Plan for Decentralized Wastewater Treatment, North Fork (NY)

1. Final Report Summary

The need to protect our water resources, both the groundwater aquifers, which are the sources of Suffolk County's drinking water, and the precious surface waters that define local character, has never been more crucial. The collapse of clam, scallop and lobster populations, impacts on fish survival, a growing list of impaired waterbodies, and evidence that nitrogen and other contaminants are elevated in groundwater indicate that we are at a tipping point where proactive remediation is necessary to protect our precious water resources.

Clean water resources are essential for all communities, but are especially important for the Towns of Riverhead and Southold, with their dependence upon maritime, agricultural and tourist industries. Scientific and modeling studies are substantiating the fact that excess nitrogen is a primary factor contributing to water impairment in marine waters. Growing evidence indicates effluent from onsite wastewater treatment in groundwater is a leading source of the nitrogen entering Long Island Sound. Within the study area comprising the Long Island Watershed in the Towns of Riverhead and Southold, 97% of the parcels (both developed and vacant) are not connected to a sewer district, and 72% are developed using onsite wastewater treatment systems (OWTS). The existing cesspools and septic systems are primary sources of excess nitrogen, which impact water quality for both groundwater and surface water bodies in the Long Island Sound Watershed on the North Fork. The excess nitrogen feeds increasingly toxic algal blooms, which in turn negatively impact shellfish and fish by reducing available dissolved oxygen, as well as contributing to the acidification of water bodies.

1.1 Scope of the Project

This study, using existing data sets, examines land characteristics and use factors that are indicative of possible environmental failure due to impacts from onsite wastewater treatment systems (OWTS). Peconic Green Growth (PGG), together with the GIS Department of the Town of Southampton (SHGIS), generated 167 maps at both town and hamlet scales to graphically depict conditions of concern. The maps were valuable as both evaluation and educational tools. Two towns and thirteen hamlets were examined. By assigning a point system to conditions of concern, PGG and SHGIS mapped priority areas and flagged lots suitable for a clustered approach to wastewater treatment (less than one-half acre in size).

PGG conducted a survey of watershed residents with outreach help from local civic and homeowner associations to assess resident receptivity to changes and willingness to consider increased costs for enhanced wastewater treatment. This survey was used to gather more specific information about onsite wastewater conditions and educate the general public on decentralized wastewater treatment issues. Surveys were gathered as of December 2013; 573 survey responses were received. Two hundred and fifty two came from residents within the LI Sound watershed.

Based on the priorities evident from the GIS mapping, data evaluation, receptivity of certain communities, and town guidance, PGG selected three sites for an initial engineering evaluation of proposed community-wastewater treatment systems. If all three projects were realized, the estimated nitrogen mitigation is a reduction of 26,629 pounds (13.3 tons) of nitrogen per year. This reduction would exceed the three ton mitigation goal identified for nonpoint sources (mainly stormwater and onsite wastewater) for Eastern Suffolk County in compliance with the Clean Water Act.[1] A 2007 study[2] suggests that the nitrogen contribution to the LI Sound attributed to onsite wastewater has been undervalued and that 39 tons of nonpoint source nitrogen should be targeted for the Suffolk County LI Sound watershed.

As part of this study, three initial engineering reports for proposed site specific wastewater treatment projects were generated. Natural Systems Utilities, Inc. developed the engineering reports and cost estimates for:

a. Fishers Island
   Secondary and Tertiary Treatment for an existing and expanded collective septic system on Fishers Island with a design flow that can treat the equivalent of 100 homes.

b. Brower Woods Cluster (Mattituck)
   Alternative collection and treatment systems were evaluated for 98 homes on the eastern side of Mattituck Creek, with a recommendation for a Septic Tank Effluent Pump (STEP) and natural wetlands treatment system.

c. Mattituck West
   Estimates for a larger system designed to handle the equivalent of 416 homes adjacent to Mattituck Creek on its western banks were generated.

Community outreach

PGG presented at twenty-one (21) meetings to gain expert input, gather information, and provide public outreach. These include seven (7) presentations to town boards or committees, usually at work sessions, fourteen (14) general public meetings, including three (3) at libraries, four (4) to civic associations (Orient, East Marion, Jamesport, Southold Rotary), three (3) for home owner associations (Browers Woods, Captain Kidds Estates, Greenway East), and two (2) at the annual Suffolk County Planning Federation (SCPF) meetings. PGG organized a panel on wastewater issues for the 2013 S.C.P.F. event. In addition, PGG organized three (3) other key panels/symposiums:

a. *And not a drop to drink: Forum on Wastewater and Water Quality,* February 16, 2013, at Poquatuck Hall, Orient. Cohosted by the Orient Association (OA) and the East Marion Community Association (EMCA). With an introduction from Venetia Hands, President of the OA, presentations were made by Sarah J. Meyland, MS, JD, professor, on hydrology and environmental need, Glynis Berry, AIA, LEED AP on planning issues, and Douglas C. Clark, PE, LEED AP, on decentralized wastewater systems. The planning maps and survey developed as

part of this project were introduced to the community. Following the presentations, an active dialog took place between the audience and the panel regarding the issues covered. Approximately 80 people attended. The presentations are available on our website at: http://peconicgreengrowth.org/orient-project/

b. *Roundtable: Decentralized Wastewater Regulation and Standards* May 22, 2013, Riverhead
The roundtable successfully gathered regulatory representatives and experts in the field of wastewater treatment. Twenty-two (22) representatives of state, county and municipal government, as well as engineers familiar with decentralized wastewater treatment issues gathered to discuss action plans. This conference was intended to provide an opportunity for brainstorming action items and needs. While extensive information was shared, most regulatory representatives appeared to maintain their respective positions. See Appendix D3 for more information.

c. *Wastewater in Our Waters: SOLUTIONS* June 21, 2013, Riverhead
This all-day symposium included twelve speakers and two panel discussions. A diverse audience of 160 attendees included representatives from of all levels of government, agency representation, professionals, civic associations and environmental groups, with strong participation by Suffolk County – a factor considered crucial to the symposium's significance. Topics included: 1) *Why Should we Care*, discussing environmental issues, water quality status and planning efforts 2) *Solutions: Technology for Decentralized Treatment* including presentations by the Suffolk County Department of Health Services (SCDHS) on recently approved community systems, and keynote presentations by Albert Robert Rubin and Ed Clerico, both national experts in wastewater engineering. The day ended with presentations and panel discussions on *Responsible Management and Financing for Decentralized Wastewater Treatment*.

This symposium was organized by PGG and cohosted by the Suffolk County Department of Economic Development and Planning, The Suffolk County Planning Commission, and the Citizens Campaign for the Environment. The AIA, Peconic Chapter, offered professional credits for attendees. The program was considered a matching event for this grant, the LI Sound Futures Fund, and a newly activated Suffolk County ¼% Clean Water grant. Nine sponsors contributed funds to cover expenses. In-kind donations, including filming by SeaTV, also contributed to the event.

The program brochure, which included a list of websites for reference, is viewable at: http://peconicgreengrowth.org/wp-content/uploads/2013/06/program-agenda-pub.pdf
Audience interest in the information, references, and lists of action items was reflected in the demand for every single program brochure available. A two page agenda, press releases, ads, handouts, minutes, and pictures taken of the event by Sarah Cedar Miller are included in Appendix D4. Selected presentations where permission for distribution was granted are

available for public viewing at: http://peconicgreengrowth.org/wastewater-in-our-waters-solutions-a- symposium-on-decentralized-wastewater-treatment/

Action Items

In order to address decentralized wastewater issues, PGG with feedback from the public, professionals, research, and symposia, generated an action list of twenty items. These included recommended changes to regulations, standards, and management practices. While these discussions were a start, PGG felt time constraints limited this exploration and that more work is needed on these important issues. The Suffolk County Department of Health Services (SCDHS) has indicated a willingness to work with PGG on the identification of an approval process for the establishment of community systems in existing neighborhoods as pilot projects.

1.2 Water Quality Assessments

Nitrogen levels in groundwater on the North Fork exhibit some of the highest levels found in Suffolk County.[3] In response, the County recommends doubling the minimum lot size from a nominal half-acre (20,000 square feet) to one acre (40,000 SF) in order to dilute excess nitrogen loading being discharged by onsite wastewater systems to drinking water standards. This strategy helps protect groundwater from the impacts of future development, but does not address existing nonconforming issues. It also does not address the more stringent nitrogen levels recommended for a healthy marine environment, which are twenty times more stringent. The official maximum limit established for nitrogen in drinking water is 10 mg/l, as opposed to the 0.3 to 0.5 mg/l recommended for healthy marine waters. As the nitrogen laden groundwater reaches the more susceptible surface water bodies, algal blooms and marine flora are affected.

Most of the open waters and bays within the study area have a NYS Department of Environmental Conservation classification of SA, the highest ranking of water quality and the only one approved for the harvesting of shellfish for human consumption. These waters have the most protected status with their impairments tracked through the State in compliance with the Clean Water Act. Wading River, tributaries south of Reeve Avenue Bridge on Mattituck Creek, and several ponds are ranked SC, which does not allow the harvesting of shellfish for human consumption. Of the freshwater bodies, only Great Pond has an A classification, the highest for fresh water. The Long Island Sound west of Mattituck Creek (Portion Five) was newly listed as impaired due to pathogens in 2012. Other impairments due to pathogens include Mattituck Inlet/Creek and Goldsmith Inlet. West Harbor/Pirates Cove is also listed as impaired, but may be reevaluated due to Southold's research efforts. Uncertified waters for shellfish harvesting due to administrative closures, whether seasonal or year-round include buffer zones around the outfall pipes of sewage treatment plants in Greenport and Plum Island, near marinas and mooring fields, and the mouths and inlets of Wading River and Baiting Hollow Creek/Fresh Pond Creek, which have a lower water quality ranking than the Sound.

Hypoxia, the state of low dissolved oxygen, is described as the most important issue for the health of the Long Island Sound, with the most critical locations at the western end of the Sound. Evidence of low dissolved oxygen levels extends as far east as Mattituck Inlet during peak events. To counter this, the Total Maximum Daily Load Analysis (TMDL) was developed by the Long Island Sound Study in compliance with the Clean Water Act and is supported by regulations in the states of New York and

Connecticut. The TMDL focuses mitigation efforts on nitrogen, which is identified as the primary cause of the algal blooms that exacerbate the hypoxic conditions. While the TMDL targets an overall nitrogen reduction of 58.5% mostly due to improvements to sewage treatment plant discharges, a 10% reduction from nonpoint sources is included in this goal. Nonpoint sources are mostly attributed to stormwater runoff and include onsite wastewater and fertilizer contributions. Two equivalency factors are applied to modify the relative impact of discharges on impairments. One factor is attenuation of nitrogen before it reaches Sound waters, such as loss during river flow. All of the LI watershed in Suffolk County (Zone 11) has a factor of 1, as little or no attenuation occurs before groundwater reaches surface waters. The other factor is labelled transfer efficiency. It judges proximity to areas of highest impairment due to hypoxia. All of East End watershed (Zone 11 East) has a 55% factor, as the target area lies west of the study area. The TMDL model did not take into account groundwater contributions to the nitrogen loading, because it assumed surface failure from onsite wastewater would be transported with other nonpoint/urban sources into stormwater runoff. Due to the excessively drained soils in the study area, the primary nitrogen loading from onsite systems is to groundwater.

Subsequent to the TMDL, the 2007 study titled, *Suffolk County North Shore Embayments Watershed Management Plan* estimated that the TMDL underestimated the nitrogen contribution coming from onsite wastewater treatment discharge into groundwater. The study recommended revising nonpoint source nitrogen mitigation goals for the LI Sound watershed in Suffolk County to 39 tons of nitrogen per year, or 19% of the overall nitrogen loading. This study is currently a strategy document and does not change the original TMDL. The 2007 study estimated that 77% of the nitrogen loading into Sound from Suffolk County is from groundwater, with onsite systems being the predominant source. This report also evaluated hydraulic discharge rates. Due to sandy soils, the Riverhead coastal area has the highest discharge rates in Suffolk County at 26-44 mgd. The faster flow transport more pounds of nitrogen for a given time span, thereby stressing adjacent waters. The Riverhead Coastal area also had the highest nitrogen contribution in Suffolk County with 509.4 tons per year. Mattituck was second with 202.2 tons per year.

Impairment is also directly impacting local economies. An algal bloom of the phytoplankton Alexandrium fundyense, which produces the chemical neurotoxin saxitoxin and is responsible for paralytic shellfish poisoning in humans, was present in Mattituck Inlet/Creek in 2012. Ninety two acres of the inlet were closed to shellfish harvesting due to this “red tide”. It was the first biotoxin closure of Mattituck Inlet/Creek since NYSDEC first detected biotoxins in shellfish in 2006 (Northport) and the earliest biotoxin closure on record in New York State.[4] In 2013 rust tide algae known as Cochlodinium polykridoides, which can be lethal to marine life, also occurred in in Mattituck Inlet.[5]

Christopher Gobler PhD, a professor with the School of Marine and Atmospheric Sciences at Stony Brook University, noted chronic issues for Mattituck Creek. “A second water quality issue (besides algal blooms) in Mattituck Creek is low oxygen or hypoxia. Oxygen is, of course, required to sustain most all marine life. In August of 2013, my lab surveyed oxygen levels in bottom waters of tributaries across Nassau and Suffolk County. Mattituck Creek had the lowest oxygen levels at 0.04 mg per liter, a level that is practically anoxic (no oxygen).” [6]

The 2007 study referenced above identified Mattituck Creek as having the highest dissolved inorganic nitrogen rates of the studied embayments, but with no dissolved oxygen problems. By 2013 it is hypoxic. A look at available test records reveal that 55.7% of the tests at one inlet location exceeded the 0.45

mg/l level, with an average of 0.65 mg/l**.** An examination of 55 groundwater water quality tests in the Mattituck Inlet sub-watershed taken at twelve locations over seven years revealed that 36% of the tests exceeded 10 mg/l, the maximum contaminant level for drinking water standards. What is clear, is that the testing needs to be more frequent and regular. Of the Mattituck Inlet tests, only one was taken during a summer month, when hypoxia is most likely to occur, and there was a gap of six years when no tests were taken at all. While the EPA expects to establish nitrogen standards for marine environments by 2018, dissolved oxygen impairment should be evaluated immediately for Mattituck Inlet/Creek in order to counter the growing presence of algal blooms.

1.3 Survey of Residents on the East End

PGG conducted a survey of local residents to help identify issues and obtain more detailed data relative to onsite wastewater systems. Forty four percent of the survey respondents lived in the target Long Island Sound watershed. While most people knew where on their lot their onsite wastewater systems were, 29% had never had their septic tanks pumped out, and 14% were not sure. Thirty seven percent had no idea when they should pump out their system. Fifty five percent had homes built before 1973, so their systems were likely to be cesspools. Positive interest in alternative treatment of wastewater outweighed negativity, with many people remaining open to exploring the options, but without embracing them. Forty five percent were willing to pay at least $500 per year for enhanced systems, but 80.8% felt that subsidies by the larger community or government were appropriate.

A more qualitative understanding of public receptivity was sensed through the cooperation of civic and home owner groups. The further east the group, the more concerned people were about the issue. While some groups were very proactive and concerned about the issue, the majority were cooperatively tentative, and some wished to avoid the issue altogether. Communities that rely on individual well water for drinking water or experience shallow depths to groundwater are more likely to care about onsite wastewater contamination and consider volunteer enhancements to wastewater treatment. The issue is more abstract for communities on higher ground with sandy soils, as the impact of excess nitrogen loading does not have a visceral impact on quality of life or on the functioning of personal onsite wastewater treatment systems. Public awareness and scientific verification are key to increasing understanding of the issues. It will probably require regulation and/or government-imposed projects to rectify conditions in some of these communities, such as the older Riverhead coastal communities. A continued three-prong effort is needed: improved science-based documentation, new government standards and oversight, and increased public demand.

1.4 Town and Hamlet Characteristics in the Long Island Sound Watershed

Various conditions affecting nitrogen loading were mapped by PGG and the Town of Southampton GIS department. Maps depicting water quality impairments, depth to groundwater, flood/SLOSH zones, soil drainage class, soil septic absorption, lot size/density, influence zones measured by groundwater travel times, and priorities were generated. PGG revised a previously developed methodology by adding three evaluation measures: 1) horizontal impacts of sea level rise, 2) data evaluation on nonconformance due to lot size, and 3) setback clearance from all structures to inform site selection criteria for collected

systems when targeting pilot projects. The depth-to-groundwater and horizontal inundation maps also help scope resiliency issues due to climate change. In addition, land use and aerial images were mapped for use in project development. From the GIS files, myriad data queries were conducted and summarized.

Riverhead was found to have a high percentage of soils not suitable for onsite treatment of wastewater, with 60% of buildings sited on soils that drained excessively. Riverhead has a high number of small lots, with 1,940 or 38.8% being less than one-quarter acre in size. Fifty eight percent of Riverhead parcels are nonconforming to the existing minimum of 20,000 SF meant to protect drinking water. This data supports the 2007 study findings that the Riverhead coastal area has the highest discharge rate and provides the largest nitrogen loading in pounds to the LI Sound in Suffolk County.

Southold has higher vulnerability due to shallow depths to groundwater (15.9 % of buildings), flood zones (8.1%), and SLOSH zones (18.6%). Fifteen percent of the parcels are nonconforming to the 20,000 SF minimum. Southold has 56.5% of its buildings in a groundwater influence zone, where it only takes contaminants in groundwater zero to two years to reach surface water bodies in the Sound watershed. Riverhead has slightly less, with 51.7% of its buildings in the zero-to-two year influence zone. This factor indicates that land-based pollution impacts are almost immediate, but also offers hope that improvements will provide remediation more quickly if executed comprehensively.

Additional findings from on hamlet-level detail:
- Mattituck has largest number of buildings with shallow depths to groundwater, in flood and in SLOSH zones
- Peconic has the highest percentage of buildings in SLOSH zones
- Wading River has the highest number of buildings on excessively drained soils, the highest number of buildings in the 0-2 year influence zone, the highest number of parcels under ¼ acre in size and the highest number of nonconforming lots less than 20,000 SF.
- Calverton, followed closely by Greenport has the highest percentage of nonconforming parcels.
- Fishers Island has 100% of its building in the 0-2 year influence zone.

Priorities
PGG assigned a point system to overlap evaluation categories and identify priorities for project focus. We then flagged any lot less than one-half acre that was located in an area of high or medium high ranking. These smaller, ranked lots were deemed potentially appropriate for a community system application. This is only a preliminary cut. Once community infrastructure projects are proposed, administrative districts, such as a home owner associations, or infrastructure configuration will change the totals. In the town of Riverhead, 153 developed lots outside sewer districts were considered prime for clustered solutions. In Southold, 672 developed parcels were considered appropriate for a clustered approach. Lots half-acre or larger with high and mid-high rankings were considered appropriate for single onsite enhancements. Riverhead had only two, while Southold had 465. In this evaluation, low-lying properties received higher points. PGG created the point allocation system based on mappable criteria developed by the County to assess distribution of incentive funding. PGG added soil unsuitability for onsite wastewater treatment. PGG is considering the need for two additional adjustments, based on the data findings: 1) increasing the points for lots less than one-quarter acre, as nitrogen loading increases and 2) adding another two points for soils that drain excessively, as this increases the rate of nitrogen loading to the Sound.

1.5 Scoping of Proposed Projects

Three schematic designs for wastewater treatment were developed as part of this project. PGG found through an analysis of twenty homes that the costs were disproportionately high compared to the benefit, because the collective system triggered maintenance requirements that were too costly for a small number of homes. Regulations/standards would need to change before such small clusters become economically viable. PGG encountered resistance in finding communities willing to participate in the engineering evaluation, as people expressed fears of early commitments, costs and impacts. PGG decided to focus on Mattituck, as the need seemed great due to the hypoxic levels identified by Dr. Gobler, the algal bloom producing saxitoxin in 2012, and the subsequent rust bloom in 2013. Mattituck Inlet/Creek is also highlighted as a strategy area in the 2007 study expanding discussion of the LIS TMDL in Suffolk County due to the prevalence of onsite systems. In addition, PGG evaluated adding secondary and tertiary treatment to the existing Fishers Island Sewer District at the request of the Town of Southold.

If the three following projects listed below were put into place, the expected total future nitrogen reduction would be 26,629 pounds or 13.3 tons per year.

1.5.1 Fishers Island Secondary and Tertiary Treatment

This project adds a vegetated, recirculating, gravity filter (VRGF) to a remediated collective septic system serving the equivalent of 100 homes. Two scenarios were evaluated: 1) for treatment to 20 mg/l for Total Nitrogen (roughly 50% mitigation) and 2) to 10 mg/l, compliant with systems exceeding Sanitation Code requirements. Although this approach was slightly different from our first concept of developing new clusters for existing homes, PGG embraced it for the following reasons: 1) it would test natural mitigation techniques, 2) the district already exists, so implementation could advance more quickly, and 3) it tests the case for adding secondary/tertiary treatment to existing large-scale septic systems that were built to the maximum allowed by the Suffolk County Sanitation Code (Article 6), and 4) it is a cost-effective way of reducing nitrogen as the primary infrastructure is already in place.

- Expected mitigation of nitrogen in pounds per year: 3471 (<20 mg/l) or 4384 (<10 mg/l)
- Design flow: 30,000 gpd
- Estimated cost per household equivalent: $11,000 - $15,000

1.5.2 Brower Woods Cluster

PGG selected Brower Woods community because its size fit our target parameters, it has a home owner association, and it directly impacts the head of Mattituck Creek. While the local association hosted a presentation, it did not commit to participation. Surveys conducted in the area revealed hesitancy, with some openness to the concept, similar to the overall survey results. This project compared the costs, both capital and maintenance, of four treatment technologies and three collection types. The final recommendation was for a Septic Tank Effluent Pump (STEP) collection system and natural wetlands treatment.

- Expected mitigation of nitrogen in pounds per year: 4756
- Design flow: 30,000 gpd
- Estimated cost per household equivalent (98 homes): $35,531

1.5.3 Mattituck West Proposal

PGG expanded the effort in Mattituck with a project on the western banks of Mattituck Creek, testing costs for a larger, but still compact system. The collection system combined gravity and low-pressure components. Treatment was generally allocated at $30/gallon for the technologies frequently implemented in Suffolk County. This project tested the cost implications of exceeding the 100-home limit of intermediate-sized systems.

- Expected mitigation of nitrogen in pounds per year: 17,492
- Design flow: 125,000 gpd
- Estimated cost per household equivalent (376 occupied lots and 36 vacant ones): $26,386

The above options cost considerably less than the $63,465/home equivalent for a large central sewer plant designed for Flanders, even if the above estimates have a 25% contingency estimate attached. The Flanders scope tested combining multiple clusters into one larger system. Basically, there are increased savings relative to size if the configuration remains compact.

1.6 Regulatory and Management Issues

In order to advance a decentralized wastewater program, changes need to be made to regulations, standards, and management practices. PGG identified 20 action items for consideration. A few are discussed below:

1.6.1 Staffing

Dedicated staffing for decentralized wastewater programs is needed in regulatory agencies, as well as a web-based management program to manage data collection and inspection reporting.

1.6.2 Cesspool phase-out

Currently cesspools are grandfathered, even if they fail. When located in areas with shallow depths to groundwater, they can be harmful to water quality. PGG proposed a program to phase-out cesspools, including definitions of failure based on both system and environmental impacts. PGG recommends subsidy programs for critical installations. Ending the grandfathered status of cesspools is necessary to leverage private participation for improvements. Otherwise there is no financial reason for homeowners to voluntarily consider upgrades. Nitrogen treatment standards also need to be introduced and enforced.

1.6.3 Identification of Priority Locations for Enhanced Wastewater Treatment

PGG advocates pilots for community systems in existing neighborhoods where conditions indicate excess nitrogen loading. Based on the maps and data queries, locations can be identified for potential projects without waiting for regulation changes. Suffolk County already has in place the concept, oversight structure, and approved technologies for intermediately sized, community systems. Current practice only proposes enhanced clustered systems in new developments exceeding Sanitation Code densities. PGG proposes applying the same technology to existing neighborhoods where nitrogen TMDL's are in place. When looking at the relative costs for nitrogen mitigation, cost/benefit advantages for clustered approaches are evident for higher degrees of treatment when comparing costs per pound of nitrogen. In evaluating costs for Brower Woods, we estimated costs at 20 mg/l and 10 mg/l flow levels and found the savings for lower treatment thresholds to only save 10% of the costs.

1.6.4 Changes to Suffolk County Sanitation Code regulations, guidelines, and memo standards

Codes, standards, and directives were evaluated for needed changes. Key changes include reversing the grandfathering of cesspools, changing the minimum lot size for dilution purposes, increasing minimal depths to groundwater to compensate for groundwater rise due to climate change, raising the maximum number of equivalent homes served by intermediate-sized systems, requiring remediation steps for nonconforming conditions, and setting guidelines for treated wastewater reuse. More technical issues include allowing service over boundary lines and variances on some of the setback issues when dealing with existing conditions.

1.6.5 Pounds of Nitrogen vs. Flow Criteria

The two principle measurements of nitrogen are flow and total pounds of nitrogen. Current regulations regarding development densities are based on nitrogen flow rates which impact drinking water. The evaluation does not take in consideration total pounds of nitrogen, which is a critical factor influencing the impacts of nitrogen loading on marine environments. Revised carrying capacities need to be considered for both flow and total poundage especially when in sensitive watershed areas. Marine environments are affected by total pounds of nitrogen, not just flow. As an example, sewage treatment plants with outflow to TMDL waters have pound limitations as well as flow maximums. Applying a revised standard for a carrying capacity defined by total pounds nitrogen could potentially do three things: define sub-watershed maximums, so localized goals based on area and formation of impact zone become automatically part of the equation, balance increased density associated with smart growth development with mitigation goals, and offer a tool to planning departments that have eschewed any kind of wastewater treatment due to a fear of unfettered development.

1.6.6 Management districts

Traditionally sewer districts are tied to physical infrastructure. Instead PGG is advocating wastewater treatment districts or watershed strategy districts that are as widespread as possible, whether county-wide, watershed-wide, town-wide, or hamlet based. Nitrogen mitigation has varying degrees of need – a universal approach may not be the most cost-effective way of addressing the problem. Instead subsidy is needed to realize projects where the impact will be most significant. Also, an application of varied strategies combining onsite with community systems and sewer district expansions can then be managed coherently by a single oversight agency.

1.7 **Assessing Costs and Benefits**

While overall protection of the aquifer in Suffolk County is needed, excess nitrogen loading on surface water bodies is more variable, being affected by size of watershed, density of development, shape and size of the receiving water bodies, soils, and depths to groundwater. Also mitigation goals may differ according to overlapping TMDL's and impairment of water quality. This means cost per pound of nitrogen mitigated is a viable method of evaluation. Using this, standard figures for nitrogen influent, effluent, and attenuation are necessary. Adding secondary and tertiary treatment to existing, large-scaled systems can be cost effective, as the basic infrastructure is already in place. But costs per pound should not be the only controlling factor. Areas relying on individual wells for drinking water, neighborhoods with a predominance of cesspools, and communities with a high number of nonconforming conditions should be prioritized for projects, as multiple environmental issues may be addressed with a single project.

1.8 Conclusions

A shift in how decentralized wastewater treatment is managed at both the County and town levels is needed. Applying a range of strategies based on efficacy and environmental conditions will achieve cost efficiencies and higher water qualities in both aquifers and surface water bodies. Government agencies need more flexible frameworks to better manage a range of options. Instead of attaching separate programs to solution types, management needs to be as far-reaching as possible. Since nitrogen mitigation will have local variation in target goals rather than universal standards, subsidy is needed for project realization in areas that will have the greatest impact on watershed water quality.

Treatment of targeted projects with the highest level of nitrogen mitigation may be the most cost effective way of meeting TMDL goals. Home owners and developers will not voluntarily take on the extra cost and maintenance burdens of enhanced systems without incentives or regulatory directives. The home owners in communities that may have the highest need for mitigation, such as older communities with small lot sizes, may also not have the fiscal resources to carry the burden of needed improvements. A policy of subsidies is appropriate to handle both social inequities and variable mitigation needs that benefit a wider population.

Suffolk County found itself in an untenable position when the only intermediately sized wastewater system approved for implementation was found to exceed maximum levels of contaminants. The county responded by both amending oversight and expanding the types of pre-approved systems. It is also open to pilot installations of alternative systems with proven track records. As a rule, community systems are only installed for new developments that exceed Sanitary Code density restrictions. Placement of these systems is especially relevant for existing neighborhoods, especially on the East End of Long Island where densities are relatively low and not cost effective for expansive central sewer districts.

Advantages of the community, intermediate-sized systems are that they can obtain a higher degree of treatment than enhanced single-onsite systems. More frequent professional oversight will ensure proper function. Community systems upgrade systems in a neighborhood simultaneously, thereby increasing the likelihood of noticeable water quality improvements. Clustered systems are also easily adaptable to improved technology. The collective system is local enough that recharge is to local watershed groundwater, avoiding the withdrawal of water from sub-watersheds. Disadvantages include the need for pumps and power, sites for collective treatment, and the lengthy process for regulatory approvals. Community systems can be an effective treatment option in neighborhoods where isolated clusters of mid to high densities exist -- a land use pattern typical for the historic hamlets and vacation communities found on the North Fork.

There are a number of locations in the study area where community systems are appropriate for consideration. These include Mattituck, Peconic, Southold, and dense historically developed enclaves from Orient to Wading River. While the need is significant in Riverhead due to high densities and permeable soils, the impacts are not as self-evident and will need more education and regulatory push to see progress. Wildwood State Park and the surrounding communities in Riverhead offer interesting potential if a coordinated approach were investigated.

Greenport is a special case because it maintains its own sewer system. The outfall pipe of the municipal district discharges to the LI Sound and is regulated by the TMDL. The recently upgraded plant has excess volume capacity. Current plans to expand the Greenport Sewer District would transfer nitrogen load

from the Peconic Estuary to the Long Island Sound, increasing the amount of nitrogen entering the Sound. If the planned expansion were extended to include residences in Greenport's Long Island Sound watershed, the reduction in direct effluent discharges compensate for the nitrogen increases if the overall watershed loading is considered. The capacity of the plant would be maximized and water quality of the Sound protected. Without the extension to the LI Sound watershed, the TMDL in pounds of nitrogen would likely be a limiting factor for the effective use of the plant.

In conclusion, community systems for the treatment of decentralized wastewater are viable options. They appear to be more cost effective if the area treated is dense and of a minimum size. The higher level of treatment attainable with community systems translates to cost efficiencies when mitigation goals are in total pounds of nitrogen. It will take changes in community awareness, government policies and regulations and management to make these improvements happen.

Peconic Green Growth has made tremendous strides in the last year. Communities throughout the North Fork have had engaged discussions about wastewater and nitrogen issues. Community forums have brought together government stakeholders in ways that had never happened before. Our engineering firms identified multiple options for diverse situations, all of which would drastically reduce nitrogen loading. Peconic Green Growth is now positioned to work on implementation of new systems and remedial action. PGG has laid the groundwork for continuing progress on this important topic.