New Hampshire Shoreland Septic System Study Commission
FINAL REPORT
October 30, 2020

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Introduction

The New Hampshire Shoreland Septic System Study Commission ("the Commission") was established by the New Hampshire Legislature on May 19, 2019 with the approval of HB 475. The role of the Commission is to

> (a) Develop approaches for achieving cooperation among communities, private property owners, environmental nonprofit groups, and state and federal agencies in solving the problem of inadequate septic systems.
> (b) Determine the most effective method for identifying potential non-state approved septic systems located within 75 feet of surface waters.
> (c) Determine what approach or approaches that respect private property rights can be taken to effect remediation of septic systems on private property, including regulatory, educational, and financial incentives.
> (d) Consider the ramifications of climate resilience, such as future groundwater and sea level rise, on the design and location of septic systems.
> (e) Consider any other issues the commission deems relevant to its study.[1]

[1] https://legiscan.com/NH/bill/HB475/2019

The Commission held six monthly meetings between September 2019 and February 2020. Meetings were suspended between March-June 2020 due to the legislative shutdown. The Commission regrouped in July 2020 and, despite its four-month hiatus, is delivering a final report by the sunset date of November 20, 2020.

This report was approved in its entirety by members of the Commission on October 29, 2020 with 10 members voting in favor, one member opposing, and one abstention.

This report includes

1. Commission members
2. Overview of meeting topics
3. Brief summary of findings
4. Recommendations for legislative consideration
5. Outstanding questions

All meeting minutes, presentations, background material and other information is available on the portal for the NH General Court Statutory and Study Committees at http://www.gencourt.state.nh.us/statstudcomm/committees/1440/default.html

1. Commission Members

HB 475 specified a diverse set of stakeholders for the Shoreland Septic System Study Commission. Members include:

Christopher Albert – CSA Environmental Consultants, Granite State Designers and Installers
Senator Martha Fuller Clark – Portsmouth
Michelle Davis – NH LAKES
Julie LaBranche - Rockingham Planning Commission
Representative Kevin Maes - Rumney (Vice-Chair)
Lynne Merrill - Merrill Bartlett Group, NH Association of Realtors
Representative Dennis Malloy - Greenland
Melissa Paly - Great Bay-Piscataqua Waterkeeper, Conservation Law Foundation (Scribe)
Barbara Richter - NH Association of Conservation Commissions
Carrie Rouleau-Cote - Town of Auburn Building Inspector, NH Municipal Association
Peter Russell - Granite State Designers and Installers
Representative Judith Spang - Durham (Chair)
Rob Tardif - Administrator, NHDES Subsurface Systems Bureau
Jean Tremblay - First Seacoast Bank
Michele Tremblay - New Hampshire Rivers Council

Alternate
Steven Couture - Administrator, NHDES Coastal Program

Staff
Joel Anderson - NH Legislative Staff
Karen Karwocki - NH Legislative Staff

2. Meeting dates and topics

September 20, 2019
• Members reviewed the scope of Study Commission and agreed to take a comprehensive look at the water quality impacts of septic systems in freshwater and estuarine shoreland areas.
• The Commission established a schedule for monthly meetings, outlined topics for consideration, and elected a Chair (Representative Spang) and Scribe (Melissa Paly).

October 25, 2019
• Commission member Chris Albert made a presentation about how properly installed and maintained septic systems work, and how systems fail due to improper siting or poor maintenance.
• Danna Truslow of Truslow Resource Consulting gave a presentation about the water quality problems associated with both properly operating and failing systems, and discussed several innovations that can reduce nutrient discharges including Permeable Reactive Barriers.
• Greg Teren of SludgeHammer discussed a retrofit technology that substantially reduces nutrient discharge from onsite systems.

November 22, 2019
Rob Tardif, Administrator of NHDES Subsurface Systems Bureau, provided an overview of how the Bureau reviews and permits septic system applications. He outlined the regulatory history of septic systems in NH, including RSA 485-A:39 pertaining to required inspection of septic systems on waterfront property at the time of sale. [2]

December 20, 2019
• Andrea LaMoreaux, Vice President of NH LAKES, discussed the LakeSmart Program, a voluntary education program started in 2019 that recognizes property owners for reducing pollution and "lake friendly living". A component of the program relates to awareness and maintenance of septic systems.
• Patricia Tarpey of the Lake Winnepesaukee Association discussed that organization's Lake Waukewan Watershed Septic System Improvement Initiative where systems installed prior to 1986 were evaluated, with grant funding available to defray costs of repair and upgrades. LWA also has information about septic systems on their website at https://www.winnipesaukee.org/category/programs-2/lakeside-learning/.

[2] http://www.gencourt.state.nh.us/rsa/html/L/485-A/485-A-39.htm

January 24, 2020

• NHDES Coastal Program Administrator Steve Couture discussed the status of water quality in the Great Bay estuary and reviewed the findings of the 2014 Great Bay Nitrogen Non-Point Source Study.[3]

• Sally Soule, Coastal Watershed Coordinator, NHDES Non-Point Source Program, discussed work related to septic systems that has been done through the Clean Water Act Section 319 program, including the Powwow Watershed, Nippo Lake, Parsons Creek (Rye), and Baboosic Lake (Amherst).

• Jon Balanoff, Executive Director of Acton Wakefield Watershed Association discussed the Septic System Cost-Share Replacement Program on Province Lake as well as the Phosphorus Load Model they are using to guide nutrient reduction priorities.

February 21, 2020

Dr. Jayne Knott of JFK Environmental Services gave a presentation about the potential impact of groundwater rise in the coastal zone on shallow buried infrastructure, where rising water tables will reduce the vertical separation between leach fields and groundwater. Dr. Knott and a team at UNH have modeled groundwater rise scenarios in several communities around the Great Bay estuary.

July 15, 2020

• Dr. Bianca Ross from University of Rhode Island discussed different approaches to advanced treatment systems that reduce nutrient pollution from septic systems in freshwater and estuarine environments. Many different technologies are available for both new construction and retrofits of existing systems, with a range of costs.

• Dr. Robert Roseen of Waterstone Engineering gave a brief overview of the septic-related findings in a feasibility analysis[4] of EPA's proposed Great Bay Total Nitrogen General Permit. Among the findings of this study are that retrofit of existing septic systems could theoretically provide a cost-effective approach to reducing as much as 40% of the non-point source and stormwater-derived nitrogen load in the Great Bay estuary.

3. Summary of findings

A. Extent of the Problem

1. An estimated 85% of households in NH utilize private septic systems for waste disposal.

2. Well-designed, installed and maintained septic systems are designed to be effective at breaking down harmful bacteria from human waste. However, they are not

[3] Available at https://www.des.nh.gov/organization/divisions/water/wmb/coastal/nonpoint/index.htm

[4] https://www.clf.org/wp-content/uploads/2020/05/Full-Study.pdf

designed to be water quality treatment systems with respect to nutrients like phosphorus and nitrogen. Septic systems do reduce phosphorus loads to some degree, but most of the nitrogen and phosphorus that is concentrated in liquid effluent of human waste flows through the septic tank and into the leach field before moving offsite into groundwater and surface water. Nitrogen and phosphorus – oftentimes called "nutrients" because they enhance plant growth - cause numerous water quality problems when excessive amounts flow into freshwater and estuarine water bodies.

3. Many water bodies in the state, both freshwater and estuarine, are experiencing water quality problems due to high levels of phosphorus (in freshwater systems) and nitrogen (in estuarine systems). Septic systems – both failing ones and those that are properly sited and maintained - contribute a substantial portion of the nutrient load to water bodies in New Hampshire.

4. Many of NH's lakes have experienced harmful algal blooms related to high levels of phosphorus and 65 lakes around the state have been identified as "impaired", meaning that phosphorus levels are so high that they cause impacts on aquatic life (see Appendix A). These lakes are spread across the state from the Lakes Region south. The number of toxic cyanobacteria blooms on lakes appears to be increasing over time but is highly variable.

5. While it may be difficult to precisely calculate the phosphorus load into NH lakes from septic systems (as opposed to other non-point sources), there have been measurable reductions in phosphorus levels – and improvement in overall water quality - in several lakes where there have been systematic efforts to identify and upgrade problematic septic systems.

6. Most waterbody segments in the Great Bay Estuary do not meet State Water Quality Standards and are classified as impaired, with many impairments due to elevated levels of nitrogen (see Appendix B). Excess nitrogen in coastal waters contributes to a process called eutrophication wherein algae proliferates, reducing water clarity, light transmission, and levels of dissolved oxygen that other marine organisms need to survive. Eutrophication also contributes to the decline of eelgrass, a foundational plant in healthy estuaries.

7. Of the total nitrogen load in the Great Bay Estuary that comes from so-called "non-point sources" – which includes everything except the load from municipal wastewater treatment facilities - nearly 30% is estimated to come from tens of thousands of septic systems used by more than half the residents of watershed communities.[5]

8. NHDES's 2014 Great Bay Nitrogen Non-Point Source Study[6] assumes an excretion rate of 10.6 pounds of nitrogen per person, 60% of which ends up in rivers and the estuary from septic systems that are within 200 meters of receiving water bodies. The delivery factor of nitrogen decreases with distance from receiving waters.

9. Systems that are in outright failure – that don't "contain or treat sewage" are fairly obvious problems to detect due to overflowing or soggy leach fields. Cesspools are, by definition, in failure and must be replaced. However, many septic systems cause water

[5] NHDES GBNPSS Report, 2014, p.1

[6] NHDES GBNPSS Report, 2014. See Appendix G and H

pollution problems without any visible sign of failure. Systems that are improperly sited, have cracked or leaking tanks, lack adequate separation between the leach field and fluctuating height of water table, or have clogged leach fields, can all contribute excess bacteria, biological oxygen demand (BOD) and nutrient pollution to groundwater or surface waters.

10. Reliable numbers for troublesome systems do not exist, but local surveys of lakes find that a substantial number of private systems predate the 1967 State permitting process, and/or are within 250 feet of the water body, and/or are in failure or underperforming.

11. On a per pound basis of nitrogen or phosphorus removed, it generally costs less to upgrade on-site septic systems than to invest in large municipal wastewater treatment facilities or extension of sewer lines. While it may make sense in some impaired, high-growth areas to extend sewer lines (i.e. Sagamore Creek in Portsmouth), it is also important to consider the role of septic systems in recharging local groundwater aquifers and not transferring water "out of basin".

12. Groundwater levels in NH's coastal zone will rise due to hydrostatic pressure from sea level rise, reducing the vertical separation between leachfield and water table. Models indicate that areas within several miles of the coastal zone will experience groundwater rise due to climate-induced sea level rise within the lifespan of septic systems being installed currently.[7][8]

13. There is a widespread lack of awareness by homeowners about the location, condition, and maintenance needs of onsite wastewater systems. This "out of sight, out of mind" problem compounds the challenge of reducing water quality impacts of septic systems.

B. Regulatory overview

1. Prior to 1967 there was no state permitting of septic systems in New Hampshire. The State Legislature adopted RSA 149-E in 1967 requiring state-approved septic plans for systems within 1000 feet of surface waters and amended it in 1971 to apply to all septic systems in the state. Regulations have become gradually more protective (e.g. Comprehensive State Water Quality Improvement law).

2. State code requires a setback of 75 feet from water bodies and wells, and a minimum separation of two feet between leach field and groundwater.

3. DES reviews all applications for septic systems. In 2019 7000 approvals were granted.

[7] https://prepestuaries.org/may-2018-as-sea-level-rises-groundwater-does-too/

[8] CONCURRENT-4.1-Jayne-Knott-and-Sherry-Godlewski.pdf

4. DES permits designers and installers, relying on these professionals for proper siting and installation. DES does not inspect septic systems until they are approximately 90% complete.

5. The agency can require replacement of an identified system in failure, defined as a system that doesn't "contain or treat sewage". However, the state does not have a mechanism of capturing systems that are underperforming, or are intermittently problematic due to changing groundwater levels, periods of more intense use of the septic system, and other variables.

6. The State of NH has standards for nitrogen ((10 Mg/l at property line). There are no standards for phosphorus, Biological Oxygen Demand (BOD), bacteria or Total Suspended Solids (TSS) for septic system installations.

7. RSA 485-A:39[9] requires site evaluation of property using septic systems within 200 feet of a waterbody at the time of transfer and reporting the findings to the buyer, but this provision is little known or enforced. It should be noted that it does not require an inspection of the septic system itself and there is no requirement that the report is submitted to NHDES.

8. Using RSA 147, municipalities can and have used authority under health codes to require additional setbacks from wells, wetlands and water bodies.[10]

9. Many home buyers do conduct septic inspections as part of the overall home inspection prior to purchase but they are not required to do so. Banks do not require septic inspections or site assessments as part of loan agreements.

10. When necessary, DES Subsurface Bureau generally issues waivers for the replacement of septic systems on non-conforming grandfathered lots and allows property owners to continue using pre-1967 waste disposal systems as long as they are not in failure. Holding tanks are considered an option of last resort since they need to be pumped regularly, but they are allowed where it is not practical to install a septic system.

C. Advanced Treatment Technology

1. NHDES has an Innovative Alternative Technology Committee that gives approval to non-conventional septic system technology that may be utilized – but not required - in non-conforming or grandfathered lots.

2. There are many approaches to improving effluent water quality from septic systems. New innovative technologies for septic systems can reduce nitrogen and, to a lesser extent, phosphorus. Other retrofit technologies can reduce nutrients within the septic tank before effluent is discharged to the leach field.

3. Costs of residential innovative technologies range widely from $2,500 - +$20,000 per household. Commercial systems can be significantly higher depending on scale. Some systems have additional monthly costs for electricity where recirculating pumps or fans are

[9] http://www.gencourt.state.nh.us/rsa/html/L/485-A/485-A-39.htm

[10] http://www.gencourt.state.nh.us/rsa/html/x/147/147-mrg.htm

required. Ongoing maintenance of such systems is critical to ensuring they are performing properly, but there is no mechanism for ensuring regular inspection.

D. Financing

1. Many property owners are unable to afford septic system evaluations or to upgrade or replace underperforming ones. Some NH watershed associations with existing watershed management plans have been able to assist homeowners with 319 grant funds. Some states, including New York and Rhode Island, have revolving loan funds and/or grant programs available to defray some of the cost of system replacement and advanced treatment. See Appendix C.

2. Other sources of funding for septic system improvements might include Clean Water Act 319 and 604 (b) funds, State Revolving funds, municipal bonds, watershed associations and private donations[11].

E. Future risks

1. The impacts of climate change - with rising sea levels, increased storm surge, and increasing intensity and frequency of precipitation events – will impact septic systems in different ways.
   a. Tidal inundation has been modeled along the NH coastline showing areas that will be impacted by different scenarios of sea level rise. Low-lying and shallow buried infrastructure is particularly vulnerable from both inundation and saltwater intrusion, including septic systems with design lifespans of several decades.[12]
   b. In the coastal zone, sea level rise exerts hydrostatic pressure on the water table, causing it to rise measurably as far as 4-5 kilometers inland from the coastal fringe. Groundwater rise reduces the unsaturated treatment zone between the leach field and water table, with the potential of exacerbating water quality impacts on groundwater and surface water.
   c. Climate change is causing increased intensity and frequency of rain events and droughts, altering water table levels, steamflow, and wetland boundaries.[13]
2. While the more densely populated regions of NH are served by public wastewater treatment facilities, an estimated 50% of the population of the Great Bay Watershed and +80% of the state as a whole are served by onsite wastewater systems. Population growth and development in rural and semi-rural communities will compound water quality problems on NH's freshwater and estuarine water resources. With a typical

[11] https://www.des.nh.gov/organization/divisions/water/wmb/was/categories/grants.htm

[12] CONCURRENT-4.1-Jayne-Knott-and-Sherry-Godlewski.pdf

[13] Knott-et-al-2016-03-18-Modeling-the-Effects-of-CC-and-SLR-on-Groundwater-with-Implications-for-Road-Infrastructure.pdf

design life of 20-30 years, septic systems installed today will have long-lasting impacts on rivers, lakes, bays and coastal areas in New Hampshire.

F. Pertinent regulatory approaches from other states – see Appendix C. There is much that NH can learn from regulations, funding programs, and advanced treatment technology research in other Northeastern states. The Study Commission would have explored these topics more fully had the pandemic not impacted the meeting schedule.

1. Massachusetts Title V requires inspection at time of property transfer, 4-5' separation requirements depending on perc rates, specifications within "nitrogen-sensitive areas", and quarterly monitoring of alternative technology systems. Barnstable County is leading work on advanced treatment.
2. Maine's Shoreland Protection Ordinance establishes a 250 foot protective zone, and has a Small Community Grant Program.
3. New York has multiple funding programs to support replacement and upgrades, especially in Suffolk County on Long Island.
4. Rhode Island has a tiered system requiring advanced treatment in Critical Resource Areas. The RI Clean Water Finance Agency provides line-of-credit and low-interest loans up to $25,000, state-required operations and maintenance contracts for advanced treatment systems,
5. Connecticut established Areas of Special Concern with more stringent requirements, use of maximum groundwater elevation rather than seasonal high water to determine 18-24" separation, has a provision that considers impacts of stormwater infiltration systems on nearby septic systems, and requires pumping every 5 years (3 years for systems serving multiple dwellings).

4. Recommendations for 2021 Legislative Session

1. It is the long-term goal of this Commission to have state-approved septic systems on all properties that impact the health of New Hampshire's lakes, rivers, bays and coastal zone. In the near term, the Commission recommends focusing enhanced septic system initiatives on those waterbodies with recognized, nutrient-related water quality impairments, including nitrogen, phosphorus, bacteria, algal blooms, and others.
2. Increase the efficacy and enforcement of RSA 485-A:39 to establish a Waterfront Protection Zone (WPZ) in areas with recognized nutrient-related water quality impairments. Within this zone – defined as **200 meters (650 feet) in tidal and 250 feet in freshwater/non-tidal regions** - inventory the location and functionality of all septic systems, with particular focus on identifying properties without State-approved septic systems. The 250-foot zone in freshwater areas is consistent with the NH Shoreland Water Quality Protection Act, while the 200-meter zone is consistent with the findings of the Great Bay Nitrogen Nonpoint Source Study that identifies 60% of the septic

system-derived nitrogen load coming from systems in this proximity to receiving waters. (See Footnote 4)[14]

3. Within this Waterfront Protection Zone, require both a site assessment and septic system evaluation before a property is sold or transferred, with the relevant reports a required disclosure to prospective buyers. These reports should also be provided to the municipality and NHDES.[15]
4. In the near term, and within the Waterfront Protection Zone, DES should recommend advanced treatment systems for all new development and any renovation that increases sewage loading, or connection to public wastewater if that option exists. The long-term goal is to require advanced treatment septic systems for all new development or renovations that increase sewage loading within the Waterfront Protection Zone, even on grandfathered or non-conforming lots.
5. Consider amending State statutes to give municipalities direct statutory authority to establish local septic system codes that are more protective of sensitive water resources than current state standards.[16]

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[14] The New Hampshire Association of REALTORS does not believe a 250 foot "Waterfront Recovery Zone" on freshwater/non-tidal waters is appropriate. Currently, RSA 485-A:39 requires a site assessment on all "developed waterfront" properties. "Developed waterfront" is defined as a parcel of land within 200 feet of the reference line. The 250-foot recommendation will create confusion and will place other recommendations in this report in conflict with RSA 485-A:39. NHAR does not believe a new "Waterfront Recovery Zone" is needed as the NH Shoreland Water Quality Protection Act already provides sufficient, and well documented, protections of non-tidal waters. The report does not provide clear guidance or recommendations relative to the rationale for the creation of this new zone.

[15] New Hampshire Associations of REALTORS believes that site assessments in the developed waterfront, meaning parcels within 200 feet of reference line, are already mandated under RSA 485-A:39. The practical application of this recommendation is to increase that existing mandate an additional 50 feet. NHAR is unaware of specific data provided to the Commission to support this expansion of the developed waterfront definition in RSA 485-A:2. Currently, property buyers, prior to transfer, are conducting property inspections when purchasing any parcel with a septic system. Replacement of a failed septic system generally costs between $15,000 to $30,000, although in certain cases the cost can reach up to $50,000, and buyers recognize the need to protect their investment before reaching a final purchase price. An inspection of the system costs between $350 to $1000. No evidence was brought forward that buyers were in fact not obtaining an inspection prior to purchase. NHAR members are involved in 90% of all property transfers, and buyers failing to engage a septic inspector are rare. In fact, NHAR's Purchase and Sale document requires a buyer to proactively agree to or reject an inspection of the sewage disposal system. Further, this recommendation does not stipulate if the new mandate is on the seller or the buyer of the property. Regardless of any inspection completed by the seller, REALTORS recommend the buyer conduct their own inspections. If the new mandate is on the seller then it will simply increase costs without providing additional benefit. While buyers are almost universally inspecting septic systems, there are certain situation where they are not. Those are primarily when the system is less than two years old or if the buyer has already acknowledged that they will need to replace the system. The buyer should retain the option to inspect on their terms.

[16] NH Association of REALTORS believes that most municipalities do not have access to appropriate professional scientific and technical assistance to make reasoned and fact-based regulations on septic regulations. The NH Department of Environmental Services is the more appropriate regulator. Many towns have used the expansion of their septic and sewage ordinances as an obstacle to the creation of new affordable housing. Forcing a $15,000 to $30,000 cost on the construction or sale of property can eliminate the economic feasibility of a project. Towns have used the costs to prevent development under the auspices of environmental protection. Such regulatory decisions should be left with NH DES and the legislature.

6. Develop a model local septic system ordinance similar to the Southeast Watershed Alliance stormwater model ordinance.
7. Develop a low-interest state revolving loan fund, tax credits and/or other financial incentives to support septic system inspections, pumping, upgrades and retrofits, operation and maintenance, and advanced treatment systems, especially for low and moderate-income homeowners in highly sensitive or impaired areas.
8. Encourage and support voluntary partnership programs between NHDES, regional planning organizations, NH LAKES, and local watershed associations in which septic systems are inventoried, problems identified, and education/outreach programs are coupled with financial incentives to improve maintenance and upgrade troublesome septic systems.
9. Provide additional staff to NHDES to handle the septic system approval process, certification of installers and inspectors, Waterfront Protection Zone requirements, and certification and monitoring of advanced treatment technologies.
10. Establish nitrogen and phosphorus removal standards, and monitoring requirements for advanced treatment systems, to ensure that such systems are performing as intended and adequately protecting water quality.
11. In tidal areas where there is anticipated sea level-induced groundwater rise, amend State siting regulations to require minimum separation distances at both current and projected seasonal high-water levels to ensure adequate separation throughout the design life of new septic system installations. State siting regulations should also consider the horizontal distance between septic systems and sensitive surface-water bodies such as fresh and saltwater wetlands, which may expand with sea level rise and sea level rise-induced groundwater rise. Additional modeling and mapping is needed to more accurately identify vulnerable coastal areas that will be impacted under different sea level rise scenarios.
12. Consider reciprocity with other states that have approved advanced treatment technologies.

5. Outstanding Questions

The Shoreland Septic System Study Commission left many questions unanswered due to lack of time, need for additional research, and differing viewpoints of members. These questions could be explored more fully if the Legislature decides to extend the life of the Shoreland Septic System Study Commission, or be taken up by a future group.

NHAR also has concerns that some towns are exceeding current statutory limitations with their septic ordinances. For instance, a community which currently mandates the inspection and replacement of any septic system, especially if it prohibits the sale of a property, is engaged in a regulatory scheme which NHAR does not believe would hold up under judicial review.

1. Should site assessment and septic system inspection be required at the time of property transfer on a statewide basis?
2. Can septic system evaluations be required when a building permit is sought for any work on a structure, whether involving increase in load or not? This would be an opportune time to locate and assess septic systems but would require involvement of local building inspectors or code enforcement officers, which not all municipalities have.
3. Currently NHDES inspects septic system installations when they are approximately 90% complete. Would earlier inspection reduce the incidence of improperly installed septic systems?
4. Should pumping be required on a periodic basis? The NH LAKES LakeSmart program recommends that property owners work with licensed Granite State Septic and Designers to determine the frequency that is appropriate based on site, technology, and usage patterns.
5. Explore a regional nitrogen and phosphorus credit trading mechanism wherein communities could fund septic system upgrades if that is a more cost-effective approach to nutrient reduction than other stormwater or wastewater investments.
6. Additional groundwater rise modeling and mapping is needed in the coastal zone to better understand areas of future vulnerability in which more protective septic system codes and requirements should be adopted.
7. What more can we learn from programs and policies in other Northeastern states that would more fully inform how septic systems are designed, regulated, monitored and financed in New Hampshire?

CONCLUSION

The NH Shoreland Septic System Study Commission (the "Commission") was convened in October 2019 and met monthly through February 2020. Meetings were suspended due to the pandemic until the group reconvened in July 2020. The Commission endeavored to learn as much as possible about the function, regulation, and environmental impact of septic systems - the onsite waste disposal system used by an estimated 85% of households in New Hampshire. The Commission focused on the water quality problems created by septic systems installed prior to 1967 which have no state approval. It also explored the larger water quality impacts of septic systems since even those that are properly sited and designed with state approval are significant sources of phosphorus and nitrogen pollution in freshwater and estuarine waterways. Climate change will create additional water quality impacts from septic systems due to altered hydrology and groundwater rise.

While there is still much to learn about the complex topic of septic system regulation, function and design, there is broad consensus by the Commission that septic systems should be more tightly regulated, particularly in "Waterfront Protection Zones" around water bodies with known water quality impairments. The NH Shoreland Septic System Study Commission urges legislators to use this report to become better informed and advance proposals that will

improve the health of the State's lakes, rivers, bays and coastal waters through enhanced regulation, additional capacity for the NHDES Subsurface Bureau, more support for voluntary education and upgrade programs, and financing mechanisms to assist homeowners in need with the costs of maintenance, replacement, and advanced treatment.

Appendix A

TP impaired Lakes in NH —Highlights are lakes proposed for delisting in 2020 – Category 4A means that a TMDL has been produced and approved.

AUID	Name	Cat
NHIMP700060402-02	WEBSTER STREAM - LOCKE LAKE	5-M
NHIMP700061403-04	POWWOW RIVER - POWWOW POND	5-M
NHLAK400010403-02	LITTLE DIAMOND POND	5-M
NHLAK600020902-01	PROVINCE LAKE	5-M
NHLAK600030601-05-01	SUNRISE LAKE	5-M
NHLAK600030606-01	LONG POND	4A-M
NHLAK600030703-01	GOVERNORS LAKE	4A-M
NHLAK600030704-02-01	PAWTUCKAWAY LAKE	4A-M
NHLAK600030705-03	NORTH RIVER POND	5-M
NHLAK600030802-03-01	PHILLIPS POND	4A-M
NHLAK600030802-04	SHOWELL POND	4A-P
NHLAK600030903-03	SWAINS LAKE	5-M
NHLAK700010701-05	WAUKEENA LAKE	5-M
NHLAK700020103-03	GARLAND POND	5-M
NHLAK700020201-02	HUNKINS POND	4A-M
NHLAK700030102-01-01	THORNDIKE POND	5-M
NHLAK700030105-01-01	ZEPHYR LAKE	5-M
NHLAK700030108-02-01	GREGG LAKE	5-M
NHLAK700030202-02-01	ISLAND POND	5-M
NHLAK700030204-03	ISLAND POND	5-M
NHLAK700030303-04	MESSER POND	5-M
NHLAK700030304-05	TOM POND	4A-M
NHLAK700030402-01	CHASE POND	5-M
NHLAK700030403-01	ADDER POND	5-M
NHLAK700030504-02-01	FRENCH POND	4A-M
NHLAK700030504-03	KEYSER POND	5-M
NHLAK700040401-02-01	POTANIPO POND	5-M
NHLAK700060101-02-01	SONDOGARDY POND	4A-M
NHLAK700060201-03	NEW POND	5-M
NHLAK700060201-05	SHELLCAMP POND	5-M
NHLAK700060202-03-01	CLOUGH POND	5-M
NHLAK700060402-03	HALFMOON LAKE	5-M
NHLAK700060502-06	JENNESS POND	5-M

NHLAK700060605-01-01	DANIELS LAKE	5-M
NHLAK700060605-04-01	HAUNTED LAKE	5-M
NHLAK700060607-02	NAMASKE LAKE	5-M
NHLAK700060802-01	DORRS POND	4A-P
NHLAK700060803-01	NUTT POND	4A-M
NHLAK700060804-02	SEBBINS POND	4A-M
NHLAK700060804-03-01	SANDY POND - CAMP FOSTER POND	4A-M
NHLAK700061002-01-01	DARRAH POND	5-P
NHLAK700061101-01-01	ISLAND POND	5-M
NHLAK700061102-03-01	CAPTAIN POND	4A-M
NHLAK700061203-02-01	BEAVER LAKE	5-M
NHLAK700061203-06-01	ROBINSON POND	4A-M
NHLAK700061204-01-01	COBBETTS POND	5-M
NHLAK700061205-02-01	LONG POND	5-P
NHLAK700061403-01-01	ANGLE POND	5-M
NHLAK801010701-02	YORK POND	5-P
NHLAK801030102-02	MARTIN MEADOW POND	5-M
NHLAK801030502-01	DODGE POND	5-M
NHLAK801030502-04	ROUND POND	5-M
NHLAK801030505-03	LOWER MOUNTAIN LAKE	5-M
NHLAK801060101-05	RESERVOIR POND	5-M
NHLAK801060105-04-01	MASCOMA LAKE	5-M
NHLAK801060401-06	EASTMAN POND	5-M
NHLAK801060402-02	BAPTIST POND	5-M
NHLAK801060402-03	CHALK POND	5-M
NHLAK801060405-03	PERKINS POND	5-M
NHLAK801070203-01	WARREN LAKE	5-M
NHLAK802010201-03	CENTER POND	5-M
NHLAK802010303-02	MEETINGHOUSE POND	5-M
NHLAK802010401-01-01	FOREST LAKE	4A-M
NHLAK802020103-04	EMERSON POND	5-M
NHLAK802020103-06	LAKE MONOMONAC	5-M

Appendix B

Draft 2020 assessment of eutrophication parameters for the Aquatic Life designated use in the Great Bay Estuary assessment zones. Assessment category definitions are provided in sections 3.1.3 and 3.1.5 of the 2020 CALM.

De-impairment	New Impairment

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Squamscott River South	2020	5-P	5-P	5-P	No Std	No Std	5-P
Squamscott River North	2020	5-P	5-P	5-M	5-P	5-P	5-P
Lamprey River North	2020	5-M	5-P	5-P	No Std	No Std	5-M
Lamprey River South	2020	5-M	3-PNS	3-PNS	5-P	5-P	5-M
Winnicut River	2020	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
Great Bay	2020	5-M	3-PNS	2-M	5-P	5-M	5-M
Oyster River	2020	5-M	5-P	5-P	5-P	5-P	5-M
Bellamy River	2020	5-M	5-P	2-M	5-P	5-P	5-P
Little Bay	2020	3-PNS	2-G	2-G	5-P	5-M	3-PNS
Cocheco River	2020	5-P	5-M	3-PAS	No Std	No Std	5-M
Salmon Falls River	2020	5-P	5-P	5-M	No Std	No Std	5-M
Upper Piscataqua River	2020	2-M	2-M	2-M	5-P	5-M	3-PNS
Lower Piscataqua River - North	2020	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
Lower Piscataqua River - South	2020	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
North Mill Pond	2020	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
South Mill Pond	2020	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
Portsmouth Harbor	2020	2-G	2-G	2-G	5-P	5-M	2-M
Sagamore Creek	2020	5-P	5-P	2-M	5-P	3-ND	5-M

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Little Harbor/Back Channel	2020	3-PAS	3-PAS	3-ND	5-M	5-M	3-ND

Aquatic Life Integrity Designated Use Assessment Summary Table

Comparison of the Final 2016 and Final 2018 (based on assessment zone) to the Draft 2020 assessment of eutrophication parameters for the Aquatic Life designated use in the Great Bay Estuary assessment zones. Assessment category definitions are provided in sections 3.1.3 and 3.1.5 of the 2020 CALM.

De-impairment | New Impairment

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Squamscott River South	2018	5-P	5-P	5-M	No Std	No Std	5-P
	2020	5-P	5-P	5-P	No Std	No Std	5-P
Squamscott River North	2018	5-P	5-P	5-M	5-P	5-P	5-P
	2020	5-P	5-P	5-M	5-P	5-P	5-P
Lamprey River North	2018	5-M	5-P	5-P	No Std	No Std	5-M
	2020	5-M	5-P	5-P	No Std	No Std	5-M
Lamprey River South	2018	5-M	2-G	3-ND	5-P	5-P	5-M
	2020	5-M	3-PNS	3-PNS	5-P	5-P	5-M
Winnicut River	2018	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
	2020	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
Great Bay	*2016*	3-PNS	3-PNS	2-M	5-P	5-M	3-PNS
	2020	5-M	3-PNS	2-M	5-P	5-M	5-M
Oyster River	2018	2-M	5-P	5-P	5-P	5-P	5-P
	2020	5-M	5-P	5-P	5-P	5-P	5-M
Bellamy River	*2016*	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
	2020	5-M	5-P	2-M	5-P	5-P	5-P
Little Bay	*2016*	3-PNS	2-G	2-G	5-P	5-M	3-PNS
	2020	3-PNS	2-G	2-G	5-P	5-M	3-PNS
Cocheco River	2018	5-P	5-M	2-M	No Std	No Std	5-M
	2020	5-P	5-M	3-PAS	No Std	No Std	5-M
Salmon Falls River	2018	5-P	5-P	5-M	No Std	No Std	5-M
	2020	5-P	5-P	5-M	No Std	No Std	5-M
Upper Piscataqua River	*2016*	2-M	3-PNS	2-G	5-P	5-P	3-PNS
	2020	2-M	2-M	2-M	5-P	5-M	3-PNS
Lower Piscataqua River - North	2018	3-PAS	2-G	2-G	5-P	3-PNS	3-PAS
	2020	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
Lower Piscataqua River - South	2018	3-PAS	2-G	2-G	5-P	3-PAS	3-PAS
	2020	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
North Mill Pond	2018	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
	2020	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
South Mill Pond	2018	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
	2020	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
	2016	2-G	2-G	3-PAS	5-P	5-M	2-M

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Portsmouth Harbor	2020	2-G	2-G	2-G	5-P	5-M	2-M
Sagamore Creek	2018	3-ND	5-M	3-PNS	5-P	3-ND	3-ND
	2020	5-P	5-P	2-M	5-P	3-ND	5-M
Little Harbor/Back Channel	2016	3-ND	3-ND	3-ND	5-P	5-M	3-ND
	2020	3-PAS	3-PAS	3-ND	5-M	5-M	3-ND

Appendix C – from *Avoiding Septic Shock: How Climate Change Can Cause Septic System Failure and Whether New England States are Prepared. Elena Mihaly, Conservation Law Foundation, February 2019, p.6*

State	Septic System Regulation	Date of updated regulation	Minimum Separation Distance	Post-construction Inspections Required?	Inspections recommended?
CT	Regs. Conn. State Agencies §19-13-B100a.	2015 (Technical Design Standards)	1.5 ft (non-coastal areas) to 2 ft (if soil percolation is faster than 1 min per inch).	No.	Local directors of public health perform inspections "when deemed necessary."
MA	310 CMR 15.000 ("Title V")	2016	4ft (if soil percolation is slower than 2 min per inch) to 5 ft (if soil percolation is faster than 2 min per inch).	Yes. Septic systems must be inspected when property is sold, increased flow, or expanded. If alt/ innovative system, then required quarterly inspections.	N/A
ME	10-144 CMR Ch. 241	2011	9 inches (outside the shore land area) to 1.25 ft (within the shoreland area).	No.	State recommends new buyers get septic inspected.
NH	Env-Wq 1000	2016	2ft-4ft, depending on slope of site and components of system.	No.	State recommends local health officers conduct inspections once every three years.
RI	R.I. Code R. 25-16-17:32, 39	2016	2ft in all watersheds, except 4ft in "critical resource area" watersheds. Mandatory advanced N-removal technologies in CRA watersheds. Requires new system (conventional or alternative/innovative) if the current system is a cesspool near a public drinking water supply, a public well, or a bordering tidal water area.	No.	State *may* at its discretion inspect any aspect of the installation, but not statutorily required (system designer is responsible for this). Existing systems inspected under town wastewater management programs.
VT	Vt. Admin. Code §16-3-300	2007	Prescriptive = 2 ft Enhanced Prescriptive = 1.5 ft Performance Based = 6 inches plus calculated induced groundwater mounding	No.	After installation, inspections are done at the discretion of the State.

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