



TOWN OF CHARLESTOWN

CHARLESTOWN, RI COASTAL GROUNDWATER PROTECTION AND RESTORATION PROGRAM

SNEP

Southeast New England Program



United States
Environmental Protection
Agency

GROUNDWATER IN COASTAL CHARLESTOWN IS IMPACTED BY NITROGEN

- Charlestown relies solely on groundwater for drinking water and on septic systems (OWTS) for wastewater management
- 80% of nitrogen (N) in groundwater in densely developed areas of Charlestown originates from septic systems¹
- N concentrations are above the drinking water standard, posing public health risks and negatively affecting water quality of coastal ponds^{2,3}
- There is a significant relationship between density of septic systems and groundwater quality²



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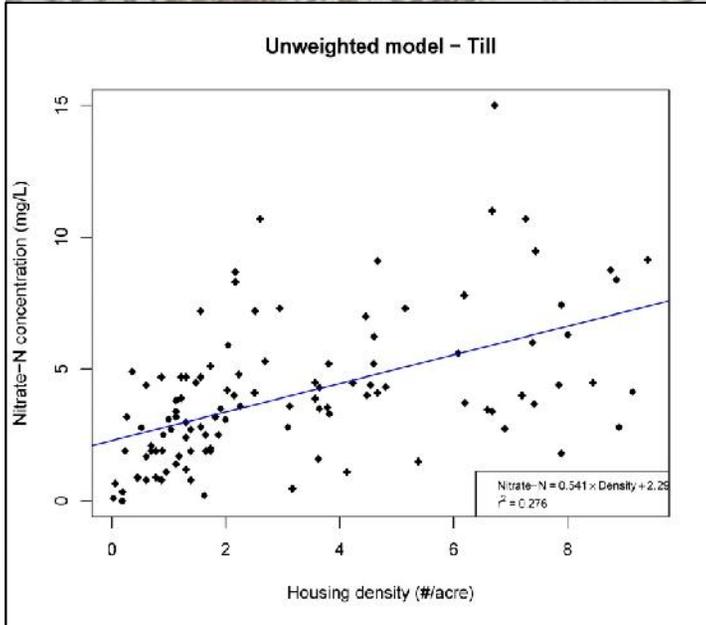
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N THREAT FROM SUBSTANDARD SEPTIC SYSTEMS CAN BE MITIGATED WITH N-REDUCING TECHNOLOGY

- Every substandard/conventional OWTS replaced with N-reducing technology reduces the N load to the watershed by at least half⁴
- A program was developed to upgrade 15 substandard OWTS in the most sensitive and overdeveloped salt ponds watersheds to N-reducing technology in 2018
- \$270,000 of grant funding was allocated to provide up to 75% cost reimbursement for property owners to upgrade to N reducing OWTS



A Nitrogen reducing OWTS is installed to replace a failing metal tank system located less than 100 feet from a coastal wetland under the Charlestown EPA SNEP Grant



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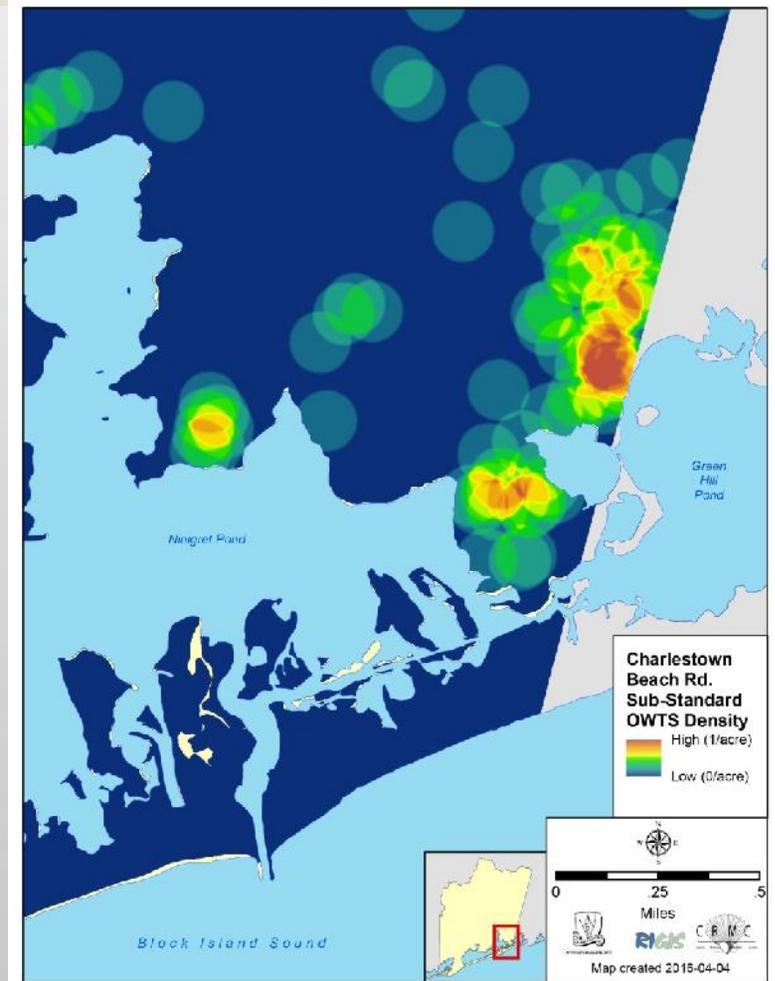
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IDENTIFYING SITES

- Charlestown retains a comprehensive OWTS tracking database containing type and condition of all septic systems in the Town
- Substandard systems include:
Cesspools, failing systems, steel tank systems, septic tanks <1,000 gallon capacity and systems installed before 1968
- Density of substandard systems were analyzed and used with a model that predicts groundwater N concentrations to develop geographic area for project implementation



Density of Substandard OWTS within the coastal zone of Eastern Ninigret and Green Hill Pond Watershed



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SUBSTANDARD SEPTIC SYSTEM UPGRADE

- \$270,000 was allocated to provide 75% reimbursement for property owners to upgrade substandard systems to N reducing OWTS technology
- A reimbursement cap of \$18,000 per system was established.
- Property owners incurred all other costs
- Initial analysis indicated a 150 pound per year total N load reduction to the watershed as a result of the 15 upgrades



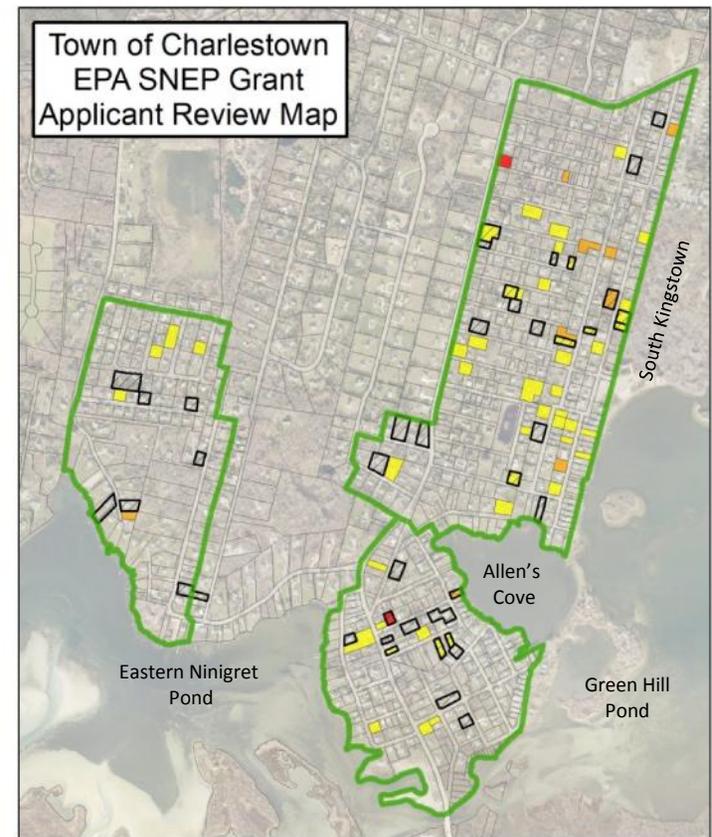
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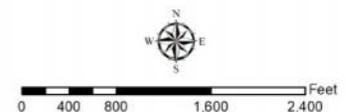
IDENTIFYING SITES

- The Eastern Ninigret Pond/Green Hill Pond watershed was identified as the target area based on the density of substandard OWTS and modeled groundwater N concentrations
- 174 substandard systems were identified within the Eastern Ninigret Pond / Green Hill Pond watershed
- An application process was developed and written correspondence was detailing the upgrade grant opportunity was submitted to the 233 property owners
- 44 property owners (18%) applied to the program



Legend

- Parcels
- Critical Nutrient Reduction Zone
- Systems of Interest**
 - Cesspool
 - Metal Tank
 - Sub-Standard





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RANKING SITES

- Applicants were ranked based on 9 numerically ranked criteria:
 - 1 System Type
 - 2 Number of Bedrooms (N-Loading)
 - 3 Location within a Critical Nutrient Reduction Zone
 - 4 Proximity to inland edge of coastal feature
 - 5 Modeled predicted groundwater N concentration
 - 6 Owner occupied / rental
 - 7 Occupancy (seasonal / year round)
 - 8 Drinking water source (private well / public water system)
 - 9 HUD low income guidelines

- The top 15 ranked sites were selected for the funding



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PROGRAM REQUIREMENTS

- Participants were required to enter into an Agreement to take part in the program based on comprehensive program requirements
- Several requirements were developed specifically to maximize total N load reduction to the watershed
- Upon completion of each installation, property owners were required to submit all final invoices and reimbursement was calculated and submitted
- All upgrades were required to be completed within one year of signing the Agreement
- The Town provided technical support, installation oversight and inspection



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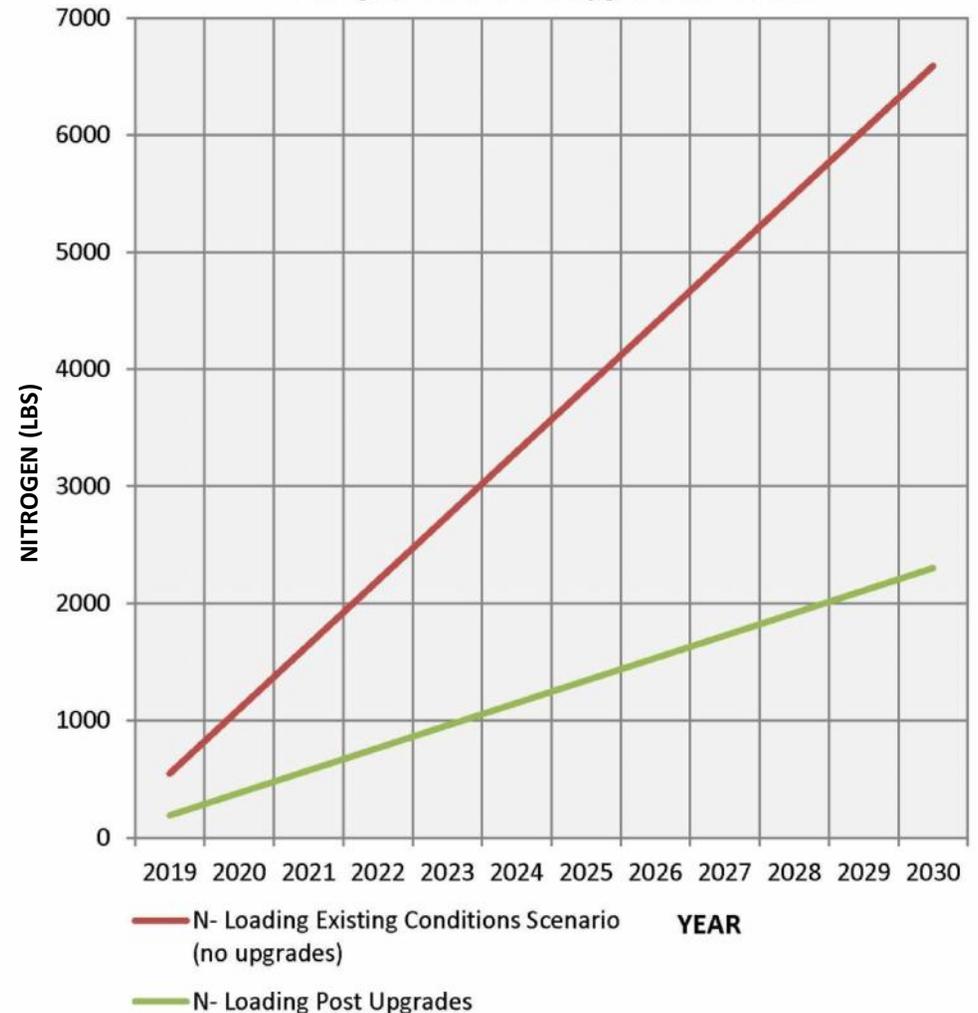
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RESULTS

- The program was a success and well received by the community
- Subsequent analysis using actual N-reducing OWTS technologies installed, calculated flows and types of systems replaced indicates that the N-load reduction was much higher than initially calculated 150 pounds per year TN
- The 15 sub standard system replacements with N-reducing technology has resulted in approximately **357 pounds TN/year**

Cumulative Nitrogen Loading Comparison
Existing Conditions and Upgrade Conditions





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RESULTS

- Future funding to upgrade additional substandard OWTS to N-reducing technology in critically nutrient impacted coastal watersheds in Charlestown and along the south shore of RI is warranted
- Subsequent to the installations, many of the applicants not ranked within the top 15 inquired about future funding opportunities
- Additionally, following the project interest was received from many other substandard system owners
- This program could be utilized as a model for other jurisdictions facing similar challenges



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REFERENCES

- ¹ URI NEMO (2014), URI Cooperative Extension (CE) Nonpoint Education for Municipal Officials, 2014, MANAGE assessment of Charlestown wastewater management zones 1, 2 and 3, Town of Charlestown, RI and the Quonochontaug East Beach/Central Beach Fire District CWHPA MANAGE assessment
- ² Donohue, J. L., (2013), Assessment of housing density impacts on groundwater: integration of water quality data into a GIS-based model for estimating groundwater nitrate concentrations, University of Rhode Island Open Access Masters Theses, Paper 3
- ³ Town of Charlestown (2019), unpublished research
- ⁴ RIDEM (2018), Rules establishing minimum standards relating to location, design, construction and maintenance of onsite wastewater treatment systems
- ⁵ Ross, B.N., Loomis, G.W., Hoyt, K.P., Amador (2018), User based photometer analysis of effluent from advanced nitrogen-removal onsite wastewater treatment systems, Water Air Soil Pollut 229: 389. <https://doi.org/10.1007/s11270-018-4039-z>