5. Groundwater

5.1. Existing Conditions

Long Island comprises eight Hydrogeologic Zones as established by the Long Island Regional Planning Board in its *Long Island Comprehensive Waster Water Treatment Plan* (hereafter referred to as the *"208 Study"*). The project site is located in Hydrogeological Zones III and VI as depicted in Figure 5-1. According to *the 208 Study*, Hydrogeological Zone III is designated as a "highest grade reservoir" with groundwater of excellent quality. This zone provides a large potential for additional development of public water supplies. Areas within this zone are identified as "deep recharge areas" which are important to the groundwater aquifers.

The three (3) major aquifers, or saturated water-bearing strata beneath the surface, of Nassau and Suffolk Counties are the Upper Glacial, Magothy, and Lloyd aquifers. As one of the three major deep recharge zones of Long Island, Hydrogeological Zone III contributes water to the Magothy aquifer which is the major water supply for Nassau and Suffolk residents. As such, it is closely monitored and protected. Nitrates from fertilizers and on-site waste disposal systems have contaminated portions of this zone. Additional contamination by synthetic organic chemicals has come from industrial and other activities.

Hydrogeological Zone VI is characterized as a shallow flow system and is thus designated as a "surface water impact area". Groundwater and surface water inputs impact the water quality in Moriches Bay and the eastern portion of Great South Bay. In order to protect the water quality and resources of the bays, groundwater and stream concentrations of nitrogen must be controlled and minimized.

According to Task 18 Memorandum – Smart Growth Impact Assessment of the Suffolk County Comprehensive Water Resources Management Plan, the water table elevation varies from approximately 23 to 32 feet across the study areas. As site elevations are from 35 to 96 feet, the water table varies from approximately 10 feet below grade at the southeastern edge of Area A and the southern boundary of Area D to 66 feet below grade at the southwest corner of Area C. A groundwater map is provided in Figure 5-2. All study areas are south of the east-west groundwater divide, and as shown in Figure 5-5, groundwater flows in an easterly direction from Area A and a southeasterly direction from the remaining areas. According to the *Long Island Comprehensive Special Groundwater*

Protection Area Plan, the project area is not within a Special Groundwater Protection Area.

The Suffolk County Water Authority provides drinking water for the vicinity of the project area. There are two existing well fields in the vicinity. The Patchogue-Yaphank Road Wellfield is located approximately 4,000 feet west of Area B and the Station Road Wellfield is located approximately 7,000 feet southwest of Area D. There is an area of known or potential private wells located southeast of Area D. These areas are shown on Figure 5-3.

5.2. Potential Impacts of Proposed Project

Impacts to groundwater include those related to withdrawals and others related to infiltration, including the quality of wastewater and stormwater that is recharged to groundwater.

5.2.1. Groundwater Withdrawals.

This project would result in increased withdrawal of groundwater from the Upper Glacial and Magothy aquifers. The daily water consumption by the proposed project is estimated to be 548,500 gallons per day. This value is based upon the wastewater design flow estimate, i.e., 477,000 gallons per day, discussed in Section 18.1.2 plus an estimated 71,500 gallons of water per day that does not enter the sanitary system. This latter component includes water for irrigation and water consumed by persons within the proposed project's various homes, offices and other facilities.

The Suffolk County Water Authority water supply and distribution system cannot, at present, meet the water demand for the entire project (Appendix B). However, this is based upon the limitations of the infrastructure and not the resource constraints of the aquifer as stated in the SCWA letter, as follows:

> *The limitation is due to the existing well and pump capacity in that area. The aquifer capacity is capable of supplying the required water. Therefore, additional well and pump capacity can be installed. When additional capacity is necessary beyond what is available from SCWA to meet the water needs of a development, the developer can contract with SCWA to construct the capacity needed to fully serve this project.*

> *SCWA is continually improving the capacity of its water supply system. The time frame of this project has not been established. When the developer can forward a construction plan with a specific construction schedule, SCWA will review the system capacity at that time. It will be determined at that time if the developer will need to provide any funding for well and pump construction to serve the project.*

Therefore, the SCWA can supply water for the entire development, however, may require a financial contribution from the developer.

According to the SCWA[8] their wells are an interconnected system and water to serve this project could be supplied through dozens of wells, both existing and new, if needed. Some of these existing wells are screened in the Upper Glacial aquifer and some are screened in the Magothy aquifer. If new wells are needed, the decision on where the wells are screened is based upon water quality and that decision cannot be made until the location of the well is known. According to the SCWA, the proposed withdrawal from this project would not be anticipated to have a significant effect on base flow to the Carmans River due to the size of the watershed recharging the aquifer and the fact that the water supply would be from an interconnected system that draws from a large area and from both aquifers.

It is important to note that the wastewater generated by the project will be treated and discharged to groundwater, thus maintaining the water table over the long term.

5.2.2. Wastewater Management.

As discussed in Section 18.1.2, the estimated wastewater design flow associated with the proposed project is approximately 477,000 gallons per day. According to the Suffolk County Department of Public Works, the actual flow is usually approximately 75% of the design flow due to conservative factors used in the design of treatment facilities. In addition, as the project is anticipated to be LEED certified it is expected that the wastewater flow will be significantly less, but the actual amount of flow cannot be quantified until the project is designed.

[8] Discussion with Steve Colabufo, February 16, 2011

The Contract of Sale requires the Selected Developer to design and build the necessary wastewater collection and treatment facilities, at its own cost. This cost is estimated at approximately $18 million dollars at $37 per gallon. The Selected Developer would construct a new privately owned sewage treatment plant, increase the capacity of an existing publicly owned sewage treatment plant, or construct a new publicly owned sewage treatment plant to handle all of the wastewater generated at the project site. The proposed treatment plant has not yet been designed. However, due to the LEED requirement and the stated goals of the Selected Developer to create a state of the art facility, it is anticipated that the new facility will have advanced treatment capabilities and will produce very high quality effluent with lower nitrogen concentration than the code limit of 10 mg/l. The County can require a specific level of treatment, which can be recommended by the Suffolk County Health Department, as part of the Contract of Sale. The County has confirmed that there is adequate depth to groundwater to handle new leaching fields in Area F.

It is noted that groundwater flow direction from the wastewater treatment plant is to the southeast and that the effluent would travel in that direction and would eventually intersect the Carmans River in the tidal portion of the river south of Sunrise Highway. The plant is located in the 10-25 year groundwater contributing area to the Carmans River.

The northern portion of the project area is located within Hydrogeological Zone III which requires a high level of protection to ensure groundwater quality. The *Long Island Comprehensive Waste Treatment Management Plan* provides a range of alternatives for wastewater management within Hydrogeological Zone III. The selection of the appropriate wastewater management alternative depends upon the project's characteristics, in particular, its development density. Since the project will comprise more than one dwelling unit per acre, "Alternative C – Maximum Sewering Option" applies.

The southern portion of the project area is situated within Hydrogeological Zone VI which requires the minimization of nitrogen concentrations in groundwater and surface waters to protection marine surface water quality. The proposed project – which will support more than one dwelling unit per acre – would comply

with the "Alternative B – Sewering Option" as the wastewater management alternative.

Within Hydrogeological Zones III and VI, there are also areawide alternatives that must be employed to protect groundwater quality. The 208 Study established the High Priority Area Alternatives regarding wastewater management. The proposed project would comply with the first alternative and the other two alternatives would not apply, as follows:

1. Require nitrogen removal for treatment plants recharging effluent.

    a. The wastewater treatment plant will meet the NYS DEC established limits for nitrogen which is currently 10 mg/l.

2. Provide for the routine maintenance of on-site disposal systems.

    a. All wastewater shall be treated at a wastewater treatment plant. There shall be no on-site wastewater systems.

3. Prohibit the use of certain chemical cleaners in on-lot systems.

    a. All wastewater shall be treated at a wastewater treatment plant. There shall be no on-site wastewater systems.

5.2.3. Stormwater Recharge

The proposed project would increase the impervious cover within the project area, thus increasing the potential for groundwater impacts through the following: 1) loss of groundwater recharge via runoff and 2) water quality impairment from contaminated runoff. The Long Island Segment of the *Nationwide Urban Runoff Program (NURP)* contains five groundwater recommendations. The County will require that the proposed project be in compliance with these recommendations.

GW 1 - Continue to use recharge basins wherever feasible for the disposal of stormwater and the replenishment of groundwater.

The proposed project stormwater management system has not been designed at this time, but it is anticipated that it will

comprise recharge basins to collect and filter the majority of the site's stormwater prior to discharge to groundwater. Depending upon site conditions and design considerations, runoff may also be recharged to groundwater through drywells, with similar replenishment of groundwater.

GW 2 - Avoid maintenance practices that would interfere with the natural revegetation of basins by grasses and shrubs.

The proposed project stormwater management system has not been designed at this time, but the stormwater detention ponds would be landscaped with low maintenance grasses and maintenance will involve typical landscape mowing, leaf and debris removal.

GW 3 - Use "ecological recharge basins" only where their aesthetic value justifies the additional cost.

The proposed project stormwater management system has not been designed at this time, but the proposed stormwater detention ponds would provide aesthetic value through the selection of appropriate vegetation.

GW 4 - Consider the use of in-line storage leaching drainage systems, or components thereof, as a substitute for recharge basins in areas, other than parking lots, where maintenance will be assured and the value of the land for development purposes is greater than the cost of installing and maintaining the underground system. These systems should also be considered for use where the installation of recharge basins is not feasible.

The proposed project stormwater management system has not been designed at this time, but in-line systems would be used in concert with or in place of recharge basins depending upon site conditions and design considerations.

GW 5 - Prevent illegal discharges to drainage systems or recharge basins. Such discharges, which often result from improper storage or deliberate dumping of chemicals must be controlled at the source.

The site does not have any illegal discharges now, and would not have any illegal discharges after development as all design and construction would be in accordance with all applicable codes and requirements.

The *208 Study* includes areawide recommendations for stormwater management in order to minimize contamination from stormwater runoff. The County will require that the project comply with these recommendations.

1. Control Stormwater Runoff:

The proposed project stormwater management system has not been designed at this time, but would comply with the following practices:

a. "Best Management Practices" ("BMPs") for stormwater include the use of stormwater detention ponds and drywell systems. Based upon the August 2003 *New York State Stormwater Management Design Manual*, these types of infiltration practices receive the highest ratings for BMPs with respect to pollutant removal (i.e., phosphorus, nitrogen, metals [cadmium, copper, lead and zinc]) and pathogens (Coliform, Streptococci and E. *Coli).*

b. A Stormwater Pollution Prevention Plan would be prepared and implemented in conformance with the Phase II Stormwater Regulations, and construction would be conducted in accordance with the *New York State Guidelines of Urban Erosion and Sediment Control Manual*, latest edition.

c. All of the stormwater generated by the proposed development would be contained on the site through the use of catch basins, drywells and recharge basins in order to minimize the transport of sediments, nutrients, metals, organic chemicals

and bacteria to ground and surface waters. No stormwater runoff would be directed offsite.

2. Ensure the Proper Functioning of On-Lot Waste Disposal Systems:

    a. Not applicable as all wastewater will be treated at a wastewater treatment plant.

3. Reduce the use of Fertilizers:

    a. The project would comply with Suffolk County's fertilizer requirements (See Section 5.3). In addition, it is anticipated that low-maintenance plant species would be utilized for the site to minimize fertilizer requirements.

4. Minimize Pollution from landfills:

    a. Not applicable as no new landfill is proposed.

5. Reduce and Control Animal Waste:

    a. It is likely that there would be pets associated with the residential component of the project. As with all residential uses throughout Suffolk County owners are required to dispose of their pet's waste properly.

6. Strengthen and Enforce Regulations Pertaining to Industrial Wastes, Product Storage and Transportation, and Residuals:

    a. It is not known at this time if the industrial uses in area D would involve industrial wastes. Any industrial wastes would have to comply with all applicable regulations including those of the Suffolk County Department of Health Services and Suffolk County Department of Public works pre-treatment standards.

7. Promote Water Conservation:

    a. As the project is anticipated to be LEED certified, water

conservation measures such as low-flow fixtures and moisture sensors would be utilized.

5.3. Suffolk County Pesticide and Fertilizer Regulations

Suffolk County has adopted several local laws to reduce fertilizer and pesticide use, including the following:

- Local Law 41-2007 " A Local Law to Reduce Nitrogen Pollution by reducing Use of Fertilizer in Suffolk County" prevents the application of fertilizer on County owned property, and prohibits the application of fertilizer on all other property between November 1 and April 1 every year. Exceptions were provided for golf courses, the Suffolk County Farm, athletic fields, (provided, however, that the County department with jurisdiction of the fields shall develop and comply with an annual plan containing best management practices to reduce use of fertilizer and avoid fertilizer leachate) and newly-seeded or planted landscapes and newly-seeded or newly-sodded areas. Waivers may be granted with appropriate terms and conditions. Decision to grant waivers consider whether the uses of groundwater, surface water and drinking water supplies will be impaired, whether the application conforms to a comprehensive management plan and/or well accepted best management practices, and whether the proposed use can be modified so that the project will not require a waiver.

- Local Law 5-2009 "A Local Law to Reduce the Use of Fertilizer Near Surface Waters in Suffolk County" added another degree of protection as follows:

  Fertilizer shall not be applied to any County-owned property, nor to any turf on any non-owned County real property, within twenty (20) feet of any regulated surface water, except, that this restriction shall not apply where a contiguous natural vegetative buffer, at least ten (10) feet wide, separates a turf area and regulated surface water.

- Chapter 380 of the Suffolk County Code describes the County's Pest Control regulations, which state:

  Effective July 1, 2003, no County department or agency, or any pesticide applicator employed by the County or agency as a contractor or subcontractor for pest control purposes, shall apply any pesticide on County property (as owner ort tenant) except as provided for in Sections 380-3 of this Chapter.

§380-3. Exemptions

A) Notwithstanding any other provisions, this chapter shall not apply to the following:

- *Pesticides otherwise lawfully used for the purpose of maintaining a safe drinking water supply at drinking water treatment plants, waste water treatment plants, reservoirs, and related collection, distribution, and treatment facilities;*
- *Anti-microbial pesticides;*
- *Pesticides in containerized baits where the least toxic of the effective alternatives available are used;*
- *Pesticides classified by the United States Environmental Protection Agency as exempt materials under 40 CFR 152.25;*
- *Biological controls and biological pesticides, such as bacillus thuringiensis or milky spore;*
- *Low-toxicity pesticides, such as boric acid, as determined by the Commissioner of the County Department of Health Services after certifying in writing that the pesticide is of such a low hazard as to have a de minimis adverse impact on the health and safety of Suffolk County residents;*
- *In a situation in which a written declaration has been issued by said Commissioner of the County Department of Health Services that a public emergency exists requiring the temporary use of a particular pesticide during the period of such public emergency. The Commissioner must in such an emergency, use the least toxic approach to the health issue that the Commissioner believes is adequate to address the emergency. After taking such action, the Commissioner shall document in a report within thirty (30) days, the steps taken to resolve the emergency, the nature of the emergency, the cause and effect of this emergency, and how and why such pesticidal actions were taken. The Commissioner shall also report how the problem causing the health emergency arose and what steps and procedures the County is taking to ensure that a similar problem will not occur again;*

- *Low toxicity pesticides used for the control of vectors capable of transmitting diseases such as the arthropod-borne encephalitis virus, as determined by the Commissioner of the County Department of Health Services, in conjunction with the Commissioner of the County Department of Environment and Energy;*

- *County-owned property leased to another party as of the effective date of this law, said exemption to apply until the expiration of such lease (exclusive of renewal periods); and*

- *Insect repellents personally applied by County employees in the course of performing County duties and/or responsibilities at County facilities.*

- *Pesticides used in medical treatment or practices*

Since the County currently owns the site of the proposed project, these limitations on fertilizer and pesticide use effectively limit the application of pesticides and fertilizer on the property. The County intends to continue this practice on this land following its sale as a condition of sale. Therefore these stringent requirements will apply in perpetuity to the land purchased by the Selected Developer.

5.4. Suffolk County Groundwater Modeling

On behalf of Suffolk County, CDM evaluated the impacts of the proposed project and two alternative development scenarios upon nitrate levels in groundwater using the pilot approach developed and documented as part of their prior work on the Suffolk County Groundwater Model. The report is provided as Appendix D and excerpts are reprinted here.

5.4.1. Methodology

The modeling approach requires the following steps:

1. Parcel-specific land use assignment for both existing conditions and for the future proposed development scenarios;

2. Assignment of nitrogen loading associated with each of the land use types;

3. Simulation of nitrogen concentrations resulting from existing land use types and wastewater management;

4. Comparison of simulated nitrogen concentrations to measured groundwater concentrations and adjustment of loading rates as necessary;

5. Simulation of nitrogen concentrations resulting from proposed land use alternatives and wastewater management techniques, and

6. Evaluation and documentation of results.

The overall modeling approach used in this evaluation did not significantly differ from the approach developed for their prior work. The only modification was in the methodology used to assign nitrogen loading rates to large parcels (i.e., greater than 25 acres) in the vicinity of the proposed development.

The Suffolk County Main Body groundwater model was used as the basis for evaluation of potential impacts to groundwater quality resulting from the proposed changes in land use. Using the regional model as the framework, a more detailed finite element grid that includes all parcels within the watershed and focuses specifically on the area of the proposed development was developed. DYNTRACK, the companion contaminant transport code, was previously re-dimensioned, to allow simulation of the more than 10,000 individual sources of nitrogen represented by each parcel. Nitrogen levels in area groundwater resulting from the cumulative effect of all of the parcel-specific sources in the western portion of the Carmans River watershed that has been defined as the study area were then estimated, using the models. Although the eastern portion of the watershed is included in the modeled area, it was not included in the nitrogen transport simulations since it is outside the proposed development study area.

The model grid is shown in Figure 5-4. The northern boundary of the grid represents the regional shallow groundwater divide and the grid extends south to the Atlantic Ocean. The eastern boundary of the grid extends to the Forge River and the western boundary extends to within approximately 1 mile of North Ocean Avenue. The grid contains 11,067 nodes comprising 22,008 elements and covers just over 119 square miles. Node spacing ranges from approximately 2,000 feet at the northern and southern boundaries down to less than 200 feet within the study area immediately west of the Carmans River. Since nitrogen loading and transport are simulated on a parcel-specific basis, very fine node discretization within the study area was required.

Stratigraphic data from the Suffolk County Main Body Groundwater Model was interpolated onto the refined model grid. Two additional model levels (total of 12 levels in the model) were added to the upper glacial aquifer to improve vertical discretization for simulation of shallow groundwater flow. The top level of the model represents topography and was intersected with the Digital Elevation Model (DEM) for Long Island. The model was run under steady-state conditions incorporating long-term average conditions of water supply pumping and recharge. As the northern boundary of the grid coincided with the average position of the regional groundwater divide, it was assigned as a no-flow boundary. The eastern and western boundaries, which run perpendicular to shallow groundwater flow, were left as no-flow boundaries. The southern boundary of the grid was assigned as a fixed head boundary condition representing sea level. Offshore nodes were set at a fixed head of 0.5 feet above mean sea level (msl) to account for recent sea level rise since 1929 (the vertical datum of the Suffolk County Main Body Groundwater Model). Heads at depth (at the southern perimeter of the grid) were fixed at the same elevations as assigned within the Suffolk County Main Body Groundwater Model and represent equivalent fresh water heads (CDM, 2003).

The simulated water table is shown on Figure 5-5. The figure illustrates that the simulated shallow groundwater flow direction of the study area is east and southeast towards Yaphank Creek and then the Carmans River.

5.4.2. Existing Land Use – Comparison of Model-Simulated and Observed Nitrate Concentrations

The groundwater flow model was used as the basis for contaminant transport simulations using DYNTRACK. The DYNTRACK code was modified during earlier work so that thousands of individual point sources can be simulated simultaneously, permitting nitrogen fate and transport evaluation on a parcel-specific basis over the relevant portion of the model domain.

Groundwater sample results characterizing nitrate concentrations that were previously collected at various locations and depths by the SCDHS and others were provided to CDM for use in this evaluation. Analytical results were available from both private supply wells and from monitoring wells tested during site investigations, including the investigation of perchlorate contamination in

Yaphank (SCDHS, 2001). Results from the period 2000 to present were used as target concentrations to refine the nitrogen loading estimates developed previously, if needed. After nitrogen loading was assigned to each parcel based on the existing land use designation, the model was run under steady-state conditions for 40 years. Existing land uses are shown in Figure 5-6. Only parcels within an approximately 50 year time of travel to the proposed development area were assigned a nitrogen load in order to limit the computation time and data management requirements. Nitrogen was simulated as a conservative tracer, i.e., no retardation or decay was simulated.

The method to assign nitrogen loading to each parcel was modified slightly from the method used during previous evaluations to account for the presence of parcels greater than 25 acres in the study area. Parcels of this size were generally not present in the Montauk Highway Corridor case study done previously. Parcel-specific nitrogen loads had been assigned to the centroid of each parcel for the Montauk Highway Corridor simulations. The assignment of nitrogen loading to the centroid of the larger parcels present in the proposed development study area results in unrealistic plumes of nitrogen emanating from the centroid of the parcel. While this approach works well for small parcels, it did not provide the level of detail necessary for this evaluation, considering the presence of more than a dozen large parcels, ranging in size from 25 acres to 1,166 acres and bounded by the Carmans River and Patchogue-Yaphank Road on the east and west, and the Long Island Expressway and Sunrise Highway on the north and south. As such, the approach was modified to distribute the nitrogen load evenly over a rectangular source, as opposed to a point source. Rectangular sources representing nitrogen loading were established in the model to approximate the size and shape of most of the large parcels in the study area. In select instances where only a portion of a large parcel was developed and/or distinct land use differences within a single large parcel were obvious from aerial imagery, the rectangular sources were adjusted in size and shape to better reflect the expected nitrogen loading for specific portions of the large parcel.

One additional adjustment was made to improve the model simulations. The approach to assigning the flow of wastewater from the Yaphank County Center STP and its accompanying nitrogen load was modified to better represent the discharge under the baseline and future scenarios. This involved assigning a

"source term" allowing particles representing nitrogen to be applied over an area consistent with the size of the STP's basins, rather than assigning a fixed concentration of nitrogen at three nodes (points). This change provides for a better representation of the effluent nitrogen load at the point of discharge to the groundwater system.

A comparison of measured and simulated total nitrogen concentrations is shown by Figure 5-7, and Figure 5-8 for the baseline scenario. Figure 5-7 compares observed and simulated nitrate concentrations from the water table to approximately 50 feet below the water table. Monitoring well data and private well nitrate results were used to characterize this portion of the upper glacial aquifer, based on the assumption that most private wells are screened in this zone. Figure 5-8 compares observed and simulated nitrate concentrations from approximately 50 to 100 feet below the water table. Observed concentrations used in this comparison were available from site investigation reports. The model-simulated nitrogen concentrations were found to generally agree with the measured concentrations in the proposed development area and east to the Carmans River without any adjustment to the land use specific nitrogen loading rates established previously with one exception. For medium density residential land uses, the number of housing units per acre used to calculate residential nitrogen loading was reduced from 3 to 1.5. This was done to better represent the medium density parcels located east of Yaphank Avenue and north of Sunrise Highway which average approximately 0.7 acres in size. Simulated nitrogen concentrations downgradient of this residential area are still slightly elevated compared to concentrations historically reported in private wells. The model-simulated concentrations from 50 to 100 feet below the water table do provide a better match in this area. The private well screened intervals were not available; it is possible that they are actually screened in this deeper zone of the aquifer.

While parcel-specific adjustments might improve the ability of the model to match observed concentrations, it is important to note that the objective of this evaluation was to evaluate the relative impacts of alternative development scenarios upon nitrate levels. The intent of this evaluation was not to specifically match historical observed concentration data, but to reproduce the general trend of nitrogen concentrations with depth. The model is based on a regional aquifer framework and therefore does not contain site-specific stratigraphic information,

and site-specific parcel information with respect to the timing of historical development and fertilization practices, etc. Site-specific refinement would be expected to improve model results within the model domain. The model-simulated nitrogen loading factors assigned for non-residential land uses are summarized on Table 1. For residential land uses, a nitrogen mass loading rate of 10 lbs -N/person/year was applied and 25 percent was assumed to be removed by the septic systems. A population density of 3.1 people per household was used, based upon estimates by the 2000 U.S. Census. The fertilizer application rate in the study area is assumed to be very low and therefore, a nitrogen load from fertilizer at residential properties was not applied in the model, except at low density residential parcels. Since these loading factors resulted in model simulated concentrations that were in general agreement with observed data, they were also used for the proposed development model simulations to evaluate the potential impacts upon nitrogen levels in groundwater resulting from the different development scenarios, as described in the following section.

Table 5-1: Sanitary Effluent Flow Rates and Nitrate/Nitrogen Concentrations For Non-Residential Land Uses used in Model Simulations

Land Use	Assigned Flow Rate (gpd/sf)	Nitrate/Nitrogen Concentration (mg/l)
Commercial	0.07	3.48
Industrial	0.04	4.25
Institutional	0.06	1.02
Recreation and Open Space	0.04	1.15
Agricultural	0.04	7.83
Vacant	0.04	1.15
Transportation	0.04	2.39
Utilities	0.04	1.02

Unlike the Montauk Highway Corridor Case Study, several sewage treatment plants (STPs) exist within the model domain. While most of these plants are too far north or too far east to impact groundwater quality in the proposed development area, the Yaphank County Center STP is located just east and south of the proposed development area. The Yaphank County Center STP currently treats approximately 93,000 gallons per day (gpd) of flow from County Administrative buildings to the north. It is anticipated that its capacity would be expanded to treat sanitary waste under all of the future development scenarios analyzed. To account for the sewered areas in the baseline simulation which are

served by the plant, the nitrogen loading rate of the developed and sewered parcels was set to zero, except in the instance where large parcels in the sewered area were only partially developed. Nitrogen loading for the undeveloped portions of these several parcels was assigned based on the vacant land use category. Nitrogen loading from the STP was assigned at three nodes in the model representing the location of the plant's effluent recharge basins.

Nitrate/nitrogen concentrations at the nodes representing the recharge basins were fixed at 9.2 mg/l, based on average total nitrogen data presented in the draft Report on the Sewage Treatment Plants of Suffolk County (SCDHS, Doroski, and Olsen, 2006). Effluent flow from the plant was set at 93,000 gpd for the baseline simulation.

5.4.3. No Build Analysis

The No Build Analysis adjusts the baseline to account for the fact that the County Jail is currently undergoing expansion. Sanitary flows from the jail expansions would be treated at the Yaphank County Center STP. Sanitary flows resulting from this scenario were estimated to be 89,250 gpd (from the jail), resulting in a total flow of 182,250 gpd. No nitrogen loads were assigned to the municipally owned parcels to represent non-sanitary loads. For the purpose of this analysis, it was assumed that nitrogen loads from stormwater runoff in these areas covered largely by impervious surfaces would be negligible. Under the No Build Analysis, the simulated average nitrate concentration in shallow groundwater within the immediate study area of the Proposed Development area is 1.7 mg/L

5.4.4. Proposed Development Scenario

The proposed development is shown in Figure 5-9. Area A covers 34+ acres and would include a mix of commercial (retail, hotel, restaurant, and office space); residential (72 rental units); and family oriented entertainment (sports and wellness facilities and an arena) uses. Area B covers 121+ acres and would include rental and ownership residential housing units. Area C covers 28+ acres and would include athletic facilities and trails. Area D covers 94+ acres and would include light industrial uses including at least four megawatts of electric production facilities. (Areas E and F were not considered as one is a replacement of uses and the other is an expansion of the wastewater treatment facility).

Sanitary flows from all four areas would be treated at the Yaphank County Center STP. Sanitary flows resulting from this development scenario were estimated to be 357,499 gpd, resulting in a total flow of 539,749 gpd. Consistent with the baseline simulation, nitrate/nitrogen concentrations in plant effluent were fixed at 9.2 mg/l for all development scenarios.

Separate from the sanitary flows going to the STP, additional nitrogen loads were added to (1) the western part of Area A to reflect fertilizer use in the open area and outdoor stadium and; (2) to Area D to reflect fertilizer use in the open areas surrounding the industrial buildings. These loads were added uniformly across the parcels using the method described in Section 2.2. Area C (athletic facilities and trails) was assigned a nitrogen load consistent with the recreation and open space category. No nitrogen loads were assigned to the eastern part of Area A and all of Area B to represent non-sanitary loads. For the purpose of this analysis, it was assumed that nitrogen loads from stormwater runoff in these areas covered largely by impervious surfaces would be negligible. Actual nitrogen loads might be estimated in the future if assumptions for stormwater management techniques, fertilizer use, and other factors are developed for these areas.

5.4.5. Estimated Nitrogen Concentrations Resulting from Proposed Development Scenario

The proposed development scenario was evaluated using the nitrogen loading factors and methodology described above. As in the existing conditions simulation, parcel specific nitrogen sources were simulated for a period of 40 years. The simulated total nitrogen concentration in the shallow portion of the upper glacial aquifer is shown in Figure 5-10. Figure 5-11 depicts the areas where simulated average nitrate concentrations in shallow groundwater were calculated.

The nitrogen concentrations in the shallow upper glacial aquifer resulting from the Proposed Development were simulated to be slightly higher than the No Build development scenario, based upon the assumptions included in the evaluation (e.g., sanitary flows from the development are directed to the sewage treatment plant, which continues to provide the existing level of nitrate removal in the future).

Under the No Build scenario, the simulated average nitrate concentration in shallow groundwater within the area immediately downgradient of the proposed development area is 1.7 mg/L, compared to 2.3 mg/l for the proposed development scenario (Table 5-2). In the larger downgradient area extending to the Carmans River, the average nitrate concentration for the No Build is 1.7 mg/L, compared to 2.2 mg/l for the Proposed Development scenarios. Because sewering was assumed for the proposed development area, there is little difference in nitrogen loading rates assigned to the parcels, which results in only very minor differences in downgradient water quality.

Under the proposed development scenario the simulated average shallow groundwater nitrate levels would still be far below the drinking water standard of 10 mg/l and the levels of 4 and 6 ppm (equivalent to 4 and 6 mg/l) discussed in the 1987 Suffolk County Comprehensive Water Resources Management Plan. The Plan states that Article 6 of the Suffolk Sanitary Code was adopted to limit average groundwater nitrogen concentrations to about 4ppm in Hydrogeologic Zone III to protect the deep aquifer recharge area and Hydrogeologic Zone VI to protect the ecology of South Shore Bays, and about 6 ppm elsewhere.

At the low average concentrations simulated, and considering the general nitrogen loading assumptions incorporated into the model simulations, the level of accuracy at the tenths of a mg/l are such that a difference of 0.6 mg/l can be considered minor. In addition, the simulated nitrate concentrations downgradient of the treatment plant are highly dependent upon the assumed effluent quality. The documented simulations were based upon a historical effluent concentration of 9.2 mg/l, however more recent data shows that effluent nitrate levels are actually lower.

Table 5-2: Comparison of Average Nitrate Concentrations in Shallow Upper Glacial Groundwater

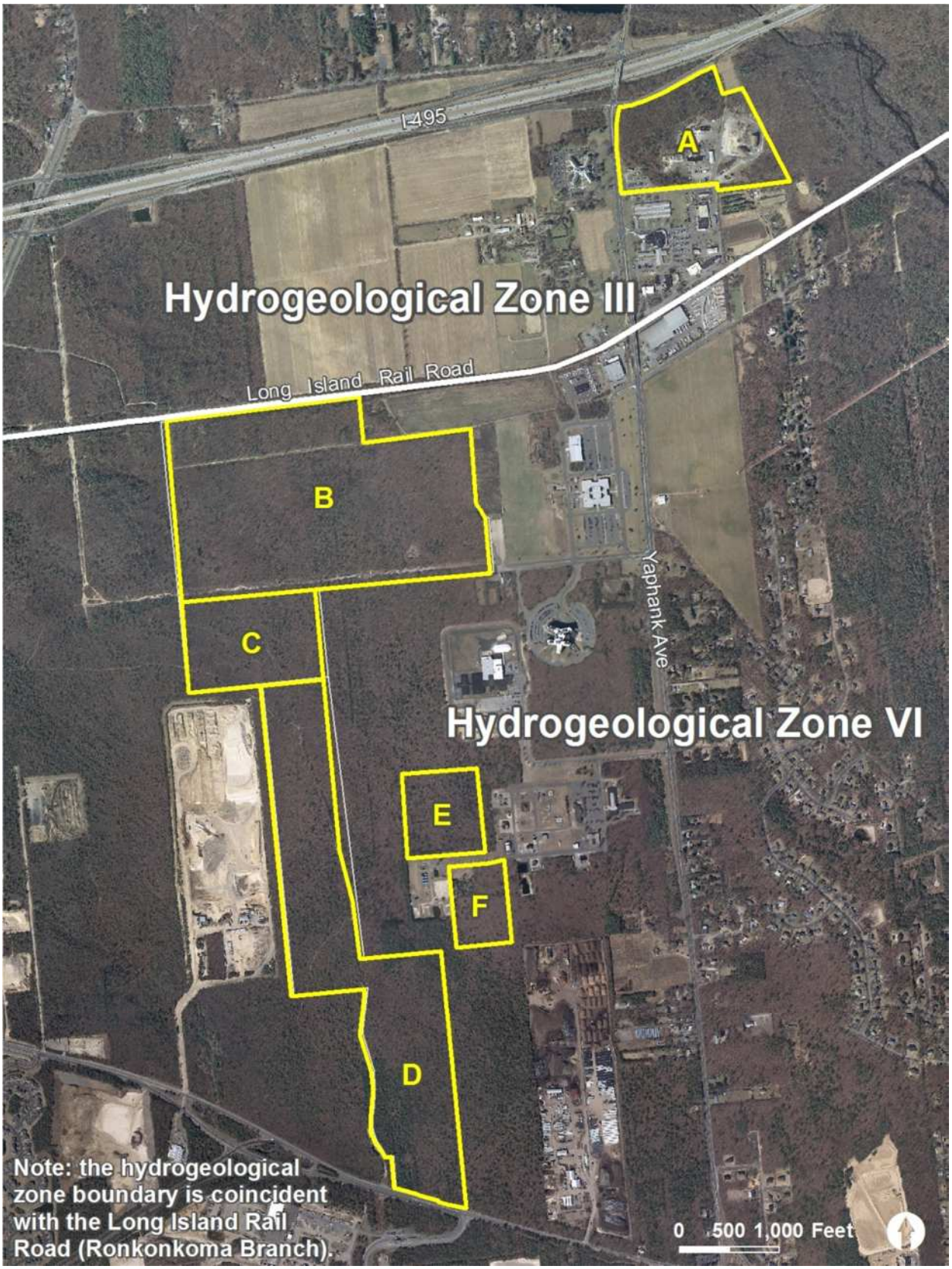
	Average Nitrate Concentration (mg/l) of Modeled Development Scenarios	
	No Build Scenario	**Proposed Action**
Immediate Downgradient Area	1.7	2.3
Complete Downgradient Area	1.7	2.2

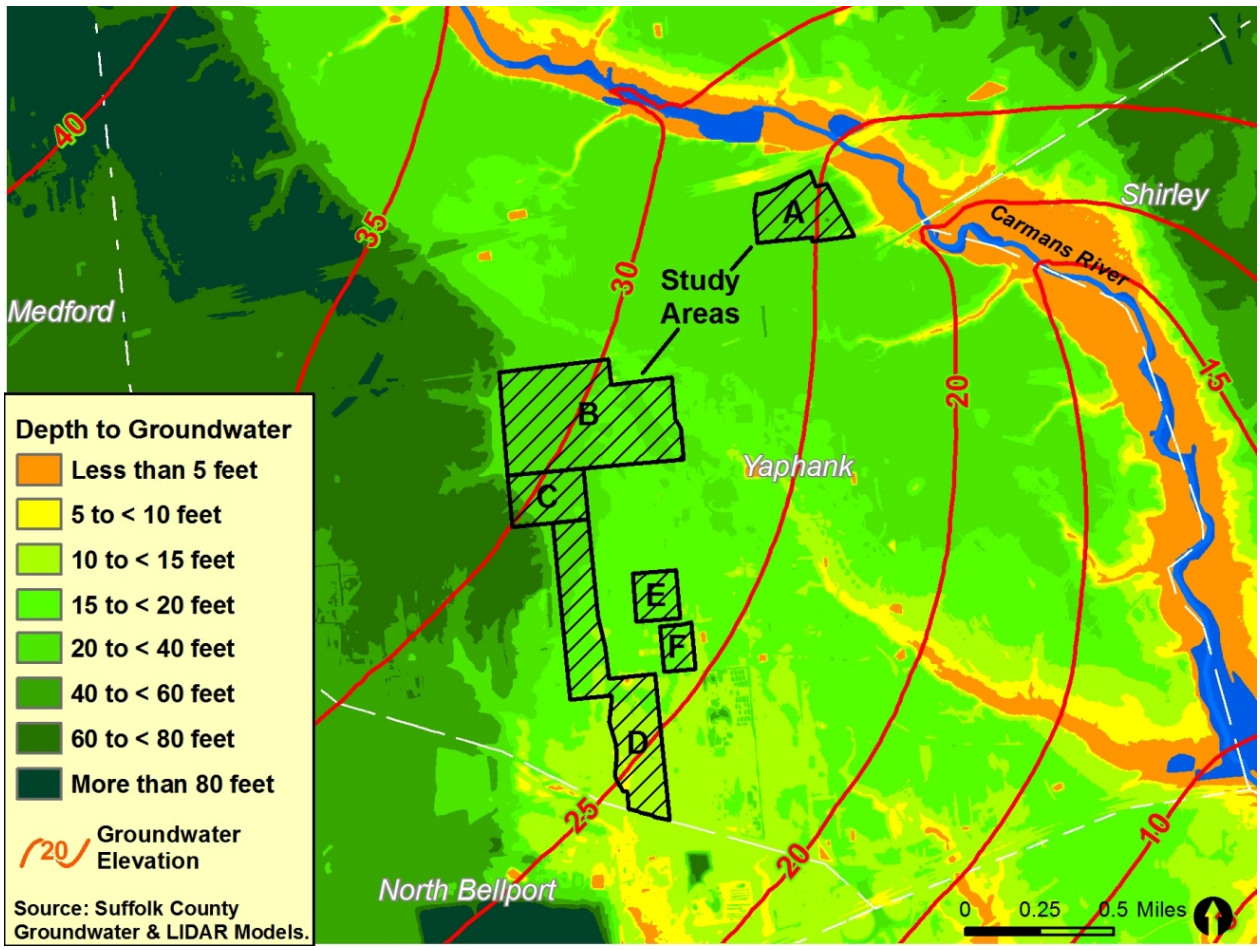
5.5. Proposed Mitigation

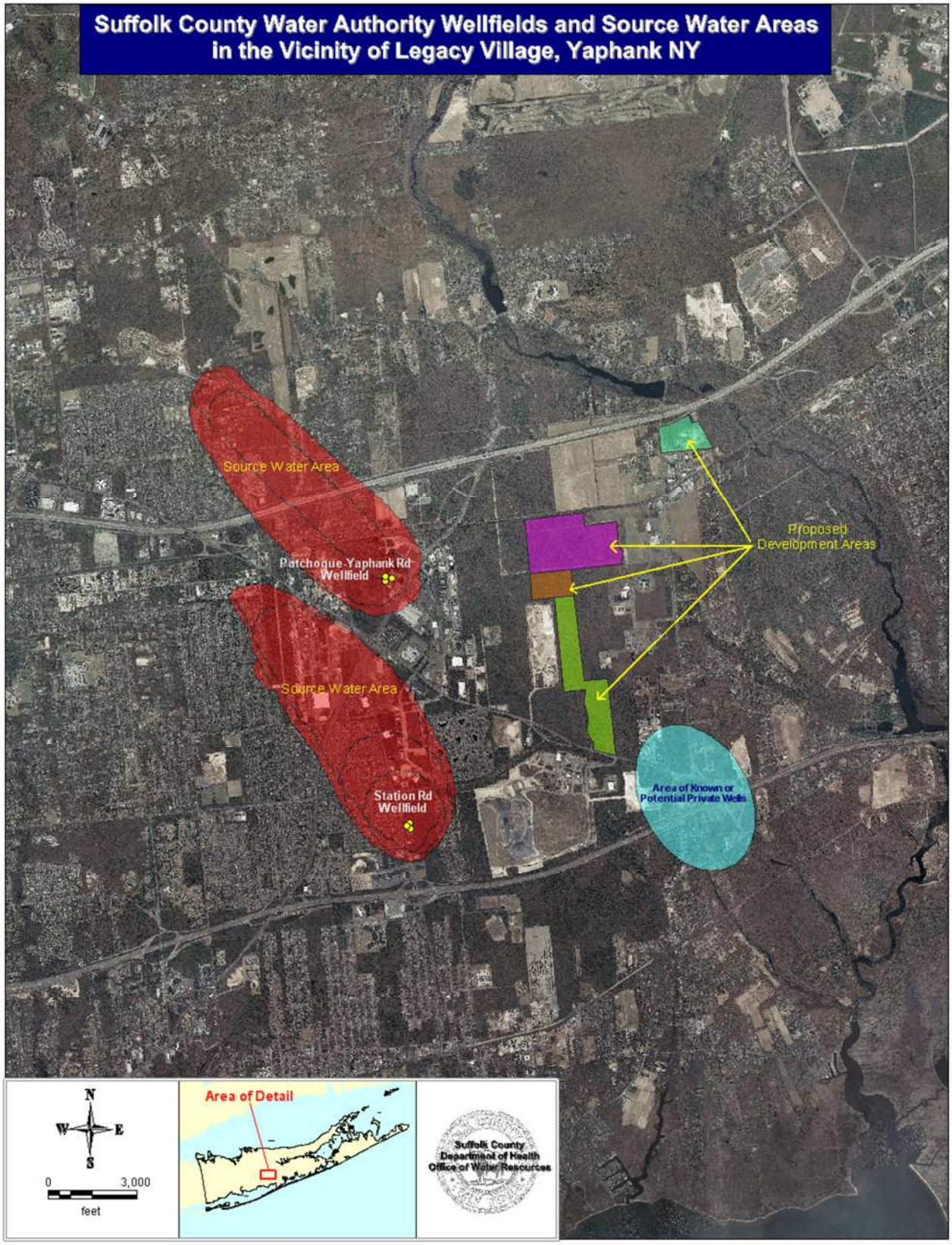
While the proposed project has not been designed at this time, it is anticipated that the following mitigation measures would be included in the design of the project:

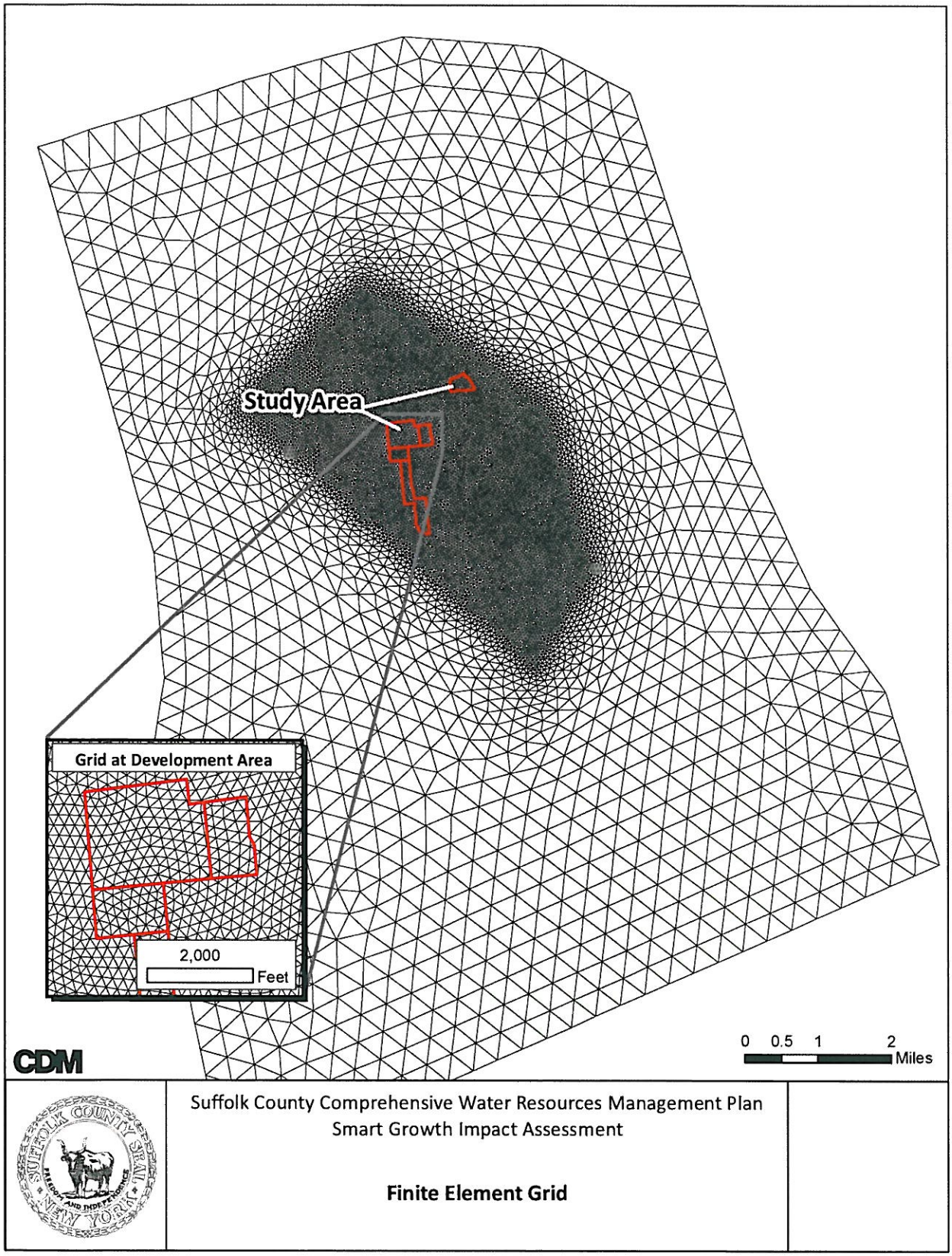
- Fertilizer and pesticide use:
    - The continuation of the requirements of the law governing application of pesticides and fertilizer on County owned properties can be made a condition of sale so that the same restrictions will continue on this property following the sale.
- Water conservation methods would reduce consumption of public water.
    - Water conserving fixtures would be utilized.
    - Native plant materials which require minimal irrigation would be utilized.
    - The irrigation system would be tied to moisture sensors and limited to the early morning to reduce unnecessary water consumption caused by evaporation losses. The irrigation system would be maintained and serviced regularly by a qualified irrigation contractor. It would be in the best interest of the proposed project to limit its irrigation volume to control costs and introduction of problems associated with over-irrigation (mold, fungus, and root decay) and daytime irrigation (evaporative losses, shallow root growth, and usage restrictions during watering events).
    - Extensive use of compost would conserve planting bed moisture.
- Stormwater would be efficiently managed to maximize treatment before recharge. The stormwater management plan would be designed to collect and recharge 100% of site runoff from an eight (8) inch storm (100-year storm event). Most of the stormwater would be directed to recharge basins where it would be subjected to initial treatment by the vegetation, photodegradation by sunlight and subsequent filtering by soil media.
- The Contract of Sale requires the Selected Developer to design and build necessary wastewater collection and treatment facilities, at its own cost, in accordance with the requirements of the County Sewer Agency, the County Department of Health

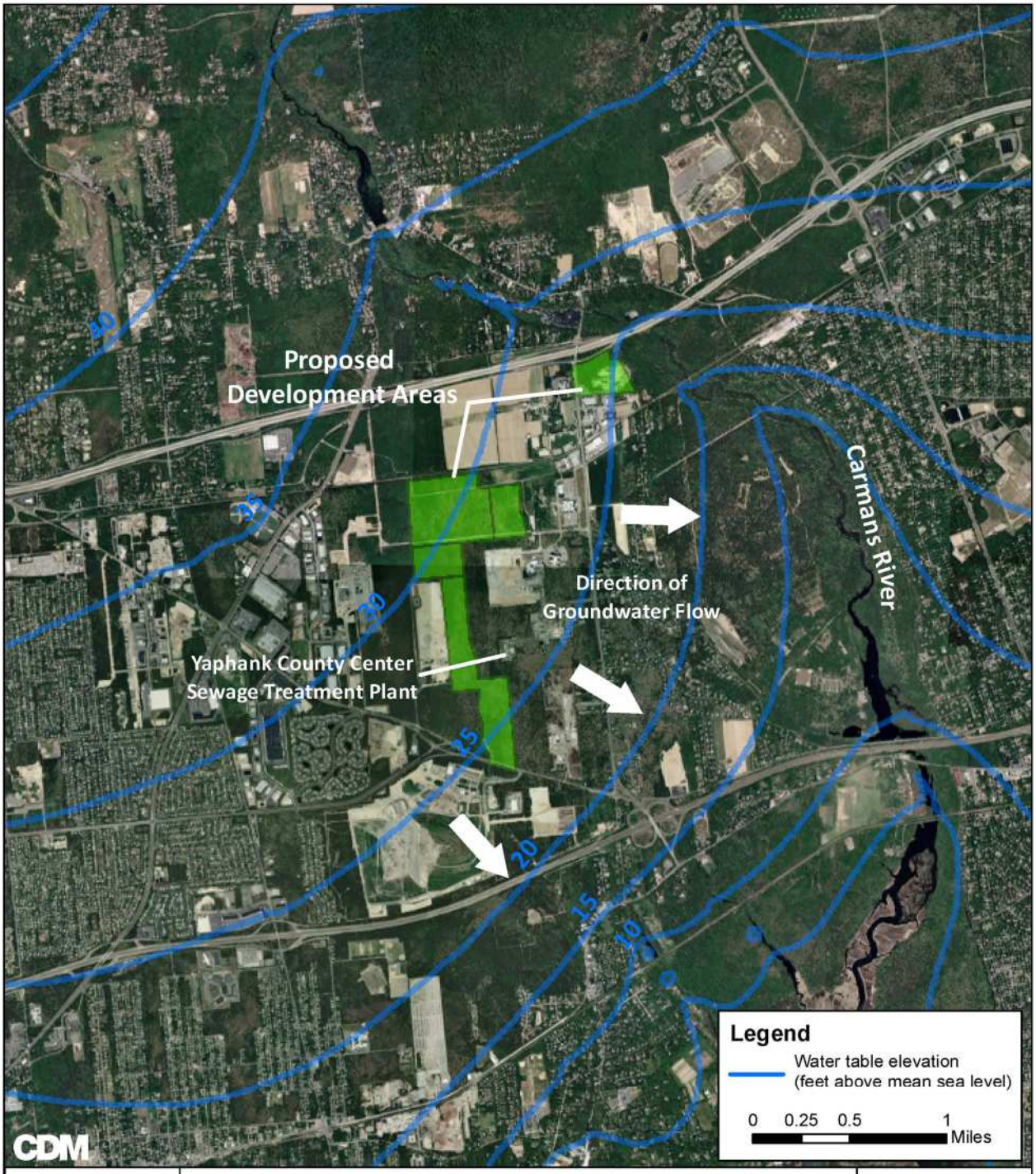
Services and the Town, based on the development as approved by the Town including installation of all sewer lines, sewer mains and any necessary pump stations to transport waste to sewage treatment facilities; and to construct sewage treatment facilities sufficient to treat the projected gallonage from the Premises as development of the Premises is finally approved by the Town. This would consist of construction of a new privately owned sewage treatment plant, an increase in the capacity of an existing publicly owned sewage treatment plant, or construction of a new publicly owned sewage treatment plant.


I-495
A
Hydrogeological Zone III
Long Island Rail Road
B
C
Yaphank Ave
Hydrogeological Zone VI
E
F
D
Note: the hydrogeological zone boundary is coincident with the Long Island Rail Road (Ronkonkoma Branch).
0 500 1,000 Feet


Depth to Groundwater
Less than 5 feet
5 to < 10 feet
10 to < 15 feet
15 to < 20 feet
20 to < 40 feet
40 to < 60 feet
60 to < 80 feet
More than 80 feet
20 Groundwater Elevation
Source: Suffolk County Groundwater & LIDAR Models.
Study Areas
A
B
C
D
E
F
Medford
Yaphank
Shirley
Carmans River
North Bellport
40
35
30
25
20
15
10
0 0.25 0.5 Miles

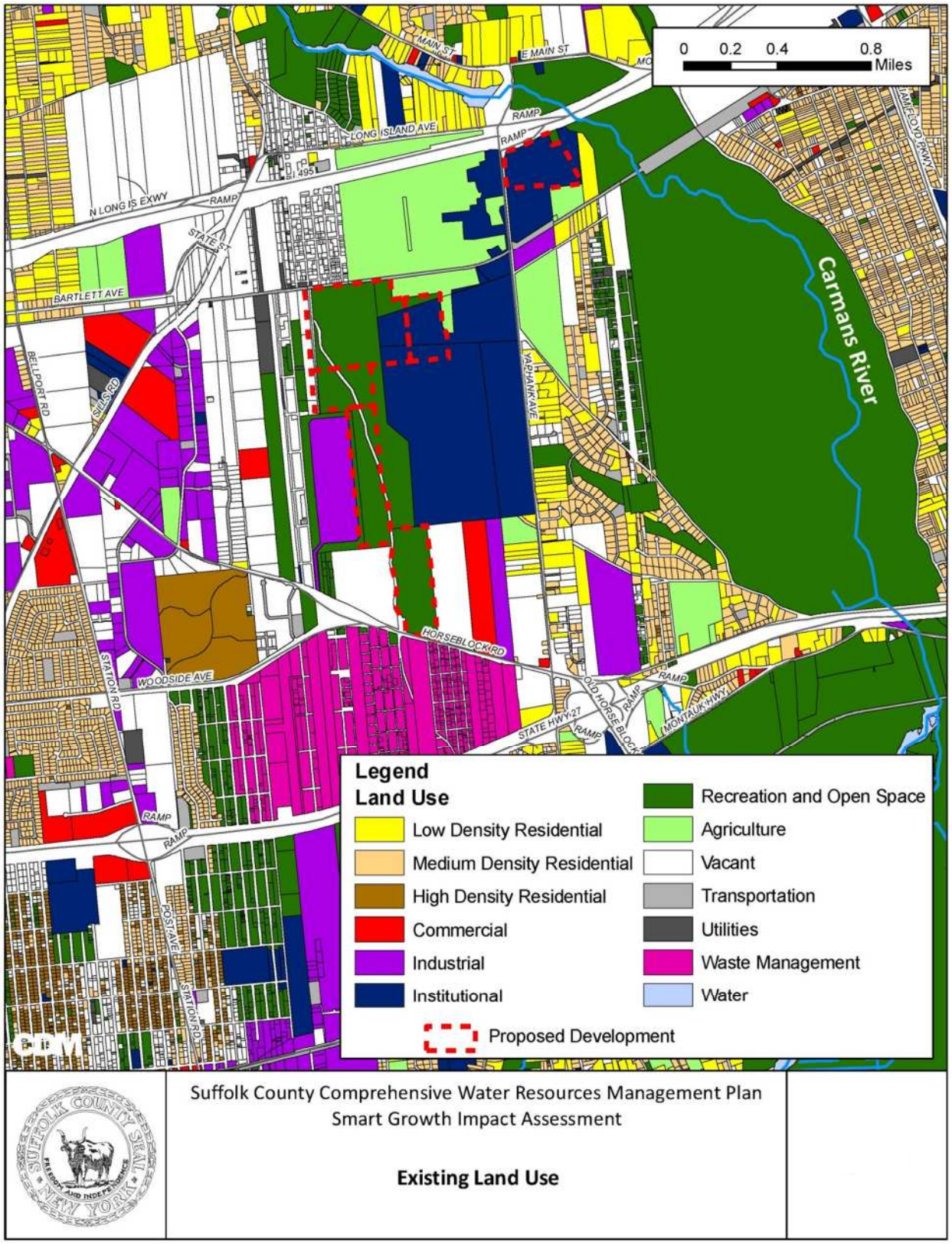

Suffolk County Water Authority Wellfields and Source Water Areas
in the Vicinity of Legacy Village, Yaphank NY
Source Water Area
Patchogue-Yaphank Rd
Wellfield
Source Water Area
Station Rd
Wellfield
Proposed
Development Areas
Area of Known or
Potential Private Wells
N
W
E
S
0
3,000
feet
Area of Detail
Suffolk County
Department of Health
Office of Water Resources

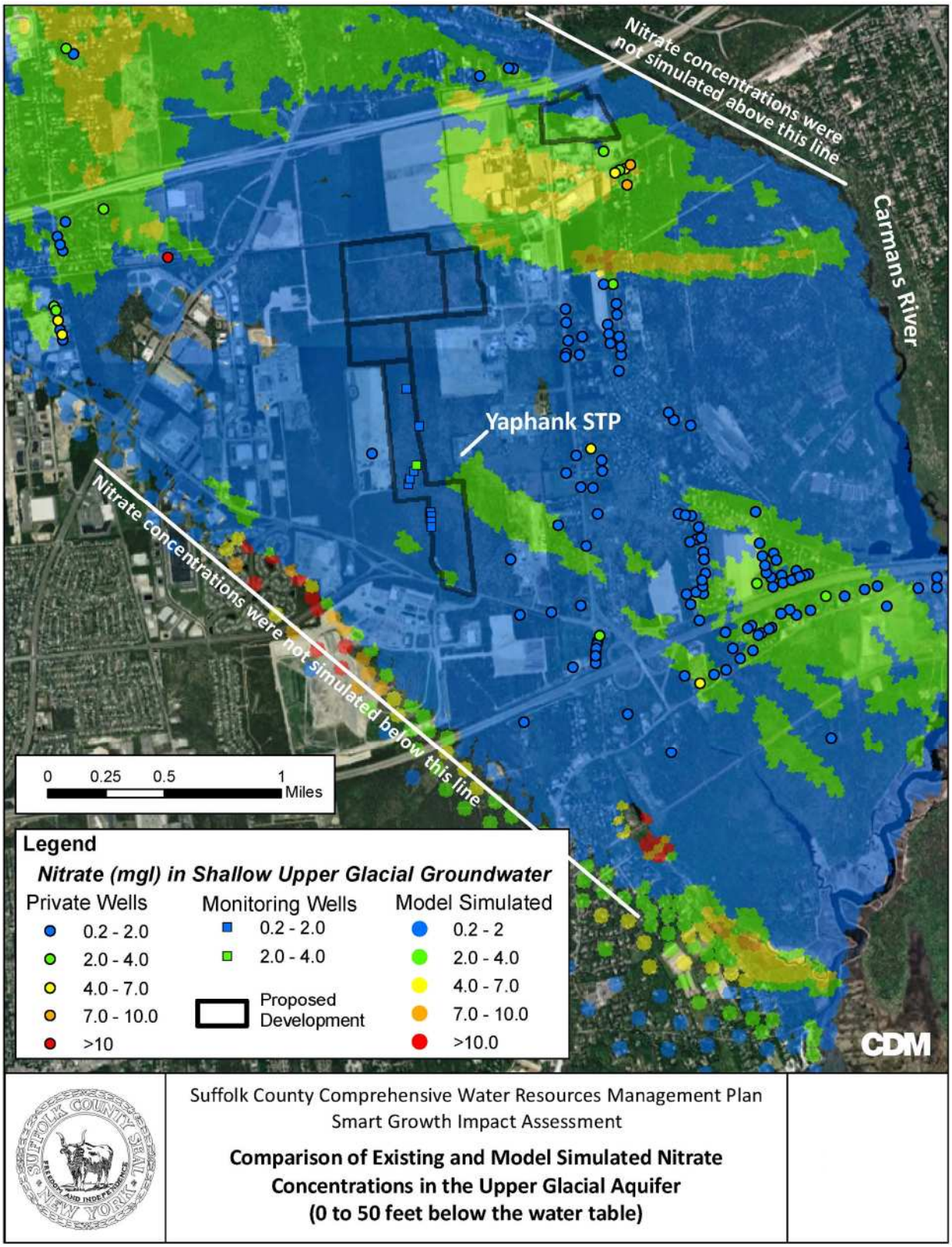

Study Area
Grid at Development Area
2,000
Feet
CDM
0 0.5 1 2
Miles
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Finite Element Grid

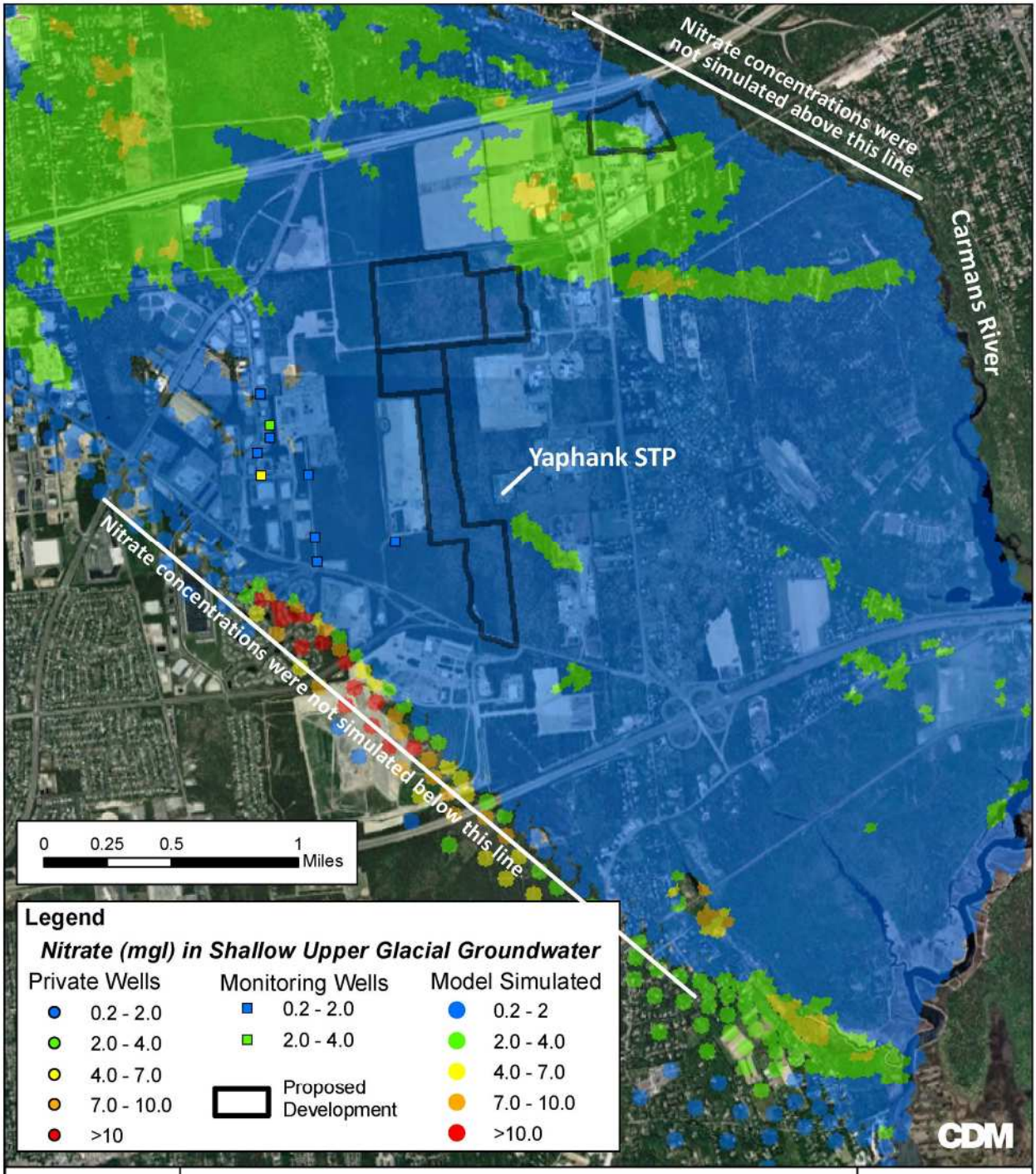


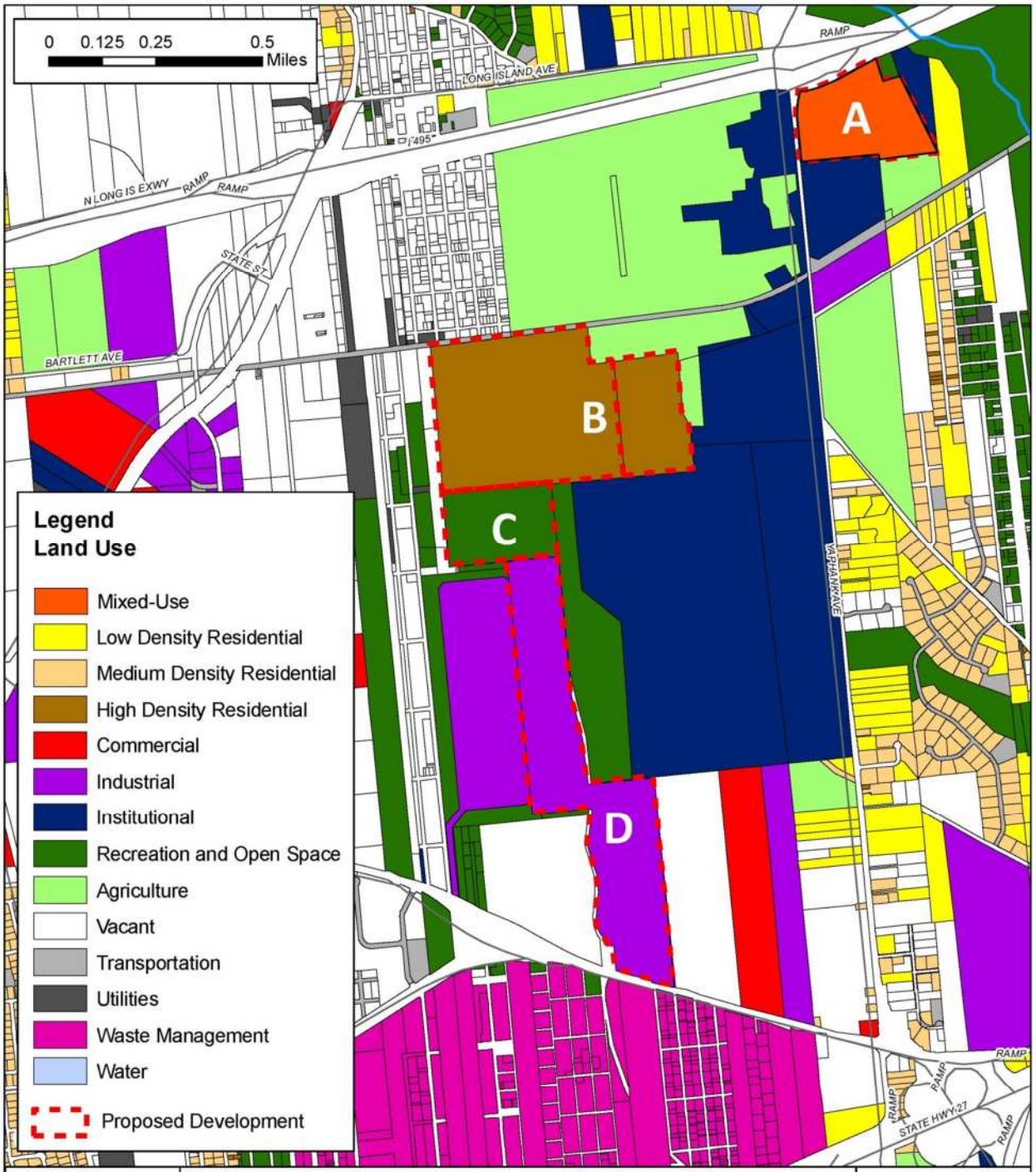
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment

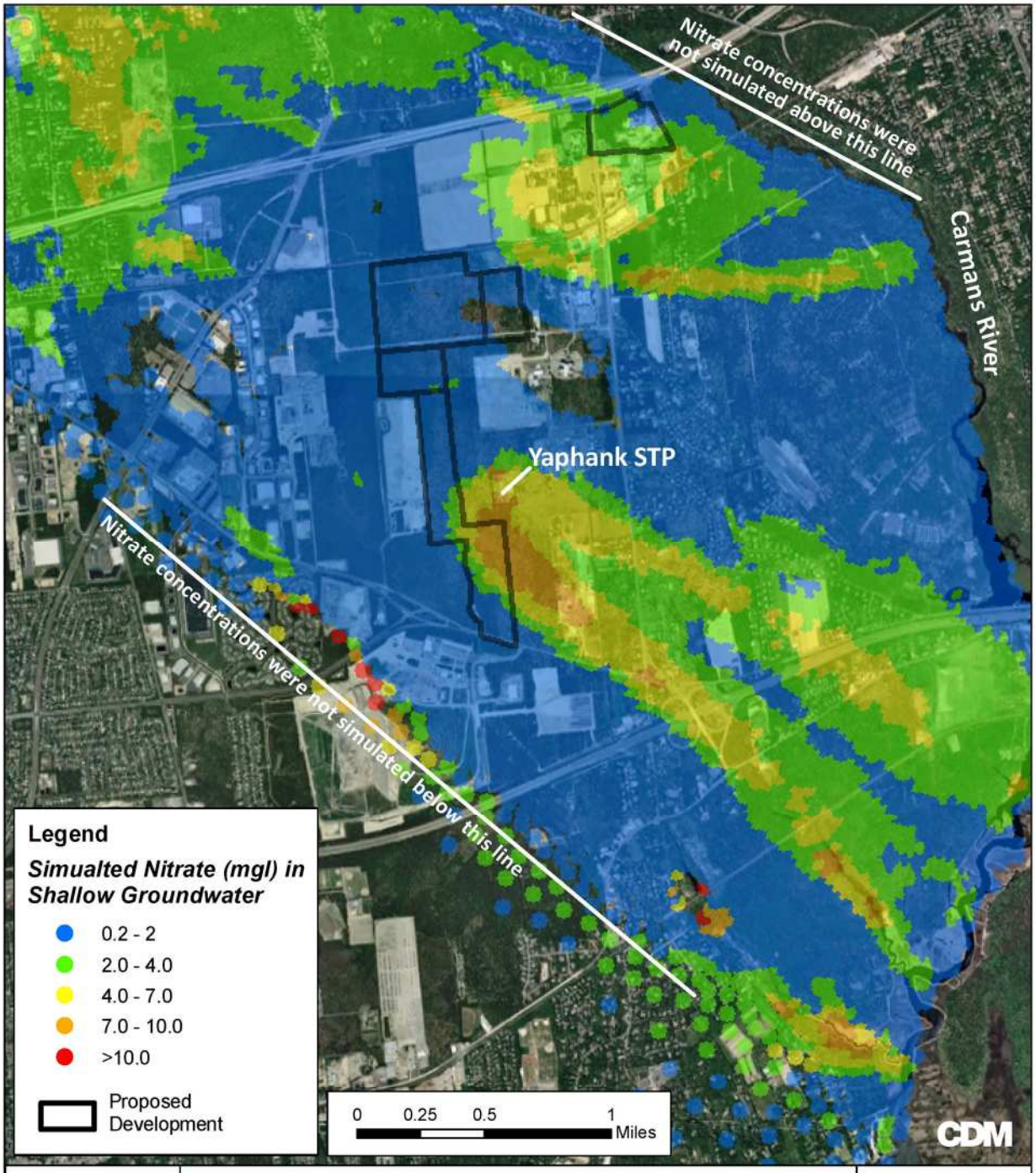
Water Table Elevation and
Direction of Shallow Groundwater Flow

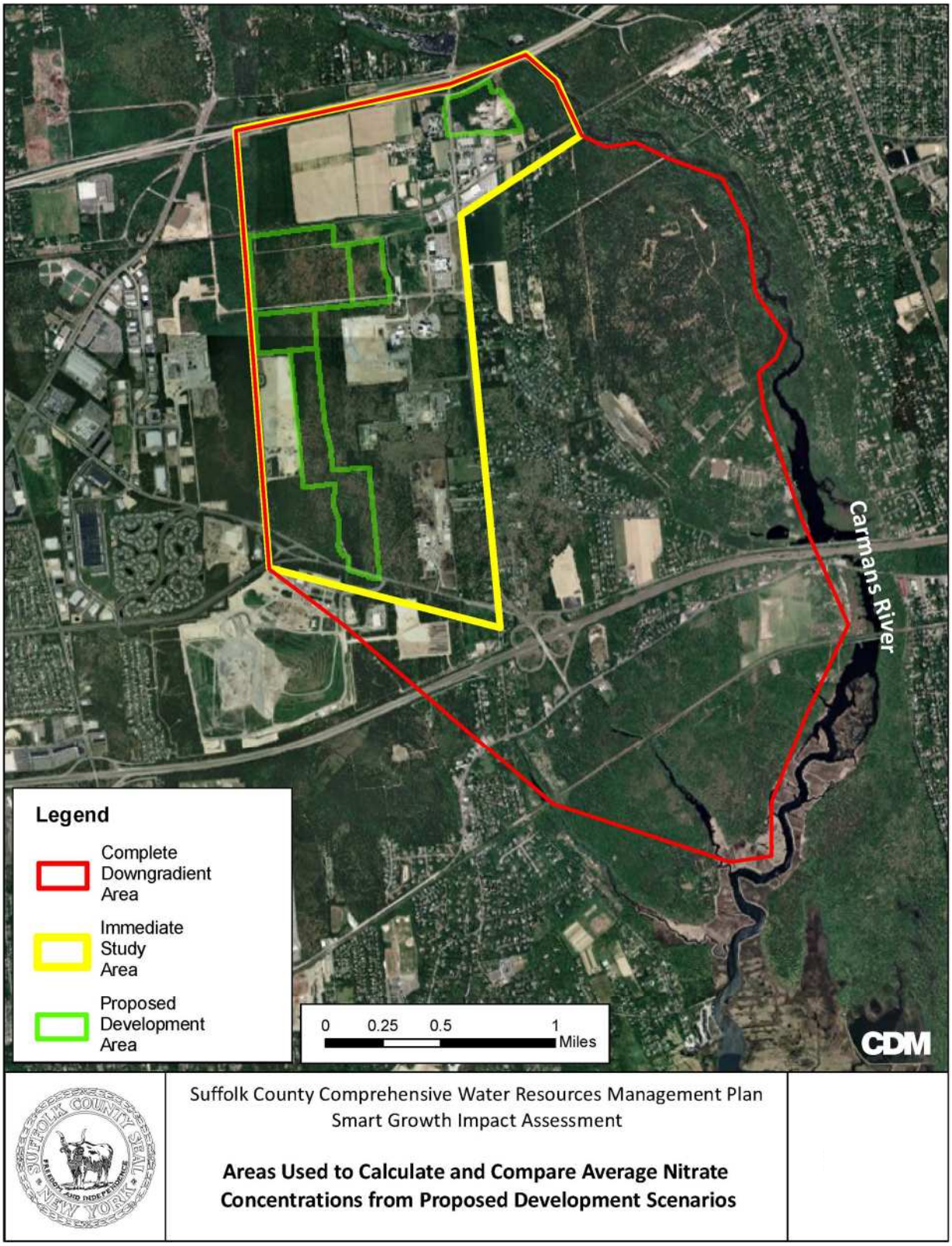

0 0.2 0.4 0.8
Miles
Carmans River
MAIN ST
E MAIN ST
LONG ISLAND AVE
RAMP
N LONG IS EXWY
STATE ST
BARTLETT AVE
BELLPORT RD
SILLS RD
YAPHANK AVE
HORSEBLOCK RD
WOODSIDE AVE
STATION RD
OLD HORSE BLOCK
STATE HWY-27
MONTAUK HWY
POST AVE
Legend
Land Use
Low Density Residential
Medium Density Residential
High Density Residential
Commercial
Industrial
Institutional
Recreation and Open Space
Agriculture
Vacant
Transportation
Utilities
Waste Management
Water
Proposed Development
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Existing Land Use


Nitrate concentrations were not simulated above this line
Carmans River
Yaphank STP
Nitrate concentrations were not simulated below this line
0 0.25 0.5 1 Miles
Legend
Nitrate (mgl) in Shallow Upper Glacial Groundwater
Private Wells
0.2 - 2.0
2.0 - 4.0
4.0 - 7.0
7.0 - 10.0
>10
Monitoring Wells
0.2 - 2.0
2.0 - 4.0
Proposed Development
Model Simulated
0.2 - 2
2.0 - 4.0
4.0 - 7.0
7.0 - 10.0
>10.0
CDM
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Comparison of Existing and Model Simulated Nitrate Concentrations in the Upper Glacial Aquifer (0 to 50 feet below the water table)


Nitrate concentrations were not simulated above this line
Carmans River
Yaphank STP
Nitrate concentrations were not simulated below this line
0 0.25 0.5 1 Miles
Legend
Nitrate (mgl) in Shallow Upper Glacial Groundwater
Private Wells
0.2 - 2.0
2.0 - 4.0
4.0 - 7.0
7.0 - 10.0
>10
Monitoring Wells
0.2 - 2.0
2.0 - 4.0
Proposed Development
Model Simulated
0.2 - 2
2.0 - 4.0
4.0 - 7.0
7.0 - 10.0
>10.0
CDM
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Comparison of Existing and Model Simulated Nitrate Concentrations in the Upper Glacial Aquifer (50 to 100 feet below the water table)


0 0.125 0.25 0.5 Miles
LONG ISLAND AVE
I 495
N LONG IS EXWY
RAMP
STATE ST
BARTLETT AVE
A
B
C
D
YAPHANK AVE
STATE HWY 27
Legend
Land Use
Mixed-Use
Low Density Residential
Medium Density Residential
High Density Residential
Commercial
Industrial
Institutional
Recreation and Open Space
Agriculture
Vacant
Transportation
Utilities
Waste Management
Water
Proposed Development
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Proposed Land Use
for Development Scenario


Nitrate concentrations were not simulated above this line
Carmans River
Yaphank STP
Nitrate concentrations were not simulated below this line
Legend
Simualted Nitrate (mgl) in Shallow Groundwater
0.2 - 2
2.0 - 4.0
4.0 - 7.0
7.0 - 10.0
>10.0
Proposed Development
0 0.25 0.5 1 Miles
CDM
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Model Simulated Nitrate Concentrations
in the Shallow Upper Glacial Aquifer
Proposed Development Scenario


Carmans River
Legend
Complete Downgradient Area
Immediate Study Area
Proposed Development Area
0 0.25 0.5 1 Miles
CDM
Suffolk County Comprehensive Water Resources Management Plan
Smart Growth Impact Assessment
Areas Used to Calculate and Compare Average Nitrate Concentrations from Proposed Development Scenarios