March 28, 2022

Water Quality Committee Report

Introduction

The focus of the activities of the Water Quality Committee has been to gather information about water chemistry, phosphorus removal, and septic system programs, all in order to be prepared for receiving the SMAST Water Quality Report. It is thought that having a broad base of knowledge during evaluation of the report will speed the process and improve the final result.

Peter Schwartzman Savery Pond Experience with SMAST

Peter Schwartzman is the president of the Savery Pond Conservancy. SMAST did a Water Quality Plan for them last year and they have done the evaluation of the report and met with SMAST. At our last BOD meeting, Brian suggested that we find out more about their experience with SMAST before undertaking the process ourselves. Below is my report of the meeting, edited by Peter.

Peter Schwartzman – Savery Pond Experience with SMAST WQP – February 25, 2022

In previous Herring Ponds Watershed Association Water Quality Committee discussion with Stephen Silva of the Taunton River Watershed Alliance, he was asked about his opinion of SMAST as a provider of water quality plans. His reluctance to comment led to a discussion at the Herring Ponds Watershed Association Board of Director meeting on February 21 about paying another expert to evaluate the upcoming report from SMAST. It was agreed that HPWA will wait until the report is received and examined by our watershed association before doing so but I had wanted to talk with Peter Schwartzman, president of the Savery Pond Conservancy (SPC) about his experience with SMAST when they prepared the Savery Pond Water Quality Plan*.

I talked to Peter, a hydrogeologist, on the phone on February 25. Peter was very discreet about his reply to my question about Savery Pond's experience with SMAST and this writeup of our conversation was sent to him for his review prior to distribution.

Peter appreciated the fact that SMAST's main conclusion from the study was effectively correct; that ground water pumping appears to have a significant impact on freshwater flushing of the pond, associated nutrient concentrations, and therefore the frequency of algal blooms. Peter would have used different methods to reach this conclusion and was disappointed that SMAST did not seem to have a lot of knowledge of groundwater. In Peter's opinion, some of SMAST's analysis did not incorporate credible information SPC provided regarding the groundwater flow system.

Peter was also disappointed that SMAST did not include significant consideration of ongoing nutrient loading from a recently fallowed cranberry bog ("East Bog") that was acquired by the Town in October 2016. SMAST was aware of data SPC had collected from the bog during their analysis but neglected to include that data in the nutrient loading analysis. Peter felt that the East Bog should have been considered in the SMAST analysis.

Peter noted that SPC had mistakenly neglected to send some field-collected data to SMAST prior to them performing their analysis. The 2017 data was sent as part of the review process and Savery Pond offered to pay extra to have the results considered. The data were included in an appendix, but not analyzed at the same level as prior data.

Peter stated that he did not consider himself enough of an expert on certain aspects of the study to be able to comment on that data, especially the biotic community surveys and the sediment core incubation analysis. SPC made no comments on those elements.

The study involved a lot of work and provided adequate value for the money. In the end, SPC decided that it was not worthwhile to battle with SWMAST about SPC's concerns and critiques as they felt that the study's conclusions had the greatest chance of benefitting the pond.

*The plan can be downloaded here: https//www.plymouth-ma.gov/marine-and-environmental-affairs/news/savery-pond-management-plan-oct-2021

Decentralized Wastewater Treatment

Septic systems are typically a major source of phosphorus in freshwater ponds. Geri and I spend the winter in Nags Head, NC and over the 25 that we have owned our Nags Head house, we have gotten to know some of the Nags Head staff and programs. One excellent program tracks septic systems in order to ensure that their groundwater, that like Plymouth's is close to the surface, stays unpolluted. Not only do they pay for all septic inspections, but they also give rebates on septic pumping costs. Nonetheless, they authorized a consultant to prepare a Decentralized Wastewater Treatment plan in order to further guarantee that their water quality would remain high.

I attended the meeting where the consultant presented the rough draft of their work. One aspect of HPWA's water quality program might involve a septic improvement component in order to ensure that any money spent on reducing phosphorus and, hence, cyanobacteria and algae blooms, would not be wasted. Below is a copy of the writeup of that meeting.

Decentralized Wastewater Management Plan – March 2, 2022

Geri and I have had a property in Nags Head, NC for 25 years. We have been impressed with their septic initiatives (free inspections, pumping cos subsidy) and have noticed that in several ways, Nags Head is like Plymouth: 1) population is much greater in the summer, 2) a great majority of the town has septic systems and 3) the water table is close to the surface.

I have built a relationship with the Nags Head Planning Department and was excited to learn that Nags Head is embarking on a decentralized wastewater treatment policy. Installation of sewer lines is very expensive, but septic is generally considered less environmentally friendly. Geri and I spend our winters in Nags Head now that we are both retired, and I attended a Nags Head Commissioners (Selectmen equivalents) meeting where a consultant presented the first draft of the Decentralized Wastewater Management Plan.

The presentation was relevant to the Herring Pond Watershed Association's imminent Water Quality Plan, so I have written a summary below.

Presentation to Nags Head Board of Commissioners

The presentation was made by Holly Miller of Tetra Tech.

The focus of the study was to find ways to make septic systems (decentralized wastewater management) work for Nags Head.

Step 1: Review Todd D Krafft Septic Health Initiative Program

Todd was a farsighted Nags Head employee who involved town government in septic issues to the extent that they would assist in sending out pumping reminders to residents and subsidize inspections and pumping costs. Based on an analysis of Todd's Septic Health Initiative Program, Tetra Tech has recommended that the number of septic inspections and pumpings be increased, the subsidies be increased, and detailed septic records be kept. In addition, it was recommended that low-cost loans be made available for residents needing septic repairs and that an extensive resident septic education effort be made by Nags Head.

Step 2: Monitor Water Quality

Nags Head currently monitors several sites for nitrate and enterococci bacteria. The consultant recommended that more sites be monitored; specifically, they suggested that 6 remote water quality data loggers be purchased and put in water quality hotspots. Furthermore, due to the amount of data that will be generated, data analysis should be performed yearly. The sensors would also gather tide, weather (storm, rainfall, etc.) to obtain a data "norm" for each site so that data variations could be accurately evaluated. Nitrate is an indicator of septic failure. Enterococci also indicates water quality problems.

Step 3: Monitor Groundwater

Groundwater can interact with saltwater and with septic wastewater. Nags Head already has an idea of where groundwater is close to the surface. Contamination is likely when septic system wastewater is less than 1.5 feet above the groundwater. Groundwater level in Dare County is showing a rising trend. Mindful of climate change considerations, it is likely that the level will continue to rise due to increased precipitation and storm events, sea level rise, or flooding. The consultant has recommended purchase of 10 remote groundwater data loggers and drilling of 10 more groundwater monitoring wells to track groundwater trends.

Recommendations

- Develop a Climate Model for Nags Head
- Incentivize Storm Water Control Measures
- Reduce Impervious Cover Wherever Possible
- Increase Ditch Capacity Along State Highways
- Preserve Open Space and Vegetation and Plant Trees
- Perform a Septic System Risk Assessment of all Nags Head Septic Systems

- For High-Risk Systems, Town of Nags Head Outreach and Advanced Level Septic Treatment Needed
- Secure State and Federal Grants
- Identify Future Open Space
- Develop Committee for Septic
- Provide Education Packets, "Do's and Don'ts"
- Identify High Water Users (they are more likely to overload septic systems)

Grants

- FEMA BRIC, FMA HMGP, CDBG
- NC DEQ DWI Grants and DWR WRDG
- NC DEQ Land and Water Fund
- NC DOJ EEG

Loans

- Clean Water State and Revolving Fund
- Infrastructure Act and Fund, American Rescue Act Fund
- Partnerships with Universities and Non-Profits

Nags Head, NC Supplementary Septic Information

I petitioned Nags Head for more information about their septic program. Originally, we were to meet to discuss but time constraints prevented our meeting. I did, however, receive a lengthy, detailed email with more information and references which is below.

Kylie Shephard <kylie.shephard@nagsheadnc.gov>
To:donald_r_williams2003@yahoo.com
Cc: Bob Muller
Fri, Mar 11 at 3:17 PM

Don,

Thank you for your interest in our initiative and the DWMP. I have answered some of your questions below. I have also CC'd Bob Muller on this email. Bob served on the Nags Head Board of Commissioners from 1985-2005. He chaired the Town's first Septic Health Initiative Taskforce and was very involved in getting the Septic Health Iniatiative implemented. He was also very involved in the first DWMP. Bob remains a key asset in the SHI, is full of information, and is very passionate about this plan and the Initiative as a whole. He also serves on the current advisory committee for the update of the Plan. I think he would be a great resource for you.

Also, please take a look at our Decentralized Wastewater Management Plan project page. Here you will find background information, meeting minutes, stakeholder documents, presentations, and a copy of the draft plan - https://www.nagsheadnc.gov/1035/Decentralized-Wastewater-Management-Plan

1. Why was sewering not considered?
    a. Through our stakeholder interviews, we found that the residents of Nags Head were extremely against central sewer. There were many reasons behind this, but the biggest one was that septic helps to control lot size. The lots can not be too confined because everyone must have a septic system.
2. Do you have any plans for combining a few nearby properties on one septic system if they don't have enough room on individual properties?
    a. “cluster systems” were addressed in the plan in certain places. However, this is not a route we plan on taking yet. There is information in the plan about how to navigate that if that is a route we take.
3. Wasn't Nags Head considering mini-sewer plants at one point?
    a. We have a wastewater treatment plant – Village of Nags Head
4. Where will the money come from to foot the bill for septic inspections, pumpings?
    a. The consultant has lined out different grant opportunities for the Town but currently the Septic Health Initiative is funded through the water fund and general fund.
5. How "connected" are both ground water and well water in Dare County? How was that determined?
    a. Potable water that we drink is bought from Dare County and brought in. Wells in Nags Head are utilized for irrigation. The interplay between ground water and wells would depend on the depth of the well because they are different aquifers.
6. Are total nitrogen, nitrate and nitrogen NO3 all the same things? They were used interchangeably in the presentation.
    a. Nitrate is the same thing as NO3. Total nitrogen is nitrate + nitrite + and ammonia.
7. Could I get a copy of the presentation?
    a. Please take a look at our Decentralized Wastewater Management Plan page
8. Why not also examine water samples for salt while looking for TP and Nitrate?
    a. On top of bacteria and nutrient samples, we also look at pH, salinity, conductivity, temp, as well as other measurements.
9. What does "SLR" in the presentation stand for?
    a. Sea Level Rise
10. I'd like to hear more about your ideas for citizen education programs.
    a. Refer to DWMP Page
11. How did the idea for a septic "PLAN" come about? How was it "sold" to citizens and town leaders?
    a. Refer to DWMP page

Best,

KYLIE SHEPHARD

Environmental Planner · Town of Nags Head

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Septic Health | Sand Relocation

Algae Control Methods

Geri brought the latest forum with Ken Wagner to my attention. This was of great interest because instead of talking about the many kinds of cyanobacteria and algae and the storied histories and longevity of these species, the presenter focused on the various ways of treating them. I took copious notes and wrote this up, summarized below.

Summary of University of New Hampshire Forum on Algae Control Methods

Ken Wagner

March 24, 2022

There were 100 people attending this presentation including Hilary Snook, USEPA, our cyanobacteria go-to expert who introduced the speaker.

Ken's first point was that most presentations on algae and cyanobacteria dealt with the blooms themselves and not how to remove them. The presentation was an excellent evaluation of the methods for dealing with algae and cyanobacteria. The 2-hour presentation was recorded, and I will get a copy that I will make it available to everyone. Meanwhile, this summary should suffice.

Algae and Cyanobacteria in General

Algae, in and of themselves, are not bad. They become a nuisance when conditions are out of control and lead to blooms.

Algae can originate: 1) at the bottom and rise to the top, 2) at the thermocline layer, or 3) at the surface. Development and agriculture are the major causes of pollution. Phosphorus is the main pollutant of freshwater ponds. Today, it is rare for ponds to have phosphorus concentrations below 0.05 mg/L. Phosphorus is expensive (but not impossibly so) to remove from a pond. It can come from the land or from internal recirculation within the pond. Recirculation sources include: 1) resuspension by wind, boats or fish, 2) release from some aquatic plants ("leaky plants"), 3) release from fish (very minor), 4) release from mineralization (decay mostly under oxic conditions) and 5) release by redox reactions under anoxic conditions. Land-based sources are usually from septic failure, runoff, or from lawn or agricultural fertilizer.

Algae/cyano blooms occur much more often if the land to water ratio in the given watershed is high. Their damage to the water system is unlikely to be completely removed if the development around the water body is greater than 30%, although holding actions can be successful. In other words, it is very difficult, costly, and time-consuming to repair damage to the land around the water body. Ken pointed out that even with only 10% development, water quality could be impacted.

There are 3 basic nutrient/pollutant/bloom controls: 1) preserve the land, 2) trap and remove the algae, and 3) inactivate the pollutant. The presentation dealt with the latter 2.

Trapping and Removing the Algae

- Machines can harvest the algal mats
- A-POD HAB (Harmful Algae Bloom) Removal -- a physical separation, containment and concentration process combined with removal of the "trapped" HABs using natural polymers.
- Portable DAF – dissolved air flotation systems are designed to remove total suspended solids.

These methods have only been tested on a small scale and do not get rid of the source of the problem.

- Flushing must be repeated every three weeks (time for algae bloom development) and large amounts of phosphorus-free water must be available (most treated water has some phosphorus added for rust inhibition).
- Sonication will kill algae but not get rid of the phosphorus. Sonication is also adversely affected by plant growth that blocks sonic effectiveness.
- Algaecides – only two (copper and peroxide) are widely available but each location must be checked to see if they will permit either, neither or only one. These must be applied during the growth cycle of the algae in order to be effective; they don't work well if the algae is well-established. Peroxide is more expensive than copper.
- Biocontrol – use of virus or bacteria is a multi-treatment, multi-step process that doesn't kill all the algae. Ken strongly emphasized that algaecides are far superior to biocontrol.
- Biochar – involves pumping water through a channel of biochar but the biochar sometimes clogs quickly. Ken stated that this method is not yet ready for use.
- In-lake detention requires designating an area to collect and harvest the algae.
- Dilution requires phosphorus-free water and a rather large staging area and has not yet been tried on a large scale.
- Dye addition limits the light needed by the cyanobacteria but adversely affects stratification and DO level at the lake bottom that may neutralize any benefit.

<u>Inactivating the Pollutant</u>

- "Rough" fish removal can help reduce the phosphorus but does not make a major contribution.
- Rooted plant assemblages can inhibit algal growth, but some plants are also "leaky" with phosphorus.
- Selective withdrawal involves pumping deeper water (closer to the sediment phosphorus source) out of the pond. The rate of pumping must be maintained and may be high enough to waste a lot of water. This process can take 20 years of more to show results.
- Dredging involves removal of the phosphorus-containing sediment. It is very expensive and involves a total reset of the pond re: flora, fauna and has no effect on the watershed land pollutants.
- Phosphorus inactivation using aluminum is flexible, effective and affordable. In 20 years of using this treatment, Ken has not seen any problems. Iron will effectively bond phosphorus unless the oxygen level is low. If iron is replaced by aluminum, the phosphorus is more tightly bound under wider ranges of pH and DO level. The active chemical is aluminum sulfate; sodium aluminate is also added to keep the pH from getting too high. Not only does the aluminum inactivate sediment phosphorus, but it also flocculates soluble phosphorus already in the water column. One treatment that Ken was aware of on Long Pond on Cape Cod has lasted 14 years in preventing cyanobacteria and algae blooms. I've heard cost estimates for an alum treatment

from $200,000 to $1,000,000. Cost, as you might expect, varies according to the aluminum dosage deemed necessary to remove enough phosphorus to prevent blooms. This is the 2nd most effective method and the next-to-least expensive method according to Ken.

- Oxygenation/Circulation is based on the principle that if the water is oxygenated, phosphorus won't be stripped from the iron in the sediment and introduced into the water column. In addition, circulation frustrates the air sac-controlled cyanobacteria and slows their growth. These methods are not quite there yet according to Ken. Care must be taken not to disturb the sediment, provide enough oxygen for demand and not to break the stratification layer.

To Do:

I have contacted James Sullivan, president of the Twin Ponds Watershed Association, and he is willing to talk to the Water Quality Committee about White Island Ponds' experience with alum treatment. I have forwarded the final report on that process to the BOD, WQC and interested parties. The experience was a good one based on the report but a personal perspective and comments on the long-term benefits of the alum would be useful. Stay tuned.