
WASTEWATER TREATMENT Engineering Report

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**Brower Woods
Mattituck, Suffolk County, New York**

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NATURAL SYSTEMS UTILITIES

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1.0 INTRODUCTION

On behalf of Peconic Green Growth, Inc., Natural Systems Utilities (NSU) has prepared this technical feasibility report which identifies and compares options for deployment of a decentralized wastewater utility solution as a means of mitigating nitrogen loadings that are affecting the quality of the Long Island Sound Watershed. This report was prepared in accordance with a grant funded by the Long Island Sound Study and the National Fish and Wildlife Foundation (Grant Project ID# 1401.12.033406).

This report provides an evaluation of a decentralized system that would serve the existing residential community referred to herein as “Brower Woods”. Brower Woods is located on the eastern banks of Mattituck Creek in the Town of Southold, Suffolk County, NY. A map defining the project boundary is provided in Figure 1 of Appendix A. This community was selected by Peconic Green Growth, Inc. (PGG) after careful analysis of existing communities located within the Towns of Riverhead and Southold. Brower Woods was determined to be suitable for a decentralized sewer system as it meets the following criteria:

- Environmental need is defined. Nitrogen present in marine environments serves as a food source for algal blooms. When these algal blooms thrive, they can severely reduce oxygen which is essential to the survival of most marine life. In addition, in certain cases, algal blooms can lead to the formation of toxins (i.e. saxitoxin) that can be harmful to humans. As in the case of Mattituck Creek, there has been recent shellfish bed closures due to toxic algal blooms caused by *Alexandrium*. *Alexandrium* synthesizes saxitoxin that leads to the human illness known as paralytic shellfish poisoning. In 2009, Mattituck Creek had higher densities of *Alexandrium* than any other system monitored on Long Island (Gobler 2011; Final report to the Long Island Sound Study). In August of 2013, Stony Brook University 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 (severely oxygen deficient).
- Existing disposal systems are comprised of either cesspools or septic systems. In the case of Brower Woods, all existing properties are served by cesspools or septic, which is contributing to excessive nitrogen levels found in the Mattituck Creek.
- Groundwater beneath the project is located within a 2 year time of travel to adjacent surface water bodies. According to the Influence Map prepared by the Town of Southold (Appendix A),

approximately 90% of the homes located within the proposed Brower Woods sewer service area are located within the 2 year zone of influence.

- Project septic density exceeds that of current conventional treatment standards.
- There is no feasible alternative for connection to a centralized sewer facility. The nearest town sewer system is in Riverhead, which is located approximately 9 miles from Brower Woods.
- Projected wastewater flows shall be greater than or equal to 30,000 gpd. The 30,000 gpd threshold was selected as a requirement for this study as it is the limit of alternative intermediate systems approved by Suffolk County.

Preliminary designs were prepared to define the components of the Brower Woods Sewer System (BWSS). Preliminary designs include the collection system, treatment system and disposal system. Each design was prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) and Suffolk County Department of Health Services (SCDHS) Standards. Alternatives were developed for the collection system and treatment system in order to identify a cost effective approach for the system. Both capital and operational expenses were determined for each alternative. The cost estimates presented in this report are high level estimates (25% +/-) and shall not be misconstrued as firm pricing.

This report assesses options for ownership and financing based on the concept sewer system and costs. These options are presented in Section 11.0.

2.0 ENVIRONMENTAL NEED

The primary purpose of a decentralized wastewater collection and treatment system is to eliminate existing, inadequate septic systems and cesspools and reduce the quantity of nitrogen and other nutrients entering the groundwater and surrounding water bodies. Reducing these nutrient loads will improve the water quality for aquatic and terrestrial wildlife species and for human use and recreation. A more detailed analysis of the need for the types of systems proposed in this report can be found in the Water Quality section of the report titled “Plan for Decentralized Wastewater Treatment, North Fork in the Long Island Sound Watershed” prepared by Peconic Green Growth, Inc., a not-for-profit organization, to be published in March 2014.

3.0 SEWER SERVICE AREA

The properties included within the proposed Brower Woods Sewer Service Area (SSA) are depicted on the Sewer Service Area Map (Appendix A). The SSA is located on the east side of Mattituck Creek approximately 0.4 miles north of Middle Road in the hamlet of Mattituck, Town of Southold, Suffolk County, NY. The sewer service area consists of approximately 98 occupied lots and 6 vacant lots (104

lots in total). The proposed SSA totals 49.03 acres, exclusive of right-of-ways. The average parcel area is 0.47 acres. The SSA is located within zone R-40 Residential Low Density (1 acre). All existing construction located within the SSA consists of single-family homes.

Existing topography is shown on the Elevation Map (Appendix A). The SSA ranges in elevation between 5 feet - 35 feet msl. The depth to groundwater within the SSA limits is greater than 13.1 ft in most locations. However, there are areas, primarily along the southern tip of Brower Woods, where the depth to groundwater is less than 1 ft.

The roadways within the community consist of gently sloped, asphalt-paved roads without curbing. A majority of the homes' finished floor elevations are constructed at or near the adjacent road grade. Gas and water utilities are present throughout the community. Storm sewers were located within a small portion of the community.

Brower Woods is located within Groundwater Management Zone IV. Wastewater generated by the homes within the community currently discharges to individual cesspools or septic systems, depending on when the home was built. For purposes of this report, it is assumed that 75% of existing homes discharge to cesspools. According to the Influence Map prepared by the Town of Southold (Appendix A) approximately 90% of existing homes located within the proposed Brower Woods sewer service area are located within the 2 year zone of influence of Mattituck Creek. The project density, lack of treatment and its close proximity to surface waters suggest that the nitrogen loading from this community is more prevalent than other residential areas along the eastern shoreline of Mattituck Creek.

There are no existing sewer districts located within close proximity of Brower Woods. The closest sewer area is a 0.04 MGD private sewer area located more than 5 miles away in the Town Riverhead. The nearest town sewer district is the Riverhead Sewer District (TSD-05) located approximately 9 miles from the project site. The lack of sewer systems within the vicinity of the project supports the concept of a decentralized system to mitigate nitrogen.

4.0 WASTEWATER DESIGN PARAMETERS

The wastewater design parameters used in this analysis are detailed in the following sections of this report.

4.1 Design Flow

The SSA consists of 104 lots in total. 98 of the existing lots are built out and consist of single family homes. The remaining 6 lots are vacant. Wastewater flow estimates were calculated using the hydraulic load unit flow criteria provided in the "Standards for Approval of Plans and

Construction for Sewage Disposal Systems for Other Than Single-Family Residences” issued by the Suffolk County Department of Health Services (SCDHS).

Existing Use = 98 single family homes x 300 gpd/home = 29,400 gpd

Maximum Build Out = 104 single family homes x 300 gpd/home = 31,200 gpd

Estimated Design Flow = 30,000 gpd

For purposes of this report, it is assumed that 100 homes will be served by the decentralized sewer system. This would result in a design flow of 30,000 gpd. The WWTP may be able to accept additional connections in the future if it is proven that the WWTP has sufficient capacity to serve the additional flow. Theoretical flow values are typically greater than actual flows in order to account for the impact of inflow and infiltration of stormwater or groundwater that can increase hydraulic load on sewers and to account for variations in wastewater generation rates that occur during peak events. As discussed later in this report, a low pressure sewer system would greatly minimize inflow and infiltration which suggests that the facility may have future capacity to service more than 100 connections.

4.2 Peak Hourly Flow Calculation

The total population served by the wastewater treatment system is estimated at 400 persons based on the following:

$$30,000 \text{ gpd} / 75 \text{ gpd per capita} = 400 \text{ persons}$$

Peak hourly flow was determined using the following formula¹:

$$P = \frac{\text{Population}}{1000} = 0.4$$
$$Q_{\text{PeakingFactor}} = \frac{Q_{\text{PeakHourly}}}{Q_{\text{DesignAve}}} = \frac{18 + \sqrt{P}}{4 + \sqrt{P}} = \frac{18 + \sqrt{0.4}}{4 + \sqrt{0.4}} = 4.02$$

Based on a population of 400, the calculated peaking factor is 4.02. This equates to a peak hourly flow of 84 gpm.

¹ Formula taken from the GLUMRB - Recommended Standards for Wastewater Facility. 2004 Edition.

4.3 Influent Characteristics

The design influent characteristics as summarized in Table 1 were used for this project.

Table 1: Design Influent Characteristics

Characteristic	Units	Design Influent Concentration
Biochemical Oxygen Demand (BOD ₅)	mg/L	272
Total Nitrogen (TN) ¹⁾	mg/L	65
Total Suspended Solids (TSS)	mg/L	300

- 1) For the purpose of this evaluation, it is assumed that there are no nitrites and nitrates in the influent and that TN is equal to Total Kjeldahl Nitrogen (TKN).
- 2) Influent characteristics based on typical values provided by “Wastewater Engineering - Treatment, Disposal, and Reuse”, Metcalf and Eddy, Inc., Third Edition and adjusted from past experience. These values have been used and accepted for previous projects presented to the SCDHS.

4.4 Treated Effluent Quality

The decentralized system will include a wastewater treatment facility that will incorporate advanced treatment to comply with effluent treatment requirements stipulated by the Suffolk County Department of Health Services (Table 2).

Table 2: Design Effluent Characteristics

Characteristic	Design Effluent Concentration
Biochemical Oxygen Demand (BOD ₅)	<10 mg/L*
Total Nitrogen (TN)	<10 mg/L
Total Suspended Solids (TSS)	<15 mg/L*
pH	6 – 8.5

*Parameter is not typically regulated by SPDES Permits

5.0 NITROGEN LOADING

The calculation provided below estimates the pounds of nitrogen currently discharged by the existing homes located within the proposed Brower Woods SSA. The calculation is based on an influent Total Kjeldahl Nitrogen (TKN) concentration of 65 mg/L, which is a SCDHS recommended design influent. For purposes of this report, it is assumed that 75% of the existing homes are serviced by cesspools where no

reduction of nitrogen occurs. The remaining 25% of existing homes are assumed to be on individual septic systems where a 10% reduction of nitrogen is obtained through treatment. This ratio of homes with cesspools to homes with septic systems was determined by reviewing aerial imagery from 1962 and 1978 available on Suffolk County's GIS Viewer to estimate how many homes were built prior to 1973 when the new regulations requiring septic systems went into effect.

Table 3: Existing System Nitrogen Loading

System Description	Number of homes	Projected Flow (gpd)	Nitrogen Concentration in Influent (mg/L)	Nitrogen Concentration in effluent (mg/L)	Nitrogen Loading (lb/d)	Nitrogen Loading (lb/yr)
Cesspools	73	21,900	65	65	11.9	4,333
Septics	25	7,500	65	58.5	3.7	1,336
Total	98	29,400			15.5	5,669

Table 4 below calculates the nitrogen loading that is anticipated following the installation of a decentralized system at full build-out. Note that the calculation is based on a total nitrogen concentration of 10 mg/L, which is a typical requirement of SPDES permitted facilities. Actual total nitrogen concentration in WWTP discharge varies depending on the treatment system design and operator performance. However, in most cases, the system should consistently discharge less than 10 mg/L if the design and operations are executed properly.

Table 4: Proposed System Nitrogen Loading

System Description	Number of homes	Projected Flow (gpd)	Nitrogen Concentration in Influent (mg/L)	Nitrogen Concentration in effluent (mg/L)	Nitrogen Loading (lb/d)	Nitrogen Loading (lb/yr)
WWTP	100	30,000	65	10	2.5	913

Based on the information provided in Tables 3 and 4 above, the total daily nitrogen loading is reduced by 13 lbs/d (4,756 lbs/yr) through the implementation of a decentralized wastewater treatment system. This comparison does not take into consideration the location of the WWTP discharge. If the WWTP discharge is situated in a location that has lesser influence on Mattituck Creek, the nitrogen loading would be further reduced.

6.0 COLLECTION SYSTEM OPTIONS

This report evaluates two options for the proposed wastewater collection system; a low pressure sewer system and a combination gravity/LPS collection system. These are described in detail in Section 6.1 and 6.2 of this report.

6.1 Low Pressure System

In a low pressure sewer (LPS) system the wastewater is conveyed from each home to an on-site, individual pump station through a PVC lateral. The pump station collects the wastewater and discharges it through a low pressure piping network which ultimately discharges flow to the proposed WWTP. The LPS network consists of small diameter PVC pipes that will run down each street within the SSA. A layout of the system can be found in the report titled "Brower Woods - Low Pressure Sewer Design" by Water Resources Technologies in Appendix C.

Each individual pump station consists of a buried simplex grinder pump system, check valve, high density polyethylene tank and controls. The benefits of this type of system include lower cost, easier installation, and a significant reduction in the potential for extraneous stormwater or groundwater to enter the system. Duplex systems are available which provides for redundancy in case a pump were to malfunction. The cost differential between a simplex and duplex pump system is valued at approximately \$ 5,000 per station. If simplex systems are selected, SCDHS requires each homeowner enter into a lifetime maintenance contract with the pump station manufacturer or other qualified service company.

For this SSA, the following approximate quantities for the pressure system were calculated based on 100 residences:

- 9,500 Linear Feet (LF) of 1 ¼" HDPE pipe for house services
- 2,000 LF of 4" PVC from house to pump stations
- 11,200 LF of 2" to 4" HDPE pipe for collection system
- 100 Simplex pump stations with controls
- 11 Flushing connections

6.2 Combination Gravity/LPS Collection System

The option of installing a gravity system in the SSA was also evaluated. Due to the variable topography within the SSA, a collection system operating completely by gravity was cost prohibitive due to the excessive sewer main depth that would be required. Therefore, a combination of a gravity and a low pressure system was considered. A conceptual layout of the gravity/LPS system is provided in Figure 4 (Appendix A)

A total of 88 properties (exclusive of vacant lots) would connect to the gravity system. Homes would tie into the collection system by gravity via a 4-inch diameter PVC lateral. The gravity collection system consists of eight (8) inch SDR 35 PVC gravity collection pipes that would be installed along the roadways with access manholes spaced throughout. A majority to the collection system will be installed at a depth of 6-8 ft.

Twelve (12) properties (exclusive of vacant lots) along Grand Avenue, Woodcliff Road, and Brower Road would be served by an LPS since these properties are located at lower elevations. Individual pump stations will feed into a low pressure system and then discharge to the nearest proposed manhole where the wastewater will continue on by gravity.

The wastewater conveyed by LPS and gravity collection systems will ultimately discharge to a pump station located in the southeast section of the Brower Woods SSA. The pump station construction shall be constructed in accordance with SCDPW standards. For purposes of this analysis, the pump station will include a duplex submersible-type pump system installed in a 6-foot diameter x 12 foot deep concrete wet well. The proposed pump station will also include a control system, an autodialer and a standby generator. A concrete meter pit will be provided downstream of the wet well and will house valving and a flowmeter. Land must be acquired for the pump station installation. It is assumed that the pump station can be situated on a portion of one of the vacant lots along Westview Drive.

A new 4-inch PVC force main would be required to convey wastewater to the proposed WWTP. The route of the forcemain will follow Westview Drive north and then east to its intersection with Grand Avenue. It will then turn north and follow Grand Avenue to the intersection with East Mill Road, where it will enter the WWTP property. A layout of the force main route can be found in Figure 6 (Appendix A).

The following approximate quantities for the gravity system were calculated based on 100 residences:

Gravity Component

- 5,100 LF of 8" PVC
- 21 Manholes
- 6,600 LF of 4" PVC house services

Low Pressure Component

- 1,000 LF of 1 ¼" HDPE pipe for house services
- 240 LF of 4" PVC from house to pump stations
- 1,800 LF of 2" to 4" HDPE pipe for collection system
- 12 Simplex pump stations with controls

- 2 Flushing connections

Pump Station and Forcemain

- 6 ft diameter concrete wet well with a duplex submersible pump system
- A concrete valve and meter chamber
- 5,700 LF of 4" PVC force main
- 5 cleanout/air relief valve chambers
- Standby generator

6.3 STEP Collection System

The option of installing a Septic Tank Effluent Pump (STEP) system was also evaluated. The STEP system is similar to the low pressure collection system described in Section 6.1 in that it is composed of a closed network of small diameter pipes under pressure. The biggest difference is that the STEP system has a septic tank with an effluent pump at each residence. The septic tank serves to trap the solids while allowing the liquid portion of the effluent to continue to the treatment plant. As with the system described in Section 6.1, the STEP system can also be installed in an area with variable topography since the system is under pressure.

As with the low pressure system, benefits of the STEP system compared to a gravity system include lower cost, easier installation, and a significant reduction in the potential for extraneous stormwater or groundwater to enter the system. The septic tanks capturing solids located at each residence would need to be pumped out periodically. This is different from the first two options described where the solids are collected at the head of the plant. This results in a higher sludge disposal cost since a sludge hauling contractor would have to visit each residence rather than pumping from a large tank at the treatment plant. Concurrently, the STEP system affords some savings in the construction cost of the treatment plant since tankage volume to hold and process the solid matter is reduced.

For this SSA, the following approximate quantities for the STEP system were calculated based on 100 residences:

- 9,500 Linear Feet (LF) of 1 ¼" HDPE pipe for house services
- 2,000 LF of 4" PVC from house to pump stations
- 11,200 LF of 2" to 4" HDPE pipe for collection system
- 100 Septic tanks with pumps and controls (where possible, existing septic tanks will be retrofitted)
- 10 Air release and isolation valves

6.4 Cost Comparison

Capital costs were developed for all collection system options as detailed in Table 5.

Table 5: Capital Cost Estimate – Collection Systems

CAPITAL COST ESTIMATE COLLECTION SYSTEM OPTIONS BROWER WOODS, MATTITUCK, NY			
DESCRIPTION	Low Pressure System	Gravity/Pressure System	STEP System
Pump Station(s)	\$ 471,300	\$ 256,556	\$ 466,250
Collection System	\$ 586,975	\$ 877,942	\$ 494,600
Force Main	\$ 65,700	\$ 120,100	\$ 65,700
Construction Subtotal	\$ 1,123,975	\$ 1,122,598	\$ 1,026,550
Engineering (12%)	\$ 134,877	\$ 134,712	\$ 123,186
Land Acquisition	\$ 0	\$ 50,000	\$ 0
WWTP Cost Reduction	\$ 0	\$ 0	\$ (75,000)
TOTAL	\$ 1,258,852	\$ 1,307,310	\$ 1,074,736

Cost Estimate Assumptions:

1. Land acquisition cost estimate is based on a \$790,000/acre unit cost. Pricing obtained from Zillow.com which cites a \$379k estimated price for the 0.48 acre parcel located in the southwest of the SSA (1025 Westview Drive). A required area of approximately 50' x 50' was calculated. No additional land is needed for pressure system option.
2. Contingency and Engineering cost percentages are based on the pump station, collection system and force main construction costs.
3. The estimate assumes that small diameter piping can be installed using a trenching machine rather than open excavation and that no blasting or dewatering will be needed.
4. Estimate includes prevailing wage rates.
5. Nitrogen removal via septic tanks in the STEP system will reduce WWTP sizing and result in construction cost savings. For the MBR, SBR, and BESST options, there is an approximate 4' reduction in building and tankage length. For the NWTS option, the STEP system reduces the volume of the treatment plant septic tanks. It was determined that the WWTP cost savings with the STEP system would be in the range of \$50,000-\$100,000 for all WWTP options.
6. Cost estimates accurate to +/- 25% and do not include a contingency.
7. Gravity mains are assumed to be in the road and installed by conventional excavation. LPS and STEP mains are assumed to be off-pavement and installed by trenching machine. Force mains from pump stations are assumed to be in the road and installed by conventional excavation.
8. The low pressure system uses simplex pumping stations.
9. The estimates include abandoning all existing cesspools or septic tanks except for the STEP option where septic tanks may be retrofitted, if possible.

The combined gravity/pressure system not only has the highest cost, but also has two disadvantages compared to the purely pressure systems: 1) it requires dedicated land area for a pump station which may be difficult to obtain, and 2) it has the highest potential for infiltration and inflow because it is not a watertight system. Of the two pressure systems, the STEP system

option is the least expensive alternative to construct at a projected cost of approximately \$1,075,000. The primary cost advantage over the gravity system is the use of smaller diameter pipe which can be installed with a trenching machine rather than by open excavation and also the elimination of manholes in the roadway. The cost advantage over the low pressure system is in the lower cost of the pumping systems at each residence. Another advantage of the STEP system over the low pressure option is that the septic tanks at each residence remove rags and debris which protects the pumps.

In addition, STEP systems provide a notable degree of wastewater treatment through septic tanks which result in a reduction in BOD, TSS and total nitrogen. This translates to reduced process tank volumes and building footprint. As noted in the table above, this can translate to approximately \$75,000 in construction cost savings at the wastewater treatment plant. Treatment cost savings may be further increased depending on the technology selected. For example, there are numerous examples of STEP systems combined with Orenco Systems® Inc. AdvanTex® Treatment System where construction cost has proven to be highly competitive.

The AdvanTex Treatment System is proven technology which relies on the activated sludge process with packed bed media filters for wastewater treatment. An example of a process flow schematic of the STEP with AdvanTex Treatment system is provided in Appendix B. Although this technology is approved by SCDHS in concept, there are no installations in Suffolk County. Furthermore, this technology has not been through the SCDHS or SCDPW approval process which make it difficult to estimate the cost of this system. Due to the limited advancement of this technology in Suffolk County, the Advantex system not considered an alternative for treatment in this report.

Section 10.0 of this report discusses alternatives that would further reduce the cost of the collection system.

An annual operational cost estimate for the three collection system options is provided in Table 6 below:

Table 6: Annual Operational Cost Estimate – Collection Systems

ANNUAL OPERATIONAL COST ESTIMATE COLLECTION SYSTEM OPTIONS BROWER WOODS, MATTITUCK, NY			
DESCRIPTION	Low Pressure System	Gravity/Pressure System	STEP System
Power	\$ 7,000	\$ 1,400	\$ 1,400
Maintenance	\$ 4,000	\$ 3,500	\$ 4,000
Sludge Removal	\$ 0	\$ 0	\$ 4,000
TOTAL	\$ 11,000	\$ 4,900	\$ 9,400

Cost Estimate Assumptions:

1. Power cost is based on a service rate of \$0.2/kWh.
2. Annual power consumption for the LPS is based on the equivalent of a 40 W light bulb per pump station, as per manufacturer calculations.
3. Maintenance cost for the LPS alternative includes a lifetime maintenance contract valued at \$40 annual charge per home as determined by the manufacturer. Service would include checking the pump amperage to make sure the pump is working properly. Contract excludes emergency repair. For the STEP system, maintenance includes cleaning the septic tank effluent filters and monitoring the level of the sludge within the septic tank to determine the need for pumping.
4. Sludge removal cost assumes pumping the septic tank at each residence every 3 years at a cost of \$0.12/gallon. There is no sludge collected within the low pressure or gravity systems.

The LPS and STEP systems provide cost saving advantages and have the ability to mitigate inflow and infiltration which makes them a better option compared to the gravity system for this application. Between the two pressure options, the STEP is the preferred alternative due to its lower construction and operating cost and its ability to reduce the cost of the treatment system.

7.0 SITE ALTERNATIVES FOR WWTP AND DISPOSAL

To select a suitable site for the wastewater treatment plant, several factors were considered including size of property, proximity to the Brower Woods SSA, limitations on development, and availability.

The minimum land area needed for the WWTP was calculated based on a typical layout of a facility designed to process 30,000 gpd of wastewater. In addition, a 150' setback to the property line was considered. For the mechanical treatment systems (BESST, MBR and SBR) the required land area would be approximately 3 acres. To accommodate the vegetated gravel filter cells in the natural treatment system, approximately 4 acres of land would be required.

Six properties with adequate area for WWTP and disposal were located in the vicinity of the Brower Woods SSA. The search radius was limited to 0.75 miles in order to keep the proposed force main

length within reason. The six parcels are shown in Figure 6 (Appendix A). Of the six parcels, four are currently being used for agriculture. These agricultural parcels include Block 300 Lots 1200 and 16000 and Block 400, Lots 1003 and 1005. Upon further examination, it was found that three of the four agricultural parcels are in Suffolk County's "Purchase of Development Rights" program and therefore are not available as WWTP development sites. Block 300, Lot 12000 was not included in this program and is available for development. While not fully examined, there do not appear to be any environmental or historical restrictions (i.e. wetland areas, endangered species habitat) on this property.

The other two parcels (lot Block 100, Lots 1003 and 2001) are partially developed. Undeveloped land on these two parcels is predominantly forest or meadow. One of the parcels includes a commercial greenhouse operation and the other with a private residence. These properties are large enough to be subdivided so that a portion could be used for the WWTP but the willingness of the owners to sell all or a portion of the property is unknown.

Block 300, Lot 12000 located at the northwest corner of East Mill Road and Grand Avenue, was the site chosen for the proposed WWTP and disposal system. This property provided enough area and is currently on the market. The site's flat topography and use for agriculture would result in limited clearing and earthmoving necessary during construction. It is envisioned that a portion of this property could be split off for the treatment facility while the remainder is either developed or preserved as farmland.

Should this property be selected, there may be opportunities to further increase the SSA to include adjacent properties. The future WWTP could be increased in size to capture the existing Sebastian's Cove community to the west as well as future development on Block 300, Lot 12000. Increasing the number of connections may help reduce the cost per user.

Another option that should be considered is reusing the treated effluent as an irrigation source for neighboring agricultural lands. A significant number of agricultural properties are located to the east of the WWTP site. This option would require the installation of a piping network and storage tanks. A conceptual design and cost for such a system was beyond the scope of this report.

8.0 TREATMENT SYSTEM OPTIONS

A design concept was developed for four (4) wastewater treatment technologies, all of which are reliable systems that are approved for use in Suffolk County. The design concepts are based on the wastewater design parameters referenced in Section 4 of this report. The selected technologies are listed below.

1. Membrane Bio-Reactor (MBR) Technology

2. Sequencing Batch Reactor (SBR) Technology
3. Biologically Engineered Single Sludge Treatment (BESST) System
4. Natural Wastewater Treatment System (NWTs)

Each system was designed to meet regulatory standards and the requirements of SCDHS for redundancy. The conceptual designs assume that all process tankage must be enclosed in a building (with the exception of the NWTs alternative). Process tankage was assumed to be of concrete construction, because steel tankage is generally not accepted by SCDHS. The primary WWTP infrastructure that is required for each alternative is described in Sections 8.1 to 8.4 below.

Regardless of which treatment system is chosen, the WWTP will be designed to best utilize the designated site. Regrading will be kept to a minimum and the facility will be landscaped to blend into the surrounding area. Fencing is typically provided around the WWTP for security but this can be preplaced with other means such as cameras and alarms. Security is taken account in the cost estimates in Section 8.5.

Typical facility layouts for the MBR, SBR and BESST systems can be found in Appendix B although the size of the building and configuration of the equipment may change to best suit a particular location. Most of the tanks and other components are either located in a building or underground. The exterior of the building can be designed to include architectural features or paint schemes to blend it into the local surroundings. An example of a building for the MBR, SBR and BESST systems can be found in Photograph 1. Because of the larger area of the wetlands cells in the Natural Wetlands Treatment System, each design for such a system is site specific so there is no “typical” layout. For these systems, tanks are underground and the most visible components are the wetlands “cells”. An example of what a Natural Wetlands Treatment System may look like is shown in Photograph 2.

Photograph 1: Example Building for MBR, SBR or BESST Systems



Photograph 2: Example of a Natural Wetlands Treatment System



8.1 Process Description: Membrane Bio-Reactor (MBR) Technology

An MBR uses an activated sludge process that utilizes tertiary filtration as a polishing step in wastewater treatment. Total nitrogen is removed by sequencing nitrification and denitrification processes in the aeration and anoxic tanks. A return activated sludge loop is implemented to maintain biological activity and increase treatment. Membrane units located in the membrane tank filter out solids to produce a clear, high quality effluent.

The proposed 30,000 gpd MBR facility for this project will include the following main components:

- A 2,885 SF masonry block control building to house a mechanical room, an electrical room, a laboratory and a two train, three stage biological treatment system consisting of the following:
 - One (1) 3,000 gallon Trash Trap
 - One (1) 12,700 gallon Equalization Tank
 - Two (2) Mechanically-Cleaned Fine Screens
 - One (1) Splitter Box
 - Two (2) 4,800 gallon Anoxic Tanks with mechanical mixing
 - Two (2) 4,675 gallon Aerobic Tanks
 - Two (2) 11,700 gallon Aerated Membrane Tanks
 - One 9,500 gallon Sludge Holding Tank
 - Aeration systems which include three (3) process blowers, three (3) membrane blowers and three (3) equalization tank/sludge holding tank blowers and associated diffusers/piping
 - Chemical Feed Systems for pH control and supplemental carbon
 - Electrical Equipment
 - HVAC Equipment
 - Odor Control System
- An effluent disposal system
- 100 kW Stand-by Generator

8.2 Process Description: Sequencing Batch Reactor (SBR) Technology

The SBR is also an activated sludge process that achieves treatment in a single reactor (tank). The tank operates in batches in which the following stages of treatment occur: fill, react, settle, decant, and idle. The SBR is followed by a filter which removes solids. Typically, SBRs are comprised of at least two identically equipped reactors in parallel. This allows the process tankage to receive a consistent inflow of wastewater throughout all hours of the day.

The proposed 30,000 gpd SBR facility was sized based on process calculations performed by Aqua Aerobics and design calculations performed by NSU. The system includes the following components:

- A 2,275 SF masonry block control building to house a mechanical room, an electrical room, a laboratory and a two train, sequencing batch reactor treatment system consisting of the following:
 - One (1) 3,000 gallon Trash Trap
 - One (1) 13,500 gallon Equalization Tank
 - Two (2) Mechanically-Cleaned Screens
 - One (1) Splitter Box
 - Two (2) 15,700 gallon Sequencing Batch Reactors with Aquacam-D Aerator/Mixer/Decanter
 - Two (2) Microscreen Drum Filters (Purestream model 5-BMF-5-0)
 - One 9,000 gallon Sludge Holding Tank
 - One (1) Metering Chamber
 - Aeration systems which include three (3) equalization tank/sludge holding tank blowers and associated diffusers/piping
 - Chemical Feed Systems for pH control and supplemental carbon
 - Electrical Equipment
 - HVAC Equipment
 - Odor Control System
- An effluent disposal system
- 60 kW Stand-by Generator

8.3 Process Description: Biologically Engineered Single Sludge Treatment (BESST) System

The BESST system is an activated sludge process that utilizes an upflow clarifier to settle solids and a cloth microfilter to screen the effluent.

The proposed 30,000 gpd BESST facility was sized based on process calculations performed by Purestream and design calculations performed by NSU. The system will include the following main components:

- A 2,600 SF masonry block control building to house a mechanical room, an electrical room, a laboratory and a two train, sequencing batch reactor treatment system consisting of the following:
 - One (1) 3,000 gallon Trash Trap
 - One (1) 12,700 gallon Equalization Tank
 - Two (2) Mechanically-Cleaned Screens
 - One (1) Splitter Box

- Two (2) 8,600 gallon Anoxic Tanks with mechanical mixing
- Two (2) 16,150 gallon Aeration Tanks
- Four (4) Upflow Clarifier Tanks, integral to the Aeration Tanks, each with a total volume of 8,557 gallons
- Two (2) Microscreen Drum Filters (Purestream model 5-BMF-5-0)
- One (1) 9,000 gallon Sludge Holding Tank
- One (1) Metering Chamber
- A blower package that includes three (3) process blowers, two (2) airlift return blowers and three (3) equalization tank/sludge holding tank blowers and associated diffusers/piping
- Chemical Feed Systems for pH control and supplemental carbon
- Electrical Equipment
- HVAC Equipment
- Odor Control System
- An effluent disposal system
- 85 kW Stand-by Generator

8.4 Process Description: Natural Wastewater Treatment System (NWTs)

The NWTs uses vegetated gravel filters in which biological activity breaks down the solids in the wastewater. Nitrification and denitrification tanks provide for the enhanced removal of nitrogen downstream of the filters.

The proposed 30,000 gpd NWTs facility was sized based on process calculations performed by NSU. The system will include the following main components:

- Three (3) 20,000 gallon septic tanks (60,000 gal capacity) will be installed in series. The third tank shall be fitted with a commercial septic tank filter.
- One (1) 15,000 gal precast concrete recirculation tank w/baffle wall will be provided. System overflow from the recirculation tank will go directly to the dispersal field in the event of a power failure or critical system maintenance.
- One (1) 6 X 8 Recirculation Tank Meter Chamber
- Four (4) 2,025 SF gravel filters at 4' depth using ¾" pea gravel underlain by 1' of drainfield rock
- One (1) 5,000 gal precast concrete Nitrification & Recycle Tank with baffle wall, including:
 - Four (4) Wedge Wire Screens
 - Bioflow 9 MBBR media
 - Aeration Diffusers and Piping
 - Two (2) Recycle Pumps
- One (1) 12,000 gal precast concrete Denitrification Tank with baffle wall including:

- Two (2) Mixers
- Bioflow 9 MBBR media
- Four (4) Wedge Wire Screens
- A 400 SF prefabricated control building to house the following:
 - Mechanical room
 - Electrical room
 - Laboratory/restroom
 - A blower package that includes two (2) Nitrification & Recycle Tank Blowers and associated diffusers/piping
 - Chemical Feed Systems for supplemental carbon
 - HVAC Equipment
- An effluent disposal system
- 20 kW Stand-by Generator

8.5 WWTP Capital and Operational Cost Estimates

The conceptual designs described in Sections 8.1 through 8.4 of this report formulated the basis for the capital and operational cost estimates presented in Tables 7 and 8 below. A quantity takeoff was completed for each alternative along with equipment selections. The cost estimates provided herein are based on the preliminary design concepts and are subject to change.

Table 7: WWTP Capital Cost Estimate

BROWER WOODS WWTP AND DISPOSAL SYSTEM MATTITUCK, TOWN OF SOUTHOLD, NY				
DESCRIPTION	MBR	SBR	BESST	NWTS
Mobilization	\$ 55,000	\$ 55,000	\$ 54,000	\$ 57,000
Site Work	\$ 137,000	\$ 137,000	\$ 136,000	\$ 138,000
Site Utilities	\$ 19,000	\$ 19,000	\$ 19,000	\$ 25,000
Process Tanks	\$ 354,000	\$ 304,000	\$ 324,000	\$ 364,000
Building	\$ 390,000	\$ 321,000	\$ 359,000	\$ 152,000
HVAC/Plumbing	\$ 54,000	\$ 54,000	\$ 54,000	\$ 37,000
Process/Mechanical	\$ 715,000	\$ 836,000	\$ 1,363,000	\$ 275,000
Electrical	\$ 412,000	\$ 310,000	\$ 316,000	\$ 245,000
Disposal System	\$ 75,000	\$ 75,000	\$ 75,000	\$ 75,000
Miscellaneous/Management	\$ 252,000	\$ 243,000	\$ 239,000	\$ 268,000
Construction Subtotal	\$ 2,463,000	\$ 2,354,000	\$ 2,939,000	\$ 1,636,000
Engineering (12%)	\$ 295,560	\$ 282,480	\$ 352,680	\$ 196,320
Land Acquisition	\$ 375,000	\$ 375,000	\$ 375,000	\$ 500,000
Total	\$ 3,133,560	\$ 3,011,480	\$ 3,666,680	\$ 2,332,320

Cost Estimate Assumptions/Clarifications:

1. Tax is included.
2. Land acquisition cost estimate is based on a \$125,000/acre unit cost. Pricing obtained from Trulia.com which cites a \$2.9M asking price for the 23.11 acre parcel located on the northwest corner of Mill Rd and Grand Ave. (1355 East Mill Road).
3. Estimate includes prevailing wage rates.
4. Cost estimates accurate to +/- 25% and do not include a contingency.

Upon review of the alternatives referenced above, the WWTP and disposal system cost ranges between \$2,332,320 for the NWTS and \$3,666,680 for the BESST system. Of the alternatives evaluated, the NWTS provides a lowest cost option for decentralized treatment. There are design alternatives that could reduce the cost of the MBR, SBR, and BESST systems that would make these alternatives more competitive to NWTS. These cost saving design alternatives are further discussed in Section 10.0 of this report.

The annual operational cost for each WWTP alternative was developed based on the preliminary designs described in Sections 8.1 through 8.4 of this report. The operational costs are summarized in Table 8 below.

Table 8: WWTP Annual Operational Cost Estimate

BROWER WOODS WWTP AND DISPOSAL SYSTEM MATTITUCK, TOWN OF SOUTHOLD, NY				
DESCRIPTION	MBR	SBR	BESST	NWTS
Labor/Maintenance	\$ 55,000	\$ 50,000	\$ 50,000	\$ 45,000
Power	\$ 36,964	\$ 25,094	\$ 37,258	\$ 12,637
Chemicals	\$ 5,000	\$ 5,000	\$ 5,000	\$ 7,300
Sludge Removal	\$ 7,621	\$ 14,673	\$ 9,023	\$ 2,880
TOTAL	\$ 104,585	\$ 94,767	\$ 101,280	\$ 67,817

Cost Estimate Assumptions:

1. Labor/Maintenance is based on one operator performing site visitations 3x/week plus costs for equipment repair or replacement. Sampling and compliance are included. Sampling requirements meet typical SPDES permit criteria. Maintenance typically includes 7-day coverage but this may be reduced if the system design and the regulatory authorities allow it. Remote monitoring may also reduce coverage. For the sake of this study, it is assumed that SCDHS will accept this concept.
2. Power cost is based on a service rate of \$0.2/kWh
3. Chemical costs for the MBR, SBR and BESST systems are projected based on actual chemical usage for similar sized facilities throughout the Northeastern US.
4. Chemical cost for NWTS is based on projected Micro CG 2000 addition at a rate of 4 gpd @ \$5/gal.
5. Sludge production is estimated based on process calculations prepared by NSU (MBR), Purestream (BESST) and Aqua Aerobics (SBR). Sludge hauling cost = \$0.12/gal
6. NWTS sludge hauling costs are based on four septic tank pump outs/year at 6,000 gallons/pumpout.

9.0 RECOMMENDED ALTERNATIVE

Based on the cost estimation performed in previous sections, the recommended system alternative for this project would be a STEP sewage collection system discharging to a natural wetlands treatment system. A summary of the estimated capital and operating costs for this alternative can be found in Tables 9 and 10, respectively.

Table 9: Capital Cost for the Recommended Alternative

BROWER WOODS WWTP AND DISPOSAL SYSTEM MATTITUCK, TOWN OF SOUTHOLD, NY	
DESCRIPTION	Capital Cost
STEP Collection System	\$ 1,026,550
Natural Wetlands Treatment System	\$ 1,561,000
Construction Subtotal	\$ 2,587,550
Engineering (12%)	\$ 319,506
Administration (4% of Const. & Eng.)	\$ 116,282
Total	\$ 3,023,338

Cost Estimate Assumptions:

1. The cost of the Natural Wetlands Treatment System has been reduced by \$75,000 because a STEP collection system reduces nutrient loading.
2. The cost of land is not included in the financial model.

Table 10: Annual Operating Cost for the Recommended Alternative

BROWER WOODS WWTP AND DISPOSAL SYSTEM MATTITUCK, TOWN OF SOUTHOLD, NY	
DESCRIPTION	Operating Cost / Year
STEP Collection System	\$ 9,400
Natural Wetlands Treatment System	\$ 66,017
Total Annual Operating Cost	\$ 75,417

Cost Estimate Assumptions:

1. The operating cost of the NWTS is reduced by \$1,800 over that shown in Table 8 due to the reduction in sludge pumping at the treatment plant because this cost is already accounted for in the sludge pumping costs for the STEP system.

The entire system is estimated to cost approximately \$3.02M to construct (+/- 25%). The costs above were used in the financial model discussed further in Section 11.0.

10.0 ALTERNATIVE COST SAVINGS

The wastewater treatment and collection systems presented in this report were designed based on standard practice and Suffolk County requirements. There are, however, opportunities for substantial cost savings if specific requirements were modified. These cost saving measures are described in more detail below.

1. **Locate Pre-treatment Tankage Outside of Building** – Suffolk County requires that wastewater treatment tankage be located within a building in order for to obtain a 150 foot setback to property lines, otherwise a 350 foot setback would be required. If the trash trap, equalization tank and/or sludge holding tank may be located outside of the building while allowing for a 150 foot setback, the cost savings resulting from a reduced building footprint could be approximately \$100,000 for the MBR, SBR and BESST systems.
2. **Eliminate the Mechanical Room** – Suffolk County requires that equipment such as the blowers and permeate pumps be located in a separate mechanical room. If this equipment could be placed on top of the process tankage, the building footprint and the amount of piping would be reduced, thereby resulting in a cost savings of approximately \$75,000 for the MBR and BESST systems. This type of configuration is appropriate for the small treatment systems ($Q < 100,000$ gpd).
3. **Packaged Steel Tank Construction** – Suffolk County recently has required that all process tankage be of concrete construction. For this size treatment plant, many manufacturers now offer package plants using steel tanks. These systems can be delivered to the site and installed on a concrete pad with minimal additional construction required. This could significantly reduce the design and construction costs for the MBR and BESST systems.

For example, a 30,000 gpd packaged BESST system constructed of steel tanks has the potential to reduce cost by \$500,000. Another example is a 25,000 gpd packaged MBR system that was recently installed in PA for a total construction cost of approximately \$1.2M. The MBR system in PA was a single train facility, which is allowed in states such as PA, VA, DE, etc. for flows under 50,000 gpd, and shows how steel packaged systems can be cost effective at facilities with lower design capacities.

4. **Sharing LPS Pumping Stations** – This evaluation considers that each home connected to low pressure wastewater collection system would have its own individual pumping station. However, each simplex station has a 700 gpd capacity which is suitable to serve up to two single family homes. If the pumping units were owned by a utility so that ownership and maintenance

conflicts are eliminated, two homes can be connected to each pump station. Reducing by half the number of pump stations and lateral connections to the street would reduce the cost of the pressure collection system by approximately \$320,000.

5. **Connecting Additional Customers** – Connecting additional users to the treatment plant will reduce the per user cost. The properties evaluated for the treatment plant location have adequate area for a larger system and are located centrally to the surrounding developments. If this option is considered during the design phase, the treatment facility could be designed to allow for future expansion. The magnitude of the cost savings will depend on which treatment plant option is chosen and how many additional customers will be connected.

11.0 OWNERSHIP STRUCTURE AND FINANCING

Development and financing of small-scale decentralized wastewater infrastructure has historically been challenging in Suffolk County. Most municipalities do not have the expertise or the resources to efficiently develop and manage dispersed wastewater infrastructure. Also many municipalities as well as Suffolk County have been exploring innovative approaches to delivering decentralized wastewater infrastructure. Therefore, this study will review alternative and innovative public private partnership approaches that are successfully working in other states such as New Jersey. These approaches leverage the expertise and capital of a private entity that specializes in deploying and managing decentralized wastewater infrastructure and harnesses a municipality's access to low cost debt, ability to assess fees to its residents and legal right to build infrastructure in public rights of way.

Public Private Partnership – An alternative to the historical approach used in Suffolk County would be to form a public private partnership that would entail the local municipality and a private entity jointly funding and implementing the project. This partnership can take several forms (i.e. sewer maintenance district), but generally harnesses the municipality's access to low costs debt and leverages some amount of capital from the private entity. The private entity would be responsible to turnkey the design, build and/or long term operations of the system. This approach has been used to some extent in New York as well as other states such as New Jersey and Massachusetts.

It is critical that the public private partnership leverage as much grant and incentive funding as possible in order to reduce costs to the residents. There are many different potential funding scenarios with different combinations of grants, municipal debt and private equity. The following summarizes a few funding scenarios and their estimated impact on user fees per customer. It is important to note that these economics assume the costs are spread over 100 users. If alternatively the costs were allocated to all customers of the town (households and commercial), then the individual cost per user would be significantly reduced.

Table 11: Annual User Fees

Funding Options	User Fee* Brower Woods Only (\$/year/customer)	User Fee* Entire Community** (\$/year/customer)	
		Connected Customer	Other Customer
100% Municipal Debt Financing	\$2,057	\$500	\$82
100% Grant Financing	\$754	\$500	\$13
80% Grant / 20% Private Equity	\$1,621	\$500	\$59

* The user fees are estimates based on certain financial assumptions. Administrative costs for legal services, insurance, billing and collections were not included. A cost of capital of 15% is included in the option using private equity.

** Assumes 2,000 users in the Town of Mattituck based on recent demographic and parcel data and reasonable estimates. The 100 connected users pay a flat fee of \$500 per year. The remaining cost is divided equally among the other 1,900 customers.

12.0 RECOMMENDATIONS FOR POLICY AND REGULATORY CHANGE

A few approaches could be used to implement Public Private Partnerships for sewer systems in Suffolk County. There are models from other states that have been used successfully and could be applied in Suffolk County. Further discussion would be needed with the State of New York and Suffolk County DPW to determine whether this type of approach could be implemented under current regulations. The State of New York has not historically allowed Design-Build projects, but recent efforts having yielded limited acceptance for certain projects conducted by DOT, Parks, DEC and a few other State Agencies.

13.0 CONCLUSIONS

The wastewater generated by the Brower Woods community in Mattituck, NY can be treated cost effectively via a decentralized collection system and wastewater treatment plant located near the community. Assuming an average daily flow of 30,000 gpd, a STEP collection system with a Natural Wetlands Treatment System would result in a drastic reduction in the total amount of pollutants discharged each year. Such a system would reduce the discharge of BOD to local waterways by 23,892 lbs, TN by 5,016 lbs, and TSS by 25,990 lbs annually and provide immense environmental benefit to the community, Mattituck Inlet, and the Long Island Sound.

* * *

APPENDIX A

DRAWINGS AND FIGURES

FIGURE 1. SEWER SERVICE AREA

FIGURE 2. TAX MAP

FIGURE 3. ELEVATION

FIGURE 4. COMBINED GRAVITY/LPS COLLECTION SYSTEM – AERIAL


FIGURE 5. COMBINED GRAVITY/LPS COLLECTION SYSTEM – ELEVATION

FIGURE 6. WWTP SITE LOCATION


TOWN OF SOUTHOLD MAPPING


- **Parcel Acreage**
- **Influence Zones**
- **Soils – Drainage Class**
- **Ground Water Depth**
- **Impaired Water**

Legend

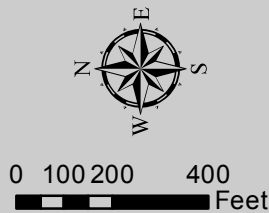
 Sewer Service Area

Parcel

 Not in SSA

 Structure

 Vacant



NATURAL SYSTEMS UTILITIES

2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286

**SEWER SERVICE AREA
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK**

Date: 10/1/2013

Drawn By: ACH

Designed By: DCS

Checked By: DCS

Project: E01489AA

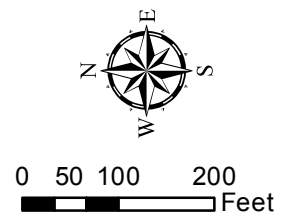
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Rev:

Figure: 1

Parcel

Hydrography



NATURAL SYSTEMS UTILITIES

**2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286**

TAX MAP
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK

Rev:	Figure: 2
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Legend

- Contour
- Hydrography

NATURAL SYSTEMS UTILITIES

2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286

**ELEVATION
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK**

Date: 10/1/2013

Drawn By: ACH

Designed By: DCS

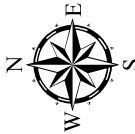
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Project: E01489AA

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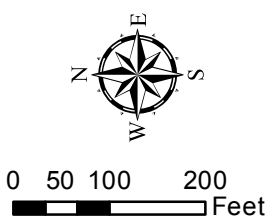
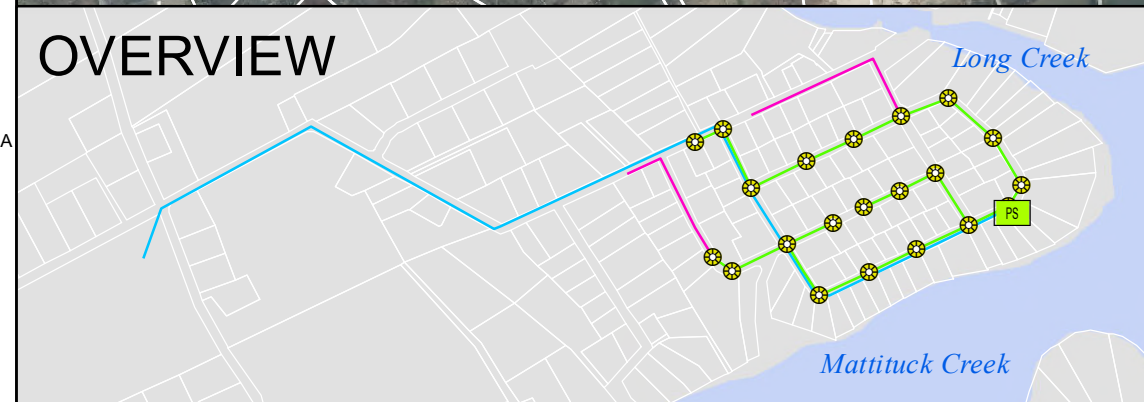
Rev:

Figure: 3



0 50 100 200
Feet

- Legend**
- Manhole: MH1 R = 36FT
- Pump Station
- Gravity Main
- Low Pressure Main
- Force Main
- Water



NATURAL SYSTEMS UTILITIES
2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286

**COMBINED GRAVITY/LPS
COLLECTION SYSTEM AERIAL
BROWER WOODS
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK**

Date: 10/11/2013	
Drawn By: ACH	
Designed By: JR	
Checked By: DCS	
Project: E0000AA	
Scale: 1" = 200'	
Rev:	Figure: 4

Legend

Manhole: MH1 R = 36FT

Pump Station

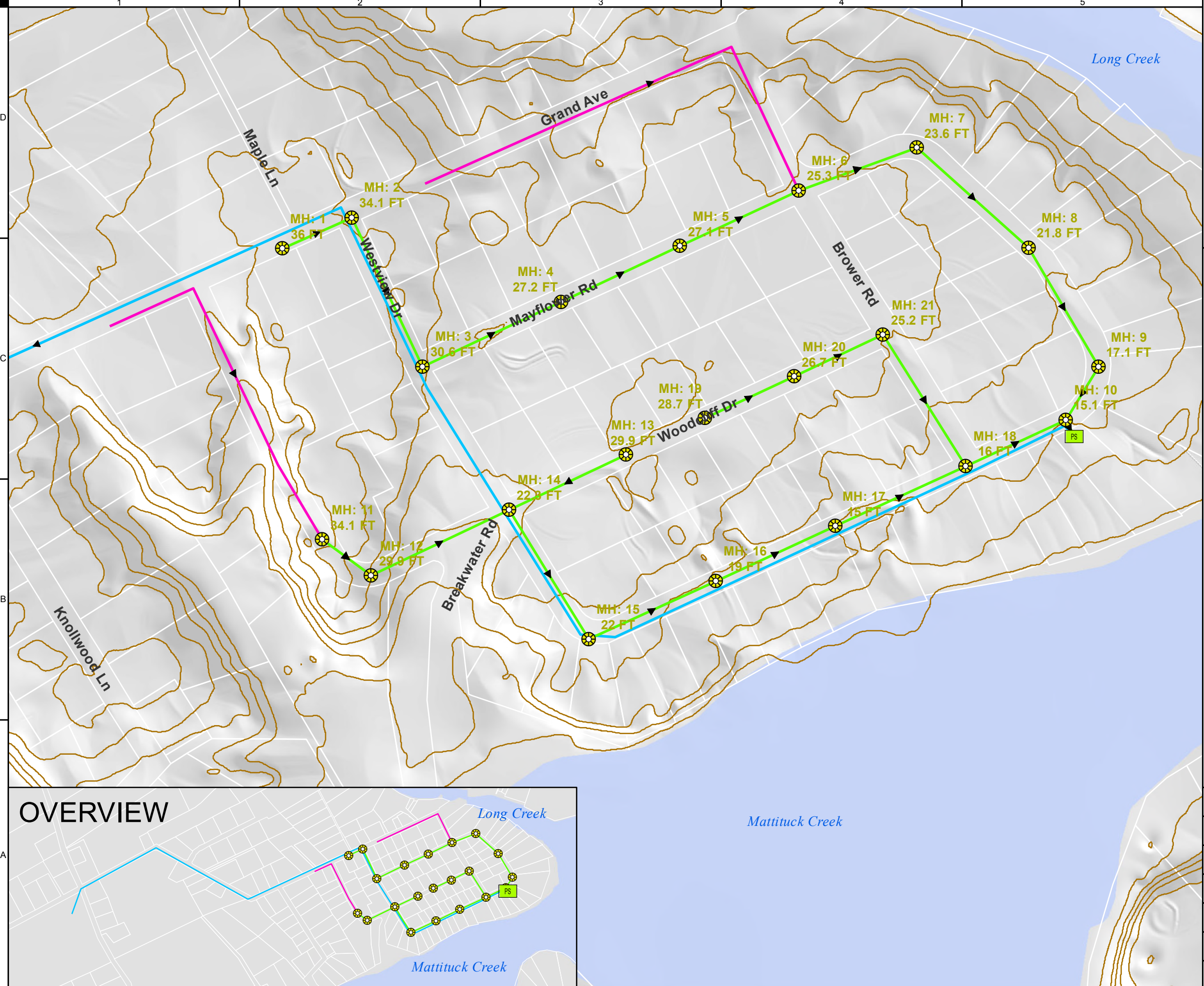
Gravity Main

Low Pressure Main

Force Main

Contour

Water

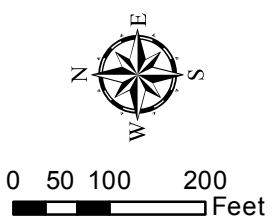


NATURAL SYSTEMS UTILITIES

2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286

COMBINED GRAVITY/LPS
COLLECTION SYSTEM ELEVATION
BROWER WOODS
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK

Date: 10/11/2013
Drawn By: ACH
Designed By: JR
Checked By: DCS
Project: E0000AA
Scale: 1" = 200'
Rev:
Figure: 5



Legend

Force Main



Min. Area for WWTP & Disposal



Proposed WWTP & Disposal Footprint



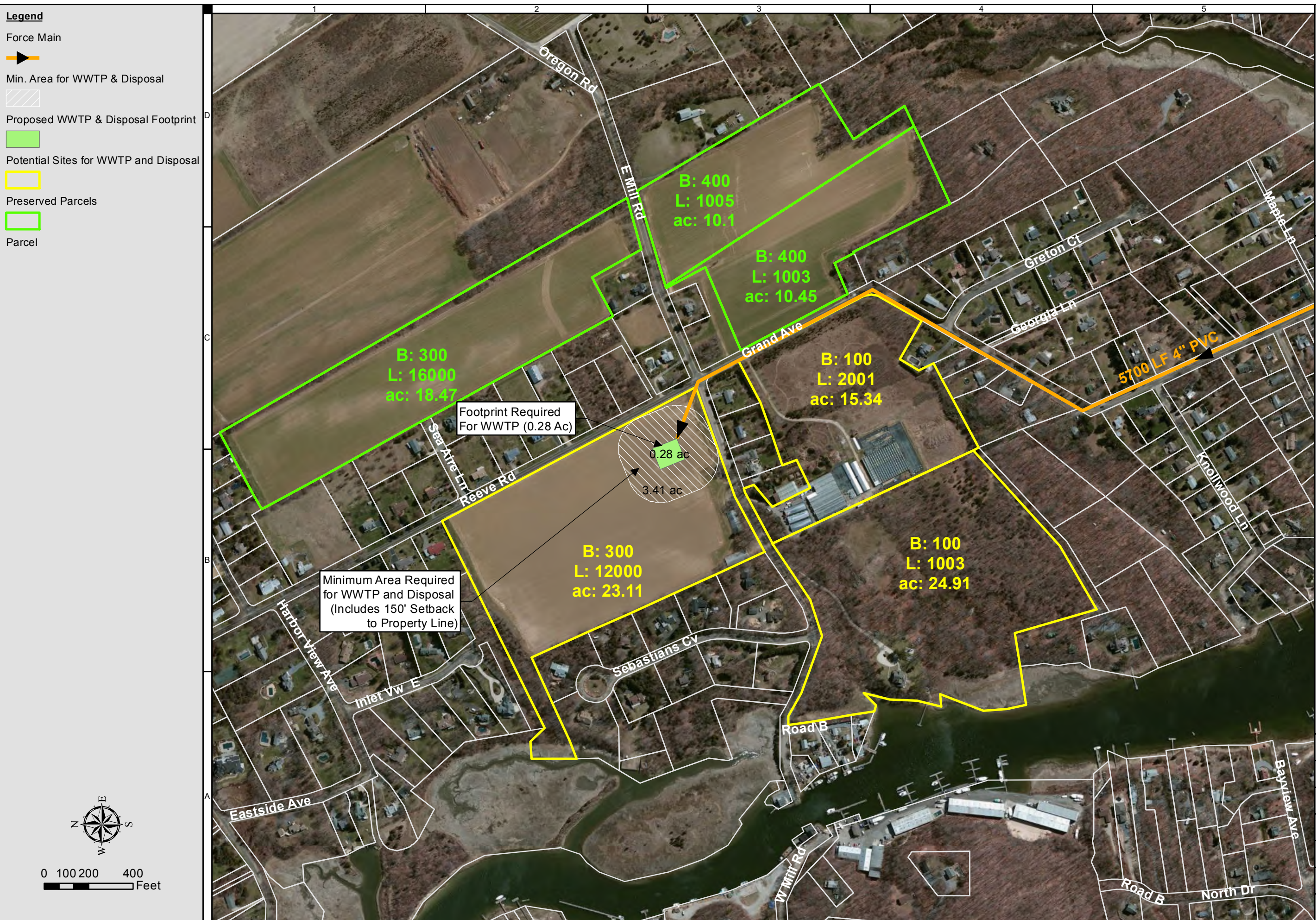
Potential Sites for WWTP and Disposal



Preserved Parcels



Parcel



NATURAL SYSTEMS UTILITIES

2 CLERICO LANE, SUITE 1
HILLSBOROUGH, NEW JERSEY 08844
PHONE: (908) 359-5501
FAX: (908) 359-8286

**WWTP SITE LOCATION
BROWER WOODS
PECONIC GREEN GROWTH
MATTITUCK, LONG ISLAND, NEW YORK**

Date: 10/10/2013

Drawn By: ACH

Designed By: DCS

Checked By: DCS

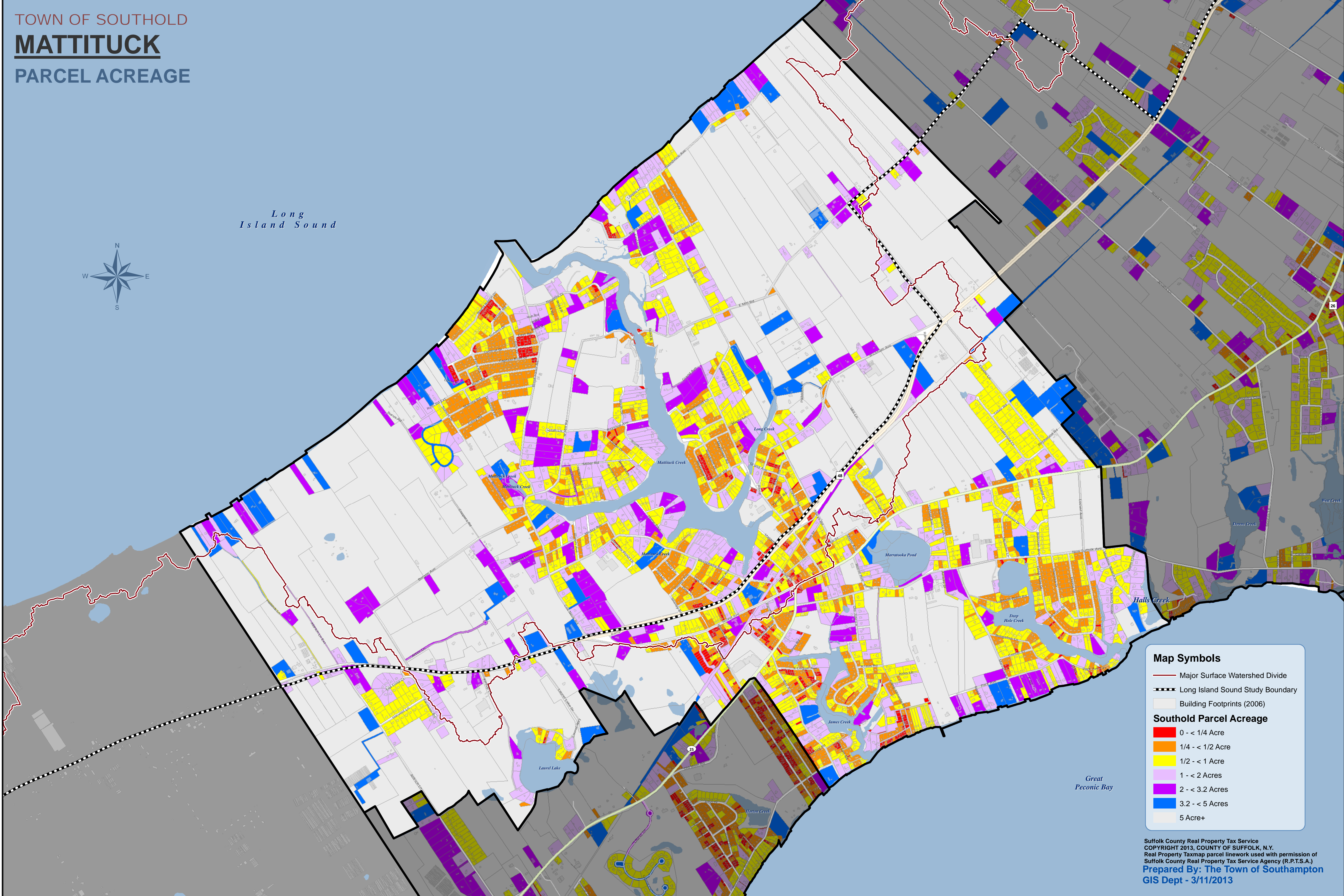
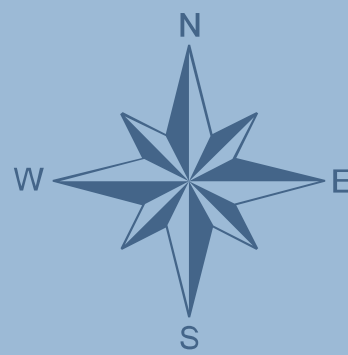
Project: E01489AA

Scale: 1" = 400'

Rev: Figure: 6

TOWN OF SOUTHOLD
MATTITUCK
PARCEL ACREAGE

*Long
Island Sound*



Map Symbols

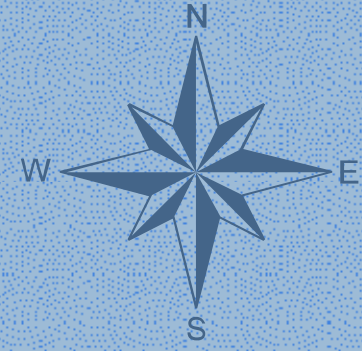
- Major Surface Watershed Divide
- Long Island Sound Study Boundary
- Building Footprints (2006)

Southold Parcel Acreage

- 0 - < 1/4 Acre
- 1/4 - < 1/2 Acre
- 1/2 - < 1 Acre
- 1 - < 2 Acres
- 2 - < 3.2 Acres
- 3.2 - < 5 Acres
- 5 Acre+

TOWN OF SOUTHOLD
MATTITUCK
INFLUENCE ZONES

*Long
Island Sound*



Map Symbols

- Major Surface Watershed Divide
- Long Island Sound Study Boundary
- Building Footprints (2006)
- DEC Impaired Water Bodies (303D)

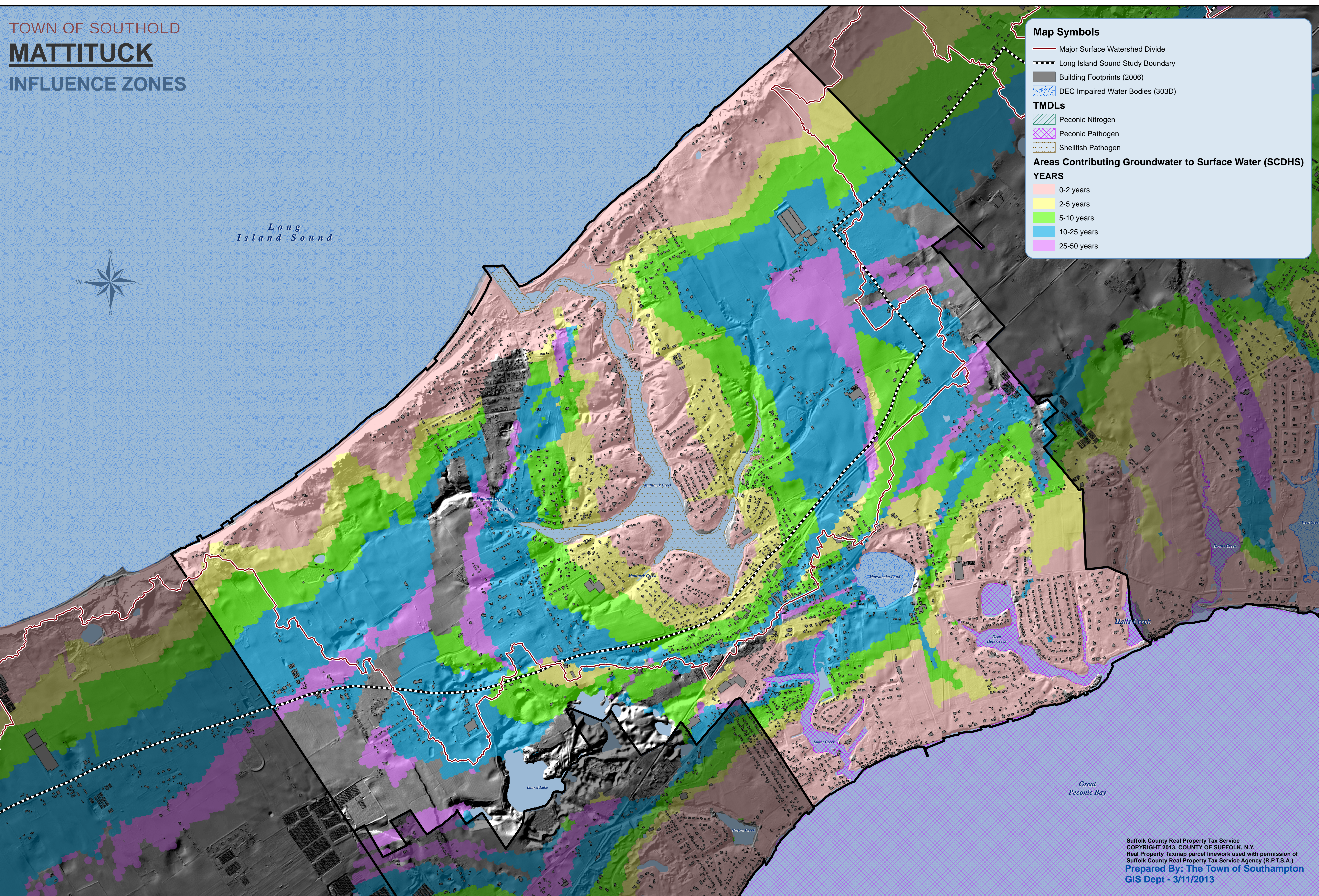
TMDLs

- Peconic Nitrogen
- Peconic Pathogen
- Shellfish Pathogen

Areas Contributing Groundwater to Surface Water (SCDHS)

YEARS

- 0-2 years
- 2-5 years
- 5-10 years
- 10-25 years
- 25-50 years



TOWN OF SOUTHOLD
MATTITUCK
SOILS - DRAINAGE CLASS

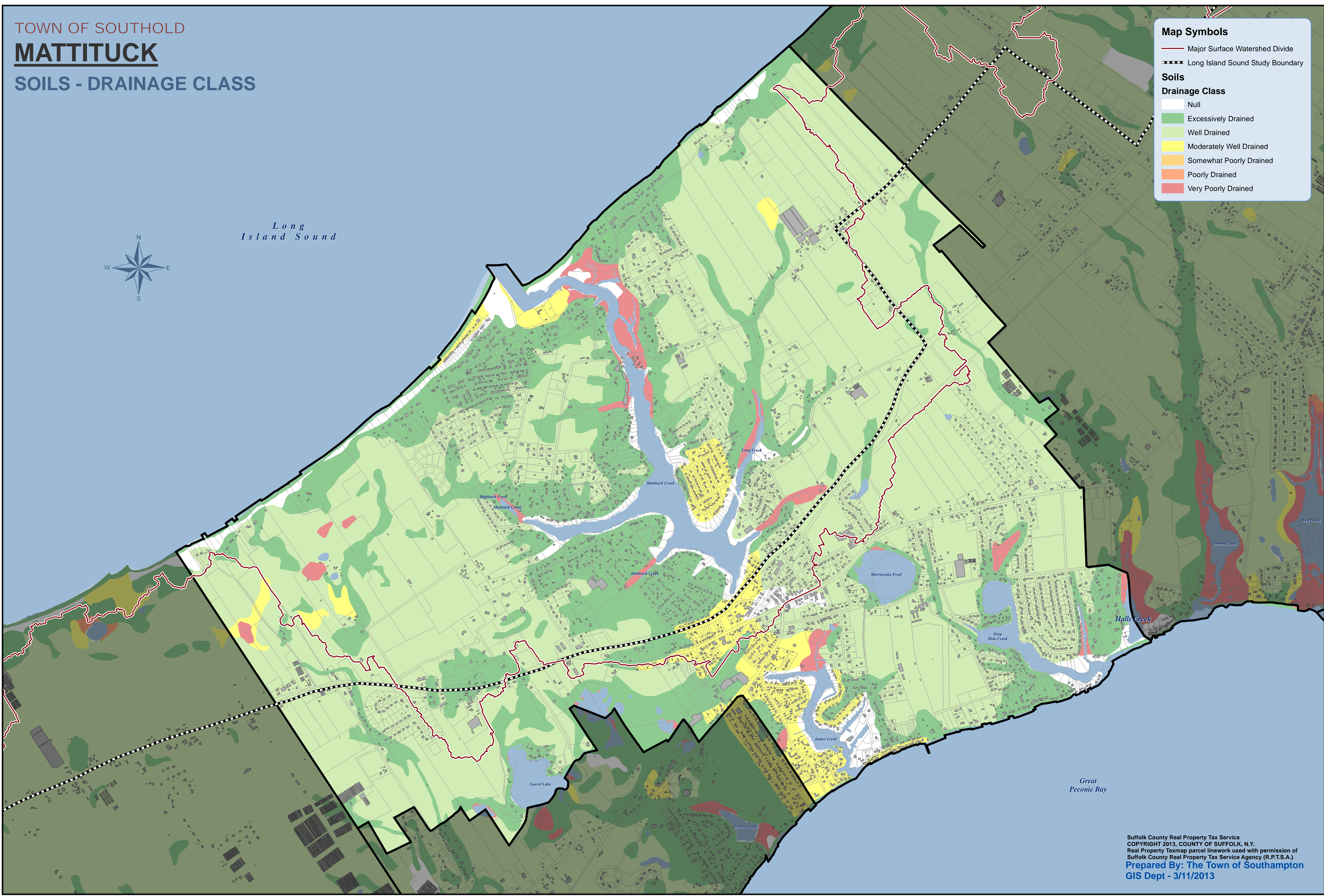
Map Symbols

- Major Surface Watershed Divide
- Long Island Sound Study Boundary

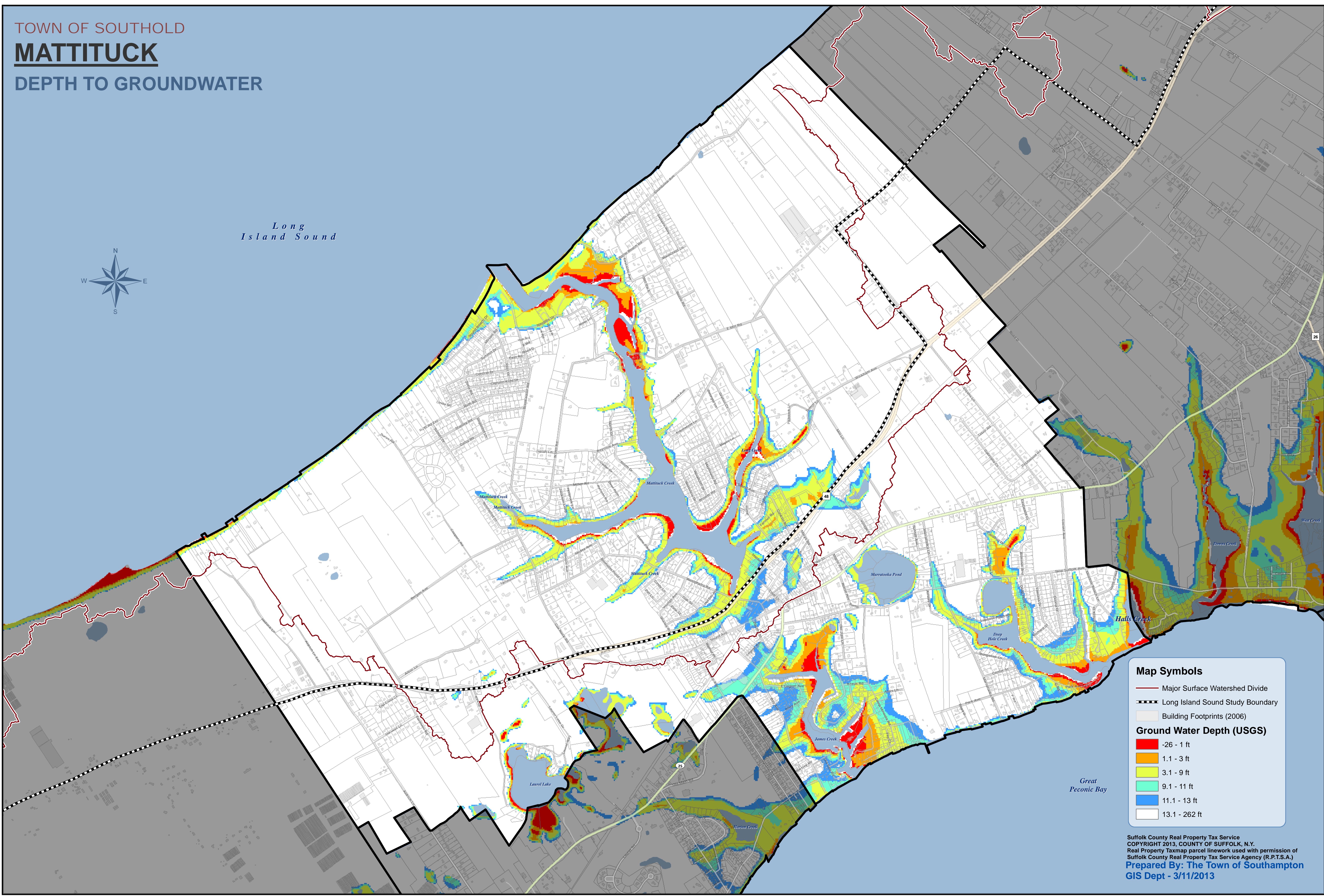
Soils

Drainage Class

- Null
- Excessively Drained
- Well Drained
- Moderately Well Drained
- Somewhat Poorly Drained
- Poorly Drained
- Very Poorly Drained



TOWN OF SOUTHOLD
MATTITUCK
DEPTH TO GROUNDWATER



Map Symbols

- Major Surface Watershed Divide
- Long Island Sound Study Boundary
- Building Footprints (2006)

Ground Water Depth (USGS)

- 26 - 1 ft
- 1.1 - 3 ft
- 3.1 - 9 ft
- 9.1 - 11 ft
- 11.1 - 13 ft
- 13.1 - 262 ft

TOWN OF SOUTHOLD
MATTITUCK
IMPAIRED WATER

Map Symbols

- Major Surface Watershed Divide
- Long Island Sound Study Boundary
- Building Footprints (2006)
- DEC Impaired Water Bodies (303D)

TMDLs

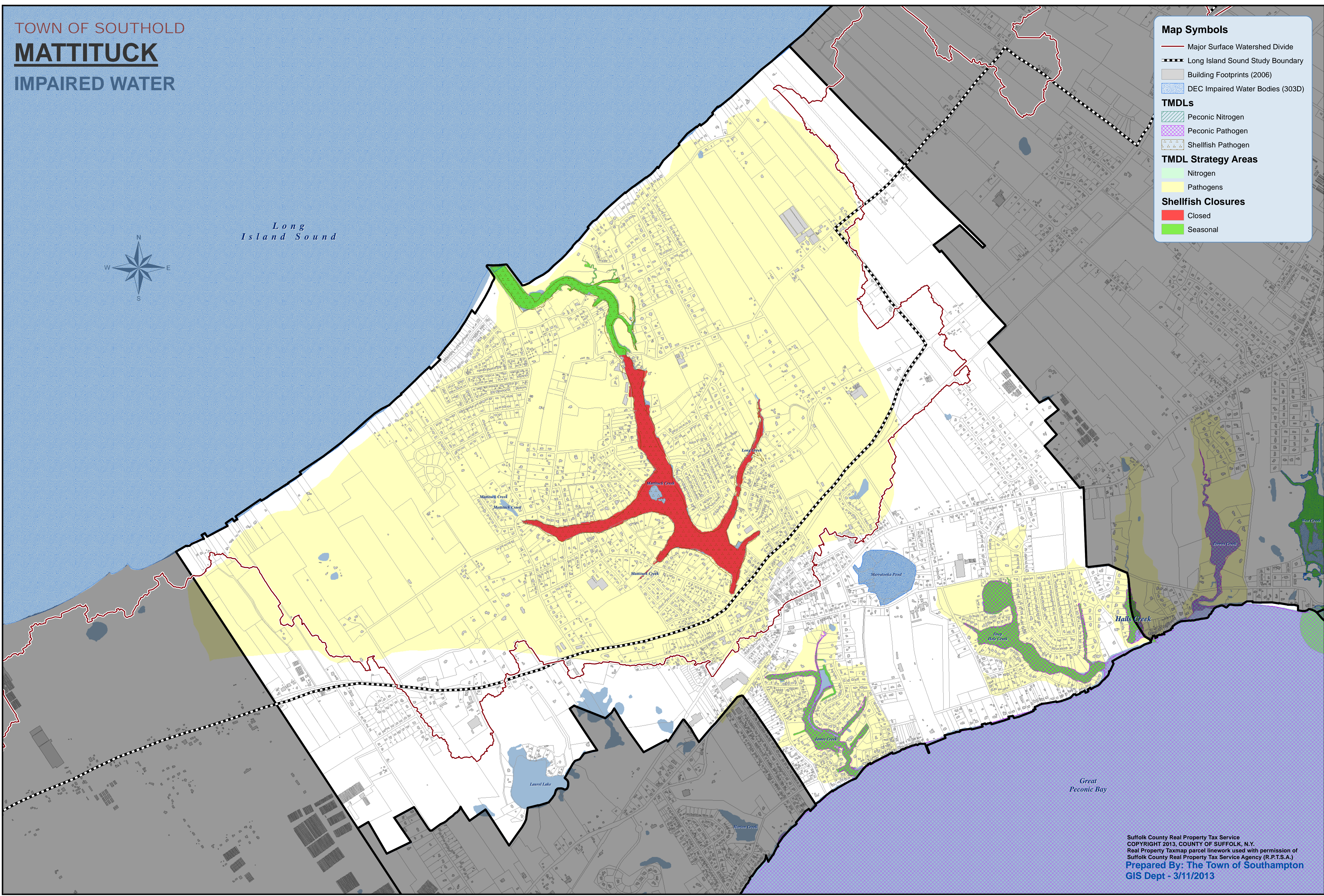
- Peconic Nitrogen
- Peconic Pathogen
- Shellfish Pathogen

TMDL Strategy Areas

- Nitrogen
- Pathogens

Shellfish Closures

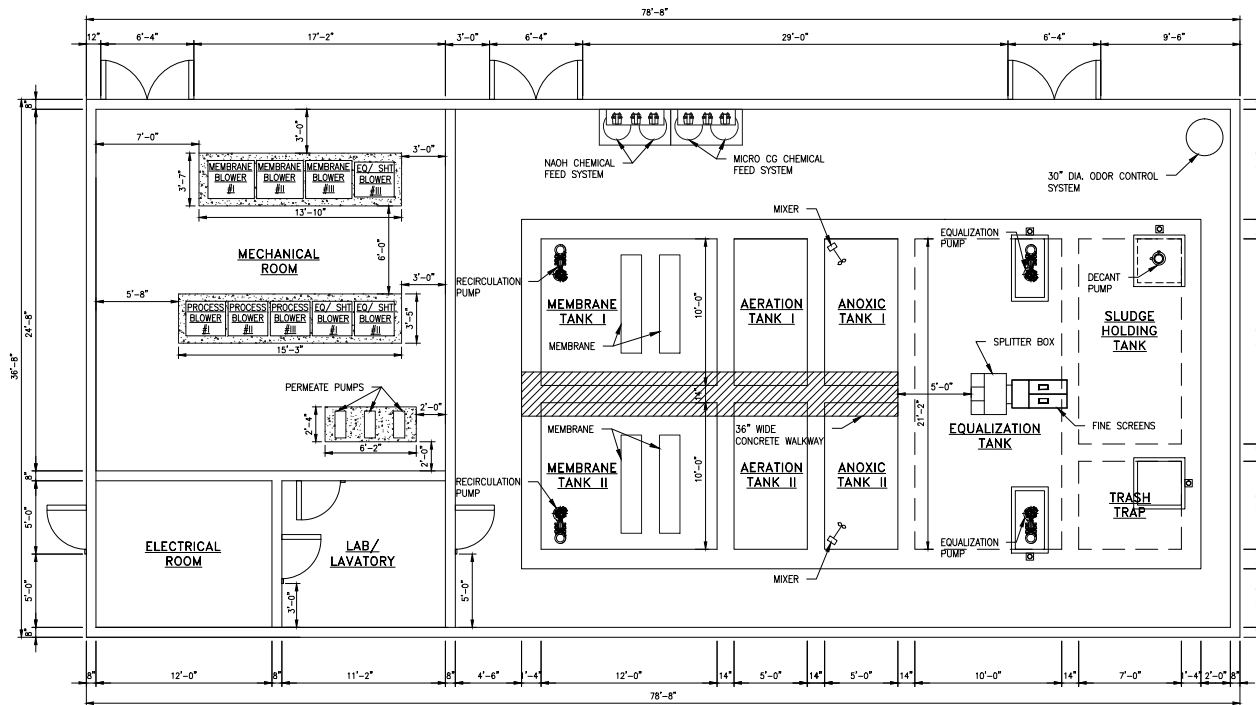
- Closed
- Seasonal



APPENDIX B

WWTP LAYOUTS

NTWS AND ADVANTEX PROCESS FLOW DIAGRAMS



FLOOR PLAN
1/4" = 1'-0"

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REVISIONS

**BROWER WOODS WWT
MECHANICAL
FLOOR PLAN
MEMBRANE BIOREACTOR (MBR) ALTERNATIVE**

HOME PROPERTIES, INC.
CORAM, SUFFOLK COUNTY, NEW YORK

Applied Water Management
An AEC Company

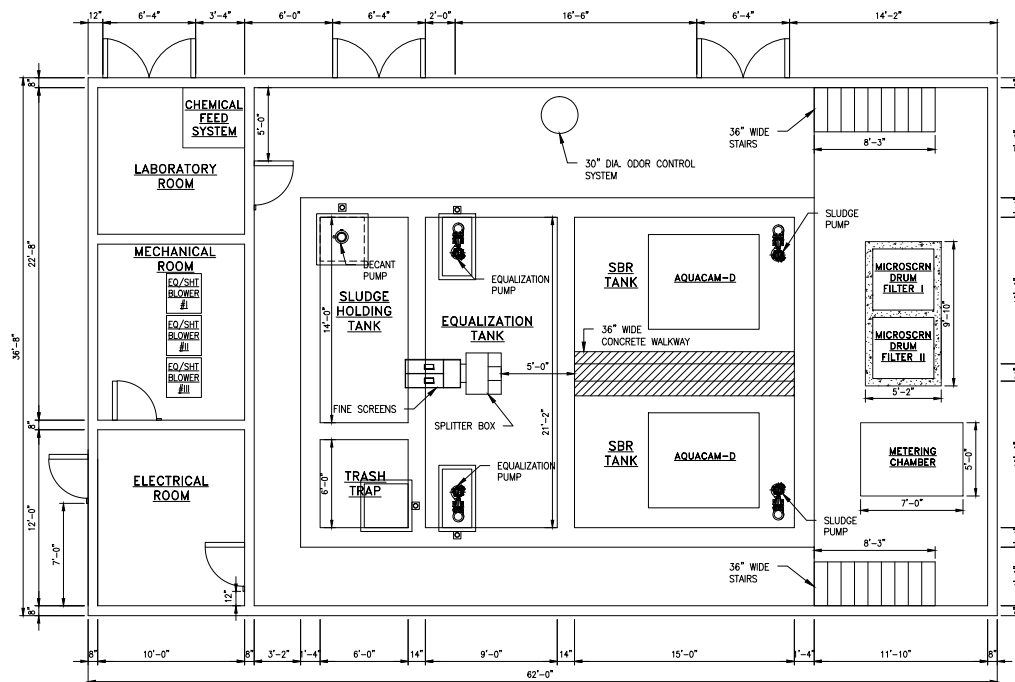
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APPROVED

DATE
PROJECT E01409AA

USE DIMENSIONS ONLY
SCALE 1/4"=1'-0"

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FLOOR PLAN
1/4" = 1'-0"

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MECHANICAL
FLOOR PLAN
SEQUENCE BIOREACTOR (SBR) ALTERNATIVE**

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2 CLERICO LANE, BUILDING 1
MILLSBOROUGH, NJ 08044

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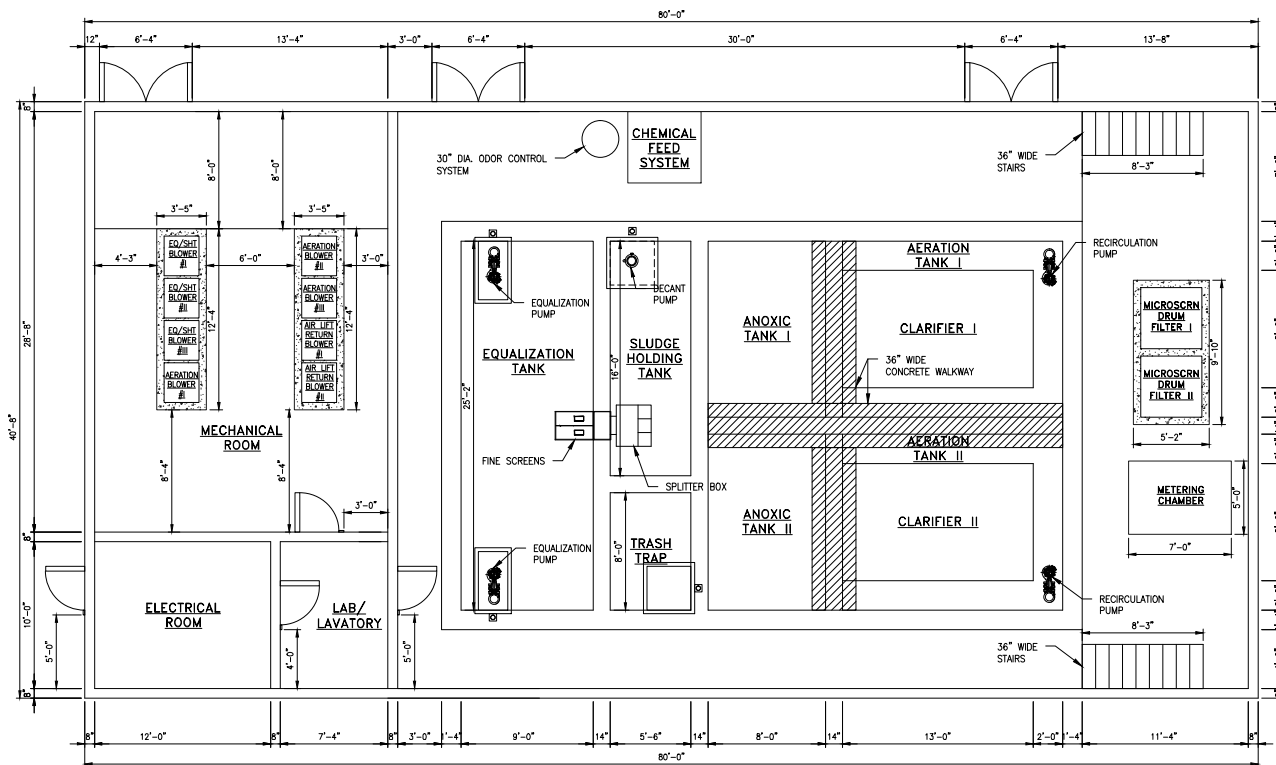
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FLOOR PLAN
1/4" = 1'-0"

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MECHANICAL
FLOOR PLAN
BESST SYSTEM ALTERNATIVE**

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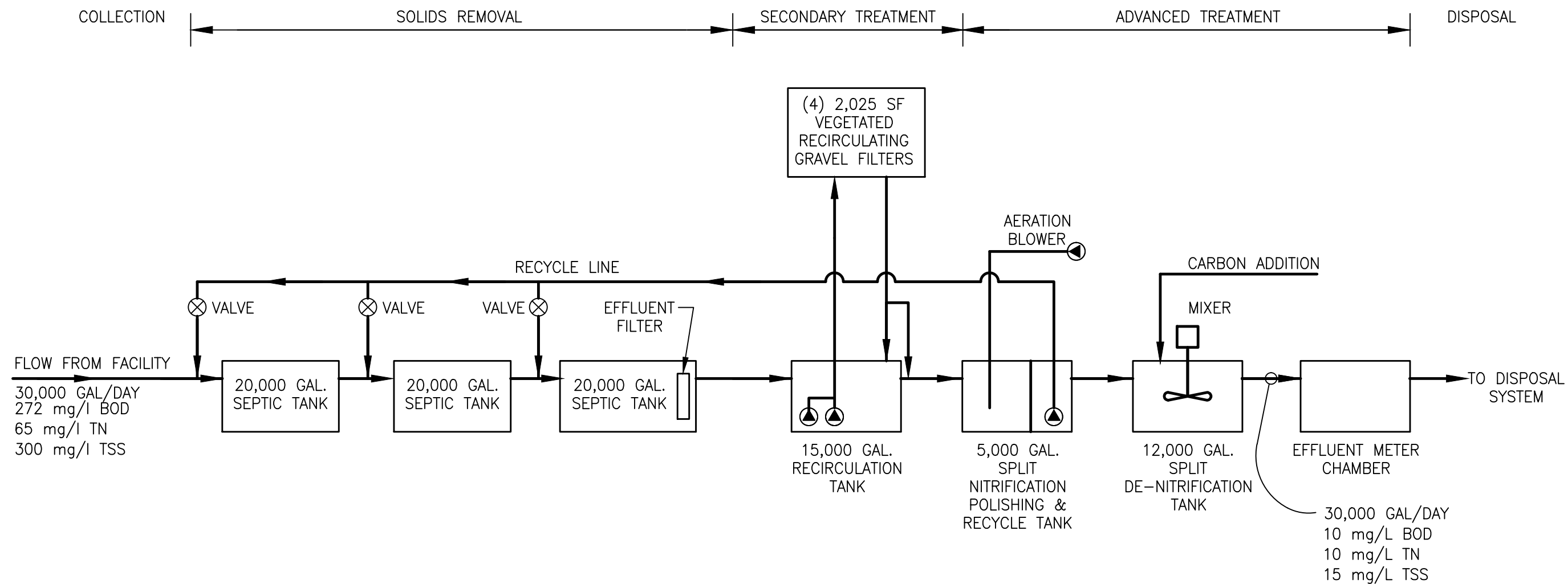
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NATURAL WASTEWATER
TREATMENT SYSTEM
PROCESS FLOW DIAGRAM

BROWER WOODS
SUFFOLK COUNTY, NY
PROJECT No. E01489AA
DATE: 12/26/2013 SHEET 1 OF 1

(NY) Brower Woods

STEP/AX-MAX Treatment Flow Schematic

