Prepared for Suffolk County for the:

Declaration as Surplus and Subsequent Sale of 250 Acres of County Owned Land in Yaphank for Mixed Use Development Purposes

Yaphank, Town of Brookhaven
Suffolk County, New York

Volume 4 of 6

March, 2011

Cameron Engineering & Associates, LLP

APPENDIX D
GROUNDWATER MODELING REPORT

A

Memorandum

To: *Douglas Feldman, SCDHS*

From: *CDM*

Date: *July 12, 2010, revised January 10, 2011*

Subject: *Task 18 – Smart Growth Impact Assessment*

1.0 Introduction

The objective of Task 18 of the **Suffolk County Comprehensive Water Resources Management Plan** was to evaluate the impacts of up to three alternative development scenarios upon nitrate levels in groundwater using the pilot approach developed and documented as part of Task 5.2 – Future Land Use Impacts. The Suffolk County Department of Health Services (SCDHS) chose to focus the evaluation on a proposed multi-use community in Yaphank (the "Proposed Development"), which lies just west of the Carmans River in the Town of Brookhaven. This task memorandum will:

- Describe the approach used to evaluate the Proposed Development and two alternative development scenarios;
- Present the results of the evaluation; and
- Document minor modifications to the modeling approach developed in Task 5.2 to evaluate land use impacts to groundwater quality.

This Task memorandum, originally submitted in July of 2010, has been updated based on revised estimates of sewage flows developed by Cameron Engineering, and reviewed by the SCDHS. Model simulations were updated with new sewage flows, re-run, and the results have been updated in the text, tables and figures of this memorandum. A "No Further Development" scenario was also added to the model simulations performed, as described in Section 2.3.

2.0 Proposed Development Evaluation

2.1 Modeling Approach

SCDHS identified the Proposed Development in the Carmans River watershed for evaluation using the approach developed in Task 5.2. The 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 and documented as part of Task 5.2. The only modification was to the methodology used to assign nitrogen loading rates to large parcels (i.e., greater than 25 acres) in the vicinity of the Proposed Development. This modification is described in detail in Section 2.2.

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 on **Figure 1**. 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 2**. The figure illustrates that the simulated shallow groundwater flow direction of the study area is east and southeast towards the Carmans River.

2.2 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 the Task 5.2 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 in Task 5.2, 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 3**. 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 the Task 5.2 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 of Task 5.2. 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 Carman's 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 originally performed as part of this task and documented in the previous (July 2010) memorandum. 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 Figures 4 and **5** for the baseline scenario. **Figure 4** 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** 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 in Task 5.2 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 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 (see Appendix A). 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.

2.3 Alternative Development Scenarios

Four alternative development scenarios were evaluated using the approach described above. The four development scenarios include:

- Proposed Development
- "As-of-Right" Development

- Continued Municipal Use
- No Further Development

Each is described in more detail below.

2.3.1 Proposed Development Scenario

The Proposed Development is shown in **Figure 6**. It consists of four distinct areas (A, B, C and D). 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. 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 539,749gpd (see the Appendix for STP flow estimate calculations for all scenarios). Consistent with the baseline simulation, nitrate/nitrogen concentrations in plant effluent were fixed at 9.2 mg/l for each of the alternative development scenarios.

Separate from the sanitary flows of areas A, B, and D 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.

2.3.2 "As-of-Right" Development Scenario

The "As-of-Right" development scenario assumes that the same parcels identified in the Proposed Development scenario will be built out privately to the maximum extent allowed under current zoning (**Figure 7**). This entails 27 low-density residential lots (40,000 square feet each) in Area A; 22 low-density residential lots in Area B; and 41 lots for office (commercial) use in Areas B, C and D ranging from 3.0 to 4.47 acres. Sanitary flows from all areas would be treated at the Yaphank County Center STP. Sanitary flows resulting from this development scenario were estimated to be 68,850 gpd, resulting in a total flow of 251,100 gpd.

Separate from the sanitary flows originating from the low density residential parcels, additional nitrogen loads were added to the low-density residential areas to reflect fertilizer use. To account for fertilizer load, a 20 percent leaching rate was assumed, using an application rate of 2.5 pounds per 1,000 square feet per year. Eighty percent of the low density residential parcels was assumed to be fertilized. No nitrogen loads were assigned to the commercial-use 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.

2.3.3 Continued Municipal Use Development Scenario

The continued municipal use scenario assumes that the County retains the ownership of the properties and develops them to support additional County administrative facilities consistent with the institutional land use category (**Figure 8**). As with the other two development scenarios, sanitary flows from the County facilities would be treated at the Yaphank County Center STP. Sanitary flows resulting from this development scenario were estimated to be 189,000 gpd, resulting in a total flow of 371,250 gpd. No nitrogen loads were assigned to the municipal-use 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.

2.3.4 No Further Development Scenario

The no further development scenario assumes that the County retains the ownership of the properties but does not develop them, other than completing the current expansion of the jail, and future expansion. Land uses for this scenario are the same as the existing land uses previously depicted by **Figure 3**. As with the other scenarios, sanitary flows from the existing County facilities and 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.

3.0 Estimated Nitrogen Concentrations Resulting from Proposed Development Scenarios

The four alternative development scenarios were 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 concentrations in the shallow portion of the upper glacial aquifer are shown in **Figures 9, 10**, **11**, and **12** for the Proposed Development, "As-of-Right", Municipal Use, and No Further Development scenarios, respectively.

In general, there are only minor variations in simulated concentrations of nitrate in shallow upper glacial groundwater between the No Further Development simulation and the three development scenarios. Based on the information provided, it is assumed that the STP will continue to provide the same level of treatment under all scenarios. Under the No Further Development Scenario, the simulated average nitrate concentration in shallow groundwater within the immediate study area of the Proposed Development area is 1.7 mg/L, compared to 2.3 mg/l for the Proposed Development Scenario (**Table 2**). In the larger study area extending to the Carmans River, the average nitrate concentrations for the No Further Development and Proposed Development scenarios are 1.7 mg/l and 2.2 mg/l respectively. **Figure 13** depicts the areas where simulated average nitrate concentrations in shallow groundwater were calculated. Average nitrate concentrations in the "As-of-Right" and Municipal Use scenarios were estimated to be slightly lower at 1.7 mg/l and 1.9 mg/l, respectively, for the immediate study area and 1.8 mg/l and 1.9 mg/l, respectively, for the complete study area.

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

Area	Average Nitrate Concentration (mg/l) of Modeled Development Scenarios			
	No Further Development Scenario	Proposed Development	"As of Right"	Municipal Use
Immediate Study Area	1.7	2.3	1.7	1.9
Entire Study Area	1.7	2.2	1.8	1.9

4.0 Conclusions

The modeling approach previously developed to simulate the impacts of changes in land use upon nitrate groundwater levels was used to evaluate the impacts of four development alternatives in the area immediately west of the Carmans River. Water quality data from private wells and site investigation monitoring wells were used to assess the model's ability to generally represent nitrogen levels under existing conditions. Previously developed loading parameters were found to be appropriate for use based on a comparison of simulated and observed nitrate concentrations. A slight adjustment was made in the modeling approach to better represent nitrogen loading from large parcels. This entailed distributing the nitrogen source over the entire parcel rather than from the centroid of the parcel. The nitrogen loading rate from medium density residential parcels was reduced by adjusting the number of housing units per acre from 3 to 1.5, which better reflects the medium density residential parcel sizes in the study area.

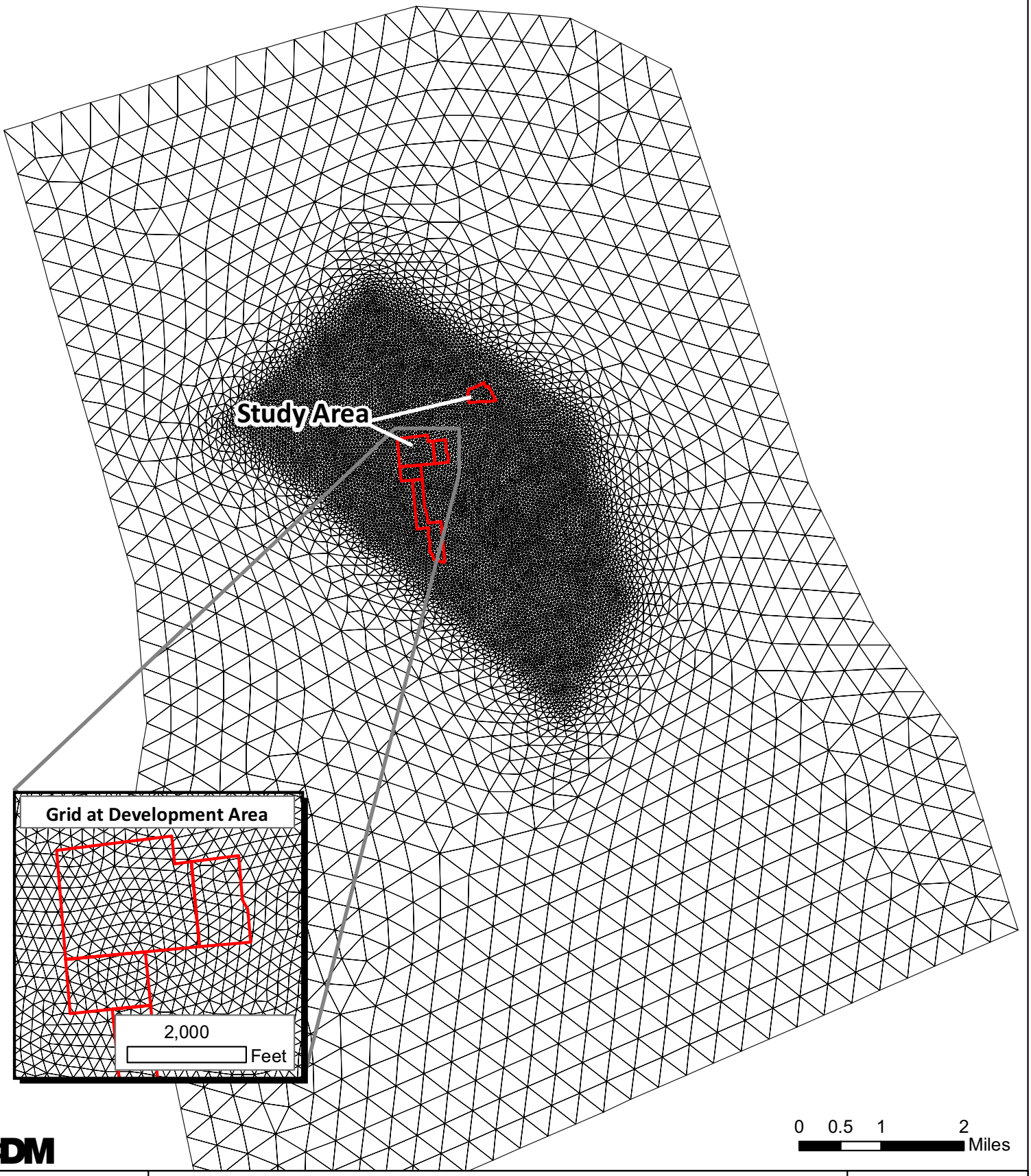
The nitrogen concentrations in the shallow upper glacial aquifer resulting from the Proposed Development were simulated to be slightly higher than the no further development scenario, based upon the assumptions included in the evaluation (e.g., sanitary flows from the development are directed to the sewage treatment plant, which continues to provide the existing level of nitrate removal in the future). The remaining two development scenarios showed even smaller impacts, compared to the No Further Development scenario. Because sewering was assumed for the proposed development area of all scenarios, there is little difference in nitrogen loading rates assigned to the parcels, which results in only very minor differences in downgradient water quality.

5.0 References

CDM. 2003. **Suffolk County Groundwater Model**. October 2003.

CDM. 2008. **Task 5.2 – Future Land Use Impacts**. Suffolk County Comprehensive Water Resources Management Plan

Suffolk County Department of Health Services (SCDHS), 2006. **Report on the Sewage Treatment Plants of Suffolk County**. Prepared by Isidore Doroski and Charles Olsen.



CDM

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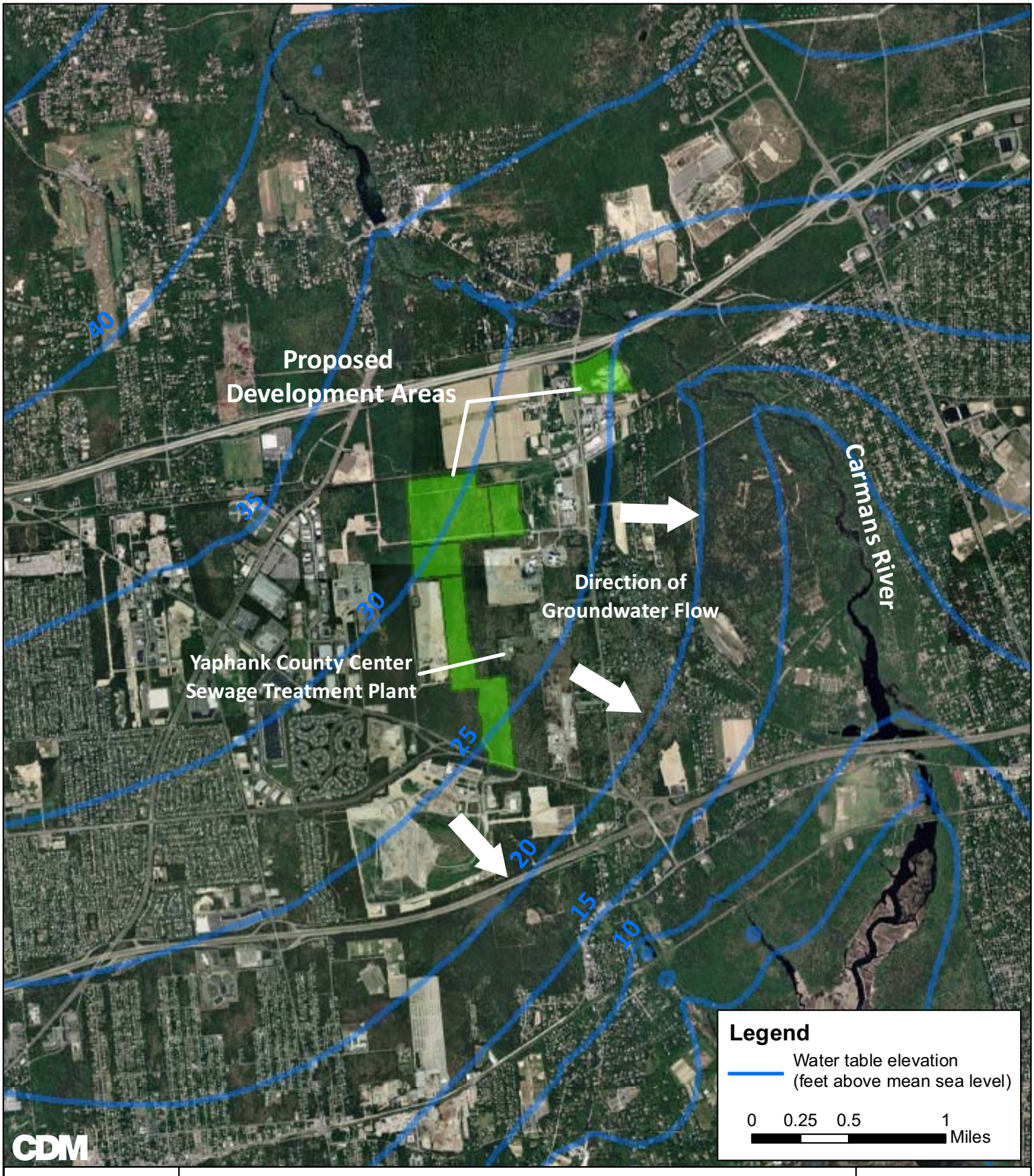
Smart Growth Impact Assessment

Finite Element Grid

Figure 1



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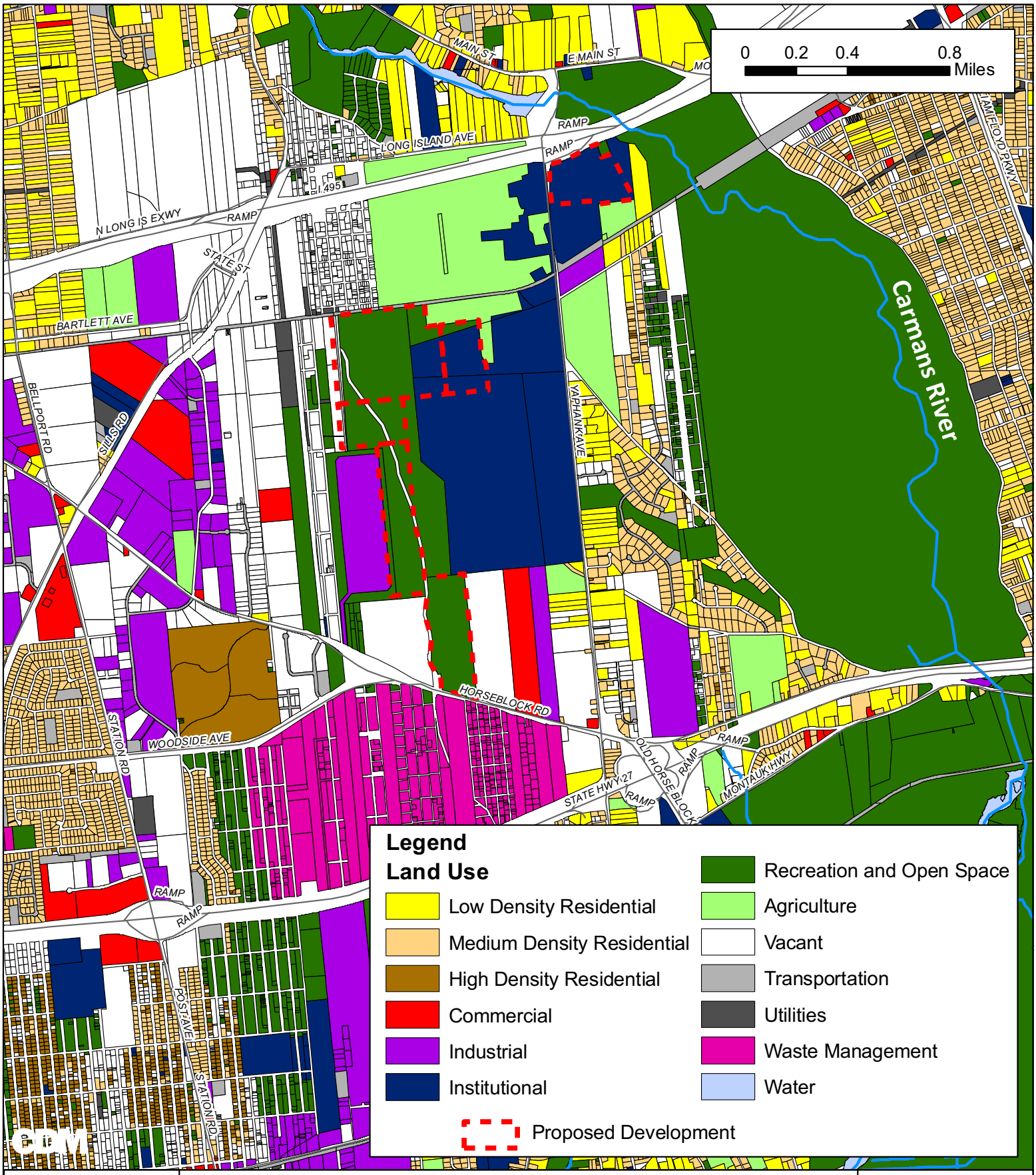
Water Table Elevation and
Direction of Shallow Groundwater Flow

Figure 2



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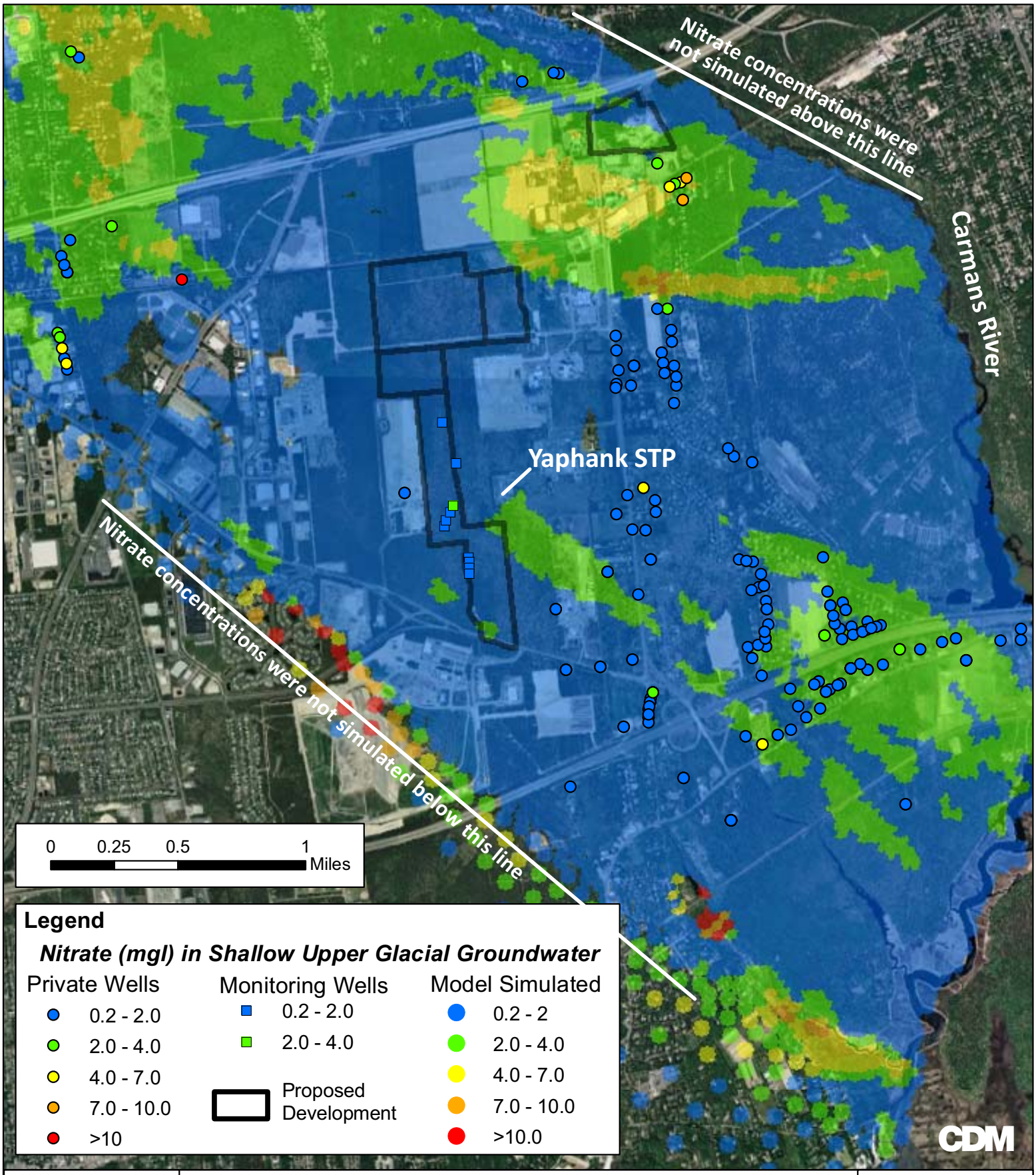
Existing Land Use

Figure 3



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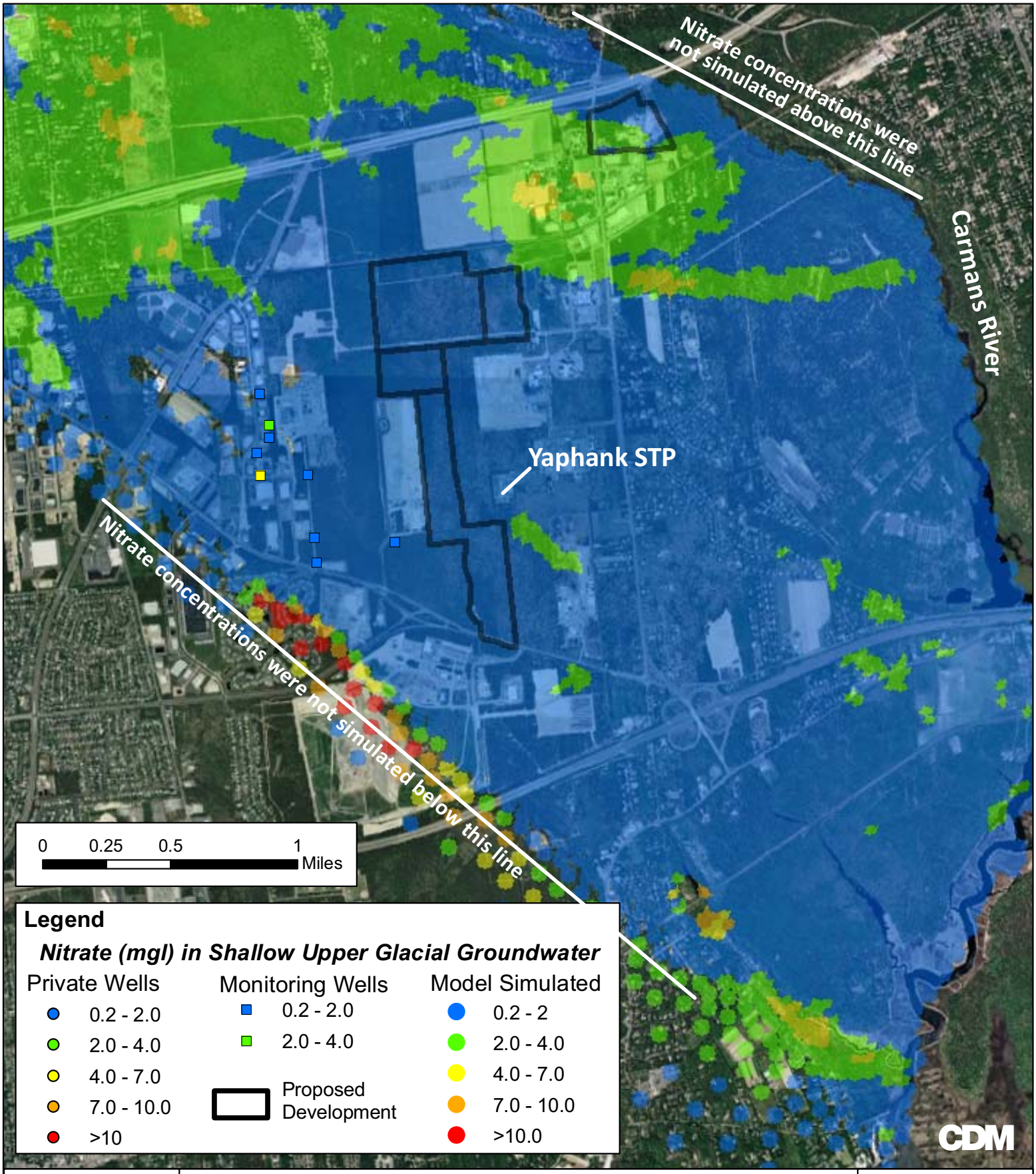
Comparison of Existing and Model Simulated Nitrate Concentrations in the Upper Glacial Aquifer (0 to 50 feet below the water table)

Figure 4



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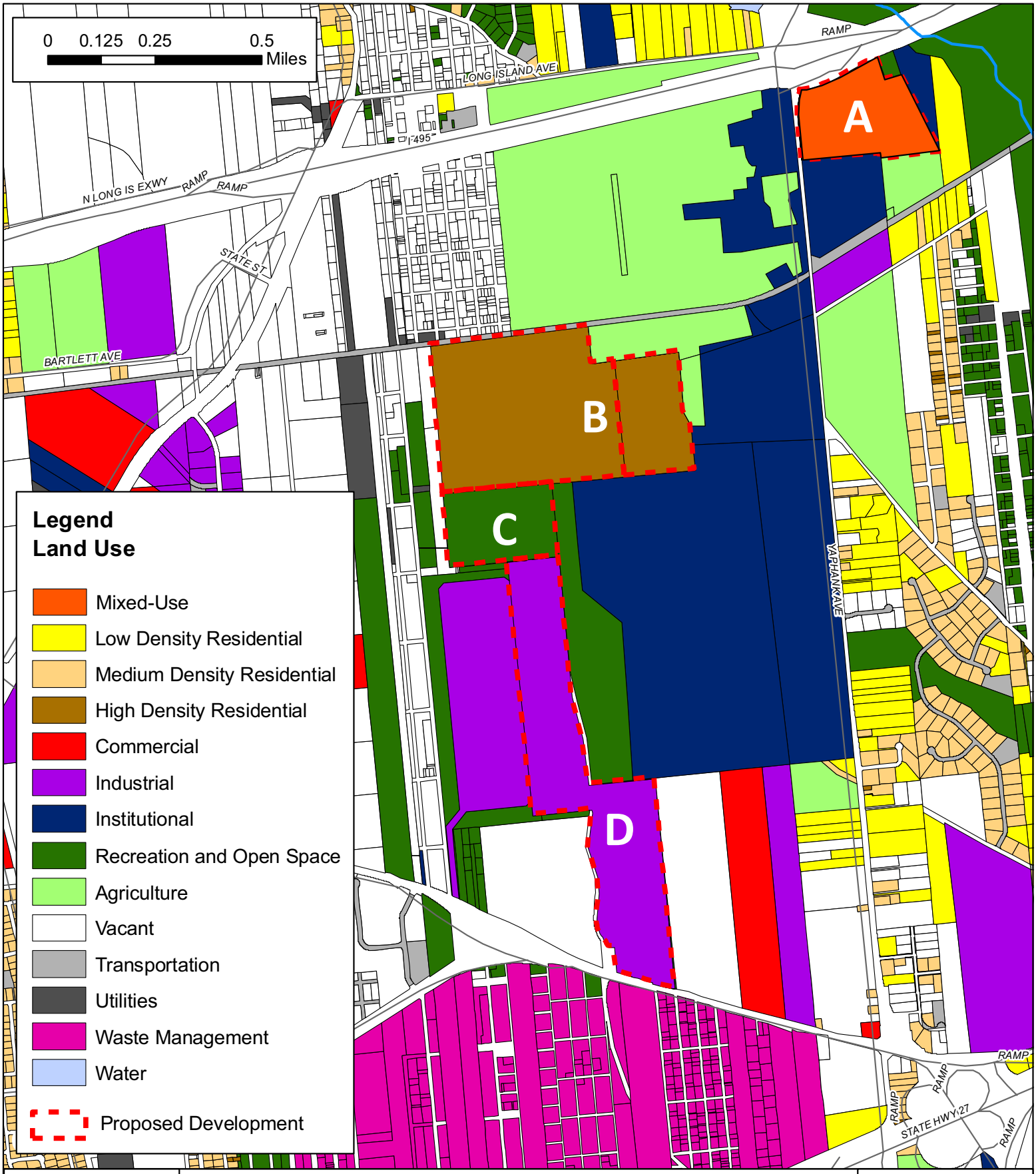
Comparison of Existing and Model Simulated Nitrate Concentrations in the Upper Glacial Aquifer (50 to 100 feet below the water table)

Figure 5



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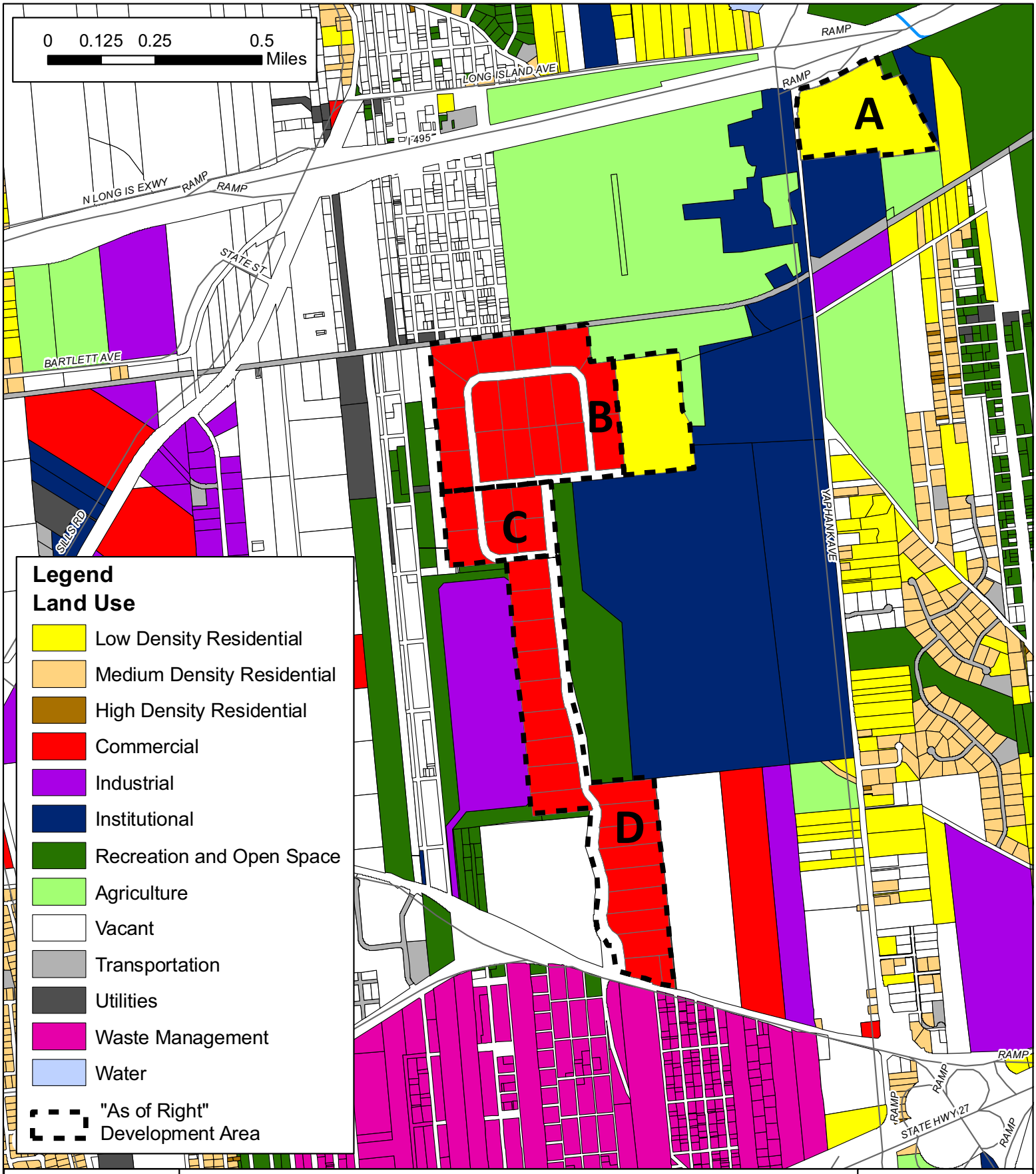
Proposed Land Use
for Development Scenario

Figure 6



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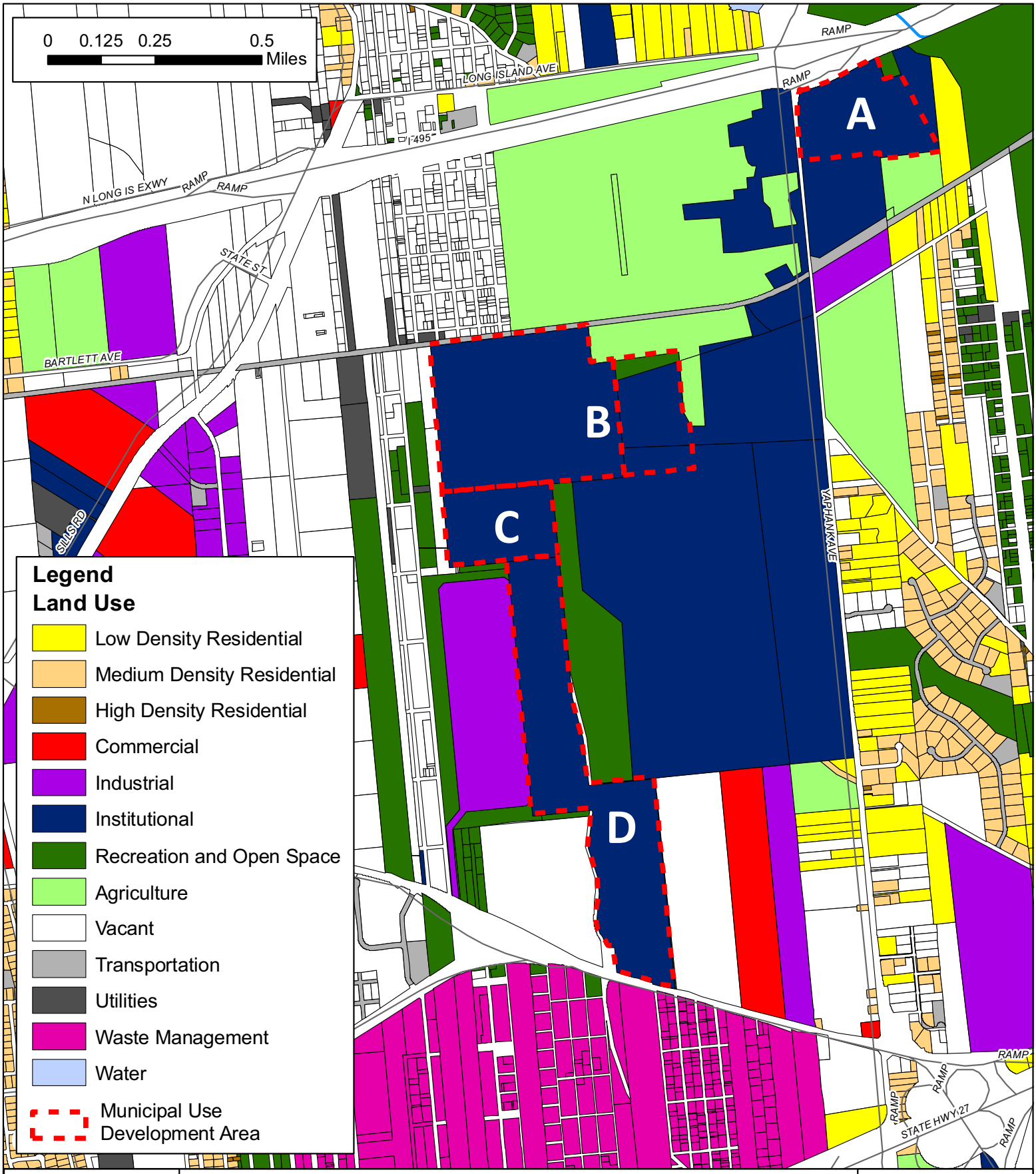
Proposed Land Use
"As-of-Right" Development Scenario

Figure 7



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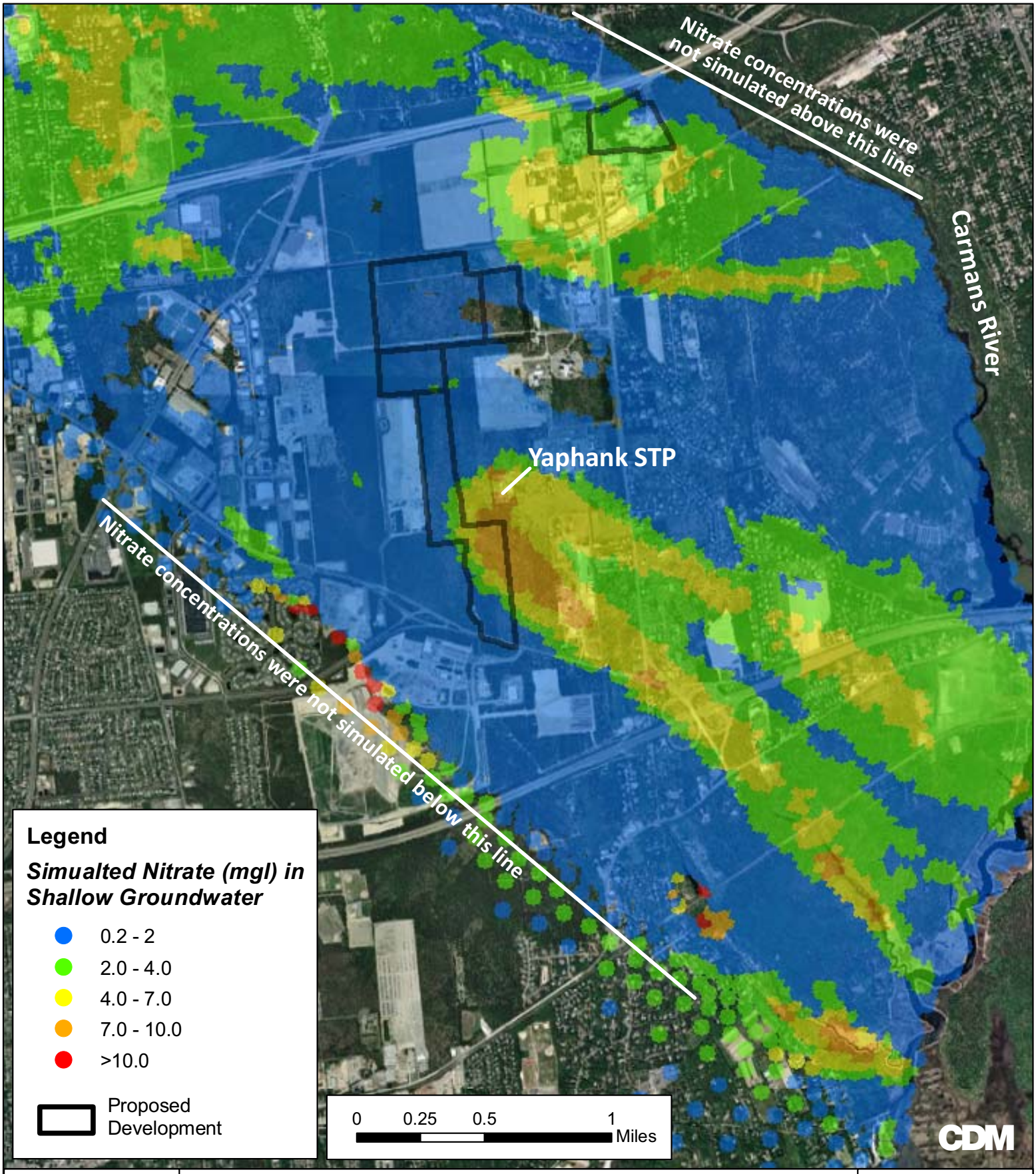
Proposed Land Use
Municipal Use Development Scenario

Figure 8



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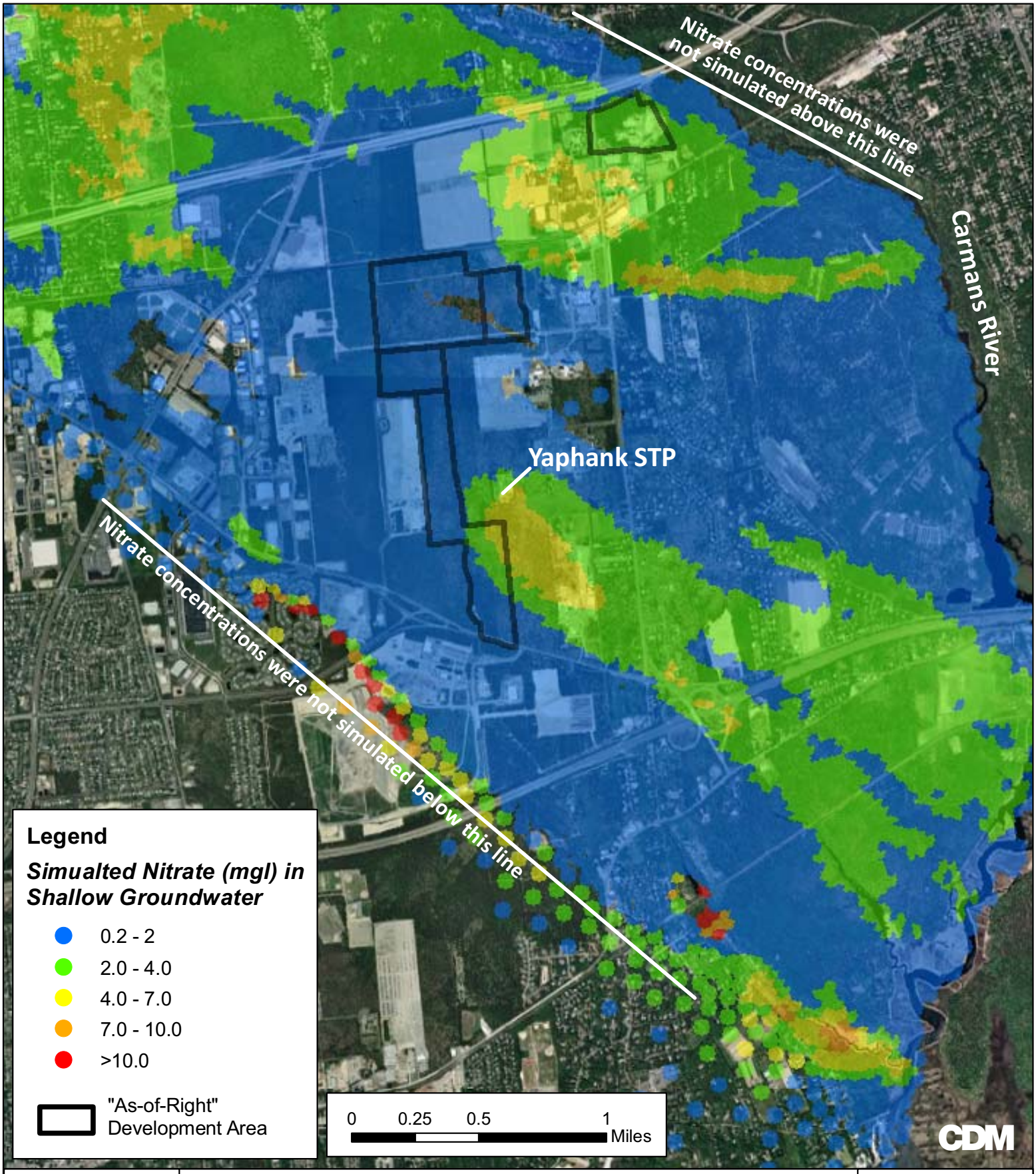
Model Simulated Nitrate Concentrations in the Shallow Upper Glacial Aquifer Proposed Development Scenario

Figure 9



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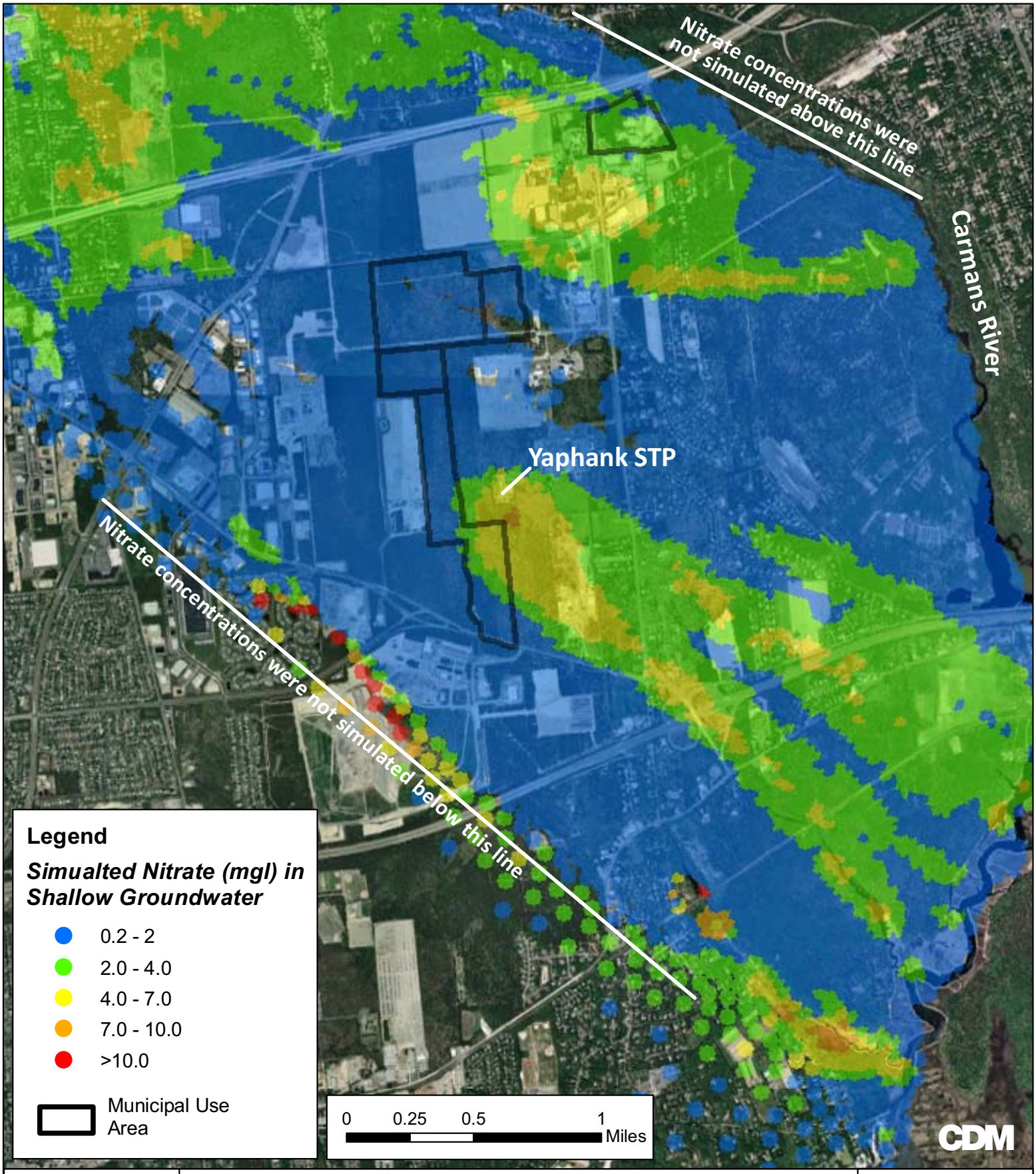
Model Simulated Nitrate Concentrations in the Shallow Upper Glacial Aquifer "As of Right" Development Scenario

Figure 10



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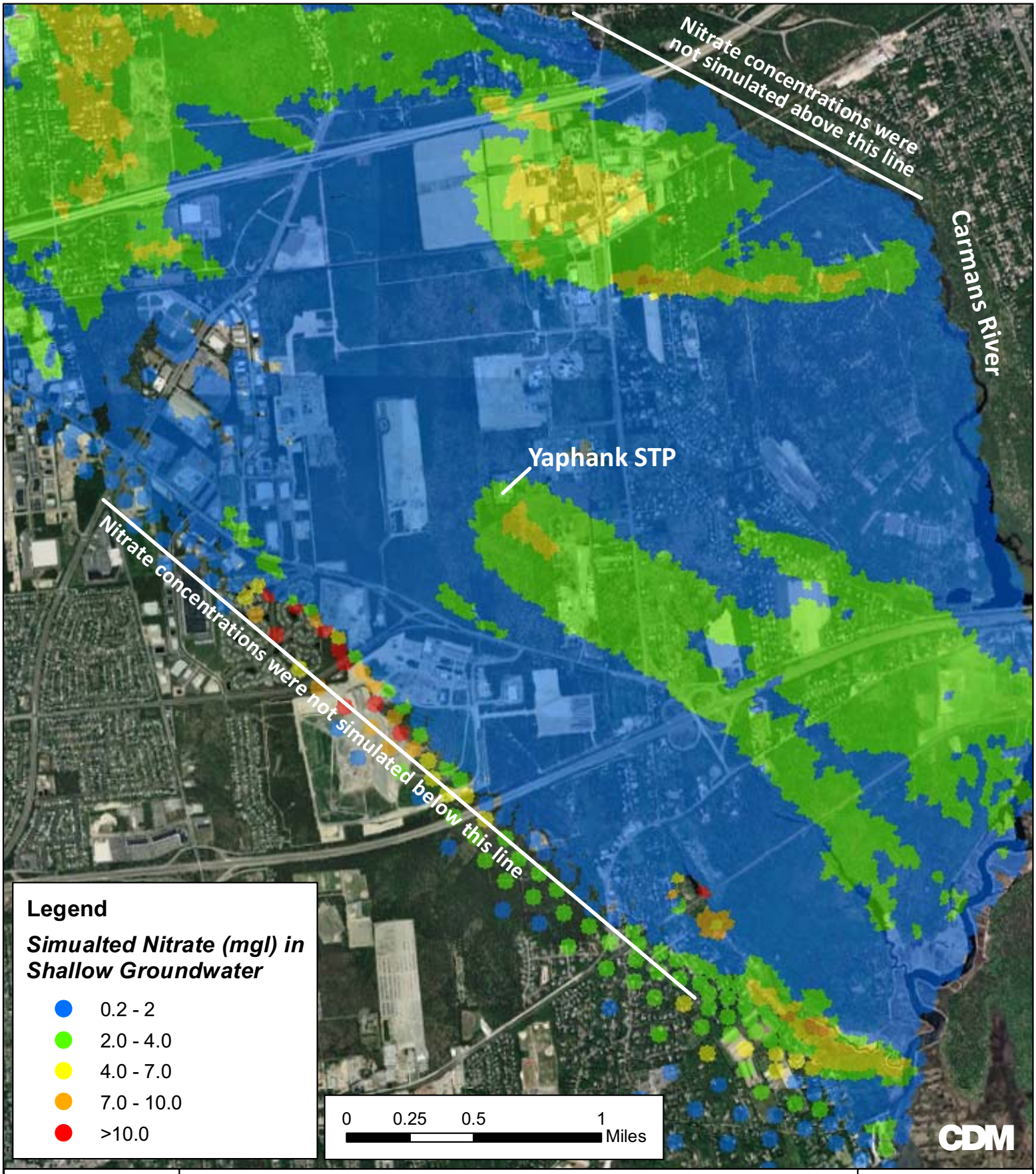
Model Simulated Nitrate Concentrations in the Shallow Upper Glacial Aquifer Municipal Use Development Scenario

Figure 11



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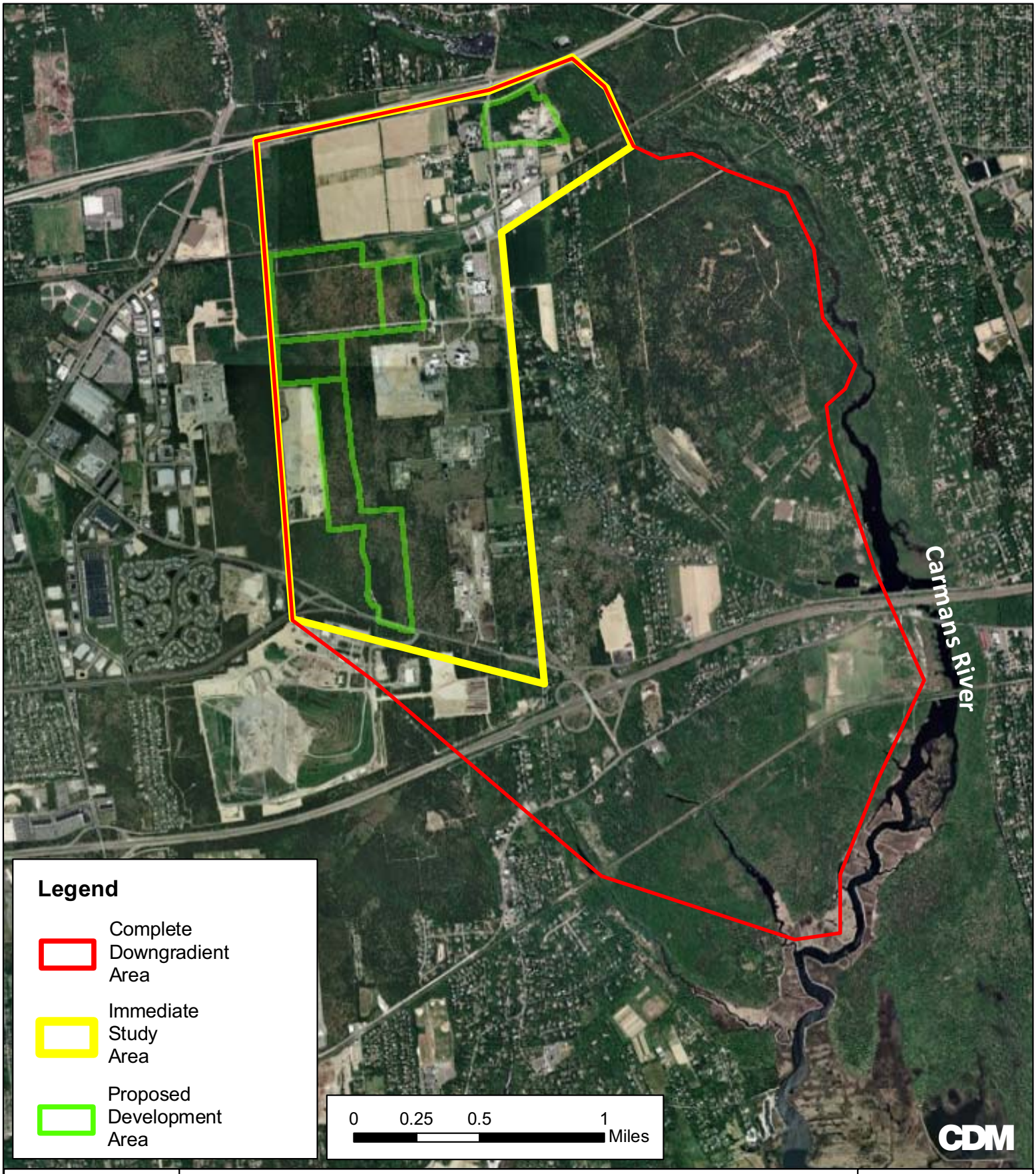
Model Simulated Nitrate Concentrations in the Shallow Upper Glacial Aquifer No Further Development Scenario

Figure 12



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Areas Used to Calculate and Compare Average Nitrate Concentrations from Proposed Development Scenarios

Figure 13

Appendix A - Yaphank County Center STP Flows
(As Provided by Cameron Engineering and Associates, LLP)

Existing Conditions

Use	Quantity	Units	Flow Rate	Design Flow (gpd)	Projected Flow for Model (gpd)	
Current Flow to Existing STP			**Existing**	**110,000**	**93,000**	Actual average flow
			Total Flow (Existing)	**110,000**	**93,000**	

No Build - Existing Conditions plus Jail - both phases; Also will serve as No further Development Alternative

Use	Quantity	Units	Flow Rate	Design Flow (gpd)	Projected Flow for Model (gpd)	
Current Flow to Existing STP			**Existing**	**110,000**	**93,000**	Actual average flow
County Jail						
Phase I (Under Construction)	Total 813,270	Sf.	Per Flow Rates accepted by SCDHS & DPW	69,000	51,750	75% of design flow
Phase II (Future)			Estimation based on Phase I flow Rates	50,000	37,500	75% of design flow
			Total	**119,000**	**89,250**	
			Total Flow (Existing and Proposed)	**229,000**	**182,250**	

Build - Proposed Development

Use	Quantity	Units	Flow Rate	Design Flow (gpd)	Projected Flow for Model (gpd)	
Current Flow to Existing STP			**Existing**	**110,000**	**93,000**	Actual average flow
County Jail						
Phase I (Under Construction)	Total 813,270	Sf.	Per Flow Rates accepted by SCDHS & DPW	69,000	51,750	75% of design flow
Phase II (Future)			Estimation based on Phase I flow Rates	50,000	37,500	75% of design flow
			Total	**119,000**	**89,250**	
Proposed Development						
Housing						
Unit Between 601-1200 sf. gross floor area	72	1 br. Apt.	225 gpd/unit	16,200	12,150	75% of design flow
Homes	785	2 br.	300 gpd/home	235,500	176,625	75% of design flow
Homes with accessory apartment	215	Total 3 br.	300 gpd/home	64,500	48,375	75% of design flow
Commercial						
Arena	5,500	Seats	3gpd/seat	16,500	12,375	75% of design flow
Arena Food Service	20,000	Sf.	0.12 gpd/sf.	2,400	1,800	75% of design flow
Hotel (70,000 sf.)	90	Rooms	150 gpd for > 400 sf. unit	13,500	10,125	75% of design flow
Restaurant (35,000 sf.)	1,200	Seats	30 gpd/seat	36,000	27,000	75% of design flow
Retail (25,000 sf.) assume 50% dry	12,500	Sf.	0.03 gpd/sf. dry retail use	375	281	75% of design flow
Retail (25,000 sf) assume 50% Wet use	12,500	Sf.	0.12 gpd/sf. food processing	1,500	1,125	75% of design flow
Office (50,000 sf.) assume 50% medical	25,000	Sf.	0.1 gpd/sf. Medical use	2,500	1,875	75% of design flow
Office (50,000 sf.) assume 50% non medical	25,000	Sf.	0.06 gpd/sf. Non-Medical	1,500	1,125	75% of design flow
Health Club	50,000	Sf.	0.3 gpd/sf. with showers	15,000	11,250	75% of design flow
Day Care (20,000 sf)	400	Occupants	7.5 gpd/occupant	3,000	2,250	75% of design flow
Outdoor Stadium	5,000	Seats	3 gpd/seat	15,000	11,250	75% of design flow
Outdoor Stadium Food Service (assume 20,000 sf.)	20,000	Sf.	0.12 gpd/sf.	2,400	1,800	75% of design flow
Light Industrial	1,200,000	Sf.	0.04 gpd/sf.	48,000	36,000	75% of design flow
Recreational Fields	170	Parking Space	15 gpd/parking space	2,550	1,913	75% of design flow
Recreational Fields Food Service (assume 2,000 sf)	2,000	Sf.	0.12 gpd/sf.	240	180	75% of design flow
			Total	**476,665**	**357,499**	
			Total Flow (Existing and Proposed)	**705,665**	**539,749**	

Alternative - As-of-Right Development

Use	Quantity	Units	Flow Rate	Design Flow (gpd)	Projected Flow for Model (gpd)	
Current Flow to Existing STP			**Existing**	**110,000**	**93,000**	Actual average flow
County Jail						
Phase I (Under Construction)	Total 813,270	Sf.	Per Flow Rates accepted by SCDHS & DPW	69,000	51,750	75% of design flow
Phase II (Future)		Sf.	Estimation based on Phase I flow Rates	50,000	37,500	75% of design flow
			Total	**119,000**	**89,250**	
Proposed Development						
Housing						
Homes	50	5 br.	300 gpd/home	15,000	11,250	75% of design flow
Light Industrial						
Office (90%)	1,080,000	Sf.	0.06 gpd/sf.	64,800	48,600	75% of design flow
Medical Office (10%)	120,000	Sf.	0.10 gpd/sf.	12,000	9,000	75% of design flow
			Total	**91,800**	**68,850**	
			Total Flow (Existing and Proposed)	**320,800**	**251,100**	

Alternative - Municipal Development

Use	Quantity	Units	Flow Rate	Design Flow (gpd)	Projected Flow for Model (gpd)	
Current Flow to Existing STP			**Existing**	**110,000**	**93,000**	Actual average flow
County Jail						
Phase I (Under Construction)	Total 813,270	Sf.	Per Flow Rates accepted by SCDHS & DPW	69,000	51,750	75% of design flow
Phase II (Future)			Estimation based on Phase I flow Rates	50,000	37,500	75% of design flow
			Total	**119,000**	**89,250**	
Proposed Development						
New Municipal Uses	2,000,000	SF	See sidebar	0	0	See Page 2
			Total Flow (Existing and Proposed)	**229,000**	**182,250**	

Appendix A - Yaphank County Center STP Flows

(As Provided by Cameron Engineering and Associates, LLP)

Municipal Use Scenario Additional Calculations

Design Flow

Active sf in 2009-2010	
948,738	sf
6,500	sf
30,000	sf
985,238	total existing building area
110,000	from SCDHS
Proposed County Facilities	
813,270	sf of proposed jail
119,000	WW flow of proposed jail
1,798,508	Total sf
229,000	Total Flow
0.127	Average gpd/sf
Additional Facilities to be added in Municipal Alternative	
2,000,000	new sf
254,656	new WW flow @ average of existing and jail
255,000	gpd rounded
484,000	Total

Projected Flow

Active sf in 2009-2010	
948,738	sf
6,500	sf
30,000	sf
985,238	total existing building area
93,000	Average 2009-2010 gpd ww flow
0.094	Average gpd/sf
Proposed County Facilities	
813,270	sf of proposed jail
89,250	WW flow of proposed jail
Additional Facilities to be added in Municipal Alternative	
2,000,000	new sf
188,787	new WW flow @0.094 gpd/sf (existing only)
189,000	gpd rounded
371,250	Total