TotEnergy = 70300; %kWh %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
Mpw = 0;
for i = 1:years
    %Find cost of O&M in specific year:
    Mpwyear = TotEnergy*OandMperkWh*((1+r)^i)/((1+d)^i);
    %Sum together:

```

```

Mpw = Mpw+Mpwyear;
end

##### Find Epw (Present Worth of Future Energy Generation): #####
%Amount PSNH will pay for surplus energy:
PSNHsurplus = 0.06; %cents paid per kWh now
%Inflation of US electricity:
rE = 0.05;

%Find energy used from bubblers:
BubEnergy = a*24*365;
ESellpw = 0; % $ from selling to PSNH
for i = 1:years;
    %Find future value of energy for each year:
    ESellpyear = -PSNHsurplus*(TotEnergy-BubEnergy)*((1+rE)^i);
    %Sum together:
    ESellpw = ESellpw+ESellpyear;
end
%Find total present worth of energy:
Epw = ESellpw;

##### Find Rpw (Present Worth of Replacements): #####
%Assume lifespan of inverter of:
LifeInv = 7; % years
Rpw = 0;
%Find number of inverter replacements needed:
Rnumber = floor(years/LifeInv);
if Rnumber > 0
    for i = 1:Rnumber
        %Future replacement value (assume inverter now is approx $1/W):
        Rfw = MaxPower*1000*((1+r)^(i*LifeInv))/((1+d)^(i*LifeInv));
        %Sum together:
        Rpw = Rpw+Rfw;
    end
end

##### Find Spw (Present Worth of Salvage): #####
Spw = 0;

##### FIND LCC #####
LCC = Cpw+Mpw+Epw+Rpw+Spw;

%Doing nothing:
LCCnothing = -Cpw*((1+d)^years)/((1+r)^years);

%Net Present Value:
NPV = LCCnothing-LCC;

```

Citations:

Olson, Scott. "Estimation of Flood Discharges at Selected Recurrence Intervals for Streams in New Hampshire." *USGS Science for a Changing World*. 5206 (2008): 1-61. Print.

Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood-flow frequency: Bulletin 17B of the Hydrology Subcommittee, Office of Water Data Coordination, U.S. Geological Survey, Reston, Va., 183 p.,
http://water.usgs.gov/osw/bulletin17b/bulletin_17B.html.

April Talon

From: Brown, Matt - NRCS, Dover, NH <matt.brown@usda.gov>
Sent: Thursday, November 12, 2020 10:59 AM
To: April Talon
Subject: RE: Mill Pond Dam final report

Thanks, April.

Matt

Matthew D. Brown, P.E.

State Conservation Engineer

USDA-NRCS New Hampshire
273 Locust St, Ste 2D, Dover, NH 03820
Cell 603.892.5688
Desk 603.868.9931 x 115
matt.brown@usda.gov

From: April Talon <atalon@ci.durham.nh.us>
Sent: Thursday, November 12, 2020 10:57 AM
To: Brown, Matt - NRCS, Dover, NH <matt.brown@usda.gov>
Cc: Keirstead, Donald - NRCS, Dover, NH <donald.keirstead@usda.gov>
Subject: RE: Mill Pond Dam final report

That is excellent thank you. I will include you in the email communications for abutters/interested residents.

Thank you!
April Talon

April Talon, PE
Town Engineer
Durham Public Works
100 Stone Quarry Drive
Durham NH 03824
Office #: 603-868-5578
Direct Office #: 603-590-1357
Mobile #: 603-343-3100

From: Brown, Matt - NRCS, Dover, NH <matt.brown@usda.gov>
Sent: Tuesday, November 10, 2020 7:13 AM
To: April Talon <atalon@ci.durham.nh.us>
Cc: Keirstead, Donald - NRCS, Dover, NH <donald.keirstead@usda.gov>
Subject: Mill Pond Dam final report

April-

I saw Pete Walker's presentation yesterday to the Stream Task Force and would like to request a copy of the final report. As a Durham resident and part of an agency that funds dam removals, I have both personal and professional

interest in the project. I'll be listening to the Council meeting next week to see how the information is accepted by the Town.

Thanks,
Matt

Matthew D. Brown, P.E.

State Conservation Engineer

USDA-NRCS New Hampshire

273 Locust St, Ste 2D, Dover, NH 03820

Cell 603.892.5688

Desk 603.868.9931 x 115

matt.brown@usda.gov

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April Talon

From: Project Nature Groupie <naturegroupie@gmail.com>
Sent: Friday, November 20, 2020 6:28 PM
To: April Talon
Subject: Mill Pond Dam

Dear Ms Talon,

Thank you for the opportunity to comment on the two feasibility study options for the future of the Mill Pond Dam In Durham.

Although I recognize the idea that the dam represents and a long-standing view in Durham, and the Mill Pond is an historic water feature in town, I support the removal of the Mill Pond dam. The substantial cost of dam upgrades seems like a decadent way to spend tax payer dollars given the lack of functionality (for example power generation) offered by the current dam.

I also believe that an injustice was done to the Oyster River generations ago when the dam was built. I see the removal of the non-functioning dam as not just a cost-saving effort, but a way to free this tidal river - and the wildlife and fish that use tidal rivers - for the future.

It may be a big change in the short term, but restoring nature (the course of the river, natural flow, fish passage) is an act of hope. People in Exeter feared a changed river when they removed their dam a few years ago, and now you can barely tell the dam was ever there.

I hope we will take the bold step to restore this part of the Oyster River by removing the Mill Pond Dam.

Thanks for accepting my comments.

Malin Clyde
29 Orchard Drive
Durham, NH

April Talon

From: CHRIS NORTHROP <c.northrop@comcast.net>
Sent: Tuesday, November 24, 2020 8:19 PM
To: April Talon
Subject: Oyster River Dam at Mill Pond Feasibility Study

April,

I am in favor of **Alternative 5 – Dam Removal** for the following reasons:

1. removal would cost 1/3 that of stabilization
2. removal will restore tidal flow upstream of the dam. I believe the river should be restored to it's natural free flowing status
3. removal would mitigate flooding of adjacent properties
4. removal would substantially improve water quality

Though dam removal would eliminate a State Register-listed resource, which would require substantial mitigation to offset, I believe that is out-weighed by the fact that removal of the dam and restoration of the river channel would create a landscape that has not existed since the seventeenth century.

I hope these comments are useful.

Chris Northrop
9 Britton Lane
Durham, NH

April Talon

From: Todd Selig
Sent: Tuesday, December 8, 2020 11:07 AM
To: Richard Reine; April Talon
Subject: FW: the dam - feedback from shawn finnegan

Dear Rich and April,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: Todd Selig <tselig@ci.durham.nh.us>
Date: Tuesday, December 8, 2020 at 10:58 AM
To: shawn finnegan <shawniekins49@gmail.com>, johnny c <john.cerullo@unh.edu>
Subject: Re: the dam - feedback from shawn finnegan

Dear Shawn,

Thank you for your email. I've suspected at times that the original donor of the dam took a page from P.T. Barnum and knew very well what she was doing transferring (i.e., donating) the by then obsolete structure and the substantial long-term cost of maintenance/operation from her heirs to the citizens of Durham. Your suggestion would be in keeping with that tradition, but it would do nothing to address the negative environmental impact of the dam, which is also a significant concern of the Town.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: shawn finnegan <shawniekins49@gmail.com>
Date: Saturday, December 5, 2020 at 10:43 AM
To: Todd Selig <tselig@ci.durham.nh.us>, johnny c <john.cerullo@unh.edu>
Subject: Fwd: the dam

Good morning, Todd. Kitty I suggested I send an email to you about the town dam. It is below.

Hope you and your family are surviving all things covid/drought and now rain and snow/pesky and annoying Durham town residents.

shawn finnegan and john cerullo

----- Forwarded message -----

From: shawn finnegan <shawniekins49@gmail.com>

Date: Sat, Dec 5, 2020 at 8:12 AM

Subject: the dam

To: Katherine Marple <kittyfmarple@gmail.com>, Bridget Finnegan <bridgetfinnegan33@gmail.com>, terry finnegan <terryfinnegan@comcast.net>, johnny c <john.cerullo@unh.edu>, Mike Cleary <mike@pfmaine.com>, Peter Marple <petermarple@me.com>

I have a suggestion regarding the town dam. Since there are a number of people who would rather pay 5 million to keep it (and do the required ongoing dredging) instead of the roughly 1 mil to remove it, why not have the wealthy people, particularly those who live in and around the twee Durham village, purchase the dam and make it a private enterprise. Let them shoulder the costs.

Exeter was able to get rid of their dam and now it is a lovely set of rapids. Also, fish ladders aside, getting rid of the dam would be better for the environment.

shawn

April Talon

From: Todd Selig
Sent: Wednesday, December 23, 2020 1:42 PM
To: April Talon; Ingrid Stefl
Cc: Richard Reine; Walker, Peter
Subject: Re: Mill Pond Dam

Dear Ingrid,

Thank you very much for taking the time to write. You are accurate that the ecosystem and funding will take a high priority as part of local discussions concerning the future of the dam. There is significant funding opportunity for dam removal for the very reasons you outline. There is not meaningful external funding available for dam repair.

Have a happy and safe holiday season.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: April Talon <atalon@ci.durham.nh.us>
Date: Wednesday, December 23, 2020 at 1:29 PM
To: Ingrid Stefl <i_stefl@yahoo.com>
Cc: Richard Reine <rreine@ci.durham.nh.us>, Todd Selig <tselig@ci.durham.nh.us>, "Walker, Peter" <PWalker@VHB.com>
Subject: RE: Mill Pond Dam

Dear Ingrid – thank you very much for taking the time to write. Happy Holidays to you and your family.

From: Ingrid Stefl <i_stefl@yahoo.com>
Sent: Wednesday, December 23, 2020 6:24 AM
To: April Talon <atalon@ci.durham.nh.us>
Subject: Mill Pond Dam

Dear Ms. Talon.

I am a relative of long-time Durham residents formerly known as the John (deceased) and Johonet Wicks family. My uncle John was my mother's brother. My Aunt Johonet changed her surname back to her maiden name, Carpenter, and she still lives in the house on Riverview Court off of Route 4 which they built in the early 1960's. I spent many summers visiting them as my cousin, Lindsey, and I became close friends. Later, I went to Oyster River High School my Junior year (1972-73) and then attended and graduated from Plymouth State College, as it was known then. I did return to my home state,

Michigan, after that to attend graduate school and have lived in the Detroit area where I grew up for most of my adulthood. I have a deep love for the State of New Hampshire and Plymouth, Durham, and the White Mountains in particular!

Since I am no longer a resident of Durham and haven't been for decades, I realize my opinion must be taken with a large grain of salt. Also, I read that the Mill Pond's existence is threatened, which might not even be accurate. I briefly subsequently read that there is a question about the dam. I think our nation installed far too many dams in the early 1900's. I know dams have their benefits, but also there are more consequences than people realized back then. I just want the Town to do whatever is best for everyone and the ecosystem.

Funding is a common problem and I am aware that the State only has a property tax and no income tax. I don't know if the State of N.H. would help a town to fund a project of this type, but it would be in the best interest of the State to help due to the fact that the Oyster River is an estuary and has a farther reaching impact than just the town.

There are other funding ideas that are probably being considered, outside of the town's tax base and budget. For example, has anyone thought about asking your local U.S. Congress people and the State Senators to try to obtain help from the Federal government? Also, it seems logical that there could be an online fundraiser, such as, but more professional than a Go Fund Me page. You know that there are people all over the world who once lived in Durham, whether as a university student or more permanent resident. I would contribute to such an endeavor. And, one of my friends here in Michigan grew up on Cape Cod and graduated from U.N.H. in the 1980's.

Thank you for taking the time to read my comments. I wish you all the best as you work with everyone to do whatever is best for the people and the ecosystem!

Sincerely,

Ingrid Nelson-Stefl

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 1:13 PM
Subject: FW: Dam Removal Motion - feedback from James Bubar
Attachments: APPROVED HDCHC Recommendation to TC - Mill Pond Dam.docx

Dear Members of the Council,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: "James@Bubar.org" <james@bubar.org>
Reply-To: "James@Bubar.org" <james@bubar.org>
Date: Friday, January 8, 2021 at 1:01 PM
To: Todd Selig <tselig@ci.durham.nh.us>
Subject: FW: Dam Removal Motion

Todd,

I am saddened our Historic District Commission has aligned with "Historic preservation seeks to protect a 'sense of place' that is important to a community – special places that reflect unique human history over time" while diminishing the indigenous peoples' heritage and the natural course of our waterways. I have not been in Durham that long, but my heritage is on being raised on the beauty and ever-changing nature of a free run river. Whether it is climate change or dam rivers, we have interfered with nature far too much and far too long, it is high time for us to give back.

I would also contend that 84% of citizen who completed the Master Plan Survey is far short of a majority of residents. If the Town Council is unable or unwilling to support the environmental and ecological approach to removing a dam, then take it to a citizen referendum at the next election. I realize that we rarely, if ever, get a majority of citizens voting in the spring but those who don't vote have given their proxy to those of us who do vote.

James A Bubar

From: Michael Behrendt <mbehrendt@ci.durham.nh.us>
Sent: Friday, January 8, 2021 11:06 AM

To: external forward for sneedell <sneedelltc@gmail.com>; Mary Ann Krebs <krebsma@gmail.com>; James Bubar (james@bubar.org) <james@bubar.org>; Jacob Kritzer (Jake.kritzer@gmail.com) <Jake.kritzer@gmail.com>; John Nachilly (nachilly@gmail.com) <nachilly@gmail.com>; walter rous (walterrous@gmail.com) <walterrous@gmail.com>; Coleen Fuerst (cfuerst@durhamboat.com) <cfuerst@durhamboat.com>; Roanne Robbins <roannerobbins@me.com>
Subject: Dam Removal Motion

All,
Last night the Historic District/Heritage Commission voted to recommend to the Town Council that the dam be preserved. You can see the motion and background information on the attachment. While the HDC and Conservation Commission would likely be in alignment on many issues, alas, it is not a surprise that the two commissions have a different view on this very difficult issue.

Michael Behrendt

Durham Town Planner
Town of Durham
8 Newmarket Road
Durham, NH 03824
(603) 868-8064
www.ci.durham.nh.us

From: Sally Needell [<mailto:sneedelltc@gmail.com>]
Sent: Friday, January 08, 2021 10:50 AM
To: Mary Ann Krebs; James Bubar (james@bubar.org); Jacob Kritzer (Jake.kritzer@gmail.com); John Nachilly (nachilly@gmail.com); walter rous (walterrous@gmail.com); Coleen Fuerst (cfuerst@durhamboat.com); Roanne Robbins
Cc: Michael Behrendt
Subject: Dam Removal Motion

Conservation Commission,

I received the following from Kitty Marple: "Thanks to you and the Conservation Commission members for providing a well written, thorough report. This is a very difficult topic (as if you did not know) and this kind of recommendation is a very strong argument for dam removal."

I'll add my kudos to Jake for his willingness to write and his skill in writing our rationale!

Take care,
Sally

Recommendation to the Durham Town Council on the Mill Pond Dam

Durham Historic District Commission/Heritage Commission January 7, 2021

During the January 7, 2021 meeting, the Durham Historic District Commission/Heritage Commission voted (6-0) on the following motion:

The Durham Historic District Commission/Heritage Commission recommends that the Town Council move forward with Mill Pond Dam Alternative # 3 - Dam Stabilization, as the alternative that will ensure its continued preservation.

Historical Preservation and Community

Historic preservation seeks to protect a 'sense of place' that is important to a community – special places that reflect unique human history over time.

Indeed, the Town of Durham has stated its commitment to historic preservation in its 2011 Master Plan where “historic resources, including archeological, architectural, **engineering**, and **cultural heritage**, are important assets in Durham that contribute to the character and quality of life in the town.” *The town preserves, protects, and celebrates these resources.....*

The Town’s 2011 Master Plan Survey further indicates 84% of citizens who completed the survey, “agree “or “strongly agree” that the Town should preserve historic structures in order to protect and promote historic and cultural character.

The Durham Historic District Commission/Heritage Commission (established in 1975, and 2006 respectively) is charged with administering Article XVII, the Durham Historic Overlay District of the Zoning Ordinance, by:

- Safeguarding and preserving structures, places, and properties that reflect elements of the cultural, social, economic, religious and political heritage of the Town.
- Fostering the preservation, restoration, and rehabilitation of structures and places of historical, architectural, and community value.
- Conserving and improving the value of property within the District (generating increased tax revenue).
- Protecting and enhancing the attractiveness of the District to the citizens as well as visitors, and thereby providing economic benefit to the Town.
- Fostering civic pride in the beauty and noble accomplishments of the past.

Clearly, the Mill Pond Dam meets all these criteria.

The Mill Pond Dam - Significant Locally, State-wide, and Nationally

The Mill Pond Dam, originally the Oyster River Dam, is an important and distinctive cultural resource that helps Durham residents better understand how those who came before us shaped their lives, and how the environment in which we live today, evolved. The loss of this significant historic resource would erode the authenticity of Durham’s man-built landscape and our connection to it. It would rob the town, the State of New Hampshire, and the nation of a rare resource.

The Dam, Waterfall, and Mill Pond – Evolution of the Rural Landscape

Indigenous peoples first occupied land along Little Bay, Great Bay and the Oyster River but an abundance of fish and timber drew European settlers in the 17th century. In 1649, Valentine Hill, (whose house has become incorporated into Three Chimney's Inn), was the first to be granted water rights to dam up the falls at Oyster River and build a sawmill. Over time a grist mill, tannery, blacksmith shop, shingle mill, and cider mill were added. As the economy prospered, the settlement grew. Shipbuilding, associated trades, and homes soon populated the waterfront near the Old Landing and throughout the 17th and 18th centuries this area was the focus of village life.

Lt. Col Adams and General John Sullivan, whose houses are across from the Mill Pond Dam, led the raid on Fort William and Mary (now Fort Constitution) in 1774 where British cannons and gunpowder were seized. The raid is now recognized as one of the first overt acts of the American Revolutionary War, and the only battle to take place in the state of New Hampshire.

Valentine Hill's sawmill needed a dam and mill pond to impound water to regulate flow to a water wheel to turn logs into lumber. This early use of water-powered technology on the Oyster River altered the landscape. Remnants of that altered landscape – the dam on the Oyster River (albeit a more modern version), the 18th century houses that survive clustered near the mill pond and Old Landing, and the spatial orientation of those houses to the waterfront – are visual reminders of our cultural heritage. Removing tangible evidence of that process of change – of the people who occupied, developed, used, and shaped the land to serve their human needs – seems short sighted. It diminishes a unique characteristic of Durham – that has survived from the Colonial times.

The Mill Pond Dam as Technological Marvel

The Mill Pond Dam is significant for its design and construction, embodying distinctive characteristics of the Ambursen dam type, with a concrete slab and buttress method of construction. This method of fabrication represents cutting edge technological advances in dam engineering of the early 1900s. Of New Hampshire's 5,000 dams, the Mill Pond Dam is the oldest of seven Ambursen-style dams known to exist in New Hampshire.

The engineer responsible for construction of the Mill Pond Dam was Charles Elbert Hewitt (1869-1934) of the New Hampshire College of Agriculture and the Mechanic Arts, now the University of New Hampshire. A native of New Hampshire, Hewitt graduated from New Hampshire College (then in Dartmouth) in 1893, and received a Master's Degree in Mechanical Engineering from Cornell in 1895. Hewitt moved to Durham and joined the New Hampshire College faculty as a professor and head of the electrical engineering department. In 1915, he was appointed Dean of the Engineering Division. The former Shop Buildings at UNH were named in honor of Professor Hewitt in 1942.

The contractor for the Mill Pond Dam was the D. Chesley Company of Durham. Daniel Chesley (1859-1953) was an experienced local contractor, stonemason, and successful farmer. Although he initially specialized in granite masonry, Chesley became adept in the use of concrete in the early 1900s. Listed in the town directories (beginning in 1898) as a stone contractor and stonemason, he advertised in 1905 as a stone contractor and builder with the granite quarry on the Dover-Durham Road (now site of Durham Public Works). Daniel Chesley was responsible for many of the structures built in town during the early 1900s.

Mill Pond Dam - Part of a Tradition of Philanthropy to the Town and the University by the Hamilton Smith Family

Mrs. Edith Angela Congreve Onderdonk built the new state of the art Mill Pond Dam in memory of her step-father Hamilton B. Smith who died in 1900.

When one of the old timber replacement dams at Mill Pond washed out in 1912, the pond drained, leaving a muddy swampy shore. The picturesque view overlooked by Red Tower (the Smiths' family home), and other Main Street houses, and the Congregational Church was lost, and the water level in the river upstream near Smith Chapel dropped. At a time when dam construction was not a municipal activity and the water power was of minimal use for local industry, Mrs. Onderdonk gave the funds for the dam in order to preserve the beauty of the Mill Pond in memory of her stepfather.

Hamilton B. Smith (1840-1900) was born and raised outside of Louisville, Kentucky, near his father's coal mines in Cannelton, Indiana. He spent time with his grandparents in Durham (18 Main) in the 1850s. Self-taught as an engineer, Hamilton Smith became an expert on hydraulic mining. From California gold mining in the 1870s, he worked for the Rothschilds in Venezuela and then formed his own South African gold and diamond mining firm based in London. Smith was involved in underground railway construction in London and Paris and invested in Alaskan mining. Hamilton Smith and Alice Robinson Jennings Congreve (Edith's mother) were married in London in 1886.

Hamilton Smith enjoyed his home in Durham, the iconic Red Tower at the top of Church Hill, only a few years. He died suddenly in 1900 in a boating accident on the Oyster River, just before his sixtieth birthday. He is buried near the river and his widow Alice Hamilton Smith erected the stone Smith Chapel in his memory.

The Smiths were philanthropic supporters of the new local college. In 1897, a donation of \$10,000 established the Valentine Smith scholarship for non-resident students. Later, Smith's will bequeathed \$10,000 for construction of a public library in Durham, and was used to build Hamilton Smith Library (now Hamilton Smith Hall) jointly with the College and Andrew Carnegie in 1907.

Eventually, the Smith Estate would be divided between Dartmouth College and New Hampshire College (UNH). While Edith Onderdonk built the Mill Pond Dam as a memorial to her step-father in 1913, she gave \$16,000 to New Hampshire College for construction of a women's dormitory in memory of her mother. With an additional \$10,000 from the State, Smith Hall was built in 1908.

Summary

The period of significance for the Durham Historic District spans from the 1600s to after 1900. In the heart of the Durham Historic District, the Mill Pond Dam remains a highly visible connection to our past. It represents the continuum of time between our earliest village center and our modern landscape.

The waterfall at Mill Pond Dam remains one of the most iconic images in Durham. While conservation issues are important to us all, there are numerous examples of successful collaborations between conservation and historical commissions. The goals of historic preservation need not be sacrificed to optimize the environmental benefit at Mill Pond. Nor should our history be sacrificed in exchange for

an unwillingness to expend financial resources. The life and the work of Durham residents who came before us must not be diminished by the removal of a most precious legacy. The Historic District Commission/Heritage Commission respectfully requests that the Town Council vote to enact Option #3 Stabilization of the Mill Pond Dam.

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 1:11 PM
To: April Talon; Richard Reine
Subject: FW: Public Comment on Mill Pond Dam
Attachments: mill pond dam_Houle.docx

From: James Houle <James.Houle@unh.edu>
Date: Friday, January 8, 2021 at 1:02 PM
To: Durham Town Council <council@ci.durham.nh.us>
Subject: Public Comment on Mill Pond Dam
Resent-From: <council@ci.durham.nh.us>

Dear Durham Town Council

Please accept these comments on the Mill Pond Dam

Thank you

Jamie

James Houle, PhD., CPSWQ, CPESC
Program Director
The UNH Stormwater Center
Dept of Civil and Environmental Engineering
35 Colovos Road
University of New Hampshire
Durham, NH 03824
Phone: 603-862-1445 Fax: 603-862-3957
web: <http://www.unh.edu/unhsc/>

January 8, 2021

Dear Durham Town Council,

I write to express my strong support for removal of the Mill Pond dam on the Oyster River based on fiscal responsibility and public safety.

Eleven years ago, as the chair of the Durham Conservation Commission we took up the issue of addressing deficiencies with the Mill Pond Dam. The options were twofold, repair the Dam or restore the free-flowing river through removal. Back then we procured \$100,000 from the NH coastal program to conduct a feasibility study. In addition, the issue was addressed by two UNH senior projects at the time.

Prior to these efforts we were in possession of an engineering study from Stevens Associates that compared repair, estimated at a cost between 1.1 to 1.7 million to removal which ranged between \$600,000 to \$800,000 in 2008 dollars.

The results of both senior projects were similar finding that repair, if the structural integrity of the dam was in fact repairable, would incur costs upward of 1.5 million dollars and removal of the dam and restoration of the river upward of \$400,000.

What was inevitably opted for was a short-term repair that was estimated to be between \$50,000 to \$150,000, essentially punting the problem to the next generation of volunteers and resource managers.

Fast forward to the present and we are debating this issue again. We have spent yet another untold amount of money on more feasibility studies, this makes at least 5 studies and no less than \$300,000 to collect information that largely hasn't changed. The dam is still structurally deficient, a threat to downstream habitat and properties and the pond behind the dam highly eutrophic with low dissolved oxygen and limiting to migrating fish. The 2002 letter of deficiency still looms over the dam and constitutes a neglected responsibility for past, present and future populations in the town. What has changed is the price tag to deal with this burden. Now, instead of 1.5 million to repair the dam, we are looking at 4 to 5 million and instead of \$400,000 to \$800,000 to remove the dam and restore the river we are looking at 1.3 million.

This is not to ignore the environmental and water resource benefits of a restored river which others will likely address more than I am here. Imagining a potential restoration of the College Brook watershed coupled with a restored downstream Oyster River would likely address many of the flooding and other problems that have been discussed with respect to other proposed development in the town. Indeed, many of the environmental and water resource benefits of a free-flowing river have been made in the past and alone have not led to the actions necessary to lift the onus of the deficiency. Ignoring the problem does not benefit anyone whether they are for repair, removal or indifferent.

The time to act is now, we can not afford to miss this opportunity to address this burdensome responsibility and subjugate yet another generation of decision makers and taxpayers and untold more

millions of dollars to its unavoidable consequence. Let us do the right thing and restore the oyster river and take care of this burden once and for all.

Sincerely

James Houle
95 Mill Road
Durham, NH 03878

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 10:34 AM
To: April Talon; Richard Reine
Subject: FW: From Dennis Meadows: essay for the Council packet
Attachments: Dam facts.pdf

From: Jennie Berry <jberry@ci.durham.nh.us>
Date: Friday, January 8, 2021 at 10:25 AM
To: Allan Howland <al.howland.13@gmail.com>, Andrew Corrow <andrew_corrow@yahoo.com>, Carden Welsh <cardentc2@gmail.com>, Dinny Waters <dinny.tod@gmail.com>, 'Jim Lawson' <lawsonje24@comcast.net>, "'kittyfmarple@comcast.net'" <kittyfmarple@comcast.net>, Sally Needell <sneedelltc@gmail.com>, Sally Tobias <Sally.tobias@me.com>, Todd Selig <tselig@ci.durham.nh.us>, Wayne Burton <wburton@northshore.edu>
Subject: FW: From Dennis Meadows: essay for the Council packet

Dear Councilors,

From Dennis Meadows for your information.

Jennie--

Jennie Berry
Admin. Assistant
Town of Durham
8 Newmarket Road
Durham, NH 03824
(603) 868-5571

From: Dennis Meadows [mailto:latailled@aol.com]
Sent: Friday, January 08, 2021 10:17 AM
To: Jen Berry
Subject: From Dennis Meadows: essay for the Council packet

Jennie, I attach the paper I would like to have included in the Council packet of materials related to the dam discussion next Monday night.

Thank you for your help.

Dennis

DATE: January 8, 2021

FROM: Dennis Meadows Durham, NH 03824

TO: Durham Town Council

RE: Dam facts

As a resident of Durham for over 30 years I have witnessed several cycles of concern, resolve, deliberation, and dispute over the fate of the Mill Pond Dam. I am happy this debate is about to end.

I have many personal connections to the issue. Hamel Brook runs through my property to merge with the Oyster River in the Mill Pond Reservoir. That reservoir forms the western border of my land. I purchased and then gave to Durham the northern half of the pasture long Route 108 which fronts on the Oyster River and the Mill Pond. Last year I helped Durham purchase a 25 acre parcel that abuts the Oyster River near the Mill Pond. This year I have overseen the permitting, design, and construction of the pedestrian bridge to link that new land with the center of Durham, giving Durham residents easy walking access to miles of trails in the conserved lands just south of the village center. Thus many people have asked what I think would be the best strategy for dealing with the problems posed by the current dam. Until now I replied that I honestly did not have an informed opinion on the matter. I saw pros and cons associated with all the options that have been discussed.

However, I have recently spent several days informing myself about the issue. Now I know what I would do. I've talked with April Talon and with Peter Walker. I've studied the incredibly diverse data in the really excellent vhb report. I have watched the Conservation Commission and the Historical Commission discussions. I have walked or driven around the entirety of the affected area.

I now believe Durham should adopt Alternative 3 of the vhb report - dam stabilization without Option 1 - pond dredging. I reached that opinion because of three facts.

Fact 1. [Removing the dam will not "restore nature."](#) It will simply replace one complex ecosystem with another. It would improve the situation for fish

in the future, but it would damage the habitat for many mammals now. My land is the home for deer, bear, beavers, otters, mink, muskrats, raccoons, possums, bats, many types of turtle, thousands of different insect and plant species, and more. Many of them would suffer from dam removal - some greatly. The current ecosystem has evolved over the 370 years since the first dam was built. If we destroy that ecosystem, another, different one will certainly evolve. But the transition will take at least a decade or two. It will require substantial investment, and it will entail a sustained battle against invasive plants and insects. It may even generate a significant stench. There is not yet any long-term plan and no budget estimate for the efforts required to making that transition successfully.

Fact 2. [The dam is a key element in the town's identity.](#) If you search for "Durham, NH" on the web, the first image Google shows you is a photograph of the dam. The town's logo shows a stylized version of the estuary below the dam. The town grew up around the mill complex enabled by the dam, a complex that began almost a century before Durham was incorporated.

All the other important gateways into Durham now feature massive building complexes. Only Route 108 from the south with its pasture, dam, and Oyster River estuary demonstrate concretely Durham's commitment to protecting the environment. Each day about 20,000 drivers pass by and enjoy this view. Should we give all that up in order to gain a mile of additional fish habitat?

Fact 3. [Estimates for the immediate financial cost of each option should not determine the choice.](#) The cost estimates for dam restoration and dam removal certainly contain errors, they are incomplete and, in any event, relatively small. A bond issue to pay for the most expensive option - stabilizing the dam and dredging the pond could be repaid over 20 years by increasing the Durham's total municipal budget less than 0.3%. That bond would cost less in real terms than the bond issues Durham citizens approved in 1989 to buy Wagon Hill Farm or the bond issued in 2003 to conserve land. The cost for Alternative 3 alone is very much less. It is estimated to be only three times what Durham already paid for the vbh study.

Through a year of involvement in our successful project to build a bridge over the Oyster River, I have learned about the procedures for the waivers and permits we will need to secure in order to carry out Alternative 3. At least we can identify them, and we know they are feasible. If we remove the dam we will confront a series of environmental, economic, and regulatory issues that we can not yet fully identify. We can't say with assurance that they will have attractive solutions.

If we restore the dam and do not dredge, the reservoir will continue to fill up with sediments. There will be a natural evolution towards a meadow. The delays and the processes involved are uncertain, but no more uncertain than our assumptions about the ecosystem post dam removal.

The evolution of the meadow would offer wonderful opportunities for learning and interpretive signage. And I believe that three decades from now Durham will have gained a valuable new recreational resource.

I hope Durham's leaders will choose the best strategy for the town and then work to minimize Durham's costs rather than choose a low cost for the town and then work to minimize Durham's options.

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 10:06 AM
To: h. heilbronner
Subject: *FW: Mill Pond matters - following up with Phyllis Heilbronner

Dear Phyllis,

I've passed along your concerns/thoughts to the Council. If you would like to provide additional feedback, feel free to email the Council directly at council@ci.durham.nh.us. We've received voluminous reports and years of ongoing feedback from engaged residents so my sense is the board is very familiar with the different perspectives of all parties, but additional feedback continues to be most welcome.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: Andrea Bodo <afbodo@gmail.com>
Date: Friday, January 8, 2021 at 9:58 AM
To: Todd Selig <tselig@ci.durham.nh.us>, Craig Stevens <dcat@ci.durham.nh.us>
Subject: Fwd: Mill Pond matters

Begin forwarded message:

From: Phyllis Heilbronner <h.heilbronner@comcast.net>
Subject: Mill Pond matters
Date: January 8, 2021 at 9:50:17 AM EST
To: andrea bodo <afbodo@comcast.net>

I watched the discussion last night on my kitchen t.v. as I'm not up to the Zoom technology. You were terrific, as was Diana Carroll, as always. I wonder if you could add my name to those of us pond and river abuters favoring either the referendum suggestion or rehabilitation. I'm certainly not in favor of making a decision on anything that brings the dam down. You know I strongly favor dam rehabilitation for so many reasons, which I wish I would have better options of expressing than sending letters, which don't seem to have the impact others have. There were many references to Laurel Lane last night, but those of us on the Mill Pond Rd. side certainly want to preserve the dam and the river, which is not only such a huge part of town history, but for us, it's what makes our lives and the value of our properties of great

importance.

Thanks for all your efforts. I really need help with my limited technology skills, but during this pandemic I'm not finding it easy to have people here to help me use Zoom . Phyllis

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 10:01 AM
Cc: April Talon; Richard Reine
Subject: FW: h

Dear Members of the Council,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

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From: Todd Selig <tselig@ci.durham.nh.us>
Date: Friday, January 8, 2021 at 9:59 AM
To: Andrea Bodo <afbodo@gmail.com>, Craig Stevens <dcat@ci.durham.nh.us>
Subject: Re: h

Dear Andrea,

Their best option would be to write a letter or an email. That will be reviewed by everyone involved. However, Craig will have to advise about calling in.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: Andrea Bodo <afbodo@gmail.com>
Date: Friday, January 8, 2021 at 9:57 AM

To: Todd Selig <tselig@ci.durham.nh.us>, Craig Stevens <dcat@ci.durham.nh.us>

Subject: h

Good morning,

I received emails from both Anita Pilar and Phyllis Heilbronner regarding their voice being heard on the Mill Pond Dam. Neither can do ZOOM.....and feel left out by their only options of sending letters. Is there any possibility of their being able to phone in to the Town Council public hearing on the dam ? Anita is now blind and both she and Phyllis have no one to help them.

When Andy Corrow read the HDC opening about COVID, I thought I heard him read that you could call in.

Andrea

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 9:55 AM
To: Bernadette Komonchak
Cc: April Talon; Richard Reine
Subject: *Re: Mill Pond - following up wit Bernadette Komonchak

Dear Mrs. Komonchak.

Thank you very much for this feedback. I know the members of the Town Council will appreciate it and give the entire matter careful consideration.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

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From: Bernadette Komonchak <bernie_nh@hotmail.com>
Date: Thursday, January 7, 2021 at 6:27 PM
To: Durham Town Council <council@ci.durham.nh.us>
Subject: Mill Pond
Resent-From: <council@ci.durham.nh.us>

I attended, along with many townspeople, the meeting held many years ago to determine the fate of Mill Pond. Two groups for whom I have high regard, the conservation group and the historical society, presented their cases. Following that meeting the town council elected to do nothing except allow the pond to degrade to the sad condition it is in now. One thing I remember from that meeting is that there are a number of other dams above ours. If the goal is restoration of the river, wouldn't a state program be a better course? Is taking our one dam down going to achieve the goal of the conservationists? I have also heard rumblings about turning the pond lands into a park. I am for leaving it in its natural state so we can continue to observe the wildlife around the pond.

For those of us with long memories, we mourn the loss of the pond as a gathering place for skaters from all over Durham. Young kids, teenagers, UNH students and oldsters all congregated on the pond. On moonlit nights, teenagers from Faculty neighborhood extended the skating into the night. Neighborhood children, now grown, have fond memories of those days.

I acknowledge that my affection for the pond is based on my 47 years of walking there and on to the estuary below the dam. Removing the dam would surely eliminate the pond and reduce the water entering the bay to a small stream. It's hard for me to picture that. I have friends who are more recent arrivals to Durham who view the pond as an eyesore. As I've said before, there are lovers of parks and lovers of nature with all its wildness and complexity. I'm in the second category.

Bernadette Komonchak
1 Thompson Lane

Sent from Jupiter

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 9:49 AM
Cc: April Talon; Richard Reine
Subject: FW: Conservation Commission Motion Regarding Mill Pond Dam on Oyster River
Attachments: Con Comm Mill Pond dam rec to Town Council 01.04.2021.docx - Google Docs.pdf

Dear Members of the Council,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

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From: Sally Needell <sneedelltc@gmail.com>
Date: Friday, January 8, 2021 at 8:44 AM
To: "'kittyfmarple@comcast.net'" <kittyfmarple@comcast.net>, Todd Selig <tselig@ci.durham.nh.us>
Subject: Conservation Commission Motion

Kitty and Todd,

I have attached the motion regarding the Mill Pond Dam and the rationale from the Conservation Commission.

The motion was passed on December 28, 2020. The explanation accompanying the motion was approved by consensus on January 4th.

Sincerely,
Sally N.

Recommendation to the Durham Town Council on the Mill Pond Dam

Durham Conservation Commission

January 4, 2021

During the December 28, 2020 meeting, the Durham Conservation Commission voted on the following motion:

The Conservation Commission recommends that the Town Council move forward with Alternative #5 for removal of the Mill Pond Dam as the alternative that will bring about the widest range of environmental benefits.

The motion passed unanimously, with one abstention.

In offering this recommendation, the Commission thanks Town Engineer April Talon and Peter Walker from VHB for providing a clear and concise briefing on the dam feasibility study. The Commission also commends VHB for producing a thorough and informative report on the study.

The study strongly concludes that, in addition to the fiscal, public safety, and other benefits, a number of important environmental benefits are expected to result from removal of the dam. These include, but are not limited to:

- Fish passage – Populations of anadromous or ‘sea-run’ herring (i.e., alewife and blueback herring) have fallen to less than 5% of the abundance seen as recently as the early 1990s. These fish serve a number of important ecological functions, especially as prey for a wide range of natural predators (marine mammals, cod, striped bass, ospreys, bald eagles, and more) and also as upstream vectors of carbon and energy from marine to freshwater ecosystems. They are listed as ‘species of concern’ by the National Marine Fisheries Service and in need of urgent restoration efforts across their range. Other sea-run species that could benefit from unobstructed passage include American eel, sea lamprey, and brook trout.
- Water quality – The Mill Pond dam adversely impacts water quality in several ways. By trapping and concentrating nutrients, the pond is prone to algal blooms. When the algae die off, bacterial decomposition uses up much of the dissolved oxygen in the water, resulting in anoxic or even hypoxic conditions. Impoundments like Mill Pond also contribute to thermal pollution given that water experiencing reduced flow in a shallow area with larger surface area warm more than naturally flowing river waters. This can create sub-optimal temperature conditions for resident species, promote growth of pond-dwelling invasive species, and exacerbate low oxygen conditions given that warm waters hold less dissolved oxygen than cooler waters.
- Sediment transport – An important function of rivers is to move sediment from the watershed to downstream areas, especially coastal marshes that provide habitat, buffer storm surge, and provide other important ecological functions. As effects of climate change increase, enabling marshes to keep pace with rising sea levels and stronger storms will be vital for coastal resilience. Restoring the ability for the river to move sediment will also help recover the natural river channel, for the benefit of resident wildlife and recreational activities.
- Wetland restoration – Wetland habitats are currently distributed in areas upstream of the dam, but many are not the types of wetlands that would naturally be found in the lower reaches of a coastal river. Tidally influenced wetland habitat has been lost by construction of the dam, but can be recovered by its removal. These habitats serve a wide variety of ecological functions, but

are vulnerable by virtue of the narrow range of conditions in which they can establish. Enabling tidal influence to reach further upstream will promote restoration of these vital habitats.

The Commission recognizes that removal of the dam represents a major change for the river and the community, but one with many positive benefits. Such positive changes have been witnessed in the myriad of other communities that have removed dams, including nearby Exeter.

However, removing the dam will not address all of the environmental stressors facing the Oyster River watershed and Great Bay. Therefore, the dam removal should serve as a springboard for expanded watershed-wide environmental stewardship activities. Building from important efforts to protect upstream open space along the river (College Woods, Oyster River Forest) and ongoing active restoration efforts (Japanese Knotweed Project, Wagon Hill Living Shoreline Project), the Town and partners should address a number of other issues. These include, but are not limited to:

- Nutrient inputs – Policies and practices by governments, residents, and other landowners should continually evolve to reduce nutrient inputs, especially from fertilizers, and better manage run-offs to minimize loading into the river.
- Tributary management – Watershed health will not be determined solely by activities along the mainstem of the Oyster River. Tributaries including College Brook, Hammel Brook, Pettee Brook, and others collectively represent significant additional stream habitat and influence the mainstem.
- Additional fish passage – Although the dam represents the first barrier and most significant bottleneck in the system, it is far from the only impediment to the free movement of sea-run and resident fishes. A high priority restoration target should be providing fish passage at the Oyster River Reservoir, at least through installation of a modern fish ladder engineered to contemporary precipitation and flow conditions. Additionally, other barriers (culverts, small dams, etc.) should be prioritized for removal or engineers to maximize habitat connectivity.

The Commission thanks the Town Council for considering our recommendations to improve the ecological health of the Oyster River. We welcome any questions about our position and continued discussion and collaboration moving forward.

April Talon

From: Todd Selig
Sent: Saturday, January 2, 2021 5:01 PM
To: Freedman, Diane
Cc: April Talon; Richard Reine
Subject: Re: Mill Pond Dam - following up with diane freedman

Dear Diane,

Thank you for your feedback. I'd recommend you be sure to take part in the upcoming public hearing on the dam with the Council later this month. We'll share your note with the Council.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

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From: "Freedman, Diane" <Diane.Freedman@unh.edu>
Date: Tuesday, December 29, 2020 at 7:08 PM
To: Todd Selig <tselig@ci.durham.nh.us>
Subject: Mill Pond Dam

I just learned that the conservation commission had a recent meeting discussing the Oyster River Dam and the Mill Pond. I was not aware. I heard only that there was to be a public meeting on January 11, in which I plan to participate.

Any and all meetings regarding the Oyster River impoundment should be communicated to abutters and community members with longstanding and well-expressed interest in the subject. I have made that necessity and good abundantly clear to April Talon, to you, and the Town Council.

I would have presumed any other Town committee would follow that lead!

Please convey my surprise, grief, and a request for public input to any decisions any relevant committee is empowered to make.

I also expressed previously my surprise that feedback to a series of documents around the Mill Pond were expected by December 4 with a tiny lead time and NO inclusion of requested important documents such as PRIOR large and public hearing on the dam in the past, including, in particular, the MILL POND TASK FORCE headed at the time by Dwight Baldwin.

Diane P. Freedman
author of [_Midlife with Thoreau: Poems, Essays, Journals_](#) (Hiraeth, 2015)

Hiraethpress.com
Professor of English
Core Faculty Member in Women's Studies
University of New Hampshire
Durham, NH 03824
dpf@unh.edu

April Talon

From: Todd Selig
Sent: Saturday, January 2, 2021 5:09 PM
To: Scot Calitri; Jen Berry
Cc: April Talon; Richard Reine
Subject: Re: Mill Pond Dam - following up with Scot Calitri

Dear Scot,

Thank you very much for your feedback regarding the Mill Pond Dam on the Oyster River. I will share it with the Town Council for their information and review.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

Do your part to help stop the spread of Covid-19: Wear a mask around others, avoid close physical contact, monitor your health, wash hands/disinfect!

From: Scot Calitri <smcalitri@gmail.com>
Date: Tuesday, December 29, 2020 at 10:57 AM
To: Todd Selig <tselig@ci.durham.nh.us>, Jennie Berry <jberry@ci.durham.nh.us>
Subject: Mill Pond Dam

Hi All and Happy Holidays!

I'm looking to make contact with whoever is leading the evaluation and next steps on the Mill Pond Dam.

Other than saving our town millions of dollars, the removal of the dam will restore native fisheries that have been squashed for generations. As a conservationist and town resident I would like to help solidify the plans to remove the dam in a responsible, environmental and aesthetic manner.

Thanks for leading me in the right direction!

Scot Calitri
125 Longmarsh Rd.

April Talon

From: Harris, Larry <Larry.Harris@unh.edu>
Sent: Friday, January 8, 2021 2:39 PM
To: April Talon
Cc: Todd Selig; Jen Berry; Richard Reine
Subject: FYI
Attachments: Thoughts on historic district commission meeting.docx

Dear April,

I have attached a short letter I wrote in response to what I heard and saw at the HDC meeting last night. I sent it to the HDC, but thought it was relevant to share with you and beyond that considering what is at stake here. All the best, Larry

Dear HDC Members:

I just read a copy of your recommendation on the Mill Pond Dam and am most in favor. Thank you. This is a short note to address some items in last night's presentation on the Mill Pond Dam. You should have a copy of the letter I sent before the meeting so I just want to speak to a couple of items that came up during the presentation by Peter Walker and Diana Carroll's comments.

1. Diana Carroll mentioned that during significant rain events, College Brook turns the color of chocolate milk due to sediment content. This is exactly what happens to the Oyster River after the same rain events. The first indication of a heavy rain is the discoloration of the Oyster River flowing behind our house at 56 Oyster River Rd.
2. Images presented by Peter Walker from the VHB report and presentation.
 - a. The image of the restored channel by the removed dam. The image shows a narrow channel lined by rock and grass and bushes planted to make it appear as a park. However, that would be impossible because as the report and Mr. Walker stated, the area would be inundated by salt water at high tides which would allow only salt marsh vegetation, likely including the invasive Phragmites, the tall invasive reed that is taking over cattail and salt marshes.
 - b. The image looking up the Hamel Brook section of the backwater with a lush meadow and shallow stream. The reality is that during drier periods of the summer, there is very little water in that section and Buckthorn and other invasive plants will dominate the newly exposed shoreline. Those of us who abutt the Mill Pond backwater have seen how little water is left during previous drawdowns.

It is the town and UNH who determine how much water is released from the reservoir farther up the Oyster River since that is the source of water for the town and university and very little is shared with the Oyster River during the summer.

Respectfully submitted,

Larry G. Harris
56 Oyster River Rd.
Durham, NH 03824
603-868-5182
Larry.harris@unh.edu

April Talon

From: Todd Selig
Sent: Friday, January 8, 2021 2:53 PM
To: April Talon; Richard Reine
Subject: FW: DHA Statement on Mill Pond Dam - 1/8/2021
Attachments: DHA - Mill Pond Dam Statement - January 8, 2021.pdf

Dear April and Rich,

For your general information.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
a: 8 Newmarket Rd., Durham, NH 03824 USA
t: 603.868.5571 | **m:** 603.817.0720 | **w:** www.ci.durham.nh.us
He/him/his pronouns

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From: DAVID STRONG <luckychuck@comcast.net>
Date: Friday, January 8, 2021 at 2:14 PM
Subject: DHA Statement on Mill Pond Dam - 1/8/2021

Attached is the Durham Historic Association's statement regarding the Town Council's **Mill Pond Dam On Oyster River Feasibility Study** public hearing scheduled on Monday, January 11.

Respectfully,

David Strong
DHA President

Dated: January 8, 2021

To: Durham Town Council

Cc: Todd Selig, April Talon, Durham Historic District Commission/Heritage Commission, Durham Conservation Commission, Jennie Berry

As the Durham Town Council weighs the options for the Mill Pond dam, the Durham Historic Association wishes express its concern that a great deal more is at stake for the people of Durham than the loss of an historic 1913 dam.

As the oldest historical society in New Hampshire the DHA has been a guardian of Durham's history since 1851 and as such it is important to remember the long arc of Durham's history in this area. The site of the natural falls of the Oyster River at the head of the tide and the freshet was the perfect place for Thomas Beard and Valentine Hill to build the first dam on the Oyster River in 1649 by a grant from the selectmen of Dover. Since the earliest settlement of our town to the present day there has always been a dam, a mill pond, and a bridge, surrounded by the homes and the businesses of the community.

Walking or driving through Durham as you cross the Oyster River bridge you see the water from the mill pond flowing over the dam into the Oyster River heading downstream surrounded by the gently sloping land upon which sit new and historic houses. The relationship of these visual elements in the landscape that Durham residents hold dear is what is at stake. Removing the dam results in a dramatic alteration of the river, the elimination of the mill pond, and the loss of the historic landscape that has existed for three hundred and seventy-two years.

The citations below demonstrate all the ways the Mill Pond dam area has been valued and given recognition by the community, the state, and the federal government:

1. The inclusion of the dam and adjacent historic homes in the Durham Historic District certified on the National Register of Historic Places since 1980.
2. The listing of the Mill Pond Dam on the New Hampshire State Register of Historic Places in 2013. NHDHR's "Statement of Significance: The site of Durham's earliest mills dating from 1648, providing waterpower for local industry for 300 years. The existing concrete dam has been in place since 1913. The dam provides the historic impoundment."
3. Six gifts of land and money for the preservation of the Mill Pond, the Dam and the Mill Pond Parks for the benefit of townspeople and the public from generous Durham residents over many years:
 - a) The donation of the dam and other secured rights by Edith Onderdonk prior to 1913 dam construction.
 - b) The Dorothy Wilcox gift of \$67,000.
 - c) The Milne Park parcel on Mill Pond Rd. in 2006.
 - d) The Runlett parcel that is the triangle of town owned land at the north bridge abutment in 1912.
 - e) The Community Church donation of all the land on the north shore of the Mill Pond between 1980 and 1992.
 - f) The La Taille de USA (Dennis Meadows) parcel on the south shore in 2018.
4. The support of the 2013 Town Council Resolution to retain the Mill Pond Dam for the duration of its natural life.

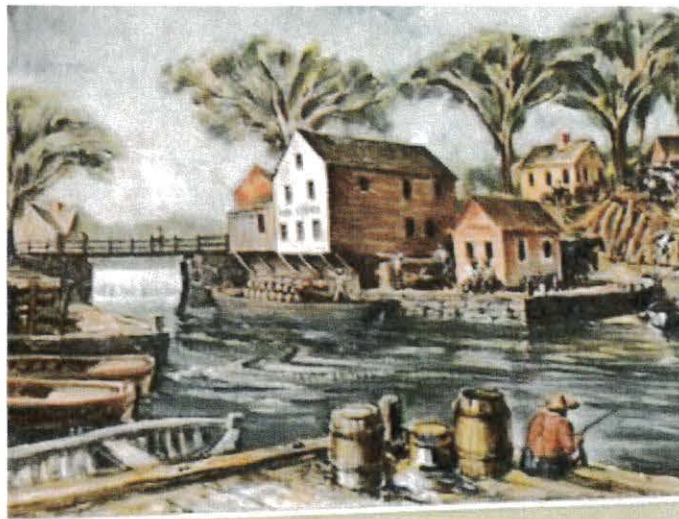
5. The recognition of the scenic and historic prominence of this area on a major gateway into Durham and its cultural significance as described in the Town of Durham Master Plan 2015.
6. The destination status of this area on the Mills Scenic Byways, an official State of New Hampshire Scenic and Cultural Byway.
7. The significance of the dam to New Hampshire history in the essay entitled **New Hampshire's Water Power Legacy** by Dr. James Garvin:
http://www.james-garvin.com/images/Dam_Preservation_Handout2.pdf
8. The status of the Mill Pond Dam as an Engineering Landmark recorded on the New Hampshire Register of Historic Places.

For all of the above reasons the Durham Historic Association opposes the removal of the Mill Pond Dam and urges the Durham Town Council to save the Mill Pond Dam and its environs. We respectfully request that should the Council opt for removal of the dam that the people of Durham have the opportunity to vote on a warrant article deciding the future of the dam.

Respectfully Yours,

The DHA Executive Board:

David Strong, President
Janet Mackie, Vice President
Doug Karo, Recording Secretary
Marjorie Smith, Treasurer
Nancy Sandberg, Museum Curator/Director
Joan Graf, Director
Mary Margaret Jaques, Director
Pam Langley, Director
Jennifer Lee, Director
Dick Lord, Director



"The Falls" by John Hatch

April Talon

From: Todd Selig
Sent: Monday, January 11, 2021 3:39 PM
To: April Talon; Richard Reine
Subject: FW: Public Comment on the Oyster River Dam at Mill Pond Feasibility Study

From: "dereksowers@hotmail.com" <dereksowers@hotmail.com>
Date: Monday, January 11, 2021 at 3:19 PM
To: Durham Town Council <council@ci.durham.nh.us>
Cc: Jennie Berry <jberry@ci.durham.nh.us>
Subject: Public Comment on the Oyster River Dam at Mill Pond Feasibility Study
Resent-From: <council@ci.durham.nh.us>

Dear Durham Town Council Members,

I submit these public comments as a property owner on the free-flowing portion of the Oyster River a short distance upstream from the Mill Pond impoundment. As an undergraduate student at UNH in 1993 I studied environmental conservation and worked summers on restoring eelgrass beds in the Great Bay Estuary. I hold a MS degree in marine resource management, a PhD in oceanography from UNH, and have worked professionally studying estuaries and implementing coastal habitat restoration projects (including dam removals here in NH) for fourteen years. I also have previously served for three years on the Durham Conservation Commission.

In my previous position at UNH I worked as the Conservation Program Manager for the Piscataqua Region Estuaries Partnership and helped to gather public input and write the [Comprehensive Conservation and Management Plan](#) for NH's coastal region. Notably, one of the highest priority actions from this plan calls for advocating for the removal of non-essential dams on coastal rivers – with a specific priority on dams located at the edge of tidal influence. This means that one of the highest priority environmental restoration projects in the seacoast region is yours to make a reality with the important decision before you this evening.

Economic Considerations:

The town has spent years of discussion and study on considering what to do with the Mill Pond Dam. The Feasibility Study provides us with a solid basis of facts to consider about the ecological and financial ramifications of dam removal as versus major dam repair options. Stabilizing the dam would cost 4x more than simply removing the dam over a 30-year life cycle cost. The cost of dam removal to Durham taxpayers could be greatly reduced by applying for existing federal habitat restoration funds – just like has been done for other dam

removals in the seacoast region. At the other end of the spectrum, stabilizing the dam will ensure a re-occurring future burden on the town beyond this 30-year planning horizon. What then? Why postpone the inevitable need to remove this dam? Let us address this issue with a true long-term financially rational approach.

The viability of the dam stabilization option hinges on several impractical contingencies. The need for the town to obtain a “non-menace waiver” from NHDES is out of town control and presents murky questions on how this would apply to future landowners adjacent to the dam. I have worked previously on permitting issues for wetland modification projects and believe that the prospects for obtaining state and federal permits for dredging the pond are highly unrealistic. The cost of dredging the pond is estimated to be over 3 million dollars. Even if this action were allowed, sediment would fill back into the pond within 5-20 years. This is not a remotely sane use of taxpayer funds. Let us invest our scarce dollars in our schools, our water treatment systems, roads, public safety, and other critical community infrastructure and services.

Historical Considerations:

The Durham Historic Association’s recommendation letter to the Council implies that the dam must be preserved indefinitely and does not address the ecological impacts of the dam nor the financial and liability burden of the dam upon the town. Respectfully, I do not find that to be a sustainable long-term solution for this issue. The history of the Oyster River and Great Bay ecosystem – and the human connection with these systems - did not begin with European settlement of this region, nor with a concrete dam built in 1913. Indeed, the natural history of a healthy coastal river with a free and open connection to the estuary and healthy migratory fish populations is the longer-term historical legacy of the Oyster River that has only recently been impinged upon with a manmade barrier of concrete. We should challenge ourselves to extend our view of historical and cultural significance and honor a deeper connection with our coastal ecosystem beyond the status quo. Historic preservation should not come at the expense of the health of the Oyster River and our native migratory fish. _

Environmental:

The presence of the dam itself creates the stagnant water environment that results in Mill Pond’s severe water quality problems that fail to meet federal Clean Water Act standards. These problems include very low dissolved oxygen levels that threaten aquatic life, and chlorophyll and bacteria concentrations that pose a risk to human health from primary contact with the water. Removal of non-essential dams is the single most effective way to simultaneously improve aquatic habitat, water quality, and fish passage. I echo the calls from the Conservation Commission and NH Fish and Game about the importance of restoring our native migratory fish populations – and this most importantly begins with the removal of head-of-tide dams.

Given the need to reduce nitrogen loading to the Great Bay Estuary, a fair question is to understand if Mill Pond currently removes nitrogen better than a free-flowing river would. A recent [UNH study](#) examined this question and determined that overall nitrogen loading to the bay would be about the same with or without the Mill Pond, and that dam removal would therefore have no significant harm or benefit with respect to this issue.

Dam removal would offer the benefit of converting a significant area of the water-quality-impaired Mill Pond habitat to one of the most ecologically critical habitats in the world: coastal salt marsh. This marsh would be allowed to naturally adapt to changes in sea level rise over time. These areas also offer excellent recreational boating opportunities at high tide. _

Some citizens have expressed concerns about a perceived uncertainty of the outcome of a dam removal project. At their core, dam removal projects are not rocket science. Remove the manmade blockage and let nature do the rest. Yes, channel restoration and controlling sediments during removal is important and has appropriately been

included in the scope of the Feasibility Study. Yes, invasive species will have to be managed to ensure a mostly native vegetation community will bounce back – and it quickly will. But once the natural flow connection between the river and the estuary is restored, nature quickly heals itself. Please visit the Exeter dam removal site and see for yourself.

I urge you to vote for the opportunity before us to restore vital connectivity between the Oyster River and the Great Bay Estuary while freeing the town from the massive (and indeed never-ending) expenditure of taxpayer funds on the Mill Pond Dam and the associated regulatory and liability issues pertaining to dam safety. The removal of the dam is a win-win for both our local ecosystem and our community.

Best Regards,

Derek Sowers
32 Oyster River Road

April Talon

From: Michael Drooker <michael.drooker@gmail.com>
Sent: Friday, January 17, 2020 10:56 AM
To: April Talon
Subject: Breached Union Dam
Attachments: 100_5169.JPG; 100_5167.JPG; 100_5168.JPG; 100_5165.JPG; 100_5166.JPG; 100_5170.JPG

Hello April,

Here are some pictures (taken around May/June, 2018) of a dam in Union, NH that was breached, but remains partially intact. It is located near the corner of Main St. and Maple St.

If our Mill Pond is to be drained, the historical record of the dam could be maintained in place if, for example, the bays at the east and west ends were removed and the remaining structure conserved as a historical monument. I'm sure it could be done more tastefully than the functional job done at the Union location. I would suggest that the remaining structure not be repaired, but rather be conserved from further deterioration.

Something to think about.

Best regards,

Mike Drooker