Abandoned Assets: The Case for Reasonable Access to Summertime Lamprey River Flow and Emergency Drought Planning

November 9, 2012

The Lamprey River flows over the Wiswall Dam on Sept 14, 2012.

"The value of summertime Lamprey flow and an enforceable drought conservation policy become clearest if you imagine, for whatever reason, that one of our wells shuts down. Without the right to draw from surface waters of the Lamprey River in the summer, we would be in big trouble." – Page 17

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AUTHOR'S NOTE: This report represents the efforts of one Town Councilor to understand and provide some guidance about challenges facing our public water system. I have drawn on my past experience as a news reporter and environmental conservation policy researcher to provide an account of a complicated problem and to propose some solutions. I owe thanks to many people who have helped me better understand these issues and fact check my report and assumptions. Among them are town staff, colleagues in several natural resources fields, and fellow residents who have followed these issues as members of water resource related committees. For thoroughness and transparency, I have included citations and a bibliography.

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Abstract

Seeking to improve our limited summertime public water supply, the UNH/Durham Water System is moving rapidly to connect to a new source – a 12-inch diameter well that plunges 135 feet into the Spruce Hole Aquifer along Packers Falls Road. Adding a new well is a major decision for any municipal water system, but the choice we face is impelled in part by our acceptance of impending state regulatory limits that will effectively end our town's summertime access to one of its cleanest and most plentiful sources of water – the Lamprey River. This paper argues that abandoning access to the Lamprey River's summer flow would be a big mistake because the new $2.35 million[1] Spruce Hole well cannot alone provide us the margin of supply or system resiliency we need now and in the future. It argues further that the policy and scientific assumptions that are poised to remove us from the Lamprey River in the summer are deeply flawed and should be challened to allow our system the right to reasonably access the river flow when needed. Finally, this paper argues for an emergecy drought plan with teeth to control our demand when needed.

Overview

In an effort to increase and diversify our public water supply, the UNH/Durham Water System is working to bring online a new water well – the Spruce Hole well off Packers Falls Road. Durham Town Administrator Todd Selig had planned to seek the Town Council's approval this fall for funding the town's share of the remaining $1.7 million in costs to connect the well to our system. However, he has learned that the university is not yet willing to commit to funding its full share of the project and so the well construction may need to wait a year for the next budget cycle (Selig, Durham Town Administrator,

[1] $64,000 approved in 2007 + $615,000 in 2009 + $302,000 proposed FY 2013 + $1,378,000 proposed 2014 (Cedarholm, Presentation and Discussion Regarding the Spruce Hole Municipal Well and Artificial Recharge Project, 2012, Selig, Letter of Transmittal for Administrator's Proposed 2013 Operational & Capital Budgets, Administrator's Proposed 2013-2022 Capital Improvement Plan, 2012)

2012). This development will provide the town and the university some time to consider the implications of the questionable bargain it is poised to make as it moves to the new well: to accept new regulatory limits that effectively end our public water system's summertime access to one of its cleanest and most plentiful sources of water – the Lamprey River (Durham Town Council Meeting Minutes, June 18, 2012). These new limits would be imposed under the impending Lamprey River Water Management Plan – part of a pilot program of the New Hampshire Department of Environmental Services which would serve as a model, along with another plan on the Souhegan River, for river management throughout the state (NHDES, Lamprey River Managament Plan Report Draft, 2011).

Durham has coped for eleven years with summertime restrictions on the Lamprey River imposed by a 401 Water Quality Certificate (WQC), so called because it is issued under the authority of Section 401 of the Clean Water Act. The WQC was issued by the state in April 2001 in conjunction with the town's construction of the Lamprey River Transmission Main Project. This 12-inch diameter water main was built to connect the UNH Water Treatment Plant directly to the Lamprey River via an older pipe that runs between the Lamprey and Oyster rivers (Cedarholm, Update on the Status of the Section 401 Water Quality Certificate and Lamprey Water Management Plan, 2012). That older pipe had been used for decades to dump Lamprey River water into the Oyster River to increase our system supply. The new project, completed in 2002, was intended to make the water system more efficient and less wasteful. The WQC has been controversial in part because Section 401 of the Clean Water Act is intended to regulate projects that "discharge into navigable waters" (Clean Water Act of 1972). While this might have been a concern during the construction of the new water pipe as it crossed wetlands, some argue it should not remain in effect today because the project has long-since been completed and involves water *withdrawal*, not discharge. The new Lamprey River Management Plan is intended to replace the old 401 WQC restrictions. The management plan has been touted as far better because it is grounded in an extensive scientific study of the river and it has been praised, along with the strategy of opening a new well, by some local scientists and policymakers (eg. Houle, 2012, Spang, 2012).

This report argues that the restrictions in the new Lamprey River Management Plan were unfairly conceived and would deprive our water system of an essential margin of resilience and supply – whether or not we elect to tap the Spruce Hole well. Drawing on a wide range of reports and correspondence, interviews with experts, and more than a half century of Lamprey River flow data, this paper proposes we prepare a strategy to legally appeal the new state rules when they go into effect. Separately, it contends that it is essential for our water system to have the ability to curb its appetite in emergencies and proposes the establishment of a comprehensive and enforceable emergency drought plan. The account in the pages that follow attempts to make tangible these twin assets – summer Lamprey flow and emergency control of our demand – and argues for embracing and not abandoning them.

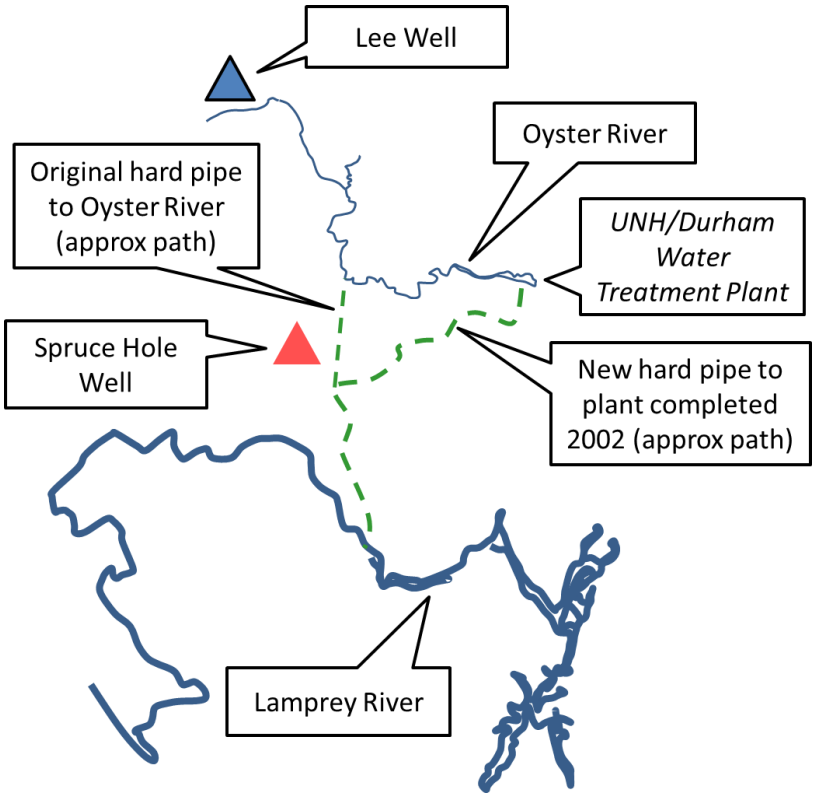
The opening section of this paper, **Our Water System & its Summertime Limits**, provides some background on the UNH/Durham Water System, and restrictions placed on it by the NHDES. A segment on **The Spruce Hole Aquifer** discusses the proposed new well and notes the potential importance of summer Lamprey River flow to the success of the well's state-required aquifer "recharge" function. A section entitled **Our Struggle with the DES**, provides a detailed account of the shortcomings of the

Protected Instream Flow Study on which the Lamprey River Management Plan withdrawal limits are based. This is informed in large part by our staff's excellent critique of the study in 2009. A section called **Our Policy Reversal** notes our town's decision to go along with DES rules and enumerates several flawed arguments against access to summertime Lamprey flow. **A Summer Supply Analysis**, grounded in data on our system demand and historical Lamprey River flows, examines four potential scenarios for our summertime supply that provide the strongest support for this paper's recommendations. The **Conclusion** spells out the recommendations for pursuing reasonable access to summer Lamprey flow and establishing a substantive, enforceable emergency drought plan.

Our Water System & its Summertime Limits

Before considering the potential effects of switching to a new water source, it is helpful to consider some basic information about our water system's supply and demand. Our system serves the University of New Hampshire campus and about half of our town's households. The other half relies on private wells. The system has three supplies: the Lee Well, the Lamprey River and the Oyster River. The Oyster River is ten times smaller than the Lamprey. When the university is in session, the daily system demand is about 1.2 million gallons a day. In the early summer months, when most of the students are away, the daily demand is about 700,000 gallons (East, 2012). Figure 1 provides an overview of our water system and the proposed Spruce Hole well.

Figure 1.



Key elements of the UNH/ Durham water system and the proposed Spruce Hole well

Durham typically has plenty of water in the spring, winter and fall after October 15th, when the state releases water from Pawtuckaway Reservoir and seasonal rainfall increases. In the late fall, the town gets its water from the Lee Well and the flow of the Lamprey River. In the dryer summer, lower flows on the Lamprey River trigger the state 401 WQC restrictions on access to that flow and the town switches to withdrawing water from the smaller Oyster River. Water from both the Lamprey and Oyster Rivers is treated at the University's Arthur Rollins Water Treatment Plant, just below the Oyster River Dam at the edge of College Woods. The Oyster River water is murkier, requiring heavier treatment with coagulant chemicals that help separate silt from the water in clumps (East, 2012).

Summer River Hopscotch

The 401 WQC certificate limits withdrawals from the Lamprey River instream flow to 258,000 gallons per day when the flow drops below 21 cubic feet per second (cfs) and cuts withdrawals altogether at 13 cfs. Water Plant Manager Wesley East says he switches to the Oyster River when the Lamprey River flow drops to 21 cfs. This is in part because the lower 258,000 gallon daily withdrawal limit is by itself not enough to meet system demand and because the water system is currently piped to allow only for withdraws from one river at a time.

This summer, the water treatment plant switched between the rivers several times, drawing from the Lamprey when the flows were well above 21 cfs and back to the Oyster when they dipped lower. The switchover process is involved and takes about eight hours, which includes time to adjust the chemical treatment to the new water piped in. In exceptionally dry summers, when the Lamprey flow is consistently off limits, the water system follows a set of three drought stages (East, 2012).

Durham Town Engineer Dave Cedarholm and Wesley East explained to me how the drought stages work: In Stage 1, the system draws down the Oyster River Impoundment. This can last awhile because we are currently allowed to capture river flow to recharge it. When the reservoir is down by about 5 million gallons, the point at which the water becomes too murky to reasonably treat, Stage 2 is reached and the system switches to the Lamprey River Impoundment, from which we are allowed to take about 17 million gallons. This supply is more limited because the system is not allowed to tap the flow of Lamprey River below limits set by the state. At or below these limits, the same amount of water flowing into the impoundment must be sent downstream. Stage 3 hits when the reservoir is drawn down by 18 inches – using up that estimated 17 million gallons. By then, the Oyster River impoundment has recharged and we switch back to it, hoping that October 15th and the Pawtuckaway Lake water release or significant rain arrives before we run out of water. After the Oyster River Impoundment is again drained, we enter a "Water Emergency".[2]

[2] This is referred to as Stage 4 Water Emergency under the system's proposed Water Conservation plan. (UNH/Durham Water System, 2012)

Technical Fixes that Could Help

As limiting as the WQC is, it is fair to say our system could operate more closely to these limits and thus increase its efficiency with the application of a couple technical improvements. Note again that the water system limited withdrawals from the Lamprey River to 21 cfs – significantly above the 13 cfs allowed by the state 401 WQC. Wesley East said the system could operate down to 13 cfs, however, by installing a modulating valve – a piece of equipment he estimates would cost about $10,000 – which would allow for the simultaneous withdrawal of water from the Oyster and Lamprey Rivers (East, 2012). With this, he said, the water system could take advantage of what latitude exists for withdrawals in the WQC between 21 and 13 cfs, meet its demand, and go easier on the Oyster River.

Figure 3

In the summer, we draw heavily on the Oyster River, one tenth the size of the Lamprey River

Separately, our system lacks the ability during a drought to capture in the Lamprey Reservoir flow from rain events that exceed the cutoffs established in the WQC. For example, if river flows swell from 12 cfs to 43 cfs – as they did in the middle of the 1964 drought – we would have to watch as a day's worth of 31 cfs of excess flow washes down the river. Half of that equals about 10 million gallons. East said this problem could be addressed with a metered siphon, which can be used to enable the dam to close its gates to capture excess river flow while also guaranteeing that the required minimum flow proceeds downstream through the siphon.

Water Conservation Plan Concession

A key condition to state permitting of the new Spruce Hole Well is the state's approval of our draft town Water Conservation plan (NHDES, Re: Final Report Large Well Siting/Large Groundwater Withdrawal Permit Application Durham/UNH Water System, PWS ID 0691010, Well #2 (DGD-PW2) Lee, New Hampshire, 2012). As drafted, the plan accepts DES limits on Lamprey River summertime flow as a fait accomplis (UNH/Durham Water System, 2012). [3] It also relies on the existing access we enjoy to summertime Oyster River flows that recharge our reservoir, despite our Town Administrator's warning that the state will soon move to restrict withdrawals from the Oyster River – a point that has been used to sell the Town Council on tapping the Spruce Hole (Town Council Meeting Extended Roundatble, 2012). The section that follows describes the purpose of the Spruce Hole well and notes the importance of the Lamprey River flow to its function.

The Spruce Hole Well

The Town of Durham has submitted an application to the New Hampshire Department of Environmental Services to withdraw up to 63 million gallons of water per year at a rate of up to 1 million gallons a day from the Spruce Hole well off Packers Falls Road (Cedarholm, Presentation and Discussion Regarding the Spruce Hole Municipal Well and Artificial Recharge Project, 2012). Engineering studies began in 2007 and a 135-foot-deep, 12-inch diameter well pipe was installed in January, 2010. Town Administrator Selig supports completing the project, which would connect the well to the UNH/Durham water system. The project has been pitched as a forward-thinking means to ensure long-term water system supply and resiliency (Cedarholm, Presentation and Discussion Regarding the Spruce Hole Municipal Well and Artificial Recharge Project, 2012).

As indicated by its official title – Spruce Hole Municipal Well and Artificial Recharge Project – the well is more than a just a well. In addition to pulling water from the ground, it will also pull water from the Lamprey River to "recharge" the aquifer beneath the well. While this will increase the well capacity to store and deliver water to the town, it should be noted that the recharge component is *required* by the state to prevent an unacceptable drawdown of the aquifer and the nearby spring-fed Chesley Brook (NHDES, Re: Final Report Large Well Siting/Large Groundwater Withdrawal Permit Application Durham/UNH Water System, PWS ID 0691010, Well #2 (DGD-PW2) Lee, New Hampshire, 2012). Without access to the flow of the Lamprey River, the well would not be allowed to operate.

The hydrogeologic consultants hired by the Town to develop a new public water supply well within the Spruce Hole Aquifer – Emery & Garrett Groundwater, Inc. of Meredith, NH – have assured the Town Council that the well is sound and will provide a reliable source of water with negligible impact to the environment and the nearby Spruce Hole kettle bog. However, some questions surfaced at the October 1, 2012 Town Council meeting as to what restrictions on withdrawals the state NHDES might impose, should planned monitoring of the nearby Chesley Brook reveal an unacceptable drop in flow during well use. Conservative estimates based on gross water budgets in Emery & Garrett Groundwater, Inc.'s

[3] Separately, the plan includes some conservation goals that are addressed later in the report on page 18.

March 2012 report suggest that withdrawing the maximum proposed 63 million gallons spread over a year could potentially divert the flow of groundwater to Chesley Brook by 50 to 69 percent – or between 100 and 138 gallons per minute for approximately 52 million gallons per year (Emery & Garrett Groundwater, Inc., 2012). It was also noted in the report that this reduction could potentially result in a 25% reduction of base flow in Chesley Brook, but that only through long-term monitoring could the exact impact be determined. According to Emery & Garrett, on-site monitoring during the testing program indicated that these estimates may be excessive and that actual impacts to the Chesley Brook would likely be significantly less.

Figure 2.

The Spruce Hole well sits off Packer's Falls Road, as yet unconnected.

In a public question and answer session at the Town Council meeting, Emery & Garrett President James Emery said that a drop in Chesley Brook flow could/would be mitigated by recharging the Spruce Hole Aquifer from the Lamprey River to maintain the Brook flow – a process that will be worked out. He said: "We'll have that sorted out, because the state [NHDES] will not allow us to use that water if there is any evidence that Chesley Brook will be [adversely] impacted."

John Brooks, Ph.D., a senior geologist/geophysicist with Emery & Garrett, explained this further in a conversation for this report. He said once the well is hooked up to the Town system, a period of testing and monitoring will help establish the amounts of Artificial Recharge to be used and groundwater

withdrawal management procedures that will keep water levels in the Aquifer within an ideal range to meet water system demand and to keep the flow in Chesley Brook at an acceptable level (Brooks, 2012). He said this process may include short periods of withdrawals from the Lamprey River during the summer and added that while State restrictions on using the Lamprey flow could be limiting at times, he did not expect them to be a significant obstacle. In fact, one of the key favorable aspects of using Artificial Recharge for the Lamprey River is that water can and will be withdrawn during periods when River flow is above Protected Instream Flow Rates (PISFs), which would include storm events and other periods of high River flow. I shared with Mr. Brooks my concern that, though a great deal of research and testing has gone into the well, it seems that the Lamprey flow restrictions could frustrate our use of the well in a very dry summer. [4]

Specifics of the operation of the proposed Spruce Hole aquifer aside, it is worth noting that Emery & Garrett shared our town's concern in 2009 about the potentially limiting effects of proposed NHDES regulations of Lamprey River flow. In a thorough memo to the NHDES outlining myriad shortcomings of the draft Lamprey River Protected Instream flow Study, the general focus of this paper's next section, James Emery, John Brooks and colleagues wrote:

> "We remain concerned about the methods used and the subsequent consequences of implementing the suggested PISF values as the basis for establishing a Management Plan. Furthermore, we have concerns about the resultant possible impacts to communities that depend upon the Lamprey River Watershed for existing and future public and private water supplies" (Emery, Garrett, Brooks, & Tinkham, 2009).

UNH/Durham Water Plant Manager Wesley East said he is concerned about the potential effects of the Lamprey River Management Plan limits on our ability to use the well in the summertime. Without adequate recharge, our hydrologists' study shows, the well could impact not only Chesley Brook but also the Oyster River – inviting the state to shut down both of these sources. I share this concern and believe it is reasonable to ask why we would be quick to accept in our Water Conservation Plan summer limits on Lamprey River withdrawals that we might need to keep the new Spruce Hole well working. Without knowing exactly how well the aquifer's recharge function will perform – that is, until the well is built and tested – this seems like a gamble. Further, East said he is apprehensive about what may happen when the NHDES moves, as our town staff predicts, to establish PISF rules on the Oyster River. He said the Lee well, which is a stone's throw from the Oyster River, doubtless impacts the Oyster River's flow. Would new limits be placed on this well as a result of PISF rules? These uncertainties, as well as record of questionable NHDES regulatory decision making documented in the following section, argue for a cautious approach on our part.

Our struggle with the DES

Recognizing the importance of the summertime Lamprey River flow to our water supply, town staff until recently resisted the state's strategies to cut it off. The town has protested the Water Quality Certificate

[4] Thanks to James Emery and John Brooks for reviewing the preceding three paragraphs.

and questioned the scientific basis for the impending Lamprey River Management Plan, which proposes permanently cutting access to Lamprey River flow below 18 cfs. To get a sense of what that flow looks like, the photo on this report's title page shows slightly more than 16 cfs flowing over the Wiswall Dam.

The WQC Limits

Concerned about limits imposed by the WQC, town staff and the Town Council have sought legal opinions on challenging it. In an October, 2006 letter to Cedarholm, attorney Walter Mitchell advised that Durham had "no valid legal objection" to the WQC. He also noted the 30-day appeal period, which began in April 2001, had expired, (Mitchell, 2006). In a closed session with the Town Council in September 2009, attorney Dana Bisbee, hired by the town to advise staff and the Town Council in their work with the DES, also advised against challenging the certificate for two main reasons: 1) the appeal period had expired and 2) the WQC would soon be replaced by the PISF rules (Bisbee, 2010). *Note that a central argument of this paper is that the town should be prepared to use its right to file a timely appeal of the PISF process when the rules go into effect.* We obviously did not do this with the WQC and the Town Council has been advised to accept the PISF study and the Management Plan on which it is based (Durham Town Council Meeting Minutes, June 18, 2012).

The PISF Study Criticized

On March 9, 2009, Durham Town Engineer Dave Cedarholm and Paul Chamberlin, UNH Assistant Vice President for Energy and Campus Development, sent an exhaustive 17-page memo to the DES spelling out many fundamental flaws with the study and its assumptions (Cedarholm & Chamberlin, Comments by Town of Durham and the University of New Hampshire on Draft Lamprey River Proposed Protected Instream Flow Report, 2009). This document, which would likely play an important role in any legal appeal of the management plan, focuses a great deal of attention on the state's disregard of the importance of the public water supply. The New Hampshire Rivers Management and Protection program rules state:

> "Each protected instream flow shall be established and enforced to maintain water for instream public uses and to protect outstanding characteristics, including recreational, fisheries, wildlife, environmental, hydropower, cultural, historical, archaeological, scientific, ecological, aesthetic, community significance, agricultural, **public water supply** [5], and the resources for which the river or segment is designated, and shall respect riparian interests on each designated river or segment consistent with the purposes of this chapter. Instream public uses shall include the state's interests in surface waters, including, but not limited to, navigation; recreation; fishing; storage; conservation; maintenance and enhancement of aquatic and fish life; fish and wildlife habitat; wildlife; the protection of water quality and public health; pollution abatement; aesthetic beauty; and hydroelectric energy production" (Title L Water Management and Protection Chapter 438 New Hampshire Rivers

[5] Emphasis added. Todd Selig notes that town staff and Attorney Dana Bisbee worked to explicitly include the words "public water supply" in this critical statute.

> Management and Protection Program, 2011, RSA 483:9-c).

Our staff argued correctly that the Protected Instream Flow (PISF) Study ignored the needs of the UNH/Durham water system in its study:

> "DES did not factor the UDWS needs into its analysis of PISFs. RSA 483:9-c requires that both instream public uses and uses for which the River was designated under the Rivers Management and Protection Act be maintained and protected. We appreciate that it is difficult to reconcile all of the protected uses in establishing PISFs, but the Town and UNH's public water supply is both an instream public use and a key reason why the River was designated in the first instance. However, the Report has not considered the needs of the UDWS at all in establishing protected flows" (Cedarholm & Chamberlin, Comments by Town of Durham and the University of New Hampshire on Draft Lamprey River Proposed Protected Instream Flow Report, 2009, p. 4).

Further, our staff argued that DES wrongly based the study on a river in "pre-colonial" condition without impoundments. Without a record, how can anyone know what the condition of the river was in pre-colonial times? [6] Emery & Garrett engineers declared this pre-colonial assumption unrealistic in their comments to NHDES (Emery, Garrett, Brooks, & Tinkham, 2009). Similarly, UNH Professor William McDowell, an expert in Water Resources, called the assumption "fundamentally flawed" and wrote: "When establishing protected instream flows, it seems necessary to model reality and incorporate the role of these dams into any modeling exercise." (NHDES, 2009, Appendix 14 p.-33). Indeed, the government's *own peer reviewers* raised concerns about it (NHDES, The Instream Flow Council's Review of the New Hampshire Instream Flow Pilot Program: Protected Instream Flow Study Phase, 2009). Wrote one:

> "It is not realistic in southern New England to try to simulate the river as it might have been in 1600 AD or earlier; there are too many variables and those conditions will almost certainly not be restored" (NHDES, The Instream Flow Council's Review of the New Hampshire Instream Flow Pilot Program: Protected Instream Flow Study Phase, 2009, p. 28).

Cedarholm and Chamberlin found both practical and legal problems with the DES approach:

> "Basing the PISFs on what could be overly conservative simulated reference conditions that do not reflect the existing hydrologic conditions or habitat and excludes the public water supply reservoir violates the statutory requirements in RSA 483:9-c which states 'each protected flow shall be established and enforced to maintain water for instream public uses and to protect the resource for which the river or segment is designated.' This statement contains two distinct requirements: (1) maintain water for instream public uses; and (2) protect the resource for which the river or segment is designated" (Cedarholm & Chamberlin, Comments by Town of Durham and the University of New Hampshire on Draft Lamprey River Proposed Protected Instream Flow Report, 2009, p. 6).

[6] The state neglected to consider the one exception, an enthusiastic pre-colonial dam builder, the beaver.

Separately, a colleague of mine who surveyed flora and fauna in rivers and streams across New Hampshire for his Ph.D. dissertation, Brian Frappier, reviewed the PISF study and noted an additional critical omission: The species habitat modeling upon which the flow limits are based lacks resolution below flows of 16 cfs – right around the limits imposed in the proposed management plan (NHDES, Final Lamprey River Protected Instream Flow Report, 2009). In other words, the DES seems to lack data to demonstrate what effects – negative or positive – withdrawing water below this limit would have on plants and animals. Writes Frappier:

> "In the absence of a demonstrated (through modeling) reduction in habitat for a critical species affected by a reduction in flow in the 4-16 cfs flow range, they [the NHDES] have absolutely no evidence to back up their assertions that 16 cfs represents a critical minimum flow even before they get to the public water supply use examination" (Frappier, 2012).

Collectively, these arguments reveal profound problems with the foundation upon which the PISF regulations sit. But for its part, the NHDES has sidestepped the protests of Cedarholm, Chamberlin and the others with the statement that public water use is not related to the establishment of Protected Instream flows: "Upon further consideration," wrote the NHDES, "this flow-dependency of the withdrawal is an artificial construct generated for the 401 WQC. Other than the management conditions defined in the 401 WQC, there is no relationship between water withdrawals (by UNH/Durham or any other water user) and a protected instream flow" (NHDES, 2009, Appendix 14 p.-2). This argument conveniently renders obsolete all criticisms of the validity of the science underlying the regulations.

Our policy reversal

Despite the endemic flaws in the state's science and policy and its implications for our public water system, town staff relented and our Administrator and Town Council chose a path of negotiation over confrontation. This bore some fruit in August, 2010 when attorney Bisbee helped renegotiate terms of the original 401 WQC, getting permission to draw down water from the Wiswall impoundment from 6 inches at a half inch a day to 18 inches at 1 inch a day (Cedarholm, Update on the Status of the Section 401 Water Quality Certificate and Lamprey Water Management Plan, 2012). But the strategy has since faltered. More recently, attorney Bisbee helped win the agreement of the NHDES to erase water restrictions in the current 401 WQC upon acceptance by the UNH/Durham Water System of the impending Lamprey River Management Plan limits. As argued in this report, that has left us far short of what our system needs to be positioned for long-term sustainability and resilience. Stopping here with the state has left us to accept a number of defective assumptions, rebutted briefly below.

Flawed arguments

A poorly-done PISF study is better than none – While researching this report, I spoke with colleagues at UNH who are comfortable with the notion that when it comes to setting flow limits on the Lamprey River, an incomplete study with erroneous assumptions is better than none. In part this comes from an environmental ethic that humans can get up and move off a river and go elsewhere; plants and animals

cannot. I sympathize with wildlife – I used to teach a wildlife ecology lab and count myself an environmentalist. But we do the environment no good – and that includes the humans, who are part of the environment – if we base our policy on flawed research. It undermines the precious credibility of the scientific and policymaking process needed to address serious problems. For example, in addition to criticizing the pre-colonial river baseline in the PISF study, the government's own peer reviewers noted that mandating minimum flows for species not present on the river (such as Atlantic salmon) makes no sense unless the state plans to reintroduce them (NHDES, The Instream Flow Council's Review of the New Hampshire Instream Flow Pilot Program: Protected Instream Flow Study Phase, 2009). This approach would not cut it elsewhere. One can only imagine if we were so lax with the people who design our bridges and roads or fabricate our firefighting equipment.

"This approach would not cut it elsewhere. One can only imagine if we were so lax with the people who design our bridges and roads or fabricate our firefighting equipment."

Somebody has to control the river so we don't suck it dry – I've heard this sentiment from some on our staff. I do not believe our water system has invested more than a million dollars in efficiency measures at the Wiswall Dam so we could suck the Lamprey River dry (Cedarholm & Chamberlin, Comments by Town of Durham and the University of New Hampshire on Draft Lamprey River Proposed Protected Instream Flow Report, 2009). Recall that with a modulating valve we might even go easier on the smaller Oyster River all the while staying within the limits of the current 401 WQC (East, 2012). Nothing proposed here would come close to sucking the river dry. Finally, there are myriad examples of fair and reasoned regulation of common environmental resources. A vital prerequisite to their success is an acknowledgement that humans are part of the environment – a concept we teach undergraduate environmental conservation students at UNH. As demonstrated above, the NHDES Lamprey River PISF policy regime ignores this basic truth and as such lacks essential credibility.

Challenging the PISF rules invites a Wild-West style water war – A successful argument in Durham against the PISF limits would not mean an end to DES management of the river. By the same token, there is no reason to believe that without the PISF regime we would have no legal limits. Three municipal water systems rely on the river for public drinking water supply: Durham, Epping and Raymond (NHDES, Lamprey River Managament Plan Report Draft, 2011). In the West, water law is based on prior appropriation – a first come, first-served system; in the East we have a Riparian Rights regime (H.Getches, 2009). There is neither a rush to exploit the Lamprey nor evidence that in the absence of the proposed DES rules our riparian rights would go away.

It is too late to protest the emerging PISF management regime – That is simply not true. Recall that attorneys Mitchell and Bisbee advised the Town Council that because they had not appealed the WQC restrictions when they went into effect, it would be difficult to do so now, many years later (Mitchell, 2006; Bisbee, 2010). The Lamprey River Management Plan has not been placed into effect and so we cannot yet file an appeal. There is no better time than now to prepare for that.

An Unwritten Bargain

This June, after lengthy discussions with DES officials about the WQC and Lamprey River Management Plan, attorney Bisbee, Administrator Selig, and Town Engineer Dave Cedarholm asked the Town Council to support the unwritten accord with the state described above: Accept the Lamprey River Management Plan and its limits on summertime withdrawal now, and when they go into effect, the DES will erase the withdrawal limits in the WQC (Durham Town Council Meeting Minutes, June 18, 2012). The Council debated and approved this by two votes.

Our Administrator asked us to support funding for Spruce Hole this fall because of the impending summer Lamprey restrictions and the possibility that the state will soon move to also restrict withdrawals from the Oyster River. He stressed that low interest rates and construction costs and a favorable water system funding formula with UNH made now the right time to fund and build the project. To put this off, he argued, would serve only to delay and increase the price of connecting to a much-needed resource. For now, Selig said, UNH is not prepared to fund its portion of the $1.7 million for the new well due to financial constraints. This provides us some breathing room to ask ourselves a critical question: Will this investment provide our water system the supply we need for the future?

The following analysis – based on measures of our system demand, historic Lamprey River flows, and estimates of our impoundment capacity – provides an answer. For the impetus to study USGS Lamprey River flow data and an excellent example of its utility, I owe thanks to fellow Town Councilor Jim Lawson for sharing his observations of our water system supply (Lawson, 2012). The next section serves to illustrate the importance of preserving our water system's right to access to summertime Lamprey River flow. It also demonstrates the benefit an ability to curb our demand by just 10 percent could provide during an exceptionally dry year. If we are indeed removed by state regulations from the Oyster River, these measures would provide an essential margin of safety.

Summer Supply Analysis

The analysis below compares estimates of the number of days of water supply the UNH/Durham system would have during the summer under four different supply and demand scenarios. In each, it is assumed that we would have a steady water supply from the Lee Well of 540,000 gallons a day.[7] Also, as a means to demonstrate the road our staff expects us to travel in the near future, I have eliminated in two scenarios the use of summertime flows on the Lamprey River. In all four scenarios, I have removed the summertime Oyster River flow from the equation entirely. This is because our staff has promoted the move to Spruce Hole on the assumption that the NHDES will set PISF rules on the Oyster River as well in the near future. It is prudent to assume, given the state's restrictions on the Lamprey River – which, again, is ten times larger than the Oyster River – that we will also lose access to summertime flows on the Oyster River.

[7] Todd Selig notes that this figure could drop should the Town of Lee exercise its legal option to take 15 percent of that permitted 540,000 gallon daily withdrawal – 81,000 gallons a day.

Figure 4.

The Lee well, under this pump house, provides a steady supply of water throughout the year.

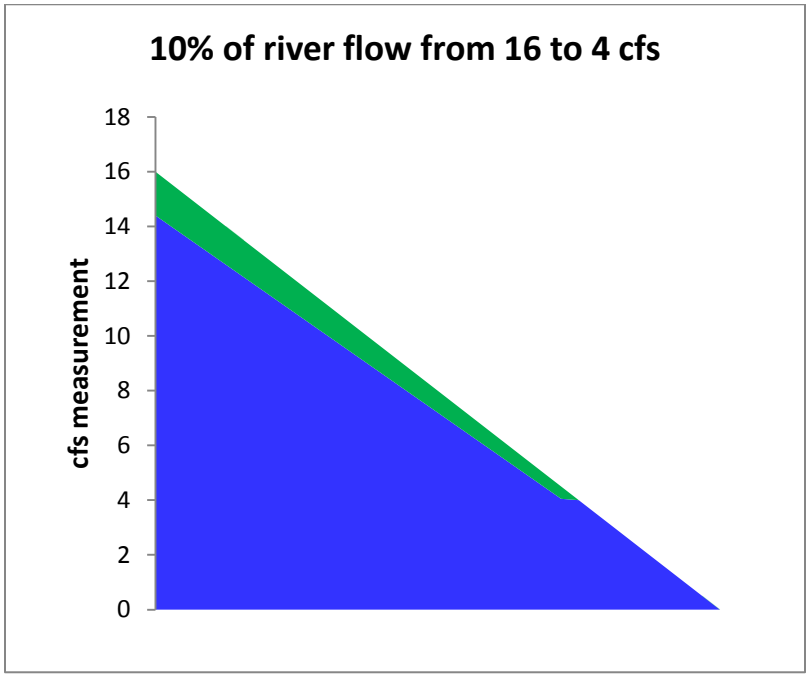
This leaves us for water sources the Lee Well, the Lamprey and Oyster River impoundments, and, if we pay for it, the new Spruce Hole well. Two of the four scenarios below include access to a "slice" of Lamprey summertime flow, represented graphically in Figure 5. It's 10 percent of the river's flow as it drops from 16 cfs to 4 cfs. This is not intended to serve as an immovable or necessarily ideal range, but a marker to provide scale and to illustrate for discussion the importance of the river's summer flows. Further, these two scenarios include a 10 percent reduction in overall demand from 1.2 million gallons a day to 1.08 gallons per day. This simulates the potential benefit of an emergency drought reduction plan applied across a dry summer. Descriptions of each scenario are outlined below.

Four Scenarios

1. **Full Demand using Spruce Hole + Lee Well + Impoundments = 128 days**. Meeting a demand of 1.2 million gallons/day – This includes operating the Lee Well at 540,000 gallons/day, and withdrawing an additional 660,000 gallon/day from one of three sources: the Lamprey impoundment (17 million gallons), the Oyster Impoundment (5 million gallons) or the Spruce Hole Aquifer (up to 63 million gallons a year).

2. **90% Demand using Spruce Hole + Lee Well + slice of Lamprey Flow + Impoundments = 211 days**. Meeting a demand of 1.08 million gallons/day (90% of scenario 1). This includes operating the Lee Well at 540,000 gallons/day, and withdrawing an additional 540,000 gallon/day from one of three sources: the Lamprey impoundment (17 million gallons), the Oyster Impoundment (5 million gallons) or the Spruce Hole Aquifer (up to 63 million gallons a year) PLUS a small slice of Lamprey River summertime flows. The "slice" of the river in this comparison = 10 percent of flows between 16 cfs and 4 cfs. Note that this serves to recharge the Lamprey impoundment and thus extends the time the town can draw from it. This value is calculated using flow data from one of the driest summers on the river recorded in the past 60 years – 1957.

Figure 5.



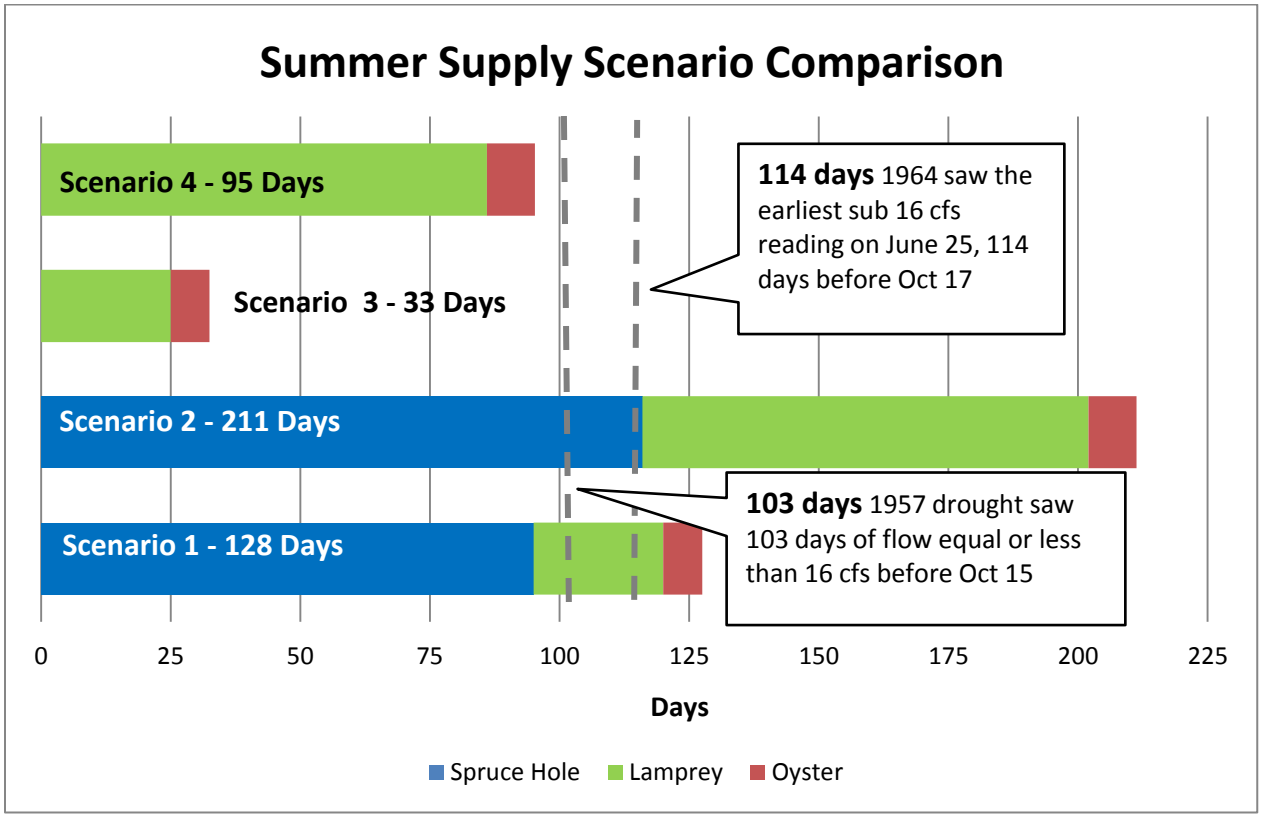
A graphic representation of a 10 percent slice of flow between 16 and 4 cfs

3. **Full Demand using Lee Well + Impoundments = 33 days.** Meeting a demand of 1.2 million gallons/day with the Lee Well and Impoundments but without use of Lamprey flow or the Spruce Hole well.

4. **No Spruce Hole but a slice of Lamprey Flow/ 90% Demand = 95 days**. Meeting a demand of 1.08 million gallons/day with the help of Lamprey flow but without the Spruce Hole Aquifer.

Figure 6 compares the four scenarios and depicts the proportion different sources would comprise in each. It also denotes two historical benchmarks – a 103 day period in 1957 of flows consistently equal or less than 16 cfs before October 15, and a 114-day period of low flows in 1964 that began on June 25.

Figure 6.



A comparison of drought supply drought scenarios.

What the estimates tell us

In the context of a plausible 114-days of Lamprey flows below 16 cfs, a 128-day supply from the combination of Spruce Hole aquifer and our impoundments in Scenario 1 would provide a 14-day margin. To be fair, this would likely be larger as Durham's summer demand is currently less than the 1.2 million gallons/day until about mid August, when UNH ramps up for the fall semester. However, as Durham and the university grow, this will change. At a minimum, this should raise concern about the ability of this supply scenario to meet our town's long-term goals. By contrast, Scenario 2 leaves an unmistakably large margin of reserves and room to grow in the future.

The value of summertime Lamprey flow and a drought conservation policy become clearest if you imagine, for whatever reason, that one of our wells shuts down – for example, a toxic spill near the Lee traffic circle, or restrictions prompted by unexpected impacts of the new well. Without the right to draw from surface waters of the Lamprey River in the summer, we would be in big trouble. Scenario 3, in which our reservoirs provide us just 33 days of water, bears this out. Scenario 4, which includes a Lamprey flow and drought policy safety net, *nearly triples* that supply to 95 days. Having these assets in reserve for unexpected problems or bad drought years is just common sense. Abandoning them, as we are in the process of doing, is a mistake for which we could wind up paying dearly.

Conclusion

It is not too late. We need not abandon the Lamprey River in the summer and we need not turn our backs on a meaningful and enforceable emergency drought conservation program and the resilience it would bring to our system. Below are some closing arguments for both.

We should preserve our legal options

Our Town Administrator has argued against pursuing legal action against the NHDES to fight the management plan. Our attorneys have told us to forget about the 401 WQC because we missed our opportunity to appeal. While the problem is essentially the same under the NHDES PISF rules – our access to water on the Lamprey is being restricted – we're being told to give up *before* it even becomes a rule. We have no written legal opinion, just a strategy that tells us to stay away.

We need a legal plan – at the very least a roadmap and an estimate – for exercising our right to appeal these unfair rules. I am no attorney, but have discussed this with a colleague who is both a veteran environmental litigator and an academic expert in water resource policy who said the likeliest avenue to challenge the management plan would be to file an appeal under the NH Administrative Procedures Act. Our Town Administrator has warned against going to court because it could run up a huge bill. But at what cost will abandoning summertime Lamprey flow come to our community's water security and its future? That is a critical question. At a minimum, I believe we owe it to our public to explore the merits of an alternative course. We are facing major non-elective surgery on our water system sources. We should spend some money now to avoid missing our chance to appeal the regulations.

We should establish an enforceable emergency drought plan

By many accounts our water systems is pretty efficient. Estimates based on the number of users and the demand on the system place us below the national average for household use of 100 gallons a day. This is due in part to the fact that many of our users are in apartments or dorms and that UNH and the town have invested considerably in conservation measures. Cedarholm and Chamberlin noted the extent and limitations of conservation in their 2009 letter to the NHDES:

> "The UDWS is committed to a water conservation program, and since 1999 the UDWS has invested more than $1M on water conservation efforts associated exclusively with the Lamprey River withdrawal. Considering the success that the UDWS has had with maintaining below average per capita water demands, implementing a more aggressive water conservation program has limitations" (Cedarholm & Chamberlain, Comments by Town of Durham and the University of New Hampshire on Draft Lamprey River Proposed Protected Instream Flow Report, 2009).

That said, a water conservation plan is a different animal than an emergency drought plan. It's as different as a fire prevention plan (don't play with matches or leave the toaster unattended) from a fire escape plan (meet here and head for this or that exit). If you want to be safe, you need both. While Durham has developed the three-stage dry-season reservoir hopscotch, it has no permanent, enforceable drought ordinance. Instead, if conditions get bad enough, our Town Administrator can go to

the Town Council during a water emergency and request a temporary drought ordinance. This is akin to making up and executing a fire escape plan after the flames have engulfed the house.

Some have argued that Durham is so good at conserving water that we need no enforceable emergency drought measures. Our Administrator has said he does not want police officers using their time to write tickets to people washing their cars during a water emergency. By contrast, the town's new draft Water Conservation Plan – this is the document noted earlier that is a prerequisite to state approval for tapping the Spruce Hole Well – includes goals of reducing system demand by 25 percent at Stage 3, and at least 40 percent in a new Stage 4 water emergency category (UNH/Durham Water System, 2012). The plan also proposes several "mandatory" conservation measures along the way to Stage 4. These include a ban on vehicle washing and limited or no watering of lawns or filling of pools. But without an ordinance that imposes a consequence, these "mandatory" measures will not be mandatory at all.

> "A lot of people were unhappy, but it was necessary and it ended up working."
>
> *– Brian Fuchs, National Drought Mitigation Center, on enforcing drought rules in Nebraska*

Brian Fuchs, a professor and climatologist with the National Drought Mitigation Center at the University of Nebraska, said such a strategy requires enforceable restrictions *that are actually enforced* (Fuchs, 2012). He cited an example from his own city, Lincoln, Nebraska, which declared a drought emergency this summer. While some families did cut back water use, neither voluntary restrictions nor warnings worked to lower overall water usage. Water use went down only when authorities, aided by a drought hotline, starting actually writing tickets. Fines were $150 with court costs. "A lot of people were unhappy, but it was necessary and it ended up working."

Fuchs told me an effective emergency drought plan should draw upon a mix of strategies, such as public education, increasing rates for heavy use, and enforceable limits on wasteful practices. He said emergency management officials in New England are just beginning to wake up to the potential for climate change to bring multi-year western-style drought conditions. For now, he said, sounding the alarm about water security and the need for emergency drought measures is a lonely business.

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