Chapter 10 [Added 9/23/09 by Resolution 2009-09-03]
Water Resources Element

Purpose of Element

Article 66B of the Maryland Annotated Code, as amended by House Bill 1141 (2006 Session), requires a Water Resources element in the Comprehensive Plan that addresses the adequacy of water supply and the suitability of receiving waters for point and non-point discharges. The WRE must evaluate the adequacy and suitability of water resources on the basis of existing and future land use, both within the Town and within the Town's growth area. Thus, the WRE is based on the Land Use and Municipal Growth elements of the Comprehensive Plan. It is also tied to the Community Facilities element (for water and sewer), and to the Plan's environmental goals and policies for protecting water supply and water quality.

Water Supply

Setting

The Town of North East straddles the geographic fall line that separates the Atlantic Coastal Plain province (composed of unconsolidated sediments) from the Piedmont Plateau province (composed of crystalline rock). In terms of water resources, the Town's dual hydro-geological settings offer two advantages: 1) the potential for high-yield wells from Coastal Plain aquifers, and 2) the potential for raw water impoundments fed by rapidly flowing year-round non-tidal streams, coming out of the Piedmont. While the Town's water system relies on reservoirs of raw water, fed by North East Creek and Little North East Creek, the following review of groundwater supply may be useful for long term planning.

The potential for high-yield groundwater production in the Coastal Plain is substantial. Long term quantity is not a problem. The productivity is about ten times greater than wells in crystalline rock. The peninsula south of Town (between the Northeast and Elk Rivers) is a favorable location for wells, with potential well depths ranging from 30 to 500 feet (brackish water exists at depths greater than 500'). Some large wells in this part of the Coastal Plain can produce over 1000 gallons per minute.

In and around North East, groundwater is stored in the Potomac group aquifers. Wells that reach the bottom horizons of the aquifer can produce yields of 200 to 500 gallons per minute. Withdrawals of groundwater can cause a "cone of depression" in the immediate area (a lowering of groundwater levels), making the placement, depth, and adequate separation of wells important considerations for planning. Although the Potomac aquifers are confined, they can leak in places, causing shifts and exchanges over time. In general, estimates of groundwater yield in Coastal Plain wells are fairly accurate (and more so than in Piedmont wells).

The quality of the ground water in all of Cecil County is generally acceptable for all uses. The groundwater is soft; many Coastal Plain wells contain iron and have a low pH. All of these conditions can be treated. With properly constructed wells, pollution of groundwater poses little problem as the surface geology provides protective filtering of potential contaminants.

Town Water System

The Town has two water filtration plants; one is located at Rolling Mill Road and the other at Leslie Road. Northeast Creek feeds raw water impoundments at both facilities, and the Rolling Mill WTP also uses Little Northeast Creek. The Leslie Road reservoir holds 2.5 million gallons and the Rolling Mill reservoir holds 4.8 million gallons.

The Town recently obtained an MDE permit to withdraw water from the tidal portion of the Northeast River, which is then pumped to the Rolling Mill WTP. The permit is valid until May 1, 2016 and allows a daily average withdrawal of .559 MGD and a maximum daily withdrawal of 3.862 MGD.

During periods of low creek flows, the Leslie Road WTP shuts down, and the difference is made up by water from the Rolling Mill WTP. The Rolling Mill WTP is notable as the first surface water direct filtration plant approved for water supply in Maryland.

A reserve capacity of about 2 million gallons is stored in seven tanks, three of which are underground and four are elevated. Significant improvements to the system have been accomplished since 2000 and are on-going. A new Rolling Mill WTP came on-line in May 2009. Additional details are summarized below.

Table 4
Water System

Plant Name	Actual Avg. Daily Flow (mgd) (Apr 08 - Mar 09)	Max Daily Flow permitted (mgd)	Avg. Daily Flow Permitted (mgd)	Design Capacity: Avg. / Max. (mgd)
Rolling Mill	0.211	3.200	1.383	Phase One: 1.15 / 2.0 Phase Two (future): 2.3 / 4.0
Leslie	0.401	0.620	0.325	0.547 / 0.830
TOTAL	0.612	3.820	1.708	Current: 1.697 / 2.830 With Phase Two: 2.847 / 4.830

Projected Water Demand for the Town and the Growth Area

The customer base in 2004 was reported to be 8,000 people. Based on the number of residential units served with water (in and out of Town), the current customer base is estimated to be 8,300. The Town of North East also serves the State's I-95 Rest Stop, which uses an average of 35,000 gallons per day, although usage varies widely from month-to-month. Slightly more than one-half of the 3,225 units served (residential, commercial, and mixed use) are in Town. In terms of only the residential units served, 47 percent (1304) are in Town and 53 percent (1446) are outside the Town.

According to the water service area map, approximately 38 percent of the area with service or planned service is located within the Town, and 62 percent of the service area is County territory (much of which is within the Town Growth Area and planned for annexation).

The following tables summarize the water needed to accommodate existing and future development under the North East Comprehensive Plan, including needs associated with the Town's Growth Area Map. Projections for the Town are based on population projections from the Maryland Department of Planning (MDP) and are expressed in five-year increments for the period 2010 to 2030. Table 5 includes two methods for projecting population: constant share and high development pressure. Need is expressed as a range, based on the two projection methods.

Table 5

Projected Water Demand for the Town of North East Based on Population Projections						
	2000	2010	2015	2020	2025	2030
Population (Constant percent of County method[1])	2744	3455	3888	4299	4709	5112
Population (High development pressure method[2])	2744	3566	4246	5030	5942	6969
Housing units: (range[3])	1020 to 1215	1309 to 1608	1495 to 1947	1679 to 2328	1861 to 2768	2037 to 3263
Water Needs (range[3])	.224 to .267mgd	.288 to .354mgd	.329 to .428mgd	.369 to .512mgd	.409 to .447mgd	.448 to .718mgd
Percent of Average Daily flow (range[3])	13 to 16	17 to 21	19 to 25	22 to 30	24 to 36	26 to 42
Percent Maximum Daily flow (range[3])	6 to 7	8 to 9	9 to 11	10 to 13	11 to 16	12 to19

[1] Data for each year represents 3.2 percent of MDP population projection for Cecil County (2009).

[2] Source: MDP growth modeling (2009). See also, Municipal Growth Element.

[3] Data represents a range between "constant percent" and "high development pressure" and assumes each unit requires 220 gallons of water per day. Percent assumes Phase One status at Rolling Mill WTP.

Projections for the Growth Area are based on data from the Municipal Growth Element, including the number of households and net acres for development. These projections also include demand from Cecil County's Urban Growth Boundary Area 1 for North East. See Table 6. (For testing purposes, the population and number of households were also projected using TAZs. The results were within the "constant-to-high pressure range" derived from MDP data.)

Table 6

Projected Water Demand for the Growth Area Based on Net Acres for Development[1]		
Land Use	Households (Residential) Acres (Commercial, Industrial)	Water Needed (gallons per day)
All Planned Residential (Tiers 1 and 2)	4080 households	897,600
Tier 1 Planned Residential (20 year horizon)	2377 households	522,940
Commercial, Industrial (Planned Economic Growth)	1655 net acres	1,655,000
Cecil County Urban Growth Boundary site (Econ. Growth)[2]	224 net acres	224,000
TOTAL (includes Tier 1 and 2) TOTAL (includes Tier 1 only)		2,776,600 2,401,940

[1] Assumes 220 GPD per household and 1,000 GPD per net acre for commercial and industrial.

[2] Cecil Co. UGB Study, 2002 amendment, reports a total of 1700 acres in this site, but that figure appears to be a typo error. The total area measures to be 350 acres, of which 298 acres are outside the Town growth area. This area yields 224 net acres for development and represents an additional source of future demand for water.

The total amount of water needed for existing and future development under the Comprehensive Plan and Growth Area Map is provided in Table 7.

Table 7

Total 2030 Water Needs* for the Town and the Growth Area: 1) Constant and High Pressure Population Growth Scenarios and 2) Growth Area Map (Tiers One and Two) (gallons per day)		
Needs Based on Pop Growth	Constant Growth	High Development Pressure
Town Customers	448,064	717,860
Existing County Customers	299,880	299,880
Total	747,944	1,017,740
Needs Based on Land Area		
Growth Area: Tier One	2,401,940	
Growth Area: Tier Two	374,660	
Town Infill	165,220	
Usage in 2009	612,000	
Total	3,553,820	
Total without Tier Two	3,179,160	

*Assumes 220 GPD/Household and 1,000 GPD/net acre of commercial and industrial

Summary of Water Supply and Demand

Based on Population Growth

Based on the 2030 population projections, the Town needs .748MGD of water for growth at the constant rate, and 1.02MGD of water for growth under the high development pressure scenario. This estimate assumes that there is no growth in non-municipal customers, and that all future County customers are annexed into the Town. The Town has adequate design capacity (without needing to implement Phase Two at Rolling Mill), and an adequate permitted daily flow to serve projected population growth.

Based on Land Area

The land for development in the Growth Area (Tiers One and Two), new infill development, and current Town and County customers, requires 3.6MGD of water. Without Tier Two, 3.2MGD of water are needed. The demand from full build out of the Growth Area would exceed the Town's average flow design capacity (even with Phase Two at Rolling Mill) by about 12 percent.

This is a long term and relatively modest shortfall, and the Town has adequate time and tools to plan for improvements as needed. Raw water supply for the WTP reservoirs does not appear to be a limiting factor. Facility improvements, if required, should likely be focused on the Rolling Mill plant. Modest adjustments to MDE permits may provide additional water to make up the long term shortfall. Finally, since the land supply in the Growth Area purposefully exceeds the amount needed for population growth to 2030 (to account for market choices), full build out of the Growth Area by 2030 is not likely.

The largest variable in projecting the supply of water needed in the future appears to be water usage by future industrial, commercial, and business uses. This element uses 1000 gallons per net acre, but this number is probably on the high end (and thus needs are overstated). Appendix C (located at the end of Chapter 10) is a table used in Cecil County for estimating the water needs of an array of non-residential uses. As specific uses are proposed in the future, the table should be used as part of a water supply capacity management system to track the impacts of new economic growth on available supply.

2008 Water Service Area Maps

The Master Water Plan on the following page (Figure 6) shows the service areas in and around North East. The Map includes the boundary of the Town's Growth Area. Nearly 100 percent of the Growth Area has public water, or is planned for water.

Conclusion

Ensuring an adequate supply of water for growth should not present difficult technical or regulatory obstacles, or higher than ordinary costs. Additional supply can be accommodated through continued improvements to the Town's two Water Treatment Plants and by using groundwater as a supplemental source. The Northeast River Wastewater Treatment Plant (and not the water plant) is the major constraint on growth

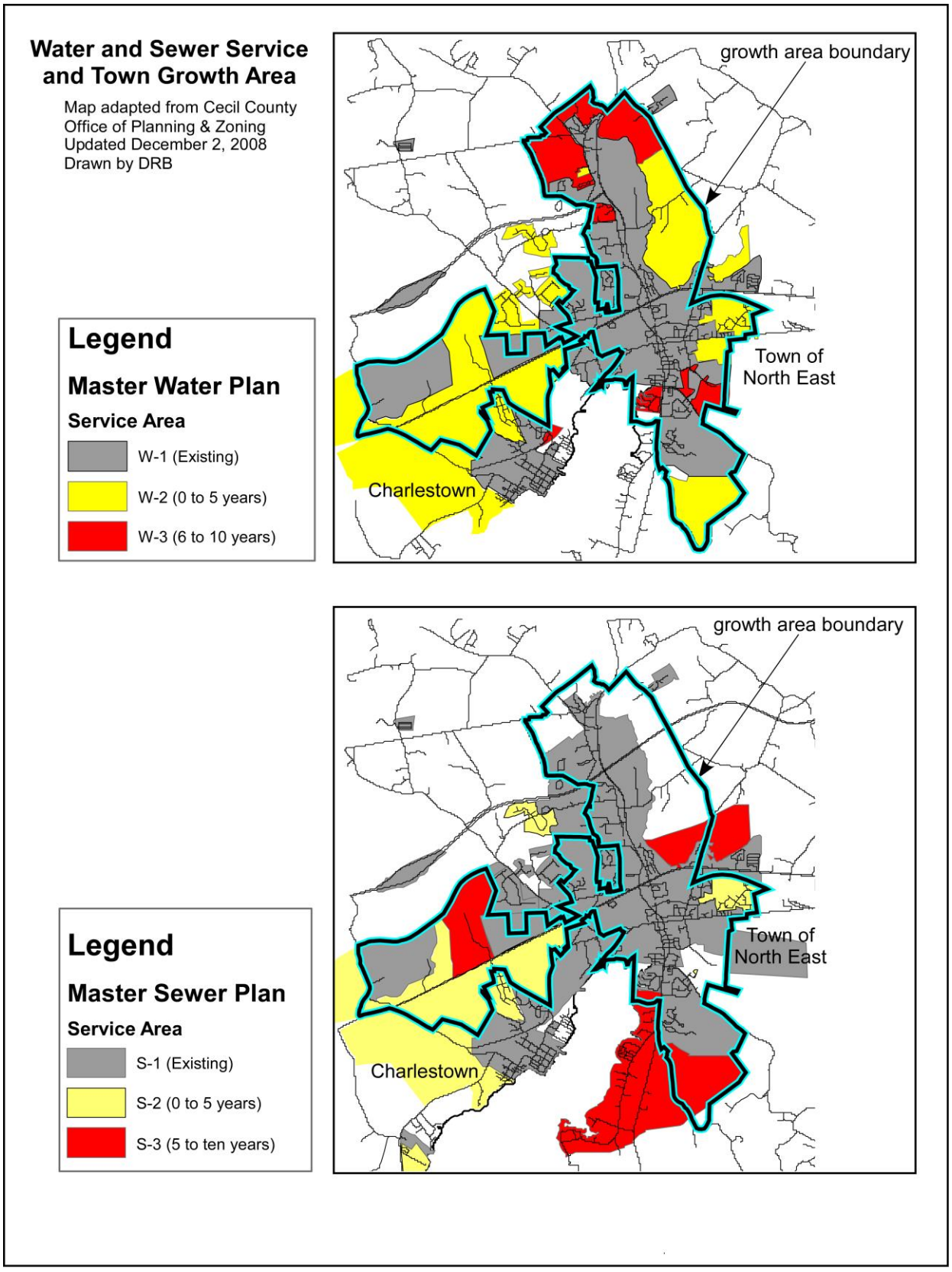

Water and Sewer Service and Town Growth Area
Map adapted from Cecil County Office of Planning & Zoning
Updated December 2, 2008
Drawn by DRB
growth area boundary
Town of North East
Charlestown
Legend
Master Water Plan
Service Area
W-1 (Existing)
W-2 (0 to 5 years)
W-3 (6 to 10 years)
growth area boundary
Town of North East
Charlestown
Legend
Master Sewer Plan
Service Area
S-1 (Existing)
S-2 (0 to 5 years)
S-3 (5 to ten years)

Figure 6

Water Quality

North East is wholly contained within the Northeast River watershed; the River receives pollution discharges from both point and non-point sources in the Town. Point sources, primarily the Town's wastewater treatment plant, are controlled by State permits. Non-point source impacts are not controlled directly via permit, but rather are a consequence of how land is used and how stormwater runoff is managed. North East has experience with water quality issues under its Chesapeake Bay Critical Area Program, where water quality plays a heightened role in the Town's decision-making.

Point Source Discharge to Northeast River

The Northeast River Advanced Wastewater Treatment Plant (WWTP) located at Seneca Point (just south of Charlestown) serves the Town of North East and most of the Town's Growth Area. The WWTP also serves the Town of Charlestown and areas in Cecil County proximate to North East (the I95 Rest Stop, several neighborhoods, institutions, industrial parks, and a shopping center).

Recent and Planned Improvements

In 2005, the County completed an upgrade of the WWTP for biological nutrient removal (BNR). As of 2009, the County is in the process of planning design modifications to improve the plant to meet enhanced nutrient removal (ENR) standards. This action, alone, would only increase maximum design (and permitted) capacity from the present 2.0MGD to 2.67MGD. Most important, the WWTP will still be grossly inadequate to handle planned County and municipal growth. A 2007 study by George, Miles and Buhr determined that the WWTP should be sized to handle 9.1MGD.

The WWTP's expansion is limited by an MDE-issued nutrient allocation (a cap) of 24,364 pounds per year of total nitrogen (TN), and 1,827 pounds per year of total phosphorous (TP). This is equal to operation at 4.0 mg/L of TN and 0.3 mg/L of TP.

In order to expand beyond the technical cap limit of 2.67MGD, the County plans to use a comprehensive program of credits and other mitigating actions that will require approval by MDE (see County Master Water and Sewer Plan, as amended April 7, 2009, p. 4-8). As planned, the County proposes to expand the WWTP in four phases up to a maximum of 9.1MGD, while maintaining the nutrient cap:

Phase One: from 2.0 to 3.7MGD
Phase Two: increase to 5.0MGD
Phase Three: increase to 7.5MGD
Phase Four: increase to 9.1MGD

The WWTP is planned to operate at 4.0 mg/L of TN and 0.3 mg/L of TP (note: this is below the nutrient cap for TP). Demand will trigger implementation of phases two through four. Design is expected to be completed in 2009 and construction of phase one completed by 2012.

WWTP Demand

In 2006, the WWTP was treating approximately .930MGD, which was already about one-third higher than the need projected by the State for the year 2020. Concern about capacity led Cecil County to adopt a resolution in 2006 that reserves .279MGD for residential growth and .120MGD for non-residential growth. As of 2008, the plant was treating about 1MGD of wastewater. It is estimated that current and allocated flows are at 1.6MGD, leaving about 400 to 500 gallons per day of treatment capacity.

Official studies prepared by, or for, Cecil County in recent years suggest that sewerage treatment capacity is a key constraint on growth; that absence of adequate sewer will result in lost economic opportunities, sprawl development in the rural environs, and greater environmental harm. See, for example: the County Growth Study, Sage Group (2007); BRAC Report (2007); and the Cecil County State of the County Report (2007).

Figure 6 shows areas of existing and planned sewer within the Town's Growth Area. Those areas without sewer (primarily at the north end, and two small areas at the south), are designated as Tier Two areas under the Town's Municipal Growth element.

The projected sewer demand for the Town and its Growth Area are summarized in the tables below:

- Table 8 presents data for the Town using the MDP high development pressure scenario. It shows that the Town will require more wastewater treatment than available before the year 2015, and this assumes that the Town is given all of the remaining allocation of .4MGD (which is unlikely). (For example, Charlestown is projecting sewer needs on the order of .16MGD by 2015.)
- Table 9 is based on land area within the Town's Growth Area.
- Table 10 summarizes the total demand for sewer from implementing the North East Comprehensive Plan including the Growth Area Map. It also shows the combined demands of the Towns of North East and Charlestown and of their respective Growth Areas.

Table 8

Projected Sewer Demand for the Town of North East Based on Population Projections						
	2000	2010	2015	2020	2025	2030
Population[1]	2,747	3,566	4,246	5,030	5,942	6,969
Households	1,081	1,431	1,733	2,072	2,463	2,904
Nonresidential Sewer demand	n/a	38,940	47,080	56,320	67,100	78,760
Residential Sewer Use (GPD)[2]	237,820	314,820	381,260	455,840	541,860	638,880
Total demand	n/a	353,760	428,340	512,160	608,960	717,640
% of permitted capacity[3]	n/a	18	21	26	30	36
% of avail. Sewer[4]	n/a	88	[107] capacity exceeded	[128]	[152]	[179]
% capacity: Phase 1 Upgrade[5]	n/a	n/a	12	14	16	19

[1]Projections are based on MDP high development pressure scenario
[2]Assumes per household use of 220GPD
[3]Assumes WWTP is at 2.0MGD
[4]Assumes .4MGD available without competition from other jurisdictions
[5]Assumes WWTP is upgraded, and credits permitted, to handle 3.7MGD by 2012

Table 9

Projected Sewer Demand for the North East Growth Area Based on Households and Net Acres for Development[1]			
Land Use	Households (Residential) Acres (Commercial, Industrial)	Sewer Needed (gallons per day)	
All Planned Residential (Tiers 1 and 2)	4,080 households	897,600	
Tier 1 Planned Residential (20 year horizon)	2,377 households	522,940	
Commercial, Industrial (Planned Economic Growth)	1,655 net acres	1,655,000	
Cecil County Urban Growth Boundary site (Econ. Growth)[2]	224 net acres	224,000	
			% Phase 1 upgrade[3]
TOTAL (includes Tier 1 and 2)		2,776,600	75
TOTAL (includes Tier 1 only)		2,401,940	65

[1]Assumes 220 GPD per household and 1,000 GPD per net acre for commercial and industrial.
[2]Cecil Co. UGB Study, 2002 amendment, reports a total of 1700 acres in this site, but that figure appears to be a typo error. The total area measures to be 350 acres, of which 298 acres are outside the Town growth area. This area yields 224 net acres for development and represents an additional source of future demand for wastewater treatment.
[3]Assumes WWTP is upgraded to 3.7MGD under Phase 1 of the County's Water and Sewer Plan by 2012.

Table 10

Total 2030 Sewer Needs for the Town and the Growth Area[1]: 1) Constant and High Pressure Population Growth Scenarios and 2) Growth Area Map (Tiers One and Two) (gallons per day)			
Need Based on Pop Growth	Constant Growth	High Development Pressure	
Total	448,064	717,860	
Need Based on Land Area			
Growth Area – Tier One	2,401,940		
Growth Area – Tier Two	374,660		
Town Infill	165,220		
Usage in 2009	612,000		
Total	3,553,820		
Total (without Tier Two)	3,179,160		
		GPD	% Phase 1 upgrade
Towns of North East and Charlestown: Projected demand for both Towns and Growth Areas[2]	North East	3,179,160	86
	Charlestown	755,000	20
	TOTALS	3,934,160	[106] exceeds capacity

[1]Assumes 220 GPD/Household and 1000 GPD/Net Acre of Commercial and Industrial

[2]Based on Charlestown Water Resources Element, Scenario 1, and North East MGE Tier One and assumes WWTP is upgraded to 3.7MGD under Phase 1 of the County's Water and Sewer Plan by 2012.

Based on Population Growth

Based on the 2030 population projections, the Town needs .448MGD of sewer for growth at the constant rate, and .718MGD of sewer for growth under the high development pressure scenario. The Northeast River Advanced WWTP should have adequate capacity under its phased upgrades of the plant, which will be triggered by demand and planned for a maximum of 9.1MGD. The County controls the allocation of treatment capacity, thus there are no concrete assurances as to how the WWTP will be shared between the County and the Towns of North East and Charlestown. However, based on mutual Town and County planning goals for growth and annexation (see the Municipal Growth element), it is reasonable to expect County support for the Town's Tier One Growth Area.

Based on Land Area

The land for development in the Town Growth Area (Tiers One and Two), new infill development, and current Town needs, require 3.6MGD of sewer. Without Tier Two, 3.2MGD of sewer are needed. The County's Phase One upgrade of the WWTP will handle 3.7MGD of treatment, but demands will also come from Charlestown and the County.

Table 10 indicates that within the 20 year time frame of the plans for North East and Charlestown, the Phase 1 upgrade will be exceeded. Thus, additional phased upgrades (as already planned) will be needed.

Except for the County's North East Urban Growth Boundary, the assessment does not account for growth on sewers in the County. The Towns of North East and Charlestown now use about 22 percent and 6 percent, respectively, of the WWTP capacity, and the remainder is used in the County.

However, it is not reasonable to assume that North East's current 22 percent share is a useful guide for the future; the Town's plan is for territorial growth and the annexation process will change the arithmetic significantly. All existing and planned sewer (as of 2009) consists of 9,657 acres. Land in the Town and the Growth Area, amounts to 78 percent of the acreage of all existing and planned service. (Note: this 78 percent is the same land designated as Tier One on the Town's Growth Area Map.) Therefore, it is clear that in the future the Town will be using a larger share of the sewer system.

Importantly, the County plans to move from Phase 1 to subsequent phases based on demand, thus the planning process is set up to change the Town's allocation as growth and development occur. The following discusses the implications of the Phase 1 upgrade (to 3.7MGD) in the context of the Town's plans for growth.

Phase One Upgrade to 3.7 MGD

Under the Phase 1 WWTP upgrade, North East would be allocated .814MGD out of a total 3.7MGD (22 percent, based on current trend). This amount would be adequate to serve population growth in Town to the year 2030 under the High Development Pressure Scenario. However, the remaining allocation (about .1MGD) would permit only about 100 acres of industrial and commercial growth within the Growth Area. This is about 6 percent of all planned economic growth in the Growth Area.

If the Town grows at a constant rate (trend growth), about .448MGD would be needed by 2030 and this would leave capacity for about 336 net acres of economic growth (about 22 percent of planned economic growth in the Growth Area).

In order to ensure adequate sewer capacity for North East, the County would have to advance to Phase 2 well before 2015. By 2015, the Town's population plus one-fourth of growth area (2015 represents one-fourth of the planning period to 2030) would need 1.2MGD of capacity (in excess of the Town's theoretical .814MGD share).

Full Upgrade to 9.1 MGD

Assuming the County is successful at implementing the full expansion of the WWTP to 9.1MGD, the North East Comprehensive Plan for the Town and Growth Area will ultimately use about 34 percent of the treatment capacity.

Tables 11 and 12 have been added to this element to provide additional information regarding available land use data for the Growth Area (Tier 1) and the Town of North East. Residential, commercial, and industrial land uses are already developed parcels that are served by a mix of onsite disposal systems and public sewers. Accordingly, forest and agricultural lands are considered to represent the primary development potential and the primary source of demand for sewage treatment capacity at the Seneca Point Wastewater Treatment Plant.

Table 11 [Added 4/28/10 by Resolution 2010-04-02]

North East Town and Growth Area Development Potential Summary							
Growth Area (tier 1)				**Town of North East**			
Land Use[1]	Acres	Development Potential (DU)[2]	WWTP gal./day	Land Use	Acres	Development Potential (DU)	WWTP gal./day
Agriculture	837	2,930	644,600	Agriculture	51	178[3]	39,270
Barren	20			Barren	0		
Commercial	148			Commercial	59		
Forest	2,447[4]	n/a	2,447,000	Forest	530	1,855[3]	408,100
High Residential	11			High Residential	22		
Med. Residential	376			Med. Residential	210		
Low Residential	611			Low Residential	158		
Industrial	112			Industrial	107		
Institutional	143			Institutional	21		
Other	247			Other	8		
Open water	0			Open water	27		
total	**4,952**			**total**	**1,193**		

[1]Land use land cover calculations based on MDP 2002 LULC data set (as utilized by Cecil County in its analysis of the watershed)

[2]Dwelling Units (one per household) assumes Priority Funding Area (PFA) density is achievable on agricultural parcels that will be developed

[3]Assumes an average density of 3.5 du/ac (per PFA standard)

[4]Nearly all forest land within the Growth Area is in areas planned for nonresidential mixed use employment development

Table 12 [Added 4/28/10 by Resolution 2010-04-02]

GIS Analysis of DAT 2007 parcel data[10]						
Vacant Residential[5] (buildable)	2,102	9,459[6]	2,080,980[7]	323[8]	1,453[9]	319,770
Vacant Commercial Industrial (buildable)	503	unknown	503,000 (est. 1000 gal/ac)	194	unknown	194,000 (est. 1000 gal/ac)
Vacant Sewered Agriculture[11]	215	752	165,440			
Vacant Sewered Forest	1,571	n/a	1,571,000 (est.1000 gal/ac)			
Vacant parcels classified "residential" by DAT may be mapped "forested" LULC(from photointerpretation)						
Agricultural land is assumed to have a base development potential equal to PFA status of 3.5 du/ac (if annexed)						

[5]2007 Department of Assessment and Taxation records

[6]Based on average net yield for PRD of 4.5 du/acre (8 du/ac – 30% open space requirement + 10% for roads)

[7]assume 220 gpd/du

[8]Acreage total subsumed within Agricultural and Forested LULC

[9]based on actual individual lots and zoning and assumes nonconforming lots can receive development approval from Board of Appeals

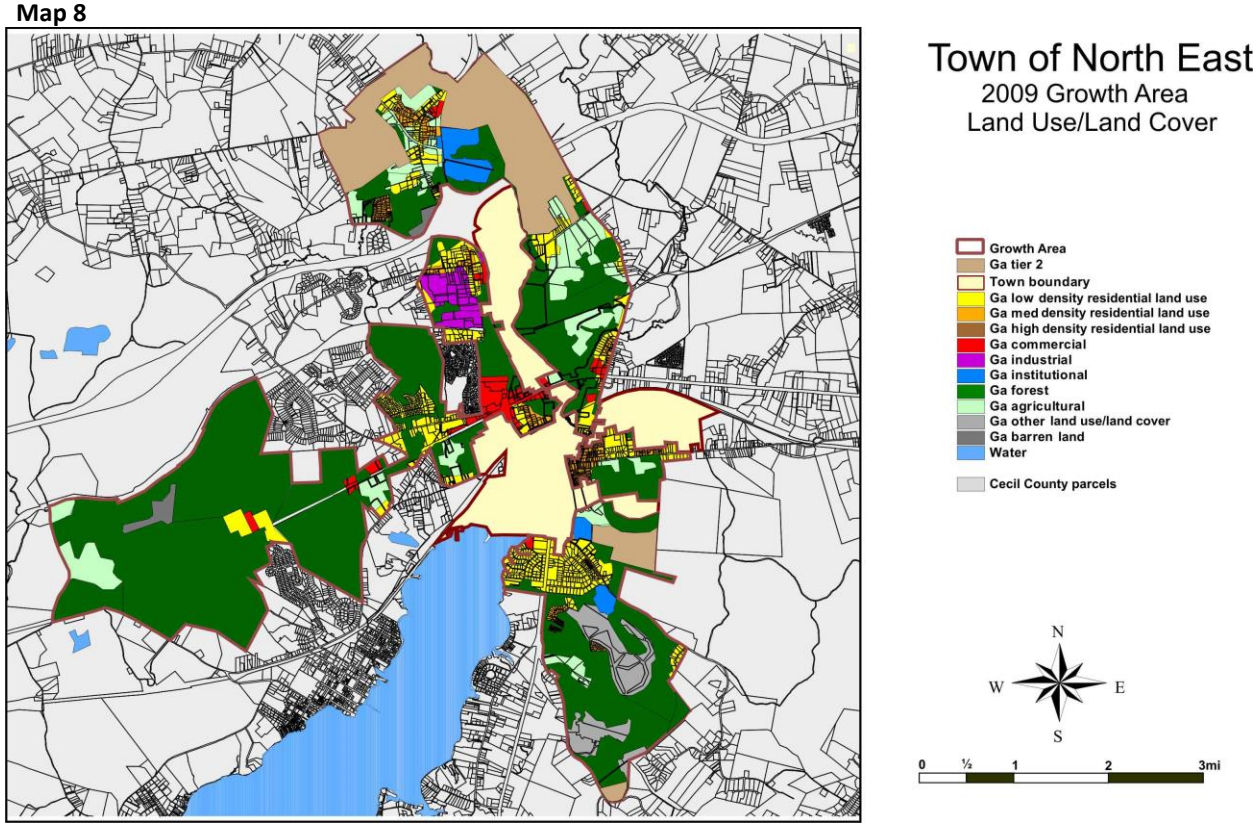
[10]Large parcel boundaries extend beyond limits of designated Growth Area

[11]Assumed (based on location and adjacent development patterns) that sewered vacant agricultural land will be a development priority and will reduce pressure on vacant "residential" lands

On Site Disposal Systems (OSDS) [Added 4/28/10 by Resolution 2010-04-02]

A study conducted for the Seneca Point WWTP found that there were approximately 1,690 septic systems in the WWTP's service boundary[1]. Septic system loads can be estimated using the formula: 9.5 lbs. of N per person per year times the average household size times a soil transport factor of 0.4 yields an average annual load of 9.386 lbs. of nitrogen per year per system resulting in a service area load 15,862 lbs. per year. Table 6.8 in the draft 2010 Cecil County Comprehensive Plan presents a 42,183 lbs. nitrogen loading for the Northeast River watershed. That suggests an additional 2,800 septic systems in the watershed beyond the North East Growth Area. The Town will cooperate with Cecil County in efforts to limit and minimize OSDS impacts both within the Growth Area and within the watershed.

Map 8



GIS analysis of DAT 2007 records was reconciled with 2002 land us land cover data mapped by the Maryland Department of Planning. This analysis is summarized in the following table: North East Town and Growth Area Development Potential Summary

1 Source: Northeast Advanced Wastewater Treatment Plant Feasibility Study, 2008

Non-Point Sources: Stormwater Runoff

Non-point source pollution involves the pollutants that wash off the land and into the Northeast River and its Creeks. The watershed contains 40,400 acres, with an estimated 2010 population of 23,601 (Cecil County). Nearly 49 percent of the watershed is forested and nearly 31 percent is agriculture. Residential development is about 20 percent, with 85 percent of that acreage consisting of either low density or very low density development (sprawl growth on septic systems).

The Town of North East makes up only three percent of the watershed while accommodating nearly 15 percent of the watershed's population on public water and sewer. The Town's Growth Area (7,061 acres outside the Town limits) amounts to an additional 17 percent of the watershed. See map below of the Watershed, 2007 Land Use, and North East Growth Area boundaries (see also Municipal Growth element).

At the State level, goals for reducing non-point pollution are primarily established by the Department of Natural Resources (the Tributary Strategies) and MDE (TMDLs: total maximum daily loads). There are also programs designed:

- to protect the designated use classification of water (e.g., shellfish harvesting, swimming, drinking supply, and so on),
- to prevent the degradation of waters down to minimum quality standards,
- to protect Critical Area and Forest Conservation stream buffers, and
- to protect source water supplies and wellheads

Estimating Non-Point Pollution

There are two basic methods for estimating the non-point impacts of land use and land use change. One method consists of a set of equations that use impervious surface, rainfall, and pollutant concentrations to estimate pollutant loadings. The second method relies on land use acreages and corresponding land use coefficients as developed by the State and the EPA's Chesapeake Bay program.

The Town tried both methods for estimating stormwater pollutant loadings. The "impervious surface/rainfall" approach was selected for the Water Resources element. The "land use/pollutant coefficient" method was found to produce improbable results (for example, achieving MDE's TMDL literally required forestation of most of the watershed). This second method, however, is useful for understanding the dynamics involved when land changes (for example) from agriculture-to-urban, or from forest-to-agriculture.

Table 13 summarizes the non-point impacts of existing conditions for the Town of North East and for the Town's Growth Area for total nitrogen, total phosphorous, and sediment. The results of both estimation methods are included for information, but the impervious surface equations are the results used as a basis for the Water Resources element.

Table 14 summarizes the non-point impacts of post-growth and development conditions for the Town of North East and for the Town's Growth Area for total nitrogen, total phosphorous, and sediment. Again, the results of both estimation methods are included for information, but the impervious surface equations are used as a basis for the Water Resource element.

Impervious Surface/Rainfall Equation

This method involves three equations:
Step 1: determine the watershed's runoff coefficient
Step 2: use the coefficient, the annual inches of rainfall, and the runoff probability factor (0.9), to determine the annual runoff
Step 3: use the annual runoff, pollutant concentration, acreage, and a metric conversion factor to determine the annual load of TN and TP

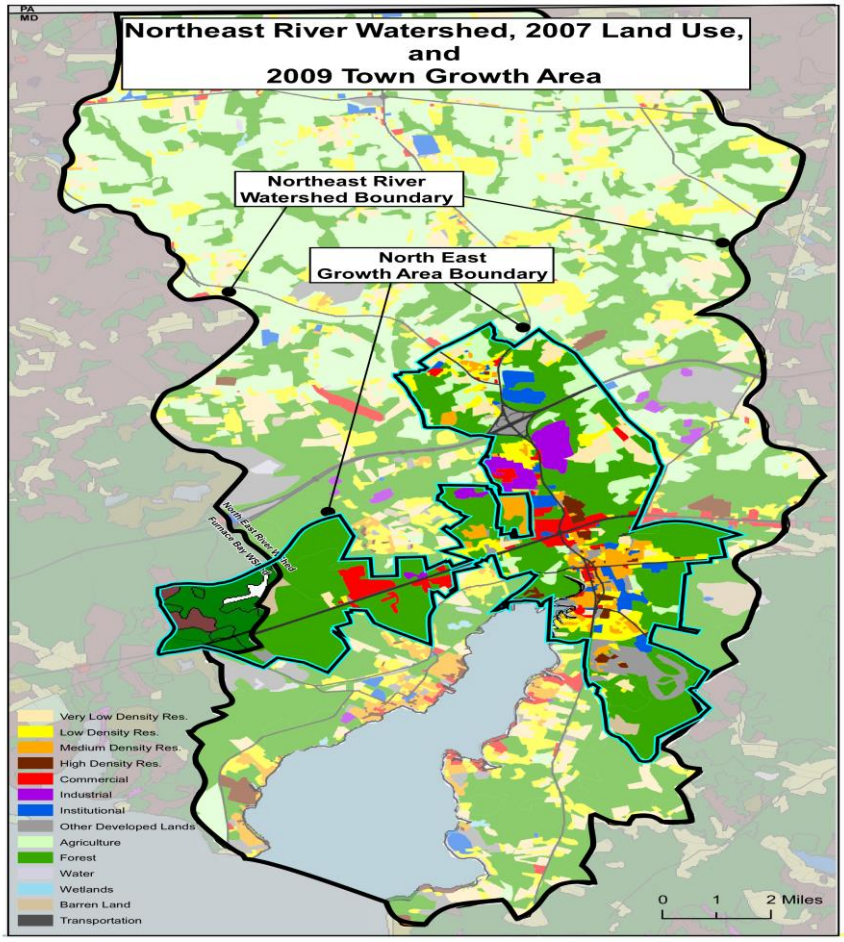


Figure 7

The equations were used to estimate pollutant loads for existing conditions and for post-growth and development conditions. Certain assumptions were made in assigning future land use. Basically 55 percent of agricultural and forest land (45 percent is saved for environmental and open space needs) is allocated to the following future land uses: 44 percent used for residential, 26 percent used for commercial, and 26 percent is used for industrial.

Land Use Coefficient Method

This method involves the land use loading coefficients developed by the Tributary Strategies (2006 data), and the acres of land use in the Town of Growth area (pre- and post-development). Future land use was assigned as described in the above paragraph.

Conclusions of the Impervious Surface Method

- Existing Conditions – Town of North East:
    - For Total Nitrogen, the Town produces about 419 pounds per month. This is about 7 percent of the non-point TMDL (6229 pounds per month)
    - For Total Phosphorous, the Town produces about 54 pounds per month. This is about 17 percent of the non-point TMDL (314 pounds per month)

- Existing Conditions – Town and Growth Area
    - For Total Nitrogen, the area produces about 2502 pounds per month. This is about 40 percent of the non-point TMDL (6229 pounds per month)
    - For Total Phosphorous, the area produces about 325 pounds per month. This is about 104 percent of the non-point TMDL (314 pounds per month).

- Post Growth and Development – Town of North East:
    - For Total Nitrogen, the Town produces about 567 pounds per month. This is about 9 percent of the non-point TMDL (6229 pounds per month)
    - For Total Phosphorous, the Town produces about 74 pounds per month. This is about 23 percent of the non-point TMDL (314 pounds per month)

- Post Growth and Development – Town and Growth Area
    - For Total Nitrogen, the area produces about 3212 pounds per month. This is about 52 percent of the non-point TMDL (6229 pounds per month)
    - For Total Phosphorous, the area produces about 418 pounds per month. This is about 133 percent of the non-point TMDL (314 pounds per month)

As the major Town and Growth Area within the watershed, comprising 20 percent of the watershed, the Town of North East can reasonably claim a large share of the TMDL. Based on the above results, the Town can fully develop within today's corporate limits (through infill and redevelopment) and produce a very low 9 percent of the TMDL for nitrogen, and a low 23 percent of the TMDL for phosphorous.

The non-point problem is primarily with the Growth Area, where a large of amount of forest will be used for growth. This land use change will have a high impact on non-point phosphorous and nitrogen loadings in the watershed. Still, with full development in the Town and its Growth Area, the nitrogen loads will be only 52 percent of the TMDL. Phosphorous, on the other hand, will rise to 133 percent of the TMDL.

This suggests a two-fold strategy for the Town to achieve water quality goals in the Growth Area:

1) Encourage preservation of as much forest as possible. For residential development, higher net densities can result in significant forest retention on each development site. For commercial and industrial uses, a program for reforestation within the watershed (or for payment of fees for tree planting) could be used to offset loss of forest land on developing sites. Site design could also be used to save on-site trees.

2) Maximize efforts to control sediment during and after construction, and follow through with timely inspection and enforcement actions. Since most phosphorous enters the waterways attached to sediment, sediment controls will help minimize phosphorous loadings.

Urban best management practices include a variety of methods for controlling non-point sources of pollution. The success of preventing runoff pollutants from entering waterways depends on selecting the right practice, making sure it is properly constructed in the proper location, and following up with maintenance over the long term. Controls for sediment and phosphorous can be very effective. Up to 100 percent of suspended solids and 30 to 80 percent of phosphorous can be eliminated, depending on specific circumstances.

A program for requiring state-of-the-art BMPs for new development on forested sites may be able to bring development of the Growth Area within the limits of the TMDL for phosphorous. If a 50 percent reduction is achieved, the post-development phosphorous loadings for the Town and Growth Area will fall to about 67 percent of the TMDL.

Table 13, Non-Point Nutrient Loading, provides non-point nutrient load summaries for total nitrogen and total phosphorus for the Northeast River watershed, the Growth Area, and the Town of North East.

Table 13 [Added 4/28/10 by Resolution 2010-04-02]

Non Point Nutrient Loading[1]						
Total Nitrogen					Nonpoint TMDL	
2009	Septic	nonpoint	TN total	TP	TN	TP
[2]Watershed	42,183	412,346	454,529	32,841	74,749	3,763
Growth Area	15,862	37,991	53,853	4,015		
North East	0	7,477	7,477	917		
GA + NE	15,862	45,468	61,330	4,932	74,749	3,763
2030 Projected Non point Nutrient Loading						
Watershed	33,298	261,600	294,898	23,421		
Growth Area	0[3]	35,592	35,592	3,899		
North East	0	7,511	7,511	1,003		
GA + NE	0	43,103	43,103	4,902	74,749	3,763

1 all loads in lbs/yr

2 figures are from 2010 Cecil County Draft Comprehensive Plan reflecting 2007 data

3 The Growth Area is scheduled for sewer service and existing OSDS will be retired achieving net gains in nonpoint loads

Table 14, Seneca Point WWTP Loads, provides point source nutrient loading summaries at the Seneca Point Wastewater Treatment Plant for total nitrogen and total phosphorus for the Growth Area, the Town of North East, and a combined total. A combined point and non-point load summary is also provided.

Table 14 [Added 4/28/10 by Resolution 2010-04-02]

Seneca Point WWTP Loads (operating at ENR levels 11 out of 12 months, 2009)[1]								
2009 Demand	Existing Nutrient load (lbs/yr)		Nutrient Load Cap[2] (lbs/yr)		2030 North East Demand (lbs/yr)		2030 Growth Area Demand (lbs/yr)	
MGD	TN	TP	TN	TP	TN	TP	TN	TP
0.95[1]	7,106[3]	1,329	24,364	1,827				
0.95	7,057[4]	1,336						
2.58[5]							19,084	3,613
1.57[6]							11,613	2,198
0.32					2,365	448		
Total	7,057	1,336			2,365	448	30,697[5,6]	5,811[5,6]
2030 Theoretical Summary								
5.42	40,119	7,595	These loads reflect theoretical maximum loads					
Loads based on Table 7 from MGE (planned loads)								
2010 total demand					2030 total demand			
353,760 gpd					717,640 gpd			
TN (lbs/yr)		TP (lbs/yr)			TN (lbs/yr)		TP (lbs/yr)	
2,611		494			5,303		1,004	
Combined Point and Nonpoint Loads 2030								
		Point Loads		Nonpoint Loads		TMDL cap for watershed		
		TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	
North East		5,303	1,004	7,511	1,003			
Growth Area		30,697	5,811	35,592	3,899			
Total		36,000	6,815	43,103	4,902	74,749	3,763	

1 Source: Cecil County Department of Public Works; CBP data reports two year average flows of 0.954 mgd for 2006 – 2007 (available data)
2 Tributary Strategy Point Source Cap for major facilities
3 Nutrient loads actual "end-of-pipe" loads (sampled)
4 Nutrient loads calculated by formula
5 Based on Theoretical Demand from all vacant residential lands plus all vacant commercial and industrial lands
6 Based on mixed use employment development on all Forested land

Suitable Receiving Waters [Added 4/28/10 by Resolution 2010-04-02]

The Northeast River is the only option for North East as a "receiving water" body. All non-point flows that are not infiltrated eventually reach the Chesapeake Bay via the North East River. MDE has established TMDL caps for nitrogen and phosphorous that analysis has shown will not be exceeded in the near term. The "near term" includes the next six-year interval until the North East Comprehensive Plan is required to be updated. The WRE will be updated at that time with information provided by MDE and Cecil County. If any material issues or concerns affect this finding of "suitability," appropriate changes will be made at that time.

Based on the WWTP's current actual level of performance, e.g. ENR[1], available capacity shown on the point source load table[2], and County plans to secure a new permit that is written for greater capacity it is anticipated that even over the long term, the North East River will be a suitable receiving water for point source discharges. County efforts at nutrient trading will also play a role in that discussion [over which the Town has no direct control]. However, the Town will be a partner with Cecil County and MDE in finding appropriate workable solutions.

The nonpoint phosphorus loadings, especially for the watershed, suggest a greater problem for "suitability." Clearly, steps will need to be taken to reduce nonpoint source loadings. Changes to stormwater management regulations and practices will need to be carefully monitored, and a watershed-based strategy for enhanced nonpoint control may need to be developed. Such an effort will also require a partnership among all affected jurisdictions.

1 Cecil County Department of Public Works, CBP data
2 Northeast Advanced Wastewater Treatment Plant Feasibility Study 2008

Source Water Protection [Added 4/28/10 by Resolution 2010-04-02]

In June 2005, the Maryland Department of Environment prepared a Source Water Assessment (SWA) study as mandated by the Safe Drinking Water Act. The study was conducted for the Northeast Creek [which supplies water to two water treatment plants that served about 5,200 people in and around the Town of North East].

Northeast Creek and its tributary Little Northeast Creek flows south and east forming the Northeast River. The intake structure for the Leslie Water Treatment Plant withdraws water from Northeast Creek upstream of the confluence with Little Northeast Creek. Water is pumped to a 1 million gallon raw water reservoir and then flows by gravity to the Leslie Water Treatment Plant. The intake structure for the Rolling Mill Treatment Plant is downstream of the confluence of the Little Northeast Creek and Northeast Creek. A third intake has been completed for the tidal area of Northeast River near the Town Park on Walnut Street.

The source water protection area for the Town of North East's intakes encompasses approximately 46 square miles (29,804 acres) of mixed land use with over 60% of cropland and pasture. Approximately 20% of the watershed extends into Pennsylvania.

Potential sources of contamination include point and non point sources, including transportation, agriculture, on-site septic systems and runoff from developed areas. Non point sources (agricultural and urban runoff) are the largest sources of contaminants in the watershed. There are several minor municipal and industrial discharges in Pennsylvania, and a quarry and a superfund remediation site at the Mechanic Valley Trade Center in Maryland's portion of the source water assessment area. Cecil County landfill (Hog Hill) is also located within the watershed of the backup intake in the tidal portion of Northeast River. The relatively low percentage of forested land within the watershed (about 30%) and continued forest loss to development present treatment and management challenges for producing safe water.

Turbidity, nutrient enrichment, and algal blooms are issues of primary concern. High turbidity levels are associated with erosion and transport of sediment during storm flows. The network of major roads (I-95 and Route 40) and rail lines in close proximity to the Town's intakes put this water supply at significant risk to impacts from potential hazardous materials spills[3].

North East recognizes these concerns and has been working cooperatively with State, County and private parties to implement a comprehensive set of protection policies that incorporate and build upon many of the policies and regulations that are already in place. Stream buffers, steep slope buffers, non-tidal wetland buffers and the Chesapeake Bay Critical Area mandated buffers all address and restrict land use activities that could have negative impacts on the Town's water supply sources.

3 Much of the language and many of the facts included in this section were paraphrased from the draft 2010 Cecil County Comprehensive Plan's Water Resources Element.

Recommendations for Source Water Protection [Added 4/28/10 by Resolution 2010-04-02]

- The Town of North East should take a lead role in forming a local watershed planning team to develop and implement strategies to protect Northeast Creek as a drinking water source.
- A formal or informal agreement should be developed to engage officials from jurisdictions in Maryland and Pennsylvania on an ongoing basis.
- Encourage broad stakeholder participation, including soil conservation districts, County Planning and Zoning, transportation officials, community associations, chambers of commerce and other business organizations, the Cecil County farm bureau and individual farmers and environmental groups.
- Establish clear and achievable goals, objectives and milestones to ensure the highest quality raw water.

- A well thought out plan for being notified of hazardous material spills, and strategy for responding is critical to ensuring safe water for the Town of North East.
- Erect road signs in strategic locations to alert the public that they are entering a drinking water watershed.
- Continue monitoring for fecal coliform and E.coli in raw water.
- Increase monitoring of nutrient loads in raw water.
- Create a body responsible for periodic field surveys of the watershed to ensure there are no new sources of contaminants.
- The Cecil County Soil Conservation District and Pennsylvania Districts should continue to develop projects to reduce pathogens and nutrients from animal waste from entering upstream tributaries. Stream fencing and establishing forested riparian buffers are particularly helpful.
- The soil and erosion control and stormwater management regulations and practices in the Pennsylvania Townships within the watershed should be reviewed and compared with Maryland's standards.
- The Town should work closely with the County's Technical Advisory Group [to encourage the application of progressive stormwater management practices to reduce future impacts (erosion and sediment transport, temperature impacts and oils, other contaminants, salts from road runoff) and runoff from new development.

Existing Measures [Added 4/28/10 by Resolution 2010-04-02]

A Town/County emergency response plan is in place that includes the Town's water company, Severn Trent. It details actions to be taken in the event of different emergencies. That plan is subject to further review and refinement.

Water Resource Goals and Objectives

Water Supply

Goals:

- The Town will provide an adequate supply and a good quality of water for existing and planned development, consistent with the Comprehensive Land Use Plan and with the State's goals and programs for water resources.
- The Town will implement measures to avoid or minimize risks associated with potential contamination or degradation of water sources from the surface.

Objectives:

- The Town will provide and maintain infrastructure including a system of raw water impoundments, filtration plants, pumps, underground and elevated tanks, distribution lines, and other components for water treatment, storage, and delivery.
- The Town will continue to monitor water usage to periodically assess the adequacy of water supply, and will continue to make individual and cumulative assessments about the resource demands and impacts associated with development projects.
- The Town will encourage Cecil County to protect water quality of the streams that the Town depends upon for raw water supply. This includes implementation of the County's plans for rural conservation and preservation, and reforestation. The Town recommends that the County implement the use of 200-foot buffers along stream edges, and require reductions in impervious surfaces for future development.
- The Town will consider new study results from USGS, MDE, and other sources as part of the State-mandated six year Plan review process, and make adjustments and recommend actions, as appropriate.
- The Town will adopt a Water Supply Capacity Management Plan, using MDE's model as input.

Water Quality

Goals:

- The Town will strive to achieve MDE's TMDL for point and non-point sources in the Northeast River watershed.
- The Town will minimize the adverse impacts of development and growth in the watershed and the larger Eastern Shore Basin.

- The Town will require that developers identify and map wetland areas on-site and in adjacent areas using the following sources:
    - National wetlands Inventory
    - DNR wetland data layers (GIS)
    - MDE's associated priority preservation and restoration areas
    - Hydric soils maps
    - 100 year floodplain maps

- The Town will require the use of Best Management Practices (BMPs) for development on infill parcels and in growth areas. BMP's that are effective in phosphorous, nitrogen, and sediment removal will be required. BMPs include, but are not limited to, low impact design, stream setbacks, tree plantings, creation of natural areas around streams and wetlands, minimized impervious surface, avoidance of sensitive areas, and stormwater management.
- The Town will require that impervious surfaces be minimized insofar as possible, consistent with the type of land use planned and zoned. High levels of impervious surface will be offset with suitable plantings and large setbacks, especially around associated streams and wetlands.
- The Town will continue implementation of its Critical Area Program, and will require superior BMPs, including 200 foot stream buffers, for future development using growth.
- The Town will use the Tributary Strategy as a guide for planning and as a consideration in decision-making.
- The Town will consider new study results from USGS, MDE, and other sources as part of the State-mandated six year Plan review process, and make adjustments and recommend actions, as appropriate.
- The Town will identify, as part of the on-going planning process, potential sites for wetland and stream mitigation that can be used to mitigate impacts of capital projects where impact avoidance is not possible.
- The Town will update the Water Resources Element to incorporate new TMDLs.
- The Town will adopt a Wastewater Capacity Management Plan, using MDE's model as input.

Appendix to the Water Resource Element:

[Added 4/28/10 by Resolution 2010-04-02]

EXHIBIT A: *EXISTING CONDITIONS: Estimated Water Quality Impacts for the Town and the Growth Area*

METHOD ONE: IMPERVIOUS SURFACE/RAINFALL EQUATION (L=.226*R*C*A)

Impervious Surface Estimates: Town of North East and Growth Area (Stormwater Management)

Land Use	Acres in Town	Acres in Growth Area	Town and Growth Area	Mean Imprevious Surface (%)	Impervious Ac - Town	Impervious Ac - GroArea	Impervious Ac Town+GroArea
Agriculture	58	518	576	2	1.16	10.36	11.52
Very Low Density Res	4	337	341	14	0.56	47.18	47.74
Low Density Res	33	510	543	21	6.93	107.1	114.03
Medium Density Res	105	274	379	28	29.4	76.72	106.12
High Density Res	68	50	118	33	22.44	16.5	38.94
Commercial	26	350	376	70	18.2	245	263.2
Industrial	102	233	335	50	51	116.5	167.5
Instituional	49	223	272	35	17.15	78.05	92.48
Open Urban	42	387	429	9	3.78	34.83	38.61
Roads	257	1405	1662		257	1404	1662
All Land (except Forest)	744	4287	5031		407.62	2136.24	2542.14

TN and TP LOADINGS (no BMPs) based on IMPERVIOUS surfaces by LU

Total Nitrogen Loads

	Imperv Surface (ac)	metric to US convers	Annual Runoff (inches)	Rv (Ia variables .31, .25, .26)	R=	Annual Loadings	Monthly Loadings	Avg Ann Monthly TMDL	% of TMDL
Town	407.62	0.226	43	0.329	14.95152	5028.016758	419.0013965	6229	0.06726624
Gro Area	2136.24	0.226	43	0.275	12.852	24903.62885	2075.302404	6229	0.33316783
Town+Gro Area	2542.14	0.226	43	0.284	13.20192	30021.3245	2501.777042	6229	0.40163382

Total Phosphorous Loads

	Imperv Surface (ac)	metric to US convers	Annual Runoff (inches)	Rv (Ia variables .31, .25,. 26)	R=	Annual Loadings	Monthly Loadings	Avg Ann Monthly TMDL	% of TMDL
Town	407.62	0.226	43	0.329	14.95152	653.6421785	54.47018154	314	0.17347192
Gro Area	2136.24	0.226	43	0.275	12.852	3237.47175	269.7893125	314	0.85920163
Town & Gro Area	2542.14	0.226	43	0.284	13.20192	3902.772185	325.2310154	314	1.03576757

SOURCES:
Annual rainfall: USGS, Wheeler (2006)
Formulas from Stormwater Resource Management Center
Formulas Used:
Rv=0.05 + 0.9*Ia (impervious %)
R= P (annual rainfall inches)*Pj (0.9 used)*Rv
Annual Loadings = 0.226 (conversion)* R * C (pollutant concentration: 2.0mg/l for TN and 0.26mg/l for TP)

With Urban BMP's	TN w/BMP @15% reduction	TP w/BMP @50% reduction
TOWN	0.057176302	0.086735958
GROWTH AREA	0.283192654	0.429600816
TOWN+GRO AREA	0.341388744	0.517883783

METHOD TWO: LAND USE COEFFICIENTS

TOWN of North East (March 2008) TN and TP LOADINGS based on ChesBayProgam Land Use Coefficients and Acres (Trib Strategies data, Eastern Shore Basin, septic loads removed from urban)

MAJOR_LAND_USE	ACRES	TN lb/ac/yr	LU Loads lb/yr	TP lb/ac/yr	LU Loads lb/yr	SED lb/ac/yr	LU Loads lb/yr
AGRICULTURE	58	9.6	556.8	0.94	54.52	0.2	11.6
FOREST	478	1.42	678.76	0.02	9.56	0.02	9.56
URBAN	429	6.07	2604.03	0.75	321.75	0.05	21.45
All Land	965		3839.59		385.83		42.61
Monthly Loads			319.9658333		32.1525		3.550833333

North East GROWTH AREA (March 2008) TN and TP LOADINGS based on ChesBayProgam Land Use Coefficients and Acres (Trib Strategies data, Eastern Shore Basin, septic loads removed from urban)

MAJOR_LAND_USE	ACRES	TN lb/ac/yr	LU Loads lb/yr	TP lb/ac/yr	LU Loads lb/yr	SED lb/ac/yr	LU Loads lb/yr
AGRICULTURE	518	9.6	4972.8	0.94	486.92	0.2	103.6
FOREST	2595	1.42	3684.9	0.02	51.9	0.02	51.9
URBAN	2383	6.07	14464.81	0.75	1787.25	0.05	119.15
	5496		23122.51		2326.07		274.65
Monthly Loads			1926.875833		193.8391667		22.8875
		Percent TMDL for TN:	0.309339514	Percent of TMDL for TP:	0.617322187		(No TMDL for SED)

TOWN AND GROWTH AREA

	Monthly Loads	lbs/acre/yr:	2246.841667	lb/ac/yr:	225.9916667	lb/ac/yr	26.43833333
		Percent TMDL for TN:	0.360706641	Percent of TMDL for TP:	0.719718684	(No TMDL for SED)	(No TMDL for SED)

EPA-APPROVED TMDL for Total Nitrogen and Total Phosphorous

TMDL non-point sources Avg Annual Flow	6229 lbs per month	314 lbs per month	(no TMDL for SED)
TMDL non-point sources Critical Low Flow	1886 lbs per month	113 lbs per month	(no TMDL for SED)

EXHIBIT B: *POST GROWTH AND DEVELOPMENT: Estimated Water Quality Impacts for the Town and the Growth Area*

METHOD ONE: IMPERVIOUS SURFACE/RAINFALL EQUATION (L=.226*R*C*A)

Impervious Surface Estimates: Town of North East and Growth Area (Stormwater Management

Land Use	Acres in Town	Acres in Growth Area	Town and Growth Area	Mean Imprevious Surface (%)	Impervious Ac - Town	Impervious Ac - GroArea	Impervious Ac Town+GroArea
(Agriculture) OpenSpace	31.9	284.9	316.8	2	0.638	5.698	6.336
Very Low Density Res	4	337	341	14	0.56	47.18	47.74
Low Density Res	33	510	543	21	6.93	107.1	114.03
Medium Density Res*	393.9	901.49	1295.39	28	110.292	252.4172	362.7092
High Density Res	68	50	118	33	22.44	16.5	38.94
Commercial	26	749.63	775.63	70	18.2	524.741	542.941
Industrial	102	604.085	706.085	50	51	302.0425	353.0425
Instituional	49	223	272	35	17.15	78.05	92.48
Open Urban	42	387	429	9	3.78	34.83	38.61
Roads	257	1405	1662		257	1404	1662
All Land (except forest)	1006.8	5452.105	6458.905		487.99	2772.5587	3258.8287

*Represents additions of developed net acres of agriculture and forest

TN and TP LOADINGS (no BMPs) based on IMPERVIOUS surfaces by LI

Total Nitrogen Loads

	Imperv Surface (ac)	metric to US convers	Annual Runoff (inches)	Rv (Ia variables .31, .25, .26)	R=	Annual Loadings	Monthly Loadings	Avg Ann Monthly TMDL	% of TMDL
Town	487.99	0.226	43	0.329	14.95152	6804.042032	567.0035027	6229	0.09102641
Gro Area	2772.5587	0.226	43	0.275	12.852	31671.84496	2639.320414	6229	0.42371495
Town+Gro Area	3258.8287	0.226	43	0.284	13.20192	38542.01609	3211.834674	6229	0.51562605

Total Phosphorous Loads

	Imperv Surface (ac)	metric to US convers	Annual Runoff (inches)	Rv (Ia variables .31, .25,. 26)	R=	Annual Loadings	Monthly Loadings	Avg Ann Monthly TMDL	% of TMDL
Town	487.99	0.226	43	0.329	14.95152	884.5254641	73.71045535	314	0.23474667
Gro Area	2772.5587	0.226	43	0.275	12.852	4117.339845	343.1116538	314	1.09271227
Town & Gro Area	3258.8287	0.226	43	0.284	13.20192	5010.462091	417.5385076	314	1.32974047

SOURCES:
Annual rainfall: USGS, Wheeler (2006)
Formulas from Stormwater Resource Management Center
Formulas Used:
Rv=0.05 + 0.9*Ia (impervious %)
R= P (annual rainfall inches)*Pj (0.9 used)*Rv
Annual Loadings = 0.226 (conversion)* R * C (pollutant concentration: 2.0mg/l for TN and 0.26mg/l for TP)

With Urban BMP's	TN w/BMP @15% reduction	TP w/BMP @15% reduction	TP w/BMP @25% reduction
TOWN	0.077372448	0.199534672	0.176060005
GROWTH AREA	0.360157706	0.928805432	0.819534205
TOWN+GRO AREA	0.438282144	1.1302794	0.997305353

METHOD TWO: LAND USE COEFFICIENTS

TOWN of North East (March 2008) TN and TP LOADINGS based on ChesBayProgam Land Use Coefficients and Acres (Trib Strategies data, Eastern Shore Basin, septic loads removed from urbe

MAJOR_LAND_USE	ACRES	TN lb/ac/yr	LU Loads lb/yr	TP lb/ac/yr	LU Loads lb/yr	SED lb/ac/yr	LU Loads lb/yr
AGRICULTURE	26.1	9.6	250.56	0.94	24.534	0.2	5.22
FOREST	215.1	1.42	305.442	0.02	4.302	0.02	4.302
URBAN	724.35	6.07	4396.8045	0.75	543.2625	0.05	36.2175
total annual loads			4952.8065		572.0985		45.7395
Monthly Loads			412.733875		47.674875		3.811625
		Percent of TMDL for TN:	0.066260054	Percent of TMDL for TP:	0.151830812		(No TMDL for SED)

North East GROWTH AREA (March 2008) TN and TP LOADINGS based on ChesBayProgam Land Use Coefficients and Acres (Trib Strategies data, Eastern Shore Basin, septic loads removed from urb

MAJOR_LAND_USE	ACRES	TN lb/ac/yr	LU Loads lb/yr	TP lb/ac/yr	LU Loads lb/yr	SED lb/ac/yr	LU Loads lb/yr
AGRICULTURE	233.1	9.6	2237.76	0.94	219.114	0.2	46.62
FOREST	1167.75	1.42	1658.205	0.02	23.355	0.02	23.355
URBAN	4095	6.07	24856.65	0.75	3071.25	0.05	204.75
total annual loads			28752.615		3313.719		274.725
Monthly Loads			2396.05125		276.14325		22.89375
		Percent TMDL for TN:	0.38466066	Percent of TMDL for TP:	0.879437102		(No TMDL for SED)

TOWN AND GROWTH AREA

Monthly Loads	lbs/acre/yr:	2808.785125	lb/ac/yr:	323.818125	lb/ac/yr	26.705375
	Percent TMDL for TN:	0.450920714	Percent of TMDL for TP:	1.031267914	(No TMDL for SED)	(No TMDL for SED)

Eastern Shore Basin. Edge of Stream. Major Land Uses. Tributary Strategy Data 2006 (assumes full implementation of the Strategy)

EPA-APPROVED TMDL for Total Nitrogen and Total Phosphorou

TMDL non-point sources Avg Annual Flow	6229 lbs per month	314 lbs per month	(no TMDL for SED)
TMDL non-point sources Critical Low Flow	1886 lbs per month	113 lbs per month	(no TMDL for SED)

Design Flow Estimation Tables[4]

Flow Projection Based Upon Gallons
Per Person per Day

Type of Establishment	Gallons per Person per Day (Unless Otherwise Noted)
Airports (per passenger)	5
Auditorium or Assembly Hall (per seat)	3
Bathhouses and swimming pools	10
Camps:	
Campground with central comfort stations	35
With flush toilets, no showers	25
Day camps (no meals served)	15
Resort camps (night and day) with limited plumbing	50
Luxury camps	100
Country clubs (based on rated capacity)	50
Dwellings:	
Boarding houses (per room)	100
Multiple family dwellings (per apartment)	220
Single family dwellings (per address)	220
Factories (gallons per person, per shift, exclusive of industrial wastes)	35
Hospitals (per bed space)	350
Hotels (per room)	120
Institutions other than hospitals (per bed space)	125
Laundries, self-service (per washing machine)	550
Mobile home parks (per space)	220
Motels (per room)	100
Picnic Parks (toilet wastes only) (per picnicker)	5
Picnic Parks with bathhouses, showers and flush toilets	10
Restaurants, bars, lounges (per seat)	25
Schools:	
Boarding	100
Day, without gyms, cafeterias or showers	15
Day, with gyms, cafeterias and showers	25
Day, with cafeterias, but without gyms or showers	20
Service Stations (per vehicle served)	10
Swimming pools and bathhouses	10

[4] Adapted from "MDE Guidelines for Estimating Water and/or Wastewater Flow," Maryland Department of the Environment, July 2005 Draft and "Design Guidelines for Sewerage Facilities; Technical Bulletin M-DHMH-EHA-S-001," Environmental Health Administration, Department of Health and Mental Hygiene, State of Maryland, 1978 Edition. Additional modifications based upon Wastewater Engineering Treatment, Disposal, and Reuse, Third Edition, Metcalf & Eddy, Inc., 1991.

Theaters:	
Indoor (per auditorium seat)	3
Drive-in (per car space)	5
Travel (transient or seasonal) Trailer Parks without individual water and sewer hook-ups (per space)	50
Travel (transient or seasonal) Trailer Parks with individual water and sewer hook-ups (per space)	110

Guiding Factors For Flow Projection Related With Commercial Establishments, Public Service Buildings or Dwelling Units

Type of Establishment	
Office Buildings	Gross Sq. Ft. x 0.09 = gpd
Medical Office Buildings	Gross Sq. Ft. x 0.62 = gpd
Warehouses	Gross Sq. Ft. x 0.03 = gpd
Retail Stores	Gross Sq. Ft. x 0.05 = gpd
Supermarkets (without food preparation)	Gross Sq. Ft. x 0.20 = gpd
Drug Stores	Gross Sq. Ft. x 0.13 = gpd
Beauty Salons	Gross Sq. Ft. x 0.35 = gpd
Barber Shops	Gross Sq. Ft. x 0.20 = gpd
Department Store with Lunch Counter	Gross Sq. Ft. x 0.08 = gpd
Department Store without Lunch Counter	Gross Sq. Ft. x 0.05 = gpd
Banks	Gross Sq. Ft. x 0.05 = gpd
Service Stations	Gross Sq. Ft. x 0.18 = gpd
Laundries & Cleaners	Gross Sq. Ft. x 0.31 = gpd
Laundromats	Gross Sq. Ft. x 3.68 = gpd
Car Wash without Wastewater Recirculation Equipment	Gross Sq. Ft. x 4.90 = gpd
Dry Goods Stores	Gross Sq. Ft. x 0.05 = gpd
Shopping Centers	Gross Sq. Ft. x 0.18 = gpd

Flow Projection for Country Clubs and Public Parks

Type of Fixture Gallons Per Day	Per Fixture
Showers	500
Baths	300
Toilets	150
Urinals	100
Sinks	50