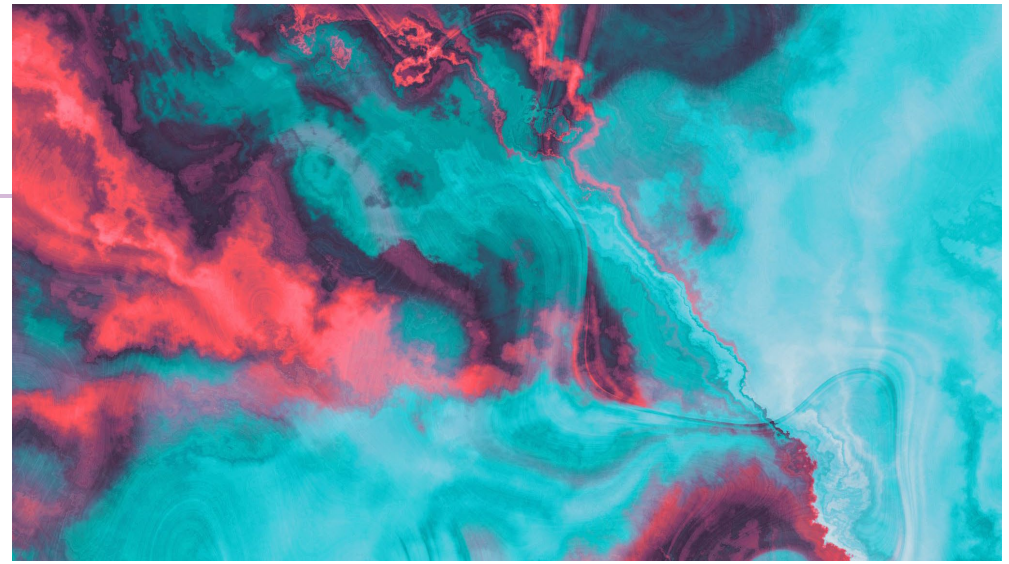
Village of Plandome Manor

Subwatershed Wastewater Management Planning



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Introduction

The Village of Plandome Manor is planning an initiative to implement evaluate new methods of sewage disposal in order to protect Village's subwatershed and water bodies from pollutants discharged from the antiquated sewage disposal systems currently serving the residential units and to improve the environmental health of the region. N + P is honored with the opportunity to present information to help streamline the study which will assist the Village in restructuring their wastewater management planning.

Background Information:

Over the past decades, there has been a nationwide concern regarding contamination of groundwater and surface water bodies by organic and inorganic pollutants which can be categorized s follows:

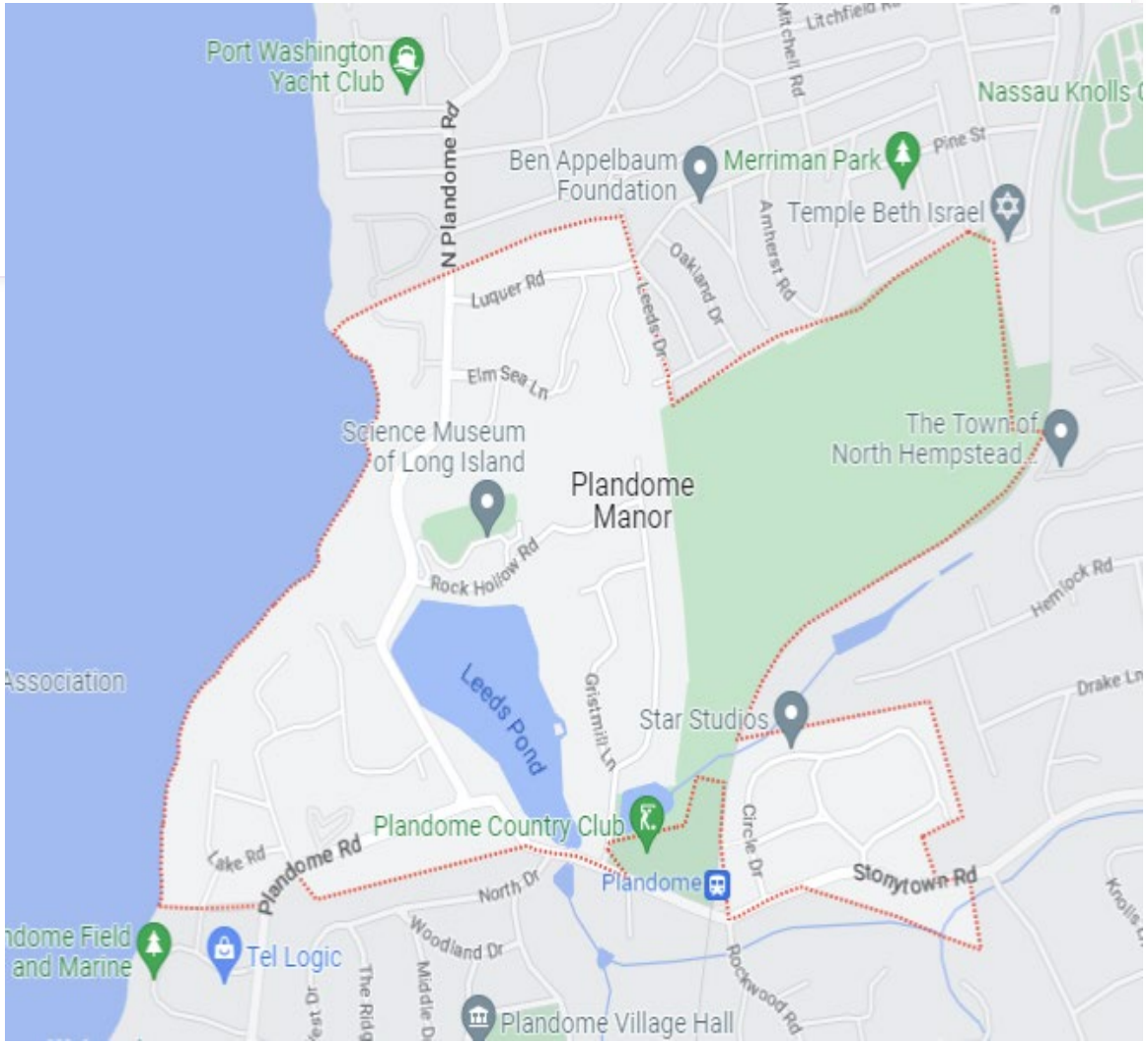
- Insoluble Solids – Primary
- Organic mass – Secondary
- Nitrogen, soluble and/or insoluble chemical compounds – Tertiary
- Pollutants from pharmaceutical and personal care products (PPCP) – Advanced Tertiary

The source of these pollutants are partly from atmospheric deposition, but mostly from direct and/or indirect disposal of wastes by human. Direct disposal of waste such as illegal dumping on land and into the surface water bodies is relatively easier to manage through legislation than indirect waste, as the impact is subtle and gradual and it takes years to detect, not until the impact is manifested in the form of deterioration of environmental health and ecological balance. One of the most concerning and subtle pollutant which results from indirect disposal of waste is “Nitrogen”. The element is discharged with human and animal excreta and is present in fertilizers and in atmospheric deposition. While atmospheric deposition cannot be controlled, use of fertilizers with nitrogen content can be controlled and discharge of nitrogen into the ground which finally flushes into the surface water bodies can be managed, if the animal and human waste can be processed utilizing the presently available wastewater treatment systems before discharging it into the ground.

Several states and counties in the United States have already adapted, scientifically analyzed, and designed sewage disposal systems in an effort to reduce discharge of nitrogen into the ground and surface waters. Contaminants from PPCP are equally concerning. Scientists are still investigating what concentration of their existence in groundwater and surface water will negatively impact the ecological balance. Once that is determined, scientists will be able to formulate a strategy to limit existence of these pollutants.

Need for an Alternative Sewage Disposal System (ASDS):

The map shows the Village of Plandome Manor's boundary line, the westerly part of which abuts Manhasset Bay and the rest Town of Port Washington, Town of North Hempstead, and Village of Plandome to the north , east , and south respectively. A significant portion of the village includes subwatershed wetlands bordering the Bay and surrounding Leeds Pond located in the Village. Therefore, most of the residential units are in or near the wetland region with shallow groundwater table where the groundwater travel time to surface water is much faster than lands upstream of the wetlands. The existing residential units use conventional subsurface sewage disposal systems as a method of disposing sanitary waste which does not take long time to travel to the bay or the pond. It appears that the bay water may not flush rapidly because of the shape of the shoreline so the pollutants from the sewage linger longer in the water shed area raising a concern. The following slides explain the reasons for the concern.



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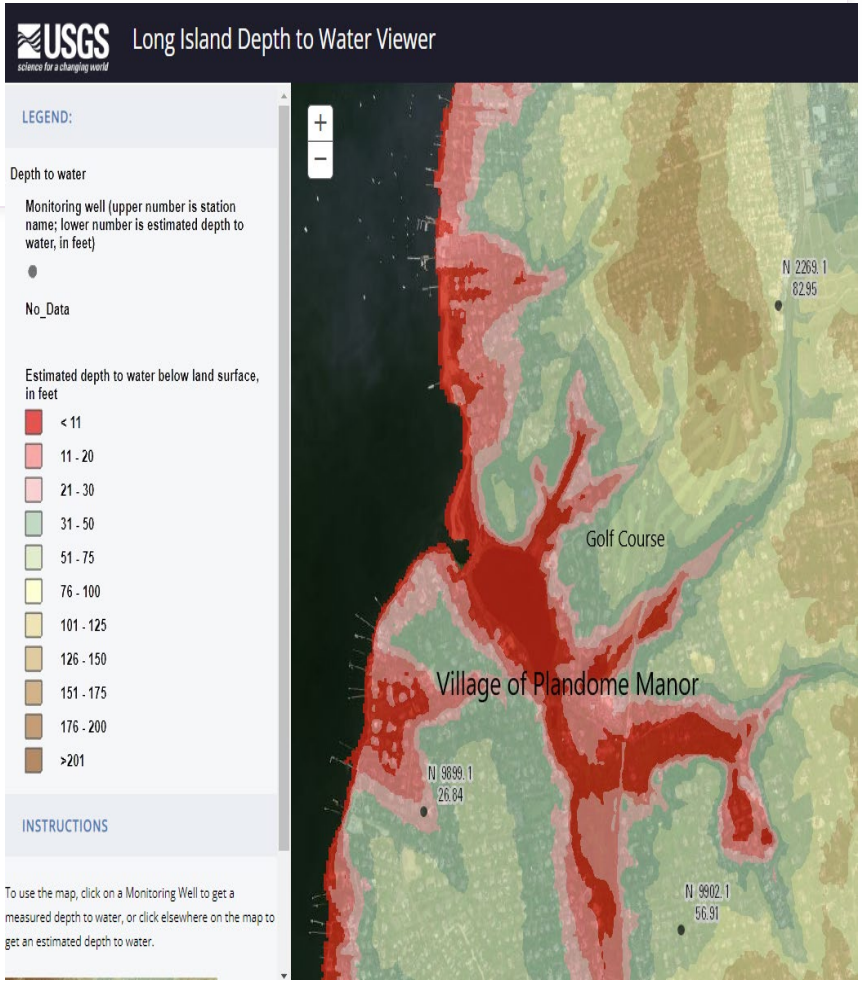
Groundwater & Surface water in and around the Village

- The picture shows the groundwater elevation which varies in accordance with the proximity of lands to the lake and the bay in the Village. The areas are color coded in accordance with their distance from the shoreline.
- Groundwater in the red area along the shoreline is less than 11 ft. below grade. The bottom of the existing sanitary system in this area may be very close to groundwater, if not partially submerged. This means that raw sewage may be directly in contact with groundwater.
- The systems within the higher regions (pink), where groundwater table is above 11 ft., may or may not be in groundwater, but the sewage will have too few layers of subsoils to percolate though, whereby the effluent can be filtered further to prevent contaminants from reaching the groundwater.
- Further, please note the proximity of the golf course to the water bodies. The fertilizers used for the golf course contain nitrogen which will percolate through the subsoils and be transported to the water bodies by groundwater.



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Need for an Alternative Sewage Disposal System (ASDS)

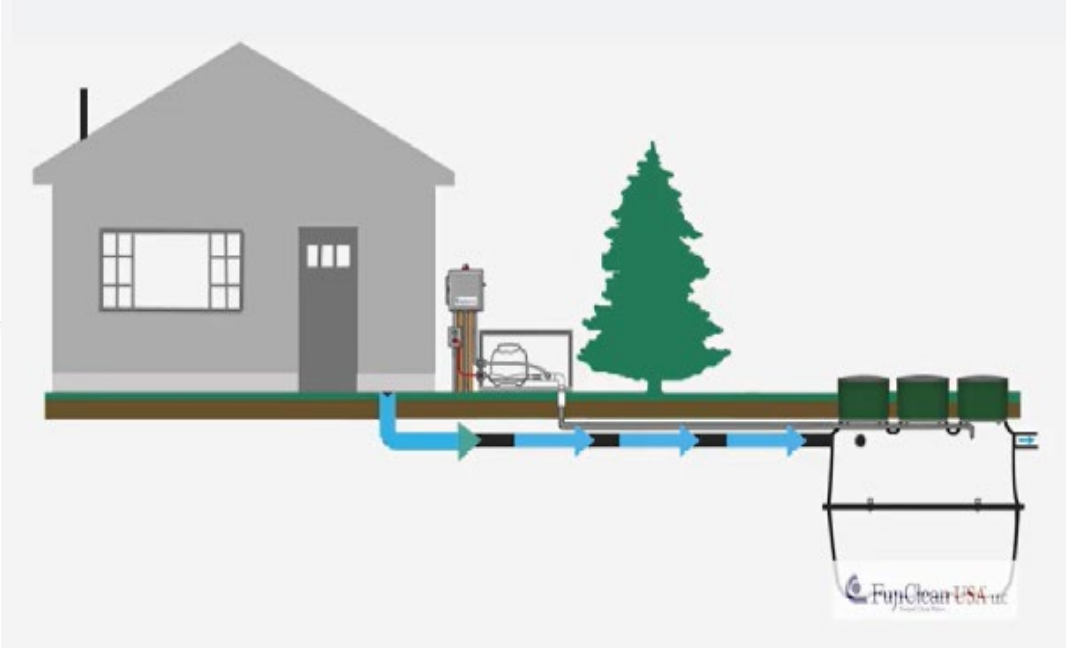
- Conventional sanitary systems settles the solids and discharges the raw sewage which contains pollutants such as nitrogen, organic mass, organic and inorganic chemicals into the ground which leaches through the subsoil layers and reaches the Long Island Aquifer and surface water body.
- Raw sewage from households typically contains a nitrogen compound concentration of 50 milligrams per liter (mg/l) and may be as high as 80 mg/l, which is a threat to public health as it contaminates groundwater with nitrates. Nitrates cause disease in babies and adults which, in some cases, may be fatal.
- The Village golf course is in close proximity of the water sensitive region. Application of fertilizers is necessary for maintaining the landscape and aesthetic appeal of the golf course; however, the fertilizers contain nitrogen which enters the ground after their application.
- Long Island aquifer is the sole source of potable water to its residents. Therefore, application of fertilizers containing nitrogen must be reduced/avoided as much as possible and an alternative method of sewage disposal should be sought to reduce nitrogen from animal and human waste before discharging it into the ground as much as practical to help preserve the pristine nature of the Long Island aquifer.
- Nitrogen and its compounds negatively impact aquatic ecosystems endangering marine life and coastal estuaries, the fishery and affecting environmental health and tourism in Long Island.
- The above explanations justify planning the transition to ASDS for the betterment of environmental health of the Village of Plandome Manor.

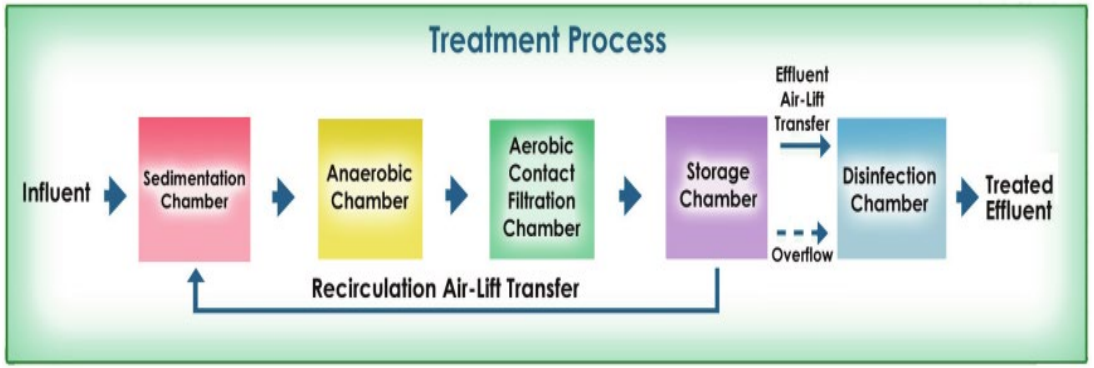
What is an ASDS?

- An ASDS is a sewage disposal system equipped with mechanical devices through which raw sewage undergoes systematic treatment processes for removal of solids and reduction of organic material, nitrogen, and other inorganic material prior to discharging the clarified effluent into the ground or surface waters.
- Most of the ASDS currently available in Long Island are capable of consistently reducing total nitrogen to 20 mg/l.
- Suffolk County Department of Health Services instituted the requirement of an alternative system back in July 2021. The requirement includes the system be NSF 245 rated for acceptance.
- ASDS Systems are equipped with a control system designed with program logic for full automation of daily operation of the system.
- A basic ASDS unit has multiple compartments for step-by-step treatment of raw sewage starting from receiving to final discharge of raw sewage. The systems may have a built-in sampling trough or a separate sampling manhole to collect and analyze samples of effluent routinely to ensure satisfactory system performance. Some of them require a separate pre-screening tank depending upon the system manufacturer.
- ASDS are entirely subsurface except for the covers which needs to be flush to grade for accessibility. The pictures show an ASDS during and after installation.
- A homeowner's involvement with the operation of the system is not required; however, action by the homeowner is needed when there is an alarm condition or notification from the system for maintenance and/or failure of a mechanical component, which is typical of any mechanical system. For example, a car needs routine maintenance irrespective of whether it is new or old.

Brief Description of ASDS Processes

- The diagram demonstrates a typical layout of a sewage collection and disposal system for a residential unit utilizing a FujiClean System.
- Raw sewage exits the building as shown on the diagram and flows through a pipe to the process chamber.
- The flow diagram shows different components within the process chamber and the arrowhead indicates the direction of flow of the sewage after it enters the process chamber.
- The solids settles in the sedimentation chamber and the liquid flows through a series of process chambers successively.
- Air is controlled in the anaerobic and Aerobic chambers to provide favorable environment for maintaining the microbial culture of different organisms required to treat raw sewage to reduce nitrogen.
- Some technologies require recirculation of treated sewage for better effluent quality.
- Treated effluent may undergo disinfection before exiting the system.
- The effluent then flows through a pipe to a leaching system or field.
- Depending upon the topography of the property, a package lift station may be required before or after ASDS to connect the sewer pipes to the available connection ports of the ASDS.





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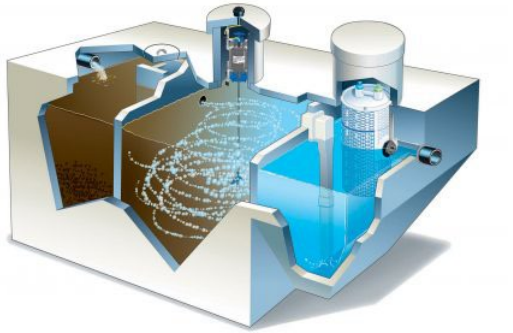
Pictures of ASDS

Hydro-Action AN

Norweco Hydro-Kinetic



Norweco Singulair TNT

Orenco Advantex AX-RT

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Benefit of ASDS

As indicated previously, ASDS reduces Nitrogen, a pollutant considered to be a major threat to the Long Island aquifer which is the sole source of drinking water for Long Islanders. The importance of nitrogen reduction and its impact can be better explained by the following simple mathematical steps:

- Sewage flow (Q) from each household may be approximated to 300 gallons per day (gpd) or 0.0003 million gallon (MG)
- Total Nitrogen (TN) concentration in effluent from a conventional system is typically considered as 50 milligram per liter (mg/l) and may be as high as 80 mg/l.
- Total Nitrogen (TN) concentration in effluent from an ASDS within the treatment limit of these systems is 20 milligram per liter (mg/l).
- Conventional systems discharges 50/20 = 2.5 times TN discharged by an ASDS. The following calculations show yearly TN load per household released to the ground.
- Pounds (lb.) of TN from a system = Q (in MG) x 8.34 (conversion factor) x TN (in mg/l)
- TN from a conventional system = (0.0003x8.34x50x365) = 45.7 lbs. per year per household
- TN from an ASDS = (0.0003x8.34x20x365) = 18.26 lbs. per year which means elimination of (45.7-18.26) lbs. = 27.44 lbs. of TN per year per household.
- The loading becomes significant when considered all the households in the entire Village. Based upon the Village's GIS map, it appears that the Village has approximately 320 buildable lots. Therefore, the yearly TN from ASDS considering all the buildable lots would be = (27.44 x 320) lbs. = 8,781 lbs.
- It would be a relief for the surface water and the Long Island aquifer if that excess amount of TN could be eliminated from wastewater.
- In an effort to limit the amount of TN discharged into Long Island Sound, NYSDEC has established TN limit for all the sewage treatment plants located along Long Island Sound.

ASDS Technologies – Cost Opinion

Suffolk County was the first governmental agency in Long Island to mandate through legislation, use of alternative sewage disposal systems (I/A OWTS) for all new developments in 2021. The County performed pilot study for acceptance of different technologies. The Table shows the approved technologies and the corresponding costs reported by the County.

Note: The costs do not include a lift station as it is a need-based item, dependent on field conditions. Further, the costs do not include engineering design services.

Technology	Cost, $
Fuji Clean System	
Hydro-Action AN Series	14,000 – 19,000
Norweco – Hydro-Kinetic	
Norweco – Singulair TNT	13,000 – 18,000
Orenco Advantex - RT	18,000
Septi Tech STAAR	

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Operation & Maintenance Costs

ASDS units involve mechanical equipment which consumes electricity for operation and system automation. Therefore, operation of the systems requires costs associated with electric consumption, maintenance repair, replacement of failed equipment, contract with manufacturers, and sampling analysis as mandated by the authority having jurisdiction which are indicated on the table as reported by Suffolk County.

Note: Repair & replacement cost shows cost of the maximum expensive item, which is the control panel. Life expectancy of the control panels for all these technologies appear to be 20 years.

Technology	One Year Contract Cost	Repair & Replacement cost	Electrical Consumption Cost/year ($0.17/KWh)
Fuji Clean System	$300.00	$400.00	$101.98
Hydro-Action AN	$250.00	$1,200.00	$161.54
Norweco Hydro-Kinetic	$300.00	$1,200.00	$231.26
Norweco Sigulair TNT	$315.00	$1,200.00	$215.53
Orenco Advantex AX20-RT	$271.66	$1,500.00	$73.88
SeptiTech STAAR	$250.00	$1,200.00	$200.64

Conventional Systems versus ASDS - Comparison

The following Table provides comparison between a conventional system and an ASDS from the standpoint of their costs, operational difficulties, maintenance, sustainability, and environmental impacts.

Conventional Subsurface Sewage Disposal System	Alternative Sewage Disposal System
• Simple design, construction, and subsurface installation.	• Simple design, construction and installation but access covers need to be brought to grade.
• Does not have mechanical components, so does not need electricity for operation.	• Has mechanical components and needs electricity for effective treatment. Can operate without electricity; however, without providing effective treatment like a conventional system.
• The systems are supposed to be checked every 5 years.	• System operation is automated electronically with electronic notification to owner of any shortcomings; however, needs owner's due diligence in frequently checking the system to ensure operational soundness.
• Floatable and solids in raw sewage may find their ways to the leaching system reducing the system's useful life.	• Floatable and solids are screened out at the head of the treatment unit reducing chances of reaching the leaching system. Longer useful life of the leaching system is expected.
• Does not provide treatment to reduce TN concentration in the effluent before discharging to groundwater. Influent may contain a TN concentration as high as 80 mg/l.	• Capable of reducing TN concentration to 20 mg/l before discharging effluent to groundwater.
• A major source of pollutants which subtly impairs the water quality of the Long Island's aquifer and poses risk to public health, estuaries and aquatic life, Long Island fisheries and tourism.	• Restricts Nitrogen contamination in groundwater and surface water, so the system can reduce risk of outbreak of diseases caused by nitrogen contamination maintaining sustainability of the environment.

Conventional Systems versus ASDS – Comparison Continued

• The cost of installation of a minimum system consisting of a septic tank and a leaching pool for a 4-bedroom single family residences costs around 10,000 dollars. A lift station will cost extra.	• Based on the cost previously discussed, an ASDS costs around 20,000 – 25,000 dollars. A lift station will cost extra.
• System is recommended to be pumped every 5 years.	• System should be checked and sampled routinely as mandated by the regulatory agencies having jurisdiction.
• System hardly needs any repair aside from unclogging pipes occasionally.	• Based on the Suffolk County report, systems are expected to have twenty years of useful life. Routine surveillance and maintenance will help prevent frequent repair and/or replacement of equipment.
• Regulatory enforcement is not needed.	• Regulatory enforcement is recommended.

In conclusion, an ASDS is more expensive and involves operation and maintenance costs compared to a conventional system; however, an ASDS discharges treated sewage unlike a conventional system which discharges untreated sewage into the ground. Therefore, wastewater may not be disposed of properly if utilizing a conventional system as its impact creates hazard for the environment and public health. Considering an excess amount of 8,781 lbs. of TN per year from conventional systems compared to alternative systems, transitioning to ASDS is justified.