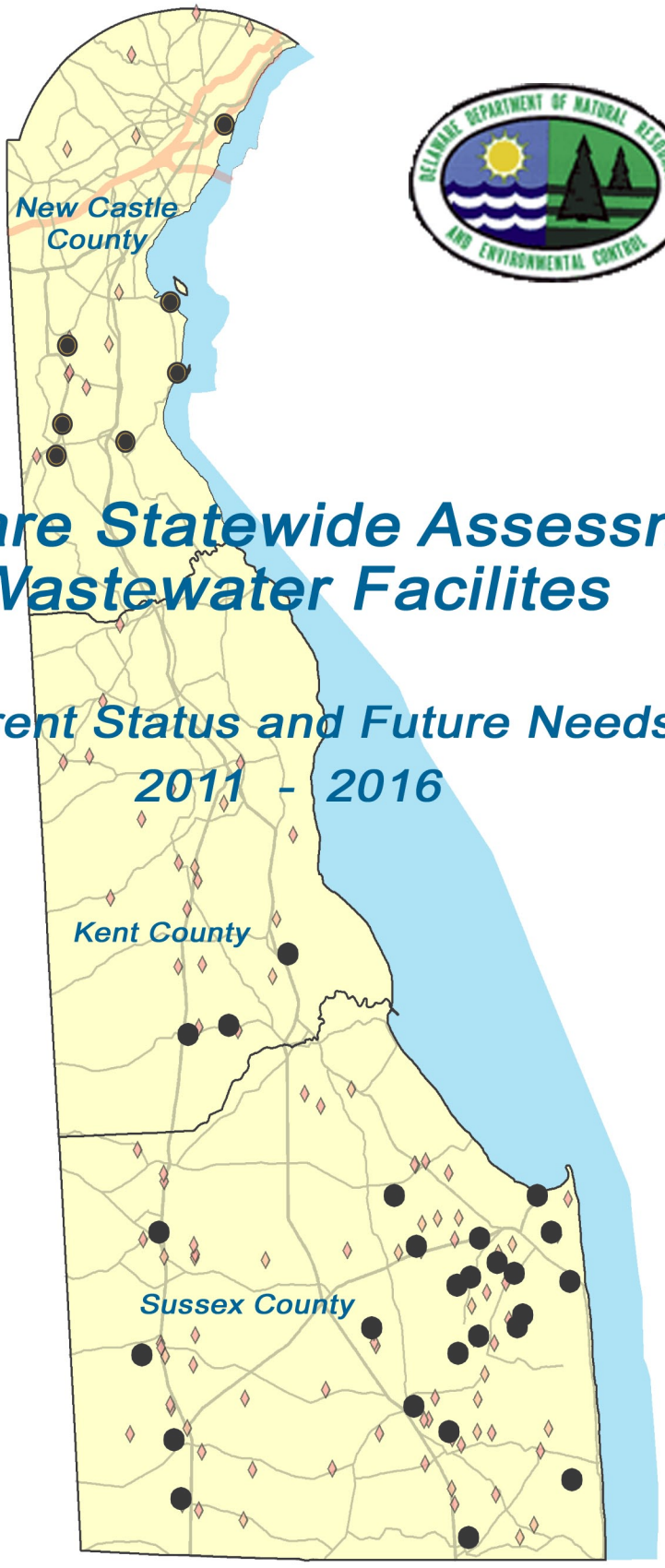

Delaware Statewide Assessment Wastewater Facilites

Current Status and Future Needs

2011 - 2016

TETRA TECH

Delaware Statewide Assessment of Wastewater Facilities

Current Status and Future Needs

2011 - 2016

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August 2012

Delaware Wastewater Study – Facilities Assessment 2011-2016

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Acronyms and Abbreviations

ANSWRF	Artesian North Sussex Regional Wastewater Recharge Facility
Artesian	Artesian Wastewater Management, Inc.
BNR	Biological Nitrogen Removal
BOD	Biological Oxygen Demand
CIP	Capital Improvement Plan
CPCN	Certificates of Public Convenience and Necessity
CSO	Combined Sewer Overflows
CWA	Clean Water Act
CWAC	Clean Water Advisory Council
DNREC	Department of Natural Resources and Environmental Control
DRBC	Delaware River Basin Commission
ENR	Enhanced Nitrogen Removal
EDUs	Estimated Dwelling Units
EPA	Environmental Protection Agency
GIS	Geographical Information System
GO	General Obligation
gpd	Gallons Per Day
I/I	Infiltration and Inflow (groundwater and stormwater entering collection systems)
LA	Load Allocations
M	Million
MG	Million Gallons
MGD	Million Gallons per Day
MHPs	Mobile Home Parks
MIH	Median Household Income
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PCBs	Polychlorinated Biphenyls
PSI	Phosphorus Site Index
RBCs	Rotating Biological Contactors
RIBs	Rapid Infiltration Basins
SEFO	Septic Extended Funding Options
SRF	State Revolving Fund
STP	Sewage Treatment Plant
Tidewater	Tidewater Environmental Services, Inc.
TMDLs	Total Maximum Daily Loads
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
UD	University of Delaware
USDA-RUS	Department of Agriculture - Rural Utility Services
UD	University of Delaware
WIP	Watershed Implementation Plan
WLA	Wasteload Allocation
WRF	Water Reclamation Facility
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

Executive Summary

Overview

This study assessed Delaware's wastewater treatment facilities at the state and county levels to determine their current status from technical and economic perspectives. The report is intended to encourage dialogue between the Clean Water Advisory Council (CWAC), Department of Natural Resources and Environmental Control (DNREC), county governments, municipalities and utilities by identifying immediate, short-term and long-term needs, the costs associated with those needs and the funding sources available to meet the needs. The study is also intended to point out trends and emerging issues, including promoting wastewater reuse and other innovative opportunities, with the goal of cost-effectively balancing human health and environmental protection in Delaware.

Wastewater System Infrastructure

There are 32 publicly owned wastewater systems in Delaware. Twenty-two of the public wastewater systems include a treatment plant and 10 of the public wastewater systems are collection-only systems. Of these 22 treatment plants, 15 facilities have surface water discharge permits and nine facilities have groundwater permits. Also surveyed are 12 operating and two proposed privately owned systems. The 22 public and 12 private wastewater treatment plants (WWTPs) provide centralized collection and treatment to a population of nearly 800,000. About 60 percent of those with centralized collection are serviced at the Wilmington WWTP. The Wilmington WWTP provides secondary treatment to an average daily flow of 75 million gallons per day (MGD) before surface water discharge. About 32,000 individuals are serviced by the other treatment plants in New Castle County with a total average daily flow of 2 MGD. About 35 percent of those with centralized collection are serviced at public treatment plants in Kent and Sussex County with average daily flows of 23.3 MGD.

In addition to the Wilmington WWTP, there are another 15 treatment plants that discharge to surface waters, serving a population of 225,000 (28 percent). The average daily flow at these 15 facilities is 21.3 MGD. Seven of these 15 facilities provide nitrogen removal and, with the exception of one plant, provide phosphorus removal. About two-thirds of the facilities already have nitrogen and/or phosphorus limits, and two facilities are expecting phosphorus and nitrogen limits within the next five years—five facilities do not anticipate nutrient limits. Three facilities indicated problems meeting their nutrient limits but have implemented or have plans to address these issues. Bridgeville's current facility is not designed to remove nitrogen sufficiently to meet anticipated future nitrogen limits, and phosphorus removal will be difficult with the current facility. Although Bridgeville has added spray irrigation, it is likely that the community would need to upgrade its current facility with biological nitrogen removal to meet its surface water discharge requirements or switch to spray irrigation completely or in conjunction with other reuse options.

There are seven public and 11 private WWTPs that provide groundwater discharge and provide treatment for about 11.5 percent of those with centralized collection. Seventeen of these facilities have nitrogen limits, and seven facilities have, or expect to have, phosphorus limits. The Lea Eara Farms WWTP indicated problems with nitrates; and the Inland Bays Regional facility indicated problems with meeting its nitrogen limits. New Castle County indicated that it may abandon the Lea Eara facility in the future. The Inland Bays Regional facility received an amended permit in 2009 adding another spray field, and a new Biolac™ system should resolve the nitrogen and anticipated phosphorus limits.

The 2030 projections of population increases and plant enlargements are generally modest for wastewater systems in New Castle County and Kent County. On the other hand, several public facilities

in Sussex County identified substantial potential for increases in population served. While it is unclear when these projections will be realized given the current economic environment and nutrient reductions called for in the Chesapeake Bay and Inland Bay TMDLs, the CWAC and DNREC should monitor this situation as significant capital investment might be necessary.

The study found that most wastewater service providers are concerned about the costs associated with managing their long-term investments while trying to meet increasingly stringent performance standards due to the Chesapeake Bay TMDL or other effluent requirements. Wastewater system owners and operators often need to decide between plant abandonment (regionalization) versus existing plant upgrades or new plant installations; and these decisions are made more difficult with the recent economic slowdown and reduced build-out rate. Collection systems require continued maintenance and upgrades. Most combined sewer systems have been eliminated or have completed a long-term control plan. Many, but not all, older collection systems have I/I issues that can cause flow issues downstream. Some plants and critical pump stations do not have a backup power supply.

Ultimately, these challenges are solved at the community level; however, CWAC and DNREC can facilitate these solutions by working with communities to i) develop long-term projections of effluent requirements and treatment levels, ii) encourage communities to reevaluate the plant capacities and revise growth projections for overdesigned/oversized plants, iii) promote water conservation to postpone or delay some capital investments, iv) investigate the opportunity for optimizing public-private partnerships to better use existing infrastructure, v) encourage projects to reduce I/I and vi) adopt backup power supplies at all treatment plants and other critically important wastewater system components.

User Rates and Revenue Generation

The average annual household sewer rate at public systems in New Castle, Kent and Sussex counties varied from $185-$350, $303-$571, and $277-$795 per household, respectively, when averaged to the wastewater system level. The average household sewer rates for private systems generally ranged from $850 to $1,245/household, although the Milton Regional facility's average household sewer rate is $350/household. At the sewer district level, the annual household sewer rate at public facilities in Sussex County were more variable and ranged from $179-$1,453 per household. Some of these differences can be attributed to different rate structures for residents inside versus outside city limits as well as a relationship to sewer district size. Interestingly, private sewer rates appear comparable to those of similarly-sized public sewer districts in Sussex County.

The average household sewer rate, when expressed as a fraction of median household income (MHI), ranges from 0.34 percent to 1.84 percent of the MHI for public wastewater systems. Ten (three) public wastewater systems have average household sewer rates already greater than 1.0 (1.5) percent of the MHI. All but two private systems have user rates greater than 1.5 percent of the MHI, with a range from 0.87 percent to 2.61 percent.

All but three public facilities indicated that they were generating sufficient annual revenue to meet the cost of their wastewater enterprise without transfer from other enterprises. Wilmington indicated that it expects to be on track by FY12. Middletown and Millsboro indicated that additional growth is needed to generate sufficient revenue. Ten of the 11 private plants indicated that they were running a deficit primarily due to lower than expected build-out rates. All but three public wastewater systems maintain a reserve account, and those three wastewater systems, Wilmington WWTP, Clayton collection system, and Georgetown water reclamation facility (WRF), are considering or moving toward establishing a reserve account.

Total annual revenue from residential customers was $40.2 million (M), $14.8M, $37.0M, and $1.6M for public facilities in New Castle County, Kent County, Sussex County, and private facilities, respectively (Table ES-1). Note that this survey did not include, at the CWAC's guidance, non-residential revenue and could give an incomplete view of a system's financial status. If all wastewater systems increased their average annual household sewer rates to 1.0 (1.5) percent of the MHI, additional residential revenue of $51.8M, $5.1M, $1.5M, and $0.1M ($97.8M, $14.7M, $12.0M, and $0.3M) would be realized for public facilities in New Castle County, Kent County, Sussex County and private facilities, respectively.

Future Capital Improvement Plans and Financing Options

The total capital project costs from 2011-2016 for the State of Delaware are estimated at $653.7M. These estimates are based on estimated costs of $288.5M, $95.9M, and $269.3M for public wastewater systems in New Castle, Kent, and Sussex counties, respectively (Table ES-2). Private wastewater systems reported another $9.1M in capital costs. Numerous additional private wastewater system projects were identified, but no cost estimates were available. About three-fourths of these project costs are related to collection and conveyance while 20 percent are related to treatment. Two wastewater systems did not report any capital costs for 2011-2016; and numerous systems did not report information for 2015 and 2016. Extrapolating the average annual capital project costs to the un-reported years suggests a potential under reporting of approximately $45.6M (7 percent).

For New Castle County-owned systems, capital project costs from 2011-2016 are $245.4M. Projects include $101.5M for the Brandywine Hundred North and South sewer rehabilitation Phase 1 and 2 projects, $33.7M for the North Delaware interceptor system, and $26.4M for the White Clay sewer basin rehabilitation. The City of Wilmington's 2011-2016 capital project costs are $36.2M with about 60 percent ($21.4M) of these projects related to sewer rehabilitation and improvements.

In Kent County, $39.1M is planned for upgrades to the Kent County Regional WWTP from 2011-2016. An additional $13.3M is planned in upgrades to the Kent County Regional collection system, which includes conveyance from satellite collection systems. Dover, Milford, Harrington, Camden-Wyoming, Clayton and Smyrna report projects totaling $31.7M, of which $24.2M is related to sewer rehabilitation and replacement.

Facilities owned by Sussex County report $189.8M in capital project costs from 2011-2016. Those needs include $136.9M for sewer collection and conveyance and $52.6M for treatment plant costs. Bridgeville, Laurel and Delmar include treatment plant upgrades totaling an estimated cost of $12.7M primarily dealing with TMDL/compliance issues. Millsboro includes $19.6M for reuse transmission and aquifer recharge costs. The City of Rehoboth 2011-2016 capital project costs includes $19.1M for the construction of a pump station, force main and ocean outfall 6,000 feet offshore along with $6M for various treatment plant upgrades and replacements including provisions for emergency power. Laurel and Delmar report $6.4M for pump station replacements, I/I studies and for sewer replacement and rehabilitation projects.

Wastewater systems project that about one-half (51.7 percent, $337.7M) of the capital project costs will be financed through issuance of bonds (Table ES-3). Nearly equal shares of these costs are expected to be financed through requests to the Clean Water State Revolving Fund (12.1 percent, $78.8M) and through municipal sinking funds, asset replacement costs savings and current municipal budgets (13.2 percent, $86.3M). Municipal requests to USDA are expected to account for 7.7 percent ($50.3M) of the 2011-2016 project costs. No funding sources were reported for $88.1M (13.5 percent) of the 2011-2016 project costs. It is noted that most ($61.5M) of the $88.1M is associated with 2011. Of the projects expected to be funded through the Clean Water State Revolving Fund, the yearly funding requests range

from $11.3M to $21.2M from 2011-2014. Expected funding requests to the Clean Water State Revolving Fund are $5.7M and $3.2M during 2015 and 2016, respectively. The potential under reporting of project costs in 2015-2016, the non-reported funding source for $88.1M, and drop off in expected Clean Water State Revolving Fund requests in 2015-2016 result in uncertainties in the expected funding requests to the Clean Water State Revolving Fund during the 2011-2016 time period.

Table ES-1. Wastewater System Current Residential Revenue and Potential Increased Revenue.

	Present Annual Residential Revenue ($M)	Additional Residential Revenue ($M)			
		1.0% MHI increase	1.5% MHI increase	2.0% MHI increase	2.5% MHI increase
New Castle County	$40.2	$51.8	$97.8	$143.7	$189.7
Kent County	$14.8	$5.1	$14.7	$24.5	$34.4
Sussex County	$37.0	$1.5	$12.0	$28.0	$44.3
Private	$1.6	$0.1	$0.3	$0.7	$1.3
State	$93.7	$58.4	$124.8	$197.0	$269.7

Table ES-2. Reported Capital Project Costs ($M) at Public Wastewater Systems, 2011-2016.

	Reported Capital Project Costs ($M), 2011-2016				
County	**Collection**	**Conveyance**	**Treatment**	**Disposal**	**Total**
New Castle	$105.9	$161.4	$16.0	$5.1	$288.5
Kent	$19.9	$35.6	$39.8	$0.7	$95.9
Sussex	$62.3	$96.6	$77.0	$33.4	$269.3
State	$188.1	$293.6	$132.8	$39.2	$653.7

Table ES-3. Reported Financing Options ($M) at Public Wastewater Systems, 2011-2016.

County	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	No funding source indicated	Other Financing Method	Total
New Castle	$0.1	$268.5	$15.9	-	$3.8	-	$0.2	$288.5
Kent	$0.5	-	$43.2	$5.9	$22.8	$18.6	$5.0	$95.9
Sussex	$3.2	$69.3	$19.7	$44.4	$59.8	$69.5	$3.4	$269.3
State	$3.7	$337.7	$78.8	$50.3	$86.3	$88.1[a]	$8.7	$653.7

[a] Most ($61.5M) of the $88.1M for which no funding source was indicated is associated with 2011.

Water Reuse

The State of Delaware promotes sustainable water management by directing infrastructure funding to targeted priority development areas and facilitating water reclamation and reuse via regulations, policy, guidance and education/outreach. The State promotes reuse for a variety of excellent reasons – water conservation, reducing nutrient discharges and recycling nutrients, recharging aquifers, maintaining agricultural land and other open space, helping farmers, and so forth.

Thirty-one of the 36 WWTPs surveyed currently include some kind of reuse feature or are planning a reuse feature, including all 14 privately operated plants along with a majority of the plants in Sussex and New Castle Counties and one of the two plants in Kent County. Most of the current applications are for

reusing treated biosolids (sludge), which is either already being done or is planned (for developments being constructed) for all but one of the privately operated plants.

With respect to water reuse, agricultural irrigation is the most common reuse option in Delaware, with significant additional interest and/or planning efforts underway to expand agricultural reuses. The State has promoted agricultural reuses and in fact, is well suited for agricultural reuse given significant agricultural land uses, particularly in Kent and Sussex Counties. In a companion study, the University of Delaware has developed a preliminary map showing potential spray irrigation sites.

Commercial and industrial reuse applications (with the exception of agricultural reuse) appear limited to a few plants with water-intensive industries nearby, and residential reuse is only being planned for two plants—one in New Castle and one in Kent County. Most of the "other" reuse category involves aquifer recharge via rapid infiltration basins (RIBs) or, in a few cases, drip or subsurface irrigation. Millsboro has partially constructed a reuse project that will involve spray irrigating athletic fields. Of these 10 collection system-only utilities, none had yet implemented reuse, which is understandable, given that these systems do not currently include their own treatment plants, but rather convey wastewater to another treatment plant, which may or may not include a reuse element. Several of these 10 collection systems did indicate an interest in implementing some kind of reuse system, including smaller-scale localized (e.g., satellite) reuse systems, industrial pretreatment and source separation, and other nontraditional options to help conserve water and reduce receiving WWTP loadings.

The major barriers to increased wastewater reuse is the limitation of land in urban areas; farmer/property owner concerns; and limited guidance, policy, and incentives. University of Delaware researchers stated in their study that representatives for the Division of Fish and Wildlife, Division of Parks and Recreation, and Coastal Management were not in favor of wastewater reuse on state lands although there are no known prohibitions. To increase reuse, it may be appropriate to i) undertake studies and market analyses to ascertain the viability of various reuse alternatives, ii) establish/standardize State policies and/or regulations regarding water reuse; iii) provide applicable incentives such as tax credits or nutrient credits; and iv) alleviate potential concerns about risks and liability by enhancing education, outreach, guidance and case studies for agricultural constituencies. It might also be appropriate to evaluate the opportunity for innovative reuse options for collection system-only utilities.

Mobile Home Parks, Clustered Individual Systems, and Community Systems

Delaware has more than 80,000 septic systems. There are more than 200 "large systems" (~3,000 gpd or greater), which include shared community cluster systems, municipal systems and commercial/industrial groundwater or spray discharge systems. This study included visiting and reporting on a representative set of 14 on-site (individual) septic systems in clustered areas and cluster (shared community) systems. It was found that the technical, managerial, financial, legal, program and enforcement issues facing individual and decentralized systems in Delaware are similar to elsewhere in the mid-Atlantic Region. Some MHPs are well-operated, but a glaring issue with some systems is the lack of proper management (e.g., homeowner associations that operate systems, lack of clear ownership or legal access to on-lot system components). Appendix D includes typical recommendations for decentralized systems and provides program-level guidance and recommendations to assist in making various case-by-case decisions, such as connection of a decentralized system to central sewer, implementing community systems and advancing treatment of individual septic systems.

Section 1 – Report Purpose, Methodology and Background

Purpose

The purpose of the study is to assess wastewater facilities at a state and county level to identify the current status of Delaware's wastewater collection and treatment systems from the technical and economic perspectives. The report is intended to encourage dialogue between the Clean Water Advisory Council (CWAC), Department of Natural Resources and Environmental Control (DNREC), county governments, municipalities and utilities by identifying immediate, short-term and long-term needs, the costs associated with those needs and the funding sources available to meet the needs. The study is also intended to point out trends and emerging issues, including promoting wastewater reuse and other innovative opportunities, with the goal of cost-effectively balancing human health and environmental protection in Delaware. The information collected for this study has been consolidated into an active database of Delaware's wastewater facilities, and much of the information is available as geographical information system (GIS) layers. Finally, an educational and outreach goal for this study is to encourage public awareness of wastewater issues and inform the public as to how they can be a part of solutions.

Why Study Delaware's Wastewater Treatment Facilities?

Nature has an ability to cope with small amounts of water wastes and pollution, but it would be overwhelmed if we did not treat the billions of gallons of wastewater and sewage produced every day before releasing it back to the environment. Treatment plants reduce pollutants in wastewater to a level nature can handle. If wastewater is not properly treated, then the environment and human health can be negatively impacted. These impacts can include harm to fish and wildlife populations, oxygen depletion, beach closures and other restrictions on recreational water use, restrictions on fish and shellfish harvesting and contamination of drinking water. [U.S. Geological Survey] http://ga.water.usgs.gov/edu/wuww.html

Methodology

The following approach was followed to collect the information used in preparing this study:

- Develop the survey questionnaire
- Pre-populate data via DNREC records
- Present questions to the entities
- Conduct interviews to collect the data
- Send interview data reports to entities for quality control verification
- Analyze the data and prepare the report
- Deliver a working database and updated GIS layers for on-going tracking

Additional discussion of the survey and study methodology is presented in Section 2. Detailed results, organized by topic and facility, are provided in Appendix A and Appendix B, respectively.

Background

The first statewide wastewater facilities assessment covering the period from 1995 through 1997 was conducted by the Financial Assistance Branch of DNREC. The *Delaware Statewide Wastewater Facilities Assessment 2006-2011* was prepared by URS. Tetra Tech, Inc. supported this current survey and assessment report (2011-2016) on behalf of DNREC and the CWAC. The role of CWAC, formerly known as the Wastewater Facilities Advisory Council, was established by 29Del. Code §8011(a). The council initiates, develops and recommends to the Delaware General Assembly, projects for the planning, construction, repair, renovation or expansion of wastewater facilities.

CWAC's role has expanded since its development, including the development of various water/wastewater subcommittees, and now also provides guidance and policy advice to the Governor and Secretary of DNREC, along with assistance in developing funding options for capital and maintenance programs related to drainage, stormwater management and flood control throughout Delaware. CWAC is also charged with providing assistance in the development and evaluation of criteria for watershed-based plans for surface water management.

CWAC is tasked to evaluate, establish, recommend and adopt a long-term wastewater facilities funding plan. To accomplish that objective, the council develops and periodically updates a comprehensive statewide wastewater facilities assessment (i.e., this report). In addition to developing a funding plan, this report, along with its survey methodology, is intended to support all levels of government (local, county, state, and federal) in terms of uniform, streamlined reporting, data tracking, and data sharing.

Regulations for, Permitting of, and Enforcement on Wastewater Facilities

Federal Regulations

The Safe Drinking Water Act establishes the statutory framework for states to regulate subsurface disposal of effluent through groundwater permits. The Clean Water Act (CWA) nonpoint source management program provides guidance for managing on-site (septic) and other decentralized wastewater treatment systems.

Section 303(d) of the CWA requires establishment of lists of impaired waters and subsequent preparation and implementation of Total Maximum Daily Loads (TMDLs). A TMDL is the maximum amount of a pollutant that a body of water can receive and still meet water quality standards that protect humans and aquatic life. Delaware used the 303(d) list to create watershed-specific TMDLs. Wastewater treatment facilities with surface water discharges subject to the National Pollutant Discharge Elimination System (NPDES) permit program pursuant to Section 402 of the CWA that are located within a watershed subject to an approved TMDL must include a wasteload allocation (WLA) for the pollutant(s) named in the TMDL.

State Regulations

In an effort to better address regional concerns, DNREC has divided the State into four major basins: (1) Chesapeake Bay Basin; (2) Inland Bays/Atlantic Ocean Basin; (3) Delaware Bay and Estuary Basin; and (4) Piedmont Basin. Within each basin, Tributary Action Teams are formed to create Pollution Control Strategies, which are designed to achieve pollution load reductions required by TMDLs.

DNREC currently manages wastewater permitting, inspection, and enforcement through two sections—Surface Water Discharges Section (SWDS) and Groundwater Discharges Section (GWDS). The SWDS manages all NPDES permits (such as stream discharge or ocean outfall), and the GWDS manages all groundwater discharges. The GWDS has two branches—one to manage large facilities (spray irrigation and rapid infiltration basins [RIBs], and such), and one to manage individual or small systems (such as septic systems). Some facilities operate on dual permits, meaning that one treatment facility may deal with both divisions if they have multiple types of discharges (e.g., spray irrigation and NPDES).

Large wastewater treatment facilities are subject to the monitoring and reporting practices typical of any individual NPDES or groundwater discharge permit. For small- to medium-sized facilities, only monitoring may be required with a stated caveat or footnote. For instance, in some facilities the following language is common for phosphorus monitoring: "Groundwater discharges may also be subject to controls if excessive levels of soil phosphorus are present, as defined by the Delaware

Nutrient Management Commission, in which case soil phosphorus levels must be tested in accordance with the University of Delaware (UD) soil testing methods. If the soil phosphorus levels become excessive, the permittee shall perform a Phosphorus Site Index (PSI) study of the site. The results of the PSI study must be submitted to the Groundwater Discharges Section within 30 days of completion of the study. Based on the results of the PSI study, the Groundwater Discharges Section may require the permittee to submit a plan for Groundwater Discharges Section review and approval detailing steps the permittee will take to reduce the phosphorus loading rates at the site."

Regional TMDLs, State-Issued TMDLs and Other State or Regional Efforts Impacting Wastewater Facilities

Various TMDLs with their own WLAs and load allocations (LAs) have been established throughout Delaware by DNREC or the U.S. Environmental Protection Agency (EPA) over the past decade in effort to restore impaired waterways. While the majority of TMDLs in Delaware target nutrients and bacteria, other TMDLs include zinc and temperature. Wastewater treatment plants (WWTPs) and other regulated entities are required to adhere to the WLA or LA assigned to them via these TMDLs. For a complete listing of Delaware TMDLs and more information, visit DNREC's website:

http://www.dnrec.delaware.gov/swc/wa/Pages/WatershedAssessmentTMDLs.aspx

The two major regional TMDL concerns for wastewater facilities are the existing and upcoming Chesapeake Bay TMDL (mostly regarding nutrient management), and the potential for an upcoming WLA regarding the Delaware River TMDL for polychlorinated biphenyls (PCBs).

Chesapeake Bay TMDL

In addition to State-issued TMDLs within the Chesapeake Bay Basin, because Delaware is one of the six Chesapeake Bay watershed states—along with Maryland, Virginia, West Virginia, Pennsylvania, and New York—and the District of Columbia that committed to a federal-state initiative to help restore the water quality of the Bay and its tidal waters by 2025. EPA is leading the effort to develop the TMDL for nutrients and sediment for the Chesapeake Bay and its tidal branches.

As part of the TMDL, each jurisdiction is required to develop a Watershed Implementation Plan (WIP) that details how load goals will be achieved and maintained into the future. This work is being done in three phases. Draft Phase I WIPs were due to EPA on September 1, 2010, with the final due on November 29, 2010. Phase II WIPs in draft and final forms are due to EPA by December 1, 2011, and March 30, 2012, respectively. Phase III WIPs are scheduled to be received by EPA in 2017. With each successive WIP, the detail of load reduction goals and actions to achieve those goals will become increasingly more specific. Deadlines for progress include all pollution control measures being in place by 2025 with 60 percent completed by 2017.

Following the release of Delaware's Draft Phase I WIP on September 1, 2010, the Interagency Workgroup received numerous comments and questions from EPA and various stakeholder groups in the watershed. EPA noted that the draft plan did not achieve load reduction goals for nitrogen or phosphorus. As a result, EPA indicated its intention to institute "backstop allocations" that would effectively target point sources by establishing more stringent limits and actions on WWTPs, municipal stormwater and regulated agriculture if the State was not able to achieve the necessary load reduction goals and provide reasonable assurance that those goals could be achieved in the final plan.

Delaware's On-Site Systems in the Chesapeake Bay Watershed

For on-site wastewater treatment and disposal (septic) systems, the rates of implementation must be collectively considered for three different practices specified in Delaware's WIP. First, several thousand existing septic systems are expected to be eliminated between now and 2025; the majority (70 percent) will likely occur by 2017. Second, a statewide pump-out and inspection program was instituted in 2011, and nutrient loading reductions from this program are expected to be steady over time due to better overall performance and fewer malfunctions. Finally, advanced treatment will be required (pending passage of a new regulation) for on-site systems within a certain proximity to tidal waters and associated tidal wetlands when those systems fail beginning in 2017, so nutrient loading reductions resulting from this practice will not occur until further in the future.

Inland Bays TMDL

Effective November 11, 2008, DNREC's Division of Water Resources, Watershed Assessment Section issued Statutory Authority: 7 Delaware Code Chapters 40, 60, 66, 70, and 72; and 29 Delaware Code §§ 8014(5) and 8025 - Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay watersheds. These regulations set new effluent performance standards that many WWTPs cannot meet with their existing equipment. Permitted discharges of nutrients into the Inland Bays or their tributaries will essentially be systematically eliminated through their NPDES renewal process. Point sources may choose to engage in water quality trading on a case-by-case basis in accordance with the following:

- Trades must occur within the same watershed (Indian River, Indian River Bay, Rehoboth Bay, or Little Assawoman Bay) as the point source discharge is located.
- Trades must involve a trading ratio of at least 2:1 between nonpoint sources and point sources.
- The nutrient load reduction involved in the trade must constitute reductions that occur beyond the baseline or the point or nonpoint source nutrient reductions required under the TMDL and this Pollution Control Strategy.

Delaware River/Estuary PCB TMDLs

PCBs have been widely dispersed throughout the environment by human activity, typically entering the atmosphere as a gas or spilling into soils and waterways and lodging in sediments. They continue to be generated as a by-product of some industrial processes. The sources of PCBs to the Delaware Estuary are multiple, including loadings from the air, the mainstem Delaware River above Trenton, New Jersey, tributaries to the Delaware River both above and below Trenton, industrial and municipal point source discharges, combined sewer overflows (CSOs), and stormwater runoff, including runoff from seriously contaminated sites.

The water quality standards that form the basis for the Stage 1 TMDLs for Zones 2 through 6 of the Delaware River Estuary are the current Delaware River Basin Commission (DRBC) water quality criteria for total PCBs for the protection of human health from carcinogenic effects. These criteria were identified as the TMDL targets by a letter dated April 16, 2003, from the Regional Administrators of EPA Regions 2 and 3 to the Executive Director of the DRBC. The criteria are 44.4 picograms per liter in Zones 2 and 3, 44.8 picograms per liter in Zone 4 and the upper portion of Zone 5, 7.9 picograms per liter in lower Zone 5, and 64 picograms per liter in Zone 6.

Significant reductions are required throughout the estuary in any case, to meet the Stage 1 TMDL, as ambient concentrations of PCBs in the water body currently exceed the criteria by two to three orders of magnitude. For purposes of the Delaware River/Estuary TMDLs, point sources include all municipal and industrial discharges subject to regulation by the NPDES permit program, including CSOs and

regulated stormwater discharges. All other discharges are considered nonpoint sources. The Total PCB WLA for zones 2–5 is 38.86 mg/day, which represents 10 percent of the total allocation (i.e., the WLA, LA plus the margin of safety). For Zone 6, the WLA is 13.12 mg/day (0.7 percent of the TMDL). The Stage 2 TMDLs are still under development as of this writing.

Other Common Issues, Impacts and Themes Affecting Wastewater Treatment in Delaware

The main focus of this report is to discuss issues associated with wastewater collection, treatment, and disposal such as regionalization of municipal wastewater, water reuse, environmental and human health, socioeconomic concerns, and then to provide some recommendations.

Delaware's wastewater systems see the typical issues, concerns, and common themes similar to other systems throughout the region, if not the country or the world. These include wet weather flows and associated problems caused by infiltration and inflow (I/I), elimination or control of combined sewer systems, municipal comprehensive plan and master planning efforts, wastewater regionalization efforts, working with private utilities and the Public Service Commission, decentralized systems, and implementing water reuse techniques.

Many collection systems in Delaware experience I/I problems that affect pump stations and treatment systems, including collection-only systems that affect a downstream system that provides the treatment. The cost to completely rehabilitate collection system I/I issues is often impractical because of expense, and the problem is typically addressed via studies that target areas to fix on an "ongoing, case-by-case" basis.

Wilmington and Laurel are the only municipalities to report having combined sewers. Wilmington is currently in the process of finalizing its CSO Long Term Control Strategy along with its updated permit through DNREC. Laurel has a small combined sewer area downtown, but did not report CSOs, and is working to eliminate its combined sewer on a case-by-case basis. In 2005 Lewes also reported having some combined sewers, but has since eliminated them.

All three counties and most of Delaware's incorporated municipalities (those with 2,000 residents or greater) are required to discuss in their comprehensive plan how their wastewater is collected and treated. In addition, all three counties have some degree of regional wastewater master-planning efforts. With these regional planning efforts, Delaware has many successful collection-only systems that act as contract (or satellite) users to other systems that provide treatment. However, there is some debate over regionalization such as the costs of force main installations, electrical and maintenance costs of force mains and pump stations, the potential loss of revenue to a local government, various annexation (municipal boundary) issues, and the inability to find or implement local water reuse options. There are five known non-sewered municipalities in Delaware, three in Kent County and two in Sussex County. The three in Kent County are Houston (between Harrington and Milford), Viola, and Woodside (both south of Camden-Wyoming). The two in Sussex County are Bethel (west of Laurel) and Slaughter Beach (along the shoreline east of Milford).

In addition to county and municipal wastewater service and planning, there are two major non-governmental wastewater utilities, Artesian Wastewater Management, Inc. (Artesian) and Tidewater Environmental Services, Inc. (Tidewater), that have wastewater systems of various sizes scattered about Delaware, mostly in Sussex County. Artesian and Tidewater also have their own planning and regionalization efforts. For this report, the terms "private utility" or "private firm" (or similar term) may also mean a "publicly traded corporation," which applies to both Artesian and Tidewater.

On July 6, 2004, legislation was enacted by the Delaware General Assembly, found at 74 Delaware Laws, Chapter 317, which granted Delaware's Public Service Commission jurisdiction to regulate non-governmental wastewater utilities having 50 or more customers in the aggregate. That authority includes the jurisdiction to grant and revoke Certificates of Public Convenience and Necessity (CPCNs). The commission has adopted rules, regulations and procedures necessary to implement this authority. While Artesian and Tidewater are the major non-governmental wastewater service providers, there are approximately nine other entities in Delaware holding CPCN rights. CPCN areas may or may not be active developments, because some areas are either under development, postponed, or simply holding rights for various reasons. As seen with drinking water, CPCN areas are important to discuss because they can have major effects on regional planning efforts, both positive and negative.

Private utilities and companies also offer the opportunity for private-public partnerships. Private companies can provide both financial backing and technical expertise that a municipality or other government entity may not otherwise have. Examples of recent success stories for public-private partnerships include Tidewater's acquisition and rehabilitation of the Town of Milton's ailing wastewater system and Artesian's work with the Town of Middletown to help design and implement a wastewater spray irrigation system. In addition, many municipal wastewater utilities contract private firms to operate their facilities. For instance, the City of Wilmington contracts Veolia Water North America and Lewes contracts Severn Trent. Private-public partnerships regarding wastewater may also include other forms of government contracting, such as engineering, construction, reporting and laboratory work.

Aside from the centralized systems, there are about 80,000 individual or dual "on-site" septic systems and about 200 large decentralized or cluster community systems permitted through DNREC's Groundwater Division (a very small quantity of large systems are permitted through the Surface Water Division). Commercial or industrial systems are considered "large systems" as well. As previously stated, any system servicing 50 or more units is considered a regulated utility. This report includes the limited-scope survey of a representative sample of the clustered individual systems and the shared community systems, many of which are mobile home parks (MHPs). The results, with respect to MHPs, are limited to summarizing the representative sample in terms of size, location and type to capture how DNREC targets and performs enforcement of failing systems.

Finally, the report addresses wastewater reuse. Delaware's most common forms of wastewater reuse are currently spray irrigation on harvested crops or limited access fields, and internal reuse within a wastewater facility. "Purple pipe" for unlimited access areas currently exists as spray facilities at golf courses, and some municipalities reported planning of purple pipe for residential lawns, parks, and institutional uses (e.g., spray for athletic fields). RIBs, drip irrigation fields, and similar groundwater systems are also currently being implemented, although the topic of aquifer recharge as water reuse is under debate. Spray or drip irrigation in forested areas (limited access or otherwise) is under current consideration from DNREC. Groundwater recharge such as deep-well injection, slow-rate infiltration basins, and other fresh water conservation concepts (such as shallow injection in bay areas to create a barrier against seawater) are also being incorporated into reports, studies, or discussions as potential effluent management options. Groundwater recharge systems were documented as "other" along with any miscellaneous renewable or "green" technologies that were documented during the survey.

Also, note that this survey did not include discussing reuse with farmers, and any information about their vision regarding reuse is inferred (second-hand) through the wastewater interviews.

Funding for Wastewater Facilities

The State has developed the Strategies for State Polices and Spending. The policy was developed to coordinate land use decision-making with the provision of infrastructure and services in a manner that makes the best use of natural and fiscal resources. The goal of the State Strategies is to act as a guide for adequate infrastructure provision throughout the State while minimizing the burden on the State's taxpayers.

State agencies are directed to fund only projects that are compliant with the strategies. To accomplish that, three general strategies have been developed:

1. Towns, cities, counties and the state are collectively involved in the infrastructure planning process;
2. Existing infrastructure should be used before new infrastructure is constructed; and
3. When it is necessary to expand existing infrastructure, it should be expanded in a logical manner that aims to serve first those areas closest to existing services.

These strategies have been used to analyze spatial data from state, county, and local agencies to create a state strategies map that depicts land in three main categories:

1. Lands not available for development or redevelopment;
2. Lands for which state and local policies do not favor growth; and
3. Lands for which state and local policies do favor growth.

These categories have been used to develop Investment Levels 1, 2, 3 and 4 provided with this report. All municipalities are directed to develop comprehensive plans, including land use and expansion of wastewater infrastructure that is in compliance with the State Strategies.

Municipal wastewater utilities within Delaware have access to federal, state, and local funding programs and mechanisms to help fund wastewater capital improvement projects. DNREC's Financial Assistance Branch was established to help municipalities understand and secure funding. Some revenue and funding types are described briefly below, and detailed information about specific programs or sub-accounts is available through the Financial Assistance Branch or the CWAC.

Revenue. Revenue generation of a wastewater utility typically covers day-to-day operations and maintenance (O&M) costs, small-scale projects or repairs, and paying off existing debt/interest. It involves billing customers, charging impact/tapping fees, collecting satellite user fees, partnering with industry, and other similar methods.

Traditional Debt. In effort to raise additional capital, municipalities can take out loans from banks similar to a personal loan and can issue municipal bonds into the bond market. Bonds issued against the assessed value of the municipality are often referred to as general obligation bonds, or "GO" bonds.

Grants or Subsidized Debt Programs. Several federal and state programs are available for wastewater improvement projects. There is a typical application/selection process, or a project will get placed on a Project Priority List. Those programs consist of the following:

1. Delaware Water Pollution Control Revolving Fund
2. Department of Agriculture - Rural Utility Services (USDA-RUS)
3. State Sources (21st Century Funds)
    a. Wastewater Management Account
        i. Affordable Sewer Grants

4. Non Federal Administrative Account
   b. Wastewater Planning Matching Grants
   c. Surface Water Planning Matching Grants
   d. Community Water Quality Planning Grants

Overview of Wastewater Treatment Plant Stages

Conventional treatment plant process stages have become a debatable topic, particularly with the advent of "package systems," recirculation systems, and chemical injection systems that can provide multiple types of treatment (physical, chemical, and biological) at one time or within a contained system.

For this survey, the Food and Agriculture Organization of the United Nations' Wastewater Treatment and Use in Agriculture - FAO Irrigation and Drainage Paper 47 (1992) was used as a standardized method for determining level of treatment. Although the following is slightly dated, it serves as a basis to discuss the various systems throughout Delaware, which vary widely in age and type, from early treatment systems that began as primary but have been upgraded over the course of a century to new, "state-of-the art" systems. It is available online at http://www.fao.org/docrep/t0551e/t0551e05.htm.

Levels of Treatment

1. *Preliminary:* The objective of preliminary treatment is the removal of coarse solids and other large materials often found in raw wastewater. Often referred to as headworks, most if not all municipal plants in this survey have some type of preliminary treatment. Preliminary treatment was not reported in the survey.

2. *Primary:* The objective of primary treatment is the removal of settleable organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming. In municipal plants, these are typically primary clarifiers or settlement chambers.

3. *Secondary:* The objective of secondary treatment is the further treatment of the effluent from primary treatment to remove the residual organics and suspended solids. In most cases, secondary treatment follows primary treatment and involves the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes. It also includes secondary clarification. In municipal plants, these are typically activated biosolids, aerated lagoons, rotating biological contactors (RBCs), trickling filters, secondary clarifiers, or some other proprietary unit.

4. *Tertiary:* Tertiary and/or advanced wastewater treatment is employed when specific wastewater constituents that cannot be removed by secondary treatment must be removed. Individual treatment processes are necessary to remove nitrogen, phosphorus, additional suspended solids, refractory organics, heavy metals and dissolved solids.

5. *Disinfection:* Disinfection normally involves the injection of a chlorine solution at the end of the treatment train. Ozone and ultraviolet irradiation can also be used for disinfection. Most, if not all, municipal plants have some type of disinfection or finishing process, although it was not reported in the survey.

Definitions of Other Key Terms Used in this Study

Nutrient removal: Nutrient management is a critical theme in Delaware's wastewater systems. Although nutrient removal is typically considered tertiary treatment, not all tertiary treatment is for nutrient removal. Furthermore, nutrient management is now commonly becoming part of secondary treatment or integrated into package systems (described below). The survey allowed for stating nitrogen and phosphorus management outside of conventional levels of treatment.

Package Systems: "Package systems" has become an unofficial term used loosely for various vendor-proprietary systems that integrate conventional secondary and tertiary treatments together. In Delaware, they are mostly implemented for nutrient management (often referred to as enhanced nitrogen removal (ENR) or biological nitrogen removal (BNR) or for added filtration. Package systems may be implemented in various sites and sizes, from "all-in-one" small cluster systems to large-scale municipal systems.

Treatment by Vegetation: DNREC currently permits spraying wastewater on crops or fields for nutrient management provided the proper soil and vegetation studies have been performed. This survey does not discuss macrophyte ponds (maturation ponds that incorporate floating, submerged or emergent aquatic plant species) or other "vegetative treatment methods" because they are not typically used in Delaware's large/municipal treatment systems.

Effluent: Once treated, wastewater effluent must be managed. In Delaware, most large wastewater systems either discharge their effluent as a point source discharge to surface water, spray irrigate it onto permitted fields, allow it to infiltrate in large basins, or implement a combination of these. Management of treated wastewater effluent is a key theme of this report.

Sludge or Solids Management: Solids left over from the treatment process are typically run through some type of digestion process, dewatered, and then either disposed of at a landfill or reused in some way. Solids management was not part of this survey, although it is mentioned.

Pretreatment: Publicly owned treatment works are required to abide by the EPA's National Pretreatment Program. Although industrial or commercial pretreatment was not a focus of this survey, it was discussed by various municipalities, both with or without a publicly owned treatment works. EPA pretreatment guidelines should be universally applied, including its exemptions.

As stated, conventional levels of treatment has become a debatable topic with the advancement of wastewater treatment. During the survey, for instance, many of the municipal wastewater entities reported successfully bypassing or removing primary treatment and going direct to secondary treatment.

There is also current debate over effluent management terminology, specifically whether groundwater recharge can be deemed as a reuse. There appears to be a lack of common or accepted theme for as to what is deemed as effluent disposal, conservation, or reuse.

Section 2 – Statewide Summary/Overview

The Delaware DNREC and CWAC commissioned the development and implementation of a survey to perform an assessment of publicly and privately owned wastewater facilities and service areas (hereafter wastewater systems) (see Appendix C, Map 1-1). With CWAC guidance, the survey was developed to include a broader array of questions examining the wastewater infrastructure and fiscal status than previous surveys. The CWAC believed that a more in-depth survey was needed to inform its policy decisions and actions to support future wastewater financing needs throughout the State as new demands for nutrient removal are realized and existing infrastructure continues to age.

The survey was implemented in three stages. First, all representatives for all wastewater systems were invited to a meeting held in Dover to listen to an overview of the survey scope and questions. Second, a pre-populated survey was provided to each wastewater system using data available from existing sources. And finally, an in-person site visit was conducted at each wastewater system to complete updates to the survey. The updated surveys were provided to each wastewater system to allow for corrections to errors or omissions.

Municipalities provided the requested survey information at varying levels of completeness and detail, which necessitated scheduling follow-up calls or meetings to try to obtain uniform information from all participants. Data checks were undertaken for quality control and survey follow-ups were performed when data outliers were found, when an interpolation had to be made or if it was determined that an interviewee's response was incomplete.

Interpolated technical data related to wastewater collection and treatment was presented to complement the information provided by survey respondents to enhance the thoroughness of the presentation. In the few instances that interpolated values were used, they were back-checked using traditional flow models and available GIS information. Interpolation of data points occurred, where necessary, for the following data categories:

- Average flows of collection systems
- Average flows of treatment plants
- Number of households
- Population served
- non-served population within a service area (decentralized/septic)
- Census populations
- Contract user population (service to outside population)
- Service area size (acres)

Revenue sufficiency of the wastewater service providers was verified by evaluating the financial data received during the study. However, back-checking the database to ascertain if sufficient revenue is being generated could only be accomplished to a lesser degree than other survey data because reporting capability and type varied widely. The Future Capital financial data collected was checked for gross errors by comparing bottom-line capital improvement plan (CIP) dollar values to those of other municipal CIPs in the mid-Atlantic region with similar type/size/location attributes.

The following information sources were used to validate or interpolate the financial stability of wastewater service providers:

- Average annual sewer rate per household and number of households
- CIPs that reported typical O&M values (labor and equipment) in addition to capital costs
- Size and type of service area and/or treatment plant and traditional historical bottom-line dollar values
- The reserve account survey question assisted in gauging the wastewater enterprise's "health"

With respect to infrastructure status, some O&M expenditures included relatively minor capital replacements and enhancements. For example, while it is understood that O&M is not a capital expenditure, the survey did not specify at what dollar amount maintenance such as pump replacements or minor enhancements like small lift stations become a project. This distinction was further blurred by the lack of standardized capital improvement reporting from municipalities, from large municipalities where projects and funds overlap with multiple treatment plants and service areas, to small municipalities with little to no capital projects reported.

This section of the report provides an overview of the survey results separated into three main components—general information, infrastructure status, financial data, and reuse. For ease of reference, detailed information on each facility is provided in a series of tables, organized by topic, in Appendix A. Appendix B provides the completed survey for each wastewater system. Following this statewide summary, county and facility level details are provided beginning with Section 3.

General Information

In Delaware, there are 32 publicly owned wastewater systems. Two of the public wastewater systems are owned and operated by a regional authority, and the rest are municipally owned (see Table 2-1). Twenty-two of the public wastewater systems include a treatment plant, and 10 of the public wastewater systems are collection-only systems.[1] Of those 22 treatment plants, 15 have surface water discharge permits and 9 facilities have groundwater permits.[2] All nine facilities with groundwater permits use a storage lagoon for spray irrigation.

This survey also includes 12 operating and two proposed privately-owned systems.[3] Artesian owns five systems, all in eastern Sussex County, while the remaining systems are owned by Tidewater, one in Kent County and the rest in Sussex County. One Tidewater facility has a surface water discharge permit, while the remaining, active privately owned systems have groundwater permits. (Also see Tables A-1, A-2, A-3, and A-4 in Appendix A for wastewater system specific information.)

[1] The Delmar treatment plant, in Maryland, is included in this assessment.
[2] Two facilities, MOT WWTP and the Town of Bridgeville WWTF, have both surface water and groundwater discharge permits.
[3] One of the operating facilities is currently under acquisition.

Table 2-1. Wastewater System Responsibilities and Ownership

Wastewater System	*Responsibilities*		*Ownership*			
	Collection	Treatment	Municipal	Authority	Private Investor	Private Non-Investor
New Castle County	10	7	10	0	0	0
Kent County	7	2	6	1	0	0
Sussex County	15	13	14	1	0	0
Private	14	14	0	0	14	0
State	46	36	30	2	14	0

Infrastructure Status

Population Served and Flows

The 22 public and 12 private WWTPs provide centralized collection and treatment to a population of 796,402 (see Table 2-2a, Table 2-2b, and Figure 2-1). Of this total, 480,797 people (60.4 percent) are serviced at the Wilmington WWTP. The Wilmington WWTP is the State's largest surface water discharger and provides secondary treatment before discharge. The average daily flow at the Wilmington WWTP is 75 MGD with peak flow of 340 MGD. The design capacity is 105 MGD. About 32,000 individuals are serviced by the other treatment plants in New Castle County with a total average daily flow of 2 MGD. Public treatment plants in Kent and Sussex Counties service 103,461 and 173,773 individuals with average daily flows of 12.7 and 10.6 MGD, respectively.

The remaining 15 treatment plants that provide surface water discharges (besides the Wilmington WWTP) service a population of 224,121 (28.1 percent) with all but two facilities (Port Penn and Harrington) providing tertiary treatment.[4] The average daily flow at these 15 facilities is 21.3 MGD with a total design capacity of 41 MGD. Seven of those 15 facilities (Middletown-Odessa-Townsend [MOT] Regional, Kent County Regional, Lewes, Rehoboth Beach, Seaford, Laurel, and Millsboro) provide nitrogen removal and, with the exception of the Millsboro plant, provide phosphorus removal. The seven public and 11 private WWTPs that provide groundwater discharge provide treatment for a population of 91,484 (11.5 percent) with an average daily flow of 4.3 MGD and total design capacity of 11.1 MGD. (Also see Tables A-5, A-8, and A-17, and A-18 in Appendix A.)

Table 2-2a. Existing Plant Service Population and Flows

	Number of Treatment Plants	Population Served	Average Daily Flow, MGD	Design Capacity, MGD
New Castle County	7	512,982	77.1	111.0
Kent County	2	103,461	12.7	17.0
Sussex County	13	173,773[a]	10.6	28.1
Private	12	6,186	0.3	1.0
Total	34	796,402	100.7	157.1

Note: The two proposed private facilities are not included.

[a] Population served value for Sussex County is believed to be in excess and was not able to be resolved.

[4] These 15 facilities include the two facilities that have both surface and groundwater permits. The Harrington plant is under plans to convert to a pump station, conveying wastes to the Kent Count Regional plant.

Table 2-2b. Existing Plant Service Population and Flows

	Number of Treatment Plants		Population Served	Average Daily Flow, MGD	Design Capacity, MGD
	Public	Private			
Wilmington	1	0	480,797	75.0	105.0
Surface Water Dischargers	14	1	224,121	21.3	41.0
Groundwater Dischargers	**7**	11	91,484	4.3	11.1
Total	22	12	796,402	100.6	157.1

Note: The two proposed private facilities are not included.

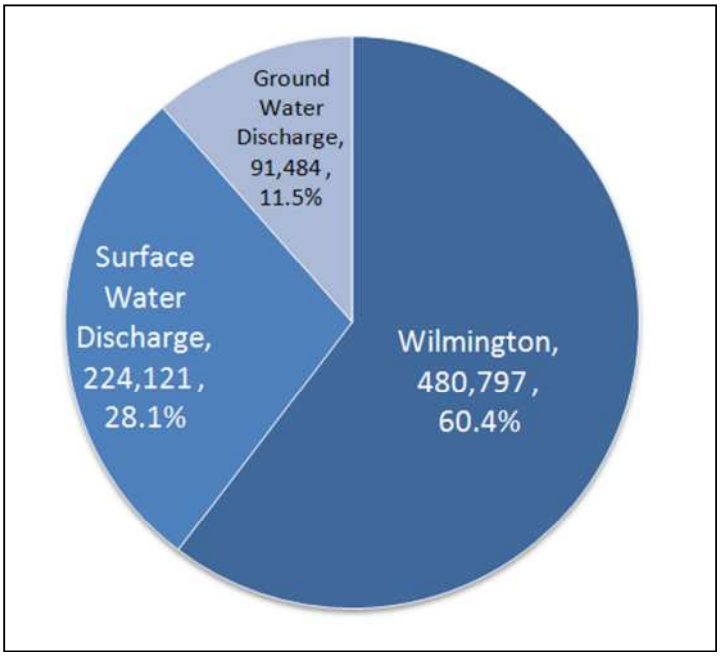

Figure 2-1. Population served for Wilmington treatment, surface water discharges and groundwater dischargers.

The percentage of average daily flow to current design flow varies from facility to facility. In New Castle County, the percentage of average daily flow to current design flow ranges from 22.8 percent at the MOT Regional WWTP to 80 percent at the Port Penn Sewage Treatment Plant (STP) (see Figure 2-2). In Kent County, the percentage of average daily flow to current design flow at the County Regional plant is 74.8 percent, and Harrington STP is 66.7 percent. In Sussex County, the percentage of average daily flow to current design flow ranges from 25.6 percent at the South Coastal Regional plant to 88.8 percent at the Selbyville plant. Private plants range from 8.6 percent to 45.7 percent.

The 2030 projections of service population increases are generally modest for public facilities in New Castle and Kent Counties with a total population served increase of approximately 35,000 with the majority of this growth attributed to the Kent County Regional WWTP and the Middletown plant. On the other hand, numerous public facilities in Sussex County identified substantial potential for increases in population served, primarily associated with the Inland Bays Regional WWTP, Wolfe Neck WWTP, and Milton (Tidewater) facility, but also to a lesser extent at the Lewes, Seaford, South Coastal Regional, Georgetown, and Millsboro plants. These projected increases in population served are associated with

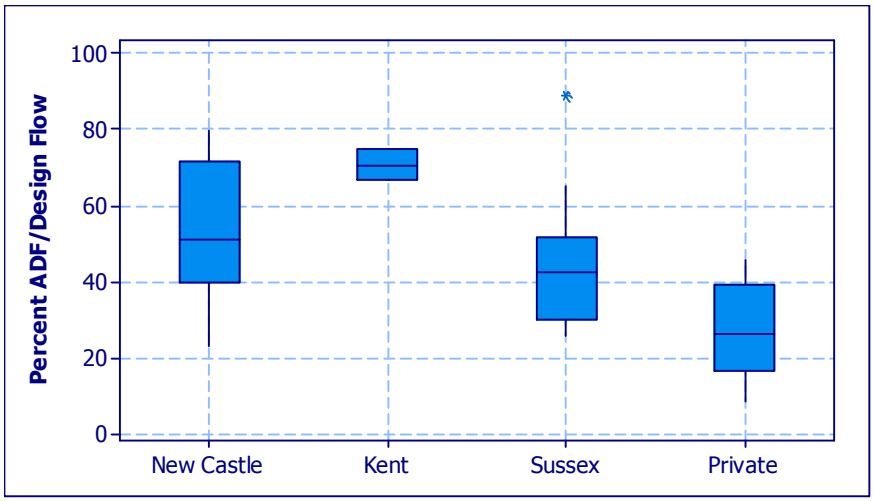

Figure 2-2. Percent of average daily flow to design capacity for treatment plants.

projected increases in anticipated and future design flows. However, it is noted that the projected increases in design flow lag the projected increases in population. This may be acceptable because some facilities have existing capacity (see Figure 2-2) and future water conservation practices might reduce future per capita flows. At this time, it is unclear when these projections will be realized given the current economic environment and nutrient reductions called for in the Chesapeake Bay and Inland Bay TMDLs. Nevertheless, if these population growth patterns begin to emerge, significant new future capital investment will be needed to meet these requirements. It is therefore recommended that CWAC and DNREC continue to monitor (1) indicators of new development, (2) changes in available existing capacity and (3) changes in per capita flow rates. To postpone or delay some capital investments, CWAC may wish to consider programs or policies that promote water conservation. (Also see Appendix Table A-8.)

Infiltration and Inflow

Four facilities—Harrington, Kent County Regional, Millsboro, and Delmar—indicated that the plant exceeded its current design flow capacity for two or more consecutive months in the past two years. Each of these facilities indicated that excessive Infiltration and inflow (I/I) contributed to these flow exceedances. Ten additional wastewater systems identified I/I issues. Progress toward addressing I/I issues include no action as of this time, ongoing investigations to quantify sources and magnitudes, and a range of rehabilitation/corrective actions. As expected, most of these investigations and remedial actions are incremental in nature, focusing on the most immediate issues commonly found in the older service areas. (For a list of all I/I comments, see Table A-8 in Appendix A.)

Treatment Plant Influent and Effluent

Four publicly and four privately owned facilities indicate above normal biological oxygen demand (BOD) and total suspended solids (TSS) levels, with three of the four public facilities indicating that the cause is food processing, whereas the other facilities did not report a cause (Table 2-3 and Table A-12).

Table 2-3. Treatment Facility Influent Strength Summary

	Below Normal *(<150 mg/L BOD and TSS)*	Normal *(150-250 mg/L BOD and TSS)*	Above Normal *(>250 mg/L BOD and TSS)*
New Castle County	**1**	**6**	**0**
Kent County	**0**	**1**	**1**
Sussex County	**0**	**10**	**3**
Private	**0**	**10**	**4**
State	**1**	**27**	**8**

Table 2-4 presents a summary of facilities with current or anticipated limits for ammonia, nitrogen or phosphorus (also see Table A-11). Of the 16 facilities with surface water discharges, about two-thirds already have nitrogen and/or phosphorus limits, and five (Delaware City, Port Penn, Wilmington, Selbyville, and South Coastal Regional) do not anticipate nutrient limits. The Inland Bays Regional facility and the Millsboro facility are expecting phosphorus and nitrogen limits within the next five years. Harrington, Delmar, Bridgeville and Millsboro all indicate problems meeting their nutrient limits. Millsboro indicated that its phosphorus problems were related to startup and likely going to rapid infiltration basin disposal with spray irrigation provided on an as-needed basis (moving away from surface water discharges). Delmar is upgrading to ENR/BNR and increasing capacity to 0.85 MGD; it plans to be in compliance with final limits within the next two years with funding and design in place. Bridgeville's facility cannot meet future nitrogen limits, and phosphorus will be difficult with the current facility. Bridgeville has added spray irrigation. It is likely that Bridgeville would need to upgrade its facility with BNR to meet the surface water discharge requirements or switch to spray irrigation completely or in conjunction with other reuse options. The existing Harrington facility cannot meet the nutrient limits; however, the facility is under plans for transition to a pump station, conveying its waste stream to the Kent County Regional facility.

Seventeen of the facilities that discharge to groundwater have nitrogen limits, and seven facilities have, or expect to have, phosphorus limits. The Inland Bays Regional facility indicated troubles with meeting its nitrogen limits. The Inland Bays Regional facility amended its permit in 2009 by adding another spray field, and it indicated that a new Biolac™ system should resolve the nitrogen and anticipated phosphorus limits.

Table 2-4. Treatment Facility Ammonia Nitrogen (NH_3-N), Total Nitrogen (TN) and Total Phosphorus (TP) Limits and Compliance

Wastewater System	Number of Facilities	Ammonia Nitrogen		Total Nitrogen					Total Phosphorus				
		Removal Required?	Non-compliance?	Limit Now?	Limit <5 years?	Limit not anticipated	Non-compliance	Anticipated non-compliance	Limit Now?	Limit <5 years?	Limit not anticipated	Non-compliance	Anticipated non-compliance
Surface Water Discharge Systems (or both Surface and Groundwater Discharge Systems)													
New Castle County	4	1	0	1	0	3	0	0	1	0	3	0	0
Kent County	2	0	0	2	0	0	1	0	2	0	0	1	0
Sussex County	9	1	1	6	1	2	2	0	7	0	2	3	0
Private	1	0	0	0	1	0	0	0	0	1	0	0	0
State	16	2	1	9	2	5	3	0	10	1	5	4	0
Groundwater-Only Discharge Systems													
New Castle County	3	0	0	3	0	0	0	0	1	0	2	0	0
Kent County	0	0	0	0	0	0	0	0	0	0	0	0	0
Sussex County	4	0	0	4	0	0	1	0	2	1	1	0	0
Private	13	0	0	10	2	1	0	0	1	2	10	0	0
State	20	0	0	17	2	1	1	0	4	3	13	0	0

Service Areas

Table 2-5 presents a summary of sewer service areas including square mileage, number of pump stations, number of holding tanks and total holding tank capacity. (Also see Table A-15 in Appendix A.) Service area maps at the state and county level are provided as Maps 1-2 through 1-3g in Appendix C.

Table 2-5. Summary of Sewer Service Areas

Wastewater System	Service Area (square miles)	Pump Stations	Holding Tanks	Hold Tank Capacity (Gallons)
New Castle County	330.8	182	19	3,137,000
Kent County	95.1	175	2	300,000
Sussex County	113.2	423	24	20,000,000
Private	51.0	29	0	0
State	590.0	809	45	23,437,000

Backup Power Supplies at Treatment Facilities

All but three of the publicly owned treatment facilities have an on-site diesel or gasoline powered backup generator (either fixed or portable) (see Table 2-6). In addition to having a backup generator, the Wilmington facility has a secondary feed from the grid, and the Kent County Regional facility has a 1.2-megawatt solar generator. The City of Rehoboth Beach facility has only a second feed from the same substation on the power grid using a different transformer, while the Frog Hollow and Middletown facilities have no backup power supply. All but one of the privately owned and operated treatment facilities have fixed on-site diesel or gasoline powered backup generators, and the one without it has a

portable unit. Three of the private facilities have portable units in addition to fixed units. (Also see Table A-7 in Appendix A.)

Table 2-6. Treatment Facility Backup Power Supply

Wastewater System	On-site Generator (diesel/gasoline)	On-site Generator (natural gas/propane from tank)	Portable Generator	None
New Castle County	3	0	2	2
Kent County	2	0	0	0
Sussex County	11	1	1	1
Private	12	0	4	0
State	28	1	7	3

Backup Power Supplies for Pump Stations

Table 2-7 presents information collected from the surveyed entities about the backup power supply options they have available for pump stations (on-site generator, portable generator, battery, none and other). Backup power represents a first line of defense against the occurrence of sanitary sewer overflows caused by either widespread or localized electrical power grid outages. (Also see Table A-16 in Appendix A.)

Table 2-7. Pump Station Backup Power Source

Wastewater System	On-site Generator (diesel/ gasoline)	Other On-site Generator (natural gas or propane)	Other On-site Generator (natural gas or propane)	Portable Generator	Battery	None
New Castle County	10	1	1	7	0	0
Kent County	6	0	1	3	0	1
Sussex County	14	1	0	9	0	6
Private	11	0	0	2	0	1
State	41	2	2	21	0	8

Wastewater System Revenue, Rates, and Planned Capital Expenditures

Wastewater system representatives were asked a series of questions about their current user rates, revenue, and future capital expenditures. As in the case of the infrastructure questions reviewed in the previous section, this section of the survey also included an expansion of scope from previous surveys. Nevertheless, questions excluded non-residential revenue and therefore may tend to give an incomplete view of a system's financial status.

Revenue Generation and User Rates

All wastewater system representatives were asked whether they were generating sufficient revenue to meet the cost of their wastewater enterprise without transfer from other enterprises. Most survey respondents answered this question by indicating whether their revenues were sufficient for the current or next fiscal year. (It was beyond the scope of the survey questions to seek out a longer term horizon to revenue generation sufficiency.) All but three public facilities indicated that they were generating sufficient revenue. Wilmington indicates that it expects to be on track by FY12. Middletown indicates that additional growth is needed to close the current gap in current plant O&M contract costs. And, Millsboro indicates that while current O&M costs are covered for its new plant, a stalled development has limited anticipated impact fees that were to cover loan payments. Ten of the 11 private plants

indicated they were running a deficit primarily because of lower than expected build-out rates; Tidewater anticipated rate adjustments in 2012 to address this issue. (Also see Table A-19 in Appendix A.)

All but three public wastewater systems maintain a reserve account, and those three wastewater systems—the Wilmington Wastewater Treatment Plant, the Clayton collection system, and the Georgetown Water Reclamation Facility—are considering or moving toward establishing a reserve account. Twenty-five of the 29 public wastewater systems with reserve accounts indicate restrictions for their wastewater enterprise. Reporting on the value of the reserve account as a percent of the wastewater system operating revenue was too varied to effectively summarize to the state level. (Also see Table A-20 in Appendix A.)

Annual average sewer rates were collected at the sewer district level. Average wastewater system sewer rates were computed on a household-weighted basis from the sewer district level data. Figure 2-A and Figure 2-B present the distribution of sewer district and wastewater system annual average sewer rates, respectively. Figure 2-C presents the wastewater system annual average sewer rate as a percent of median household income (MHI) (also see Table 2-8). Sewer rates varied by a factor of four across public wastewater systems, ranging from $185/household at the Middletown and Frog Hollow facilities to $795/household for the City of Lewes. Within each county, the variation in average household user rates was less, ranging from 2 to 3. The average household sewer rates for private systems generally ranged from $850 to $1,245/household, although the Milton Regional facility's average household sewer rate is $350/household. Additionally, Tidewater has applied for a rate increase. Expressing the average household sewer rate as a function of MHI, the average household user rate for public facilities ranged from 0.34 to 1.84 percent of the MHI, while private facilities ranged from 0.87 to 2.61 percent of the MHI. (Also see Table A-22 and Table A-23 in Appendix A.)

Another observation is apparent when comparing the distribution of average sewer rates between Figure 2-4A and Figure 2-4B for Sussex County. The distribution of sewer rates among sewer districts within Sussex County ranges from $179/household to $1,453/household while the range is smaller when averaged to the wastewater system level. Some of these differences can be attributed to different rate structures for residents inside versus outside city limits as well as a relationship to sewer district size. This latter issue is portrayed in Figure 2-4 which displays sewer rates by the number of households in the sewer district and wastewater system. While sewer rates in Kent and New Castle Counties tend to be relatively flat with respect to district size, sewer rates in Sussex County tend to decrease with increased sewer district size. Interestingly, private sewer rates appear comparable to those of similarly-sized public sewer districts in Sussex County.

Table 2-8 presents information on current and potential revenue scenarios. Total annual revenue from residential customers was $40.2M, $14.8M, $37.0M, and $1.6M for public facilities in New Castle County, Kent County, Sussex County, and private facilities, respectively. If all wastewater systems increased their average household sewer rates to 1.5 percent of the MHI, additional residential revenue of $97.8M, $14.7M, $12.0M, and $0.3M would be realized, respectively. It should be recognized that three public (Greenwood, Georgetown, and Laurel) and all but two private systems with average household sewer rates already greater than 1.5 percent of their MHI would not realize any increased revenue under this scenario. If all wastewater systems increased their average household sewer rates to 1.0 percent of the MHI, additional residential revenue of $51.8M, $5.1M, $1.5M, and $0.1M would be realized for public facilities in New Castle County, Kent County, Sussex County and private facilities, respectively. In this scenario, 10 public would not realize increased revenue since their average user rates exceed 1.0 percent of the MHI. Table 2-8 also presents additional scenarios for increasing sewer rates to 2.0 and 2.5 percent of MHI. Facility specific results are provided in Appendix A, Table A-22.

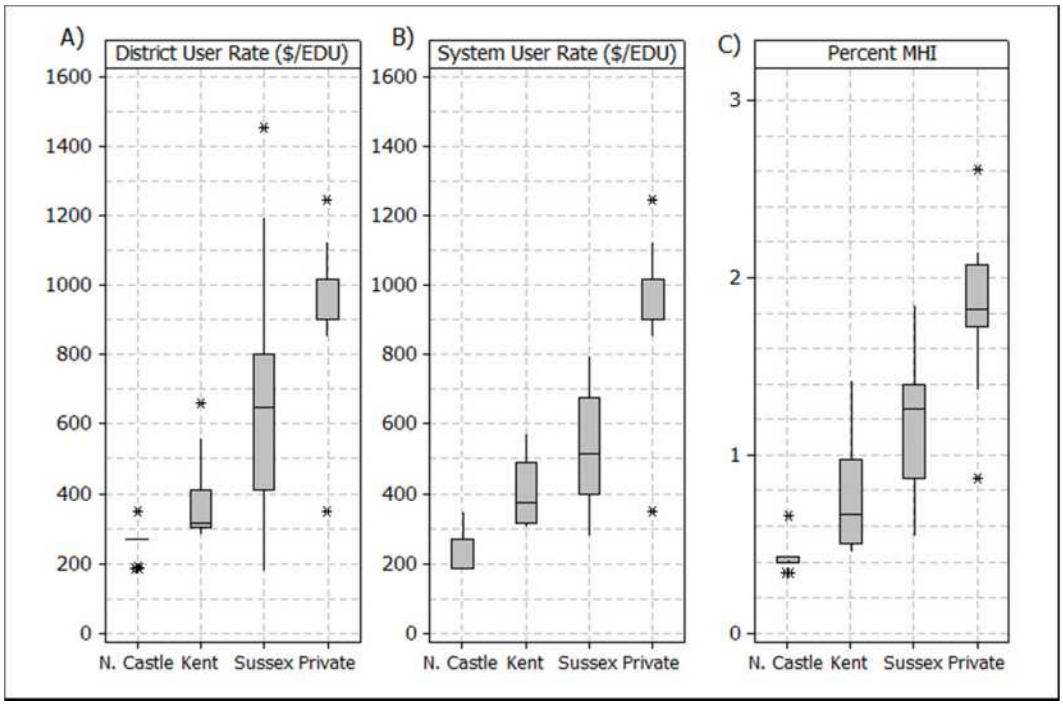

Figure 2-3. Distribution of A) sewer district annual sewer rates, B) wastewater system annual sewer rates, and C) wastewater system annual average sewer rate as a percent of MHI.

Table 2-8. Wastewater system annual average sewer rates, MHI, current residential revenue and potential increased revenue.

	Average Sewer Rate ($/house-hold) [a]	Median House-hold Income (MHI) [a]	Average Rate as % of MHI [a]	Present Annual Residential Revenue ($M) [b]	Additional Residential Revenue ($M) [b]			
					1.0% MHI increase	1.5% MHI increase	2.0% MHI increase	2.5% MHI increase
New Castle County	$185 $252 $350	$45,623 $58,100 $62,293	0.341 0.434 0.656	$40.2	$51.8	$97.8	$143.7	$189.7
Kent County	$303 $397 $571	$40,204 $52,309 $66,853	0.453 0.807 1.421	$14.8	$5.1	$14.7	$24.5	$34.4
Sussex County	$277 $536 $795	$34,532 $46,884 $66,817	0.540 1.166 1.843	$37.0	$1.5	$12.0	$28.0	$44.3
Private [c]	$350 $921 $1,245	$40,313 $50,442 $65,773	0.868 1.837 2.609	$1.6	$0.1	$0.3	$0.7	$1.3
State	$185 $554 $1,245	$34,532 $51,231 $66,853	0.341 1.126 2.609	$93.7	$58.4	$124.8	$197.0	$269.7

[a] Minimum, arithmetic average, maximum for all wastewater systems.
[b] Summation for all wastewater systems.
[c] Does not include proposed Trussum and Wandendale facilities.

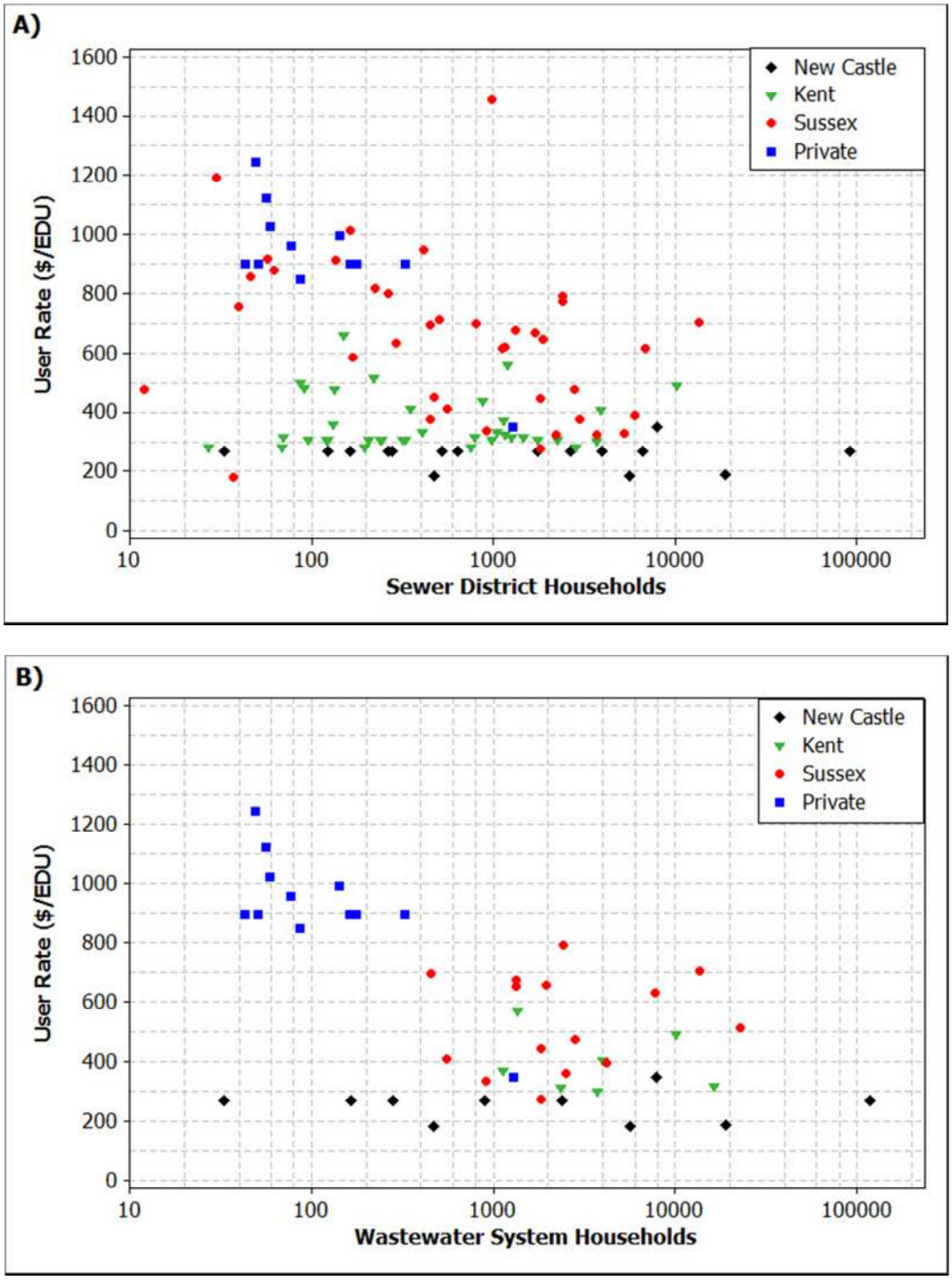

Figure 2-4. Annual average sewer rate as a function of the number of households for A) sewer districts and B) wastewater systems.

Capital Project Costs

The total capital project costs from 2011-2016 for the State of Delaware are estimated at $653.7M (Table 2-9). These estimates are based on estimated costs of $288.5M, $95.9M, and $269.3M for public wastewater systems in New Castle, Kent and Sussex Counties, respectively. Private wastewater systems reported another $9.1M in capital costs. Numerous additional private wastewater system projects were identified, but no cost estimates were available. About three-fourths of these project costs are related to collection and conveyance while 20 percent are related to treatment. For the projects reported, $353.6M was incurred before 2011 and an additional $99.7M is necessary to finish out these projects after 2016. Costs prior to 2011 or after 2016 are not included in Table 2-9. It is noted that Greenwood and Selbyville did not report any capital project costs. Of the remaining 20 wastewater systems (or system groups) listed in Table 2-9, four systems did not report any project costs for 2015 and 12 systems did not report any project costs for 2016. Extrapolating the average annual capital project costs to the un-reported years suggests a potential under reporting of approximately $45.6M (7 percent). (See Table A-25 in Appendix A for a list of projects by wastewater system.)

For New Castle County-owned systems, capital project costs from 2011-2016 are $245.4M. Projects include $101.5M for the Brandywine Hundred North and South sewer rehabilitation Phase 1 and 2 projects, $33.7M for the North Delaware interceptor system, and $26.4M for the White Clay sewer basin rehabilitation. The City of Wilmington's 2011-2016 capital project costs are $36.2M with about 60 percent ($21.4M) of these projects related to sewer rehabilitation and improvements.

In Kent County, $39.1M is planned for upgrades to the Kent County Regional WWTP from 2011-2016. An additional $13.3M is planned in upgrades to the Kent County Regional collection system, which includes conveyance from satellite collection systems. Dover, Milford, Harrington, Camden-Wyoming, Clayton and Smyrna report projects totaling $31.7M of which $24.2M is related to sewer rehabilitation and replacement.

Facilities owned by Sussex County report $189.8M in capital project costs from 2011-2016. Those needs include $136.9M for sewer collection and conveyance and $52.6M for treatment plant costs. Bridgeville, Laurel, and Delmar include treatment plant upgrades totaling an estimated cost of $12.7M primarily dealing with TMDL/compliance issues. Millsboro includes $19.6M for reuse transmission and aquifer recharge costs. The City of Rehoboth 2011-2016 capital project costs includes $19.1M for the construction of a pump station, force main and ocean outfall 6,000 feet offshore along with $6M for various treatment plant upgrades and replacements including provisions for emergency power. Laurel and Delmar report $6.4M for pump station replacements, I/I studies, and sewer replacement and rehabilitation projects.

Wastewater systems project that about one-half (51.7%, 337.7M) of the capital project costs will be financed through issuance of bonds (Table 2-10). Nearly equal shares of these costs are expected to be financed through requests to the Clean Water State Revolving Fund (12.1%, $78.8M) and through municipal sinking fund, asset replacement costs savings and current municipal budgets (13.2%, $86.3M). Municipal requests to USDA are expected to account for 7.7 percent ($50.3M) of the 2011-2016 project costs. No funding sources were reported for $88.1M (13.5%) of the 2011-2016 project costs. It is noted that most ($61.5M) of the $88.1M is associated with 2011. Of the projects expected to be funded through the Clean Water State Revolving Fund, the yearly funding requests range from $11.3M to $21.2M from 2011-2014. Expected funding requests to the Clean Water State Revolving Fund are $5.7M and $3.2M during 2015 and 2016, respectively (Table 2-11). The potential under reporting of project costs in 2015-2016, the non-reported funding source for $88.1M, and drop off in expected Clean Water State Revolving Fund requests in 2015-2016 result in uncertainties in the expected funding requests to

the Clean Water State Revolving Fund during the 2011-2016 time period. (See Table A-26 in Appendix A for projections by wastewater system.)

Table 2-9. Reported Capital Project Costs ($M), 2011-2016

Wastewater System	Reported Capital Project Costs ($M), 2011-2016				
	Collection	Conveyance	Treatment	Disposal	Total[a]
New Castle County					
New Castle County owned systems [b]	$92.8	$142.3	$6.1	$4.3	$245.4
Town of Middletown - Frog Hollow and Middletown WWTFs	$0.8	$0.9	$1.1	$0.9	$3.5
Wilmington WWTP	$10.8	$16.6	$8.8	-	$36.2
City of Newark Sewer Authority (treated by Wilmington WWTP)	$1.6	$1.7	-	-	$3.3
Kent County					
Kent County Regional WWTP	$2.7	$10.7	$39.1	<$0.1	$52.5
City of Harrington WWTP	$2.8	$4.0	$0.7	$0.7	$8.0
Camden-Wyoming Sewer and Water Authority (treated by Kent County WWTP)	$3.3	$2.1	-	-	$5.5
Dover Sewer Authority (treated by Kent County WWTP)	$2.9	$7.4	-	-	$10.3
Milford Sewer Authority (treated by Kent County WWTP)	$4.8	$7.0	-	-	$11.8
Town of Clayton (treated by Kent County WWTP)	$1.7	$1.7	-	-	$3.4
Town of Smyrna (treated by Kent County WWTP)	$1.8	$2.8	-	-	$4.5
Sussex County					
Sussex County owned facilities [c]	$56.1	$80.8	$52.6	$0.3	$189.8
City of Lewes STP	$0.8	$1.1	$0.4	<$0.1	$2.3
City of Rehoboth Beach STP	-	$1.1	$8.1	$15.9	$25.1
City of Seaford WWTP	-	$0.1	$0.1	$0.1	$0.4
Delmar WWTP	$2.2	$3.1	$6.0	-	$11.3
Town of Georgetown WRF	$2.8	$3.0	$2.8	$2.8	$11.4
Town of Bridgeville WWTF	<$0.1	<$0.1	$0.8	<$0.1	$0.8
Town of Greenwood (treated by Bridgeville WWTF)	-	-	-	-	-
Town of Laurel STP	-	$1.1	$6.0	-	$7.1
Town of Millsboro WWTF	$0.3	$6.3	$0.3	$14.1	$21.0
Town of Selbyville WWTF	-	-	-	-	-
New Castle County Total [a]	**$105.9**	**$161.4**	**$16.0**	**$5.1**	**$288.5**
Kent County Total [a]	**$19.9**	**$35.6**	**$39.8**	**$0.7**	**$95.9**
Sussex County Total [a]	**$62.3**	**$96.6**	**$77.0**	**$33.4**	**$269.3**
State Total [a,d]	**$188.1**	**$293.6**	**$132.8**	**$39.2**	**$653.7**

[a] Row and column totals may not add consistently due to independent rounding.
[b] Capital needs for New Castle County were summarized at the county level for all New Castle County-owned facilities including Delaware City WWTP, Lea Eara Farms WWTP, Port Penn STP, MOT WWTP, Water Farm #2 CS, and the North of the C&D CS.
[c] Capital needs for Sussex County were summarized at the county level for all Sussex County-owned facilities including Inland Bays WWTF, Piney Neck WWTF, South Coastal WWTF, Wolfe Neck WWTF, and Sussex County CS.
[d] State total does not include $9.1M reported by private facilities. Numerous capital needs for private facilities were reported that did not have cost data available or had costs that were still to be decided.

Table 2-10. Reported Financing Options ($M), 2011-2016.

	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	No funding source indicated	Other Financing Method	Total
New Castle County	$0.1	$268.5	$15.9	-	$3.8	-	$0.2	$288.5
Kent County	$0.5	-	$43.2	$5.9	$22.8	$18.6	$5.0	$95.9
Sussex County	$3.2	$69.3	$19.7	$44.4	$59.8	$69.5	$3.4	$269.3
State	$3.7	$337.7	$78.8	$50.3	$86.3	$88.1[a]	$8.7	$653.7

[a] Most ($61.5M) of the $88.1M for which no funding source was indicated is associated with 2011.

Table 2-11. Reported Request to the Clean Water State Revolving Fund by Year ($M), 2011-2016.

	2011	2012	2013	2014	2015	2016	2011-2016
State	$20.4	$11.3	$21.2	$16.9	$5.7	$3.2	$78.8

Water Reuse and Related Sustainability Initiatives

The State of Delaware promotes sustainable water management by directing infrastructure funding to targeted priority development areas and facilitating water reclamation and reuse via regulations, policy, guidance and education/outreach. The State promotes reuse for a variety of excellent reasons—water conservation, reducing nutrient discharges and recycling nutrients, recharging aquifers, maintaining agricultural land and other open space, helping farmers, and so forth.

The level of treatment required for water reuse in Delaware depends on two primary factors: how the reclaimed water will be used, and the degree of public contact the site may receive. At sites where public access is not restricted (such as lawns, golf courses, and such), tertiary treatment must be provided with TSS and BOD concentrations below 10 milligrams per liter (mg/L), fecal coliform levels below 10 colonies/100 milliliters, and a disinfection residual. On agricultural sites where buffers from reuse areas are at least 150 feet and public access is restricted, TSS and BOD levels should average less than 50 mg/L, fecal coliform levels must be below 200 colonies/100 milliliters, and disinfection must be provided.

Loading rates on sites using reclaimed water for irrigation are limited both hydraulically and by the amount of nutrients that can be applied. Maximum hydraulic loading rates are based on soil permeability rates determined by field testing, whereas nutrient loading rates are dictated by the requirements of the crops being grown. Typically, the nitrogen loading rate is the overriding factor that limits the amount of reclaimed water that can be applied on a site.

Delaware has a long history of beneficial reuse of reclaimed water, primarily via spray irrigation to agricultural lands. Some fields in Delaware have been receiving reclaimed water since the 1970s with no adverse effects on the fields, crop yields or groundwater beneath the field. Current water reuse practices, perspectives and plans presented in this section were determined using the aforementioned survey instrument. On the basis of those survey results, Table 2-12 summarizes water reuse options either planned or currently used at each treatment plant, whereas Table 2-13 summarizes the results by county and Table 2-14 summarizes the results by level of planning at treatment plants responding to the question: Has this entity evaluated options for reuse via the listed reuse options?

Table 2-12. Reuse Currently Used or Planned by Treatment Plant

Wastewater System	Irrigation - Ag	Commercial/ Industrial	Residential	Municipal Biosolids	Other	Other Uses
New Castle County						
New Castle County - Delaware City WWTP	No	No	No	No	No	
New Castle County - Lea Eara Farms WWTP	Yes	No	No	No	No	
New Castle County - Port Penn STP	No	No	No	No	No	
New Castle County - Water Farm #1 aka MOT Regional WWTP	Yes	No	No	No	No	
Town of Middletown - Frog Hollow WWTF	No	Yes	No	No	No	
Town of Middletown - Middletown WWTP	Yes	Planned	Planned	No	Yes	parks, planning on golf courses
Wilmington WWTP	No	No	No	Yes	No	
Kent County						
City of Harrington WWTP	No	No	No	No	No	
Kent County Regional WWTP	No	No	No	Yes	Yes	Spray irrigation at plant
Sussex County						
City of Lewes STP	No	No	Planned	Yes	Yes	plant internal reuse
City of Rehoboth Beach STP	No	No	No	Yes	No	
City of Seaford WWTP	No	No	No	Yes	Planned	planning reuse on golf courses
Delmar WWTP	No	No	No	No	No	
Sussex County - Inland Bays Regional WWTF	Yes	No	No	Yes	No	
Sussex County - Piney Neck Regional WWTF	Yes	No	No	Yes	No	
Sussex County - South Coastal Regional WWTF	No	No	No	Yes	Yes	plant internal reuse
Sussex County - Wolfe Neck WWTF	Yes	No	No	No	No	
Town of Georgetown WRF	Yes	No	No	Yes	No	
Town of Bridgeville WWTF	Yes	No	No	Yes	No	
Town of Laurel STP	Planned	No	No	No	Planned	RIBs
Town of Millsboro WWTF	Planned	Planned	Planned	No	Planned	RIBs
Town of Selbyville WWTF	No	No	No	No	No	
Private						
Artesian - Beaver Creek	No	No	No	Yes	Yes	RIBs
Artesian - Heron Bay	No	No	No	Yes	Yes	RIBs
Artesian - Reserves at Lewes Landing	No	No	No	Yes	Yes	Drip Irrigation
Artesian - Stonewater Creek	No	No	No	Yes	Yes	RIBs
Artesian - Villages at Herring Creek	Yes	No	No	No	No	
Tidewater - Bay Front Regional	No	No	No	Yes	Yes	RIBs
Tidewater - Breeder's Crown	No	No	No	Yes	Yes	RIBs
Tidewater - Country Grove	No	No	No	Yes	Yes	RIBs
Tidewater - Hart's Landing	No	No	No	Yes	Yes	Drip Irrigation

Wastewater System	Irrigation - Ag	Commercial/ Industrial	Residential	Municipal Biosolids	Other	Other Uses
Tidewater - Milton Regional	Planned	No	No	Yes	No	
Tidewater - Retreat	No	No	No	Yes	Yes	Subsurface irrigation
Tidewater - The Ridings *In Process of Acquiring*	No	No	No	Yes	Yes	Drip Irrigation
Tidewater - Trussum *Proposed*	No	No	No	Planned	Planned	RIBs
Tidewater - Wandendale *Proposed*	Planned	No	No	Planned	Planned	RIBs

As illustrated in Table 2-12, 31 of the 36 WWTPs surveyed currently include some kind of reuse feature or have a feature in planning, including all 14 privately operated plants along with a majority of the plants in Sussex and New Castle Counties as well as the Kent County regional plant. As shown in Table 2-13, most of the current applications are for reusing treated biosolids (sludge), which is either already being done or is planned (for developments being constructed) for all but one of the privately operated plants.

With respect to water reuse, agricultural irrigation is the most common reuse option in Delaware, with significant additional interest and/or planning efforts underway to expand agricultural reuses. The State has promoted agricultural reuses and, in fact, is well suited for agricultural reuse given significant agricultural land uses, particularly in Kent and Sussex Counties.

The CWAC commissioned the University of Delaware (UD) to study the potential for expanding agricultural reuses, primarily by identifying large agricultural tracts of land proximate to treatment facilities. The objectives of this study are as follows:

1. Identify potential spray irrigation sites for wastewater disposal for new development and existing WWTPs in Sussex, Kent and New Castle Counties;
2. Compare the costs of spray irrigation with other wastewater treatment options;
3. Recommend changes to existing regulations and new policies to implement spray irrigation as a viable wastewater treatment option; and
4. Ensure that the use of State land for the slow rate land application of treated wastewater (spray irrigation) is consistent with existing management plans and the intended public use of these lands.

The results of the survey associated with this statewide inventory and needs assessment have been provided to UD, and UD has developed a preliminary report and map showing potential spray irrigation sites (Map 5-1 in Appendix C). A summary of the UD report is presented in the next section.

Commercial and industrial reuse applications (with the exception of agricultural reuse) appear limited to a few plants with water-intensive industries nearby; residential reuse is being planned for only three plants—Middletown, Lewes, and Millsboro. Most of the "other" reuse category involves aquifer recharge via RIBs or, in a few cases, drip or subsurface irrigation. Additionally, several plants reuse water internally for various non-potable purposes within the WWTP.

Similar survey data were obtained for 10 county-operated collection systems. Of these 10 systems, none had yet implemented reuse (understandable, given that these systems do not currently include their own treatment plants, but rather convey wastewater to another treatment plant that may or may not include a reuse element). One system (New Castle Water Farm #2) is planning an irrigation site; however, this likely will not be implemented until it can be supported by population growth, which may be 15 to 30 years into the future. Several of these 10 collection systems indicated an interest in implementing some kind of reuse system, including smaller-scale localized (e.g., satellite) reuse systems, industrial pretreatment and source separation, and other nontraditional options to help conserve water and reduce receiving WWTP loadings. These results indicate that innovative reuse guidance targeted to collection system-only utilities might be warranted.

The full database output of the survey results for the wastewater reuse questions is provided in Tables A-27 through A-35 in Appendix A and includes additional details about the reasoning behind decisions to pursue or not pursue reuse at each of the surveyed plants. These data, as also summarized in Table 2-14, show that most of the plants have at least considered and, to some extent, have studied potential reuse options. Agricultural reuse has generated most of the interest and study among surveyed plants. Several plants indicated that a lack of clear guidance, state policy or incentives precluded their further pursuit of reuse options. While no plants explicitly indicated that reuse treatment requirements were prohibitive, detailed responses from the facilities regarding their ability to meet Unlimited Public Access Site Limitations (also provided in Appendix A) show that an inability to meet specified BOD, TSS, TN, or TP limits restricts some plants (Table 2-15 indicates the numbers of systems in each county that meet Unlimited Public Access Site Limitations for irrigation reuses).

Additional discussion about specific water reuse responses are summarized within Sections 3, 4 and 5 for New Castle, Kent and Sussex Counties, respectively.

Table 2-13. Treatment Plant Reuse Currently Used or Planned by County (Current/Planned)

County (#WWTPs)	Total Reuse (Current & Planned)	Irrigation - Agriculture	Commercial/ Industrial	Residential	Biosolids	Other
New Castle (7)	5	3/0	1/1	0/1	1/0	1/0
Kent (2)	1	0/0	0/0	0/0	1/0	1/0
Sussex (13)	11	5/2	0/1	0/2	8/0	2/3
Private (14)	14	1/2	0/0	0/0	11/2	10/2
TOTAL (36)	31	9/4	1/2	0/3	21/2	14/5[a]

[a] The Middletown WWTP implements reuse in its parks currently and is planning on reuse on golf courses; it was counted as current only once in this table.

Table 2-14. Statewide Summary of Reuse Options Evaluated/Considered at Treatment Plants

Reuse Option	Not Considered	No, but Interested	Yes, but not viable	Yes, planning performed	Yes, currently implementing reuse
Irrigation - Agriculture	14	5	4	4	9
Commercial/Industrial Use	23	7	3	2	1
Residential Use	26	5	2	3	0
Municipal Sludge Reuse	6	7	0	2	21
Other Reuse	13	4	0	5	14

Table 2-15. Number of Treatment Plants in Each County that Meet Unlimited Public Access Site Limitations (# Meeting/Total # of systems)

Wastewater System	Meets Unlimited Public Access Limitations
New Castle County Total	2/7
Kent County Total	1/2
Sussex County Total	5/13
Private Total	4/14
State Total	12/36

Survey respondents were also asked to summarize the availability of agricultural lands for potential effluent spray irrigation reuse sites. These results are provided in the database output in Appendix A. In general, the privately owned/operated systems tended to be located relatively close to potential agricultural reuse sites; however, it is believed that their effluent flow rates are too small to meet minimum agronomic demands for reclaimed water.

Respondents representing other municipal plants in Sussex and Kent Counties indicate that agricultural land may be available and that farmers may be quite interested in using reclaimed water provided that the farmers have a sufficient amount of control over flows. However, some farmers may also be concerned about nutrient management, solids management and other secondary issues pertaining to the use of reclaimed water, implying that an enhanced focus on education and outreach to agricultural constituencies may be worthwhile. Additionally, standardizing policies regarding the provision of reclaimed water to agricultural users and/or providing applicable incentives (e.g., tax credits, nutrient credits) may help alleviate potential concerns about their risks and liability.

In response to general questions about water reuse and related sustainability initiatives, a number of plants indicated that they were pursuing energy-efficiency initiatives or renewable energy projects, including biogas (at Wilmington) and solar and other renewables at several other plants. Responses to survey questions indicated that relatively few plants use water reuse to help meet permit limits, although several plants are switching to ocean outfalls or pursuing nutrient trading initiatives to help meet Inland Bays nutrient limits.

Responses to survey questions regarding potential capital needs for upgrading to reuse varied widely as shown in Table 2-16. Some respondents indicated that major general plant upgrades are needed, while others provided specific unit processes or system components needed to implement reuse. Only two plants provided cost estimates for needed upgrades, while one (Kent County Regional) indicated that funding is already in place for upgrading the plant to reuse.

University of Delaware Spray Irrigation Study

The University of Delaware (UD), led by Dr. William Ritter, conducted a study to further evaluate the feasibility of increased use of spray irrigation of treated wastewater effluent, for nutrient management and to enhance agriculture in all three counties in Delaware. The specific objectives of the project included developing a tool to identify potential spray irrigation sites for new and existing wastewater treatment facilities, comparing the costs of spray irrigation versus alternative nutrient removal options, recommending new or modified regulations and policies to enhance the responsible use of spray irrigation, and assessing the viability of using State-owned land for spray irrigation consistent with existing land management plans and intended land uses. The available draft report from UD, dated October 2011, was reviewed and integrated into this report.

The primary product of the UD study as it relates to the Statewide Assessment of Wastewater Facilities was the development of a screening-level assessment tool which can be used to identify potential spray irrigation sites. UD developed a GIS-based tool that uses spatial soil and parcel characteristics to preliminarily identify sites meeting certain pre-specified feasibility criteria. The GIS-based tool uses the following data:

- Soil characteristic data from Delaware Natural Resources and Environmental Control (DNREC) and the US Department of Agriculture, Natural Resources Conservation Service (NRCS);
- Surface water features derived from the National Hydrology Dataset (NHS) data, distributed by Delaware DataMIL;
- Parcel data from each of the three Delaware counties; and
- Locations of treatment plants provided by the Financial Assistance Branch of DNREC via Tetra Tech.

The screening tool employs an algorithm that identifies as potential spray irrigation sites areas featuring the following characteristics:

- Soil mapping units (SMUs) classified by NRCS as "somewhat limited" (versus "very limited") for slow rate application and meeting DNREC suitability for spray irrigation of wastewater (based on saturated hydraulic conductivity, estimated groundwater table depth, soil geomorphology and other applicable characteristics)[5];
- Minimum parcel size of 50 acres (corresponding to an effluent dispersal capacity of approximately 200,000 - 350,000 gallons per day)[1]; and
- Located within 5 miles of an existing municipal wastewater treatment plant.

The tool also separated out areas of parcels needed to maintain regulatory setback distances from other landscape features such as surface waters and property lines, but it was unclear from the draft report whether this attribute is factored into the algorithm's screening criteria (listed above) or captured in a separate post-processing step.

Although the referenced, draft UD report does not include modeling results that could directly inform the Statewide Assessment, the tool and its supporting datasets represent an excellent resource for DNREC, wastewater treatment system managers, planners and property owners to identify potential sites within reasonable access to treatment facilities where spray irrigation may be feasible and cost effective.

The results of the UD study also showed that reed canary grass is currently the most common cover crop used in Delaware on wastewater effluent spray irrigation sites, exhibiting strong nitrogen uptake rates and a high hydraulic loading tolerance. Other potential crops that could be used include corn, soybeans, winter wheat, alfalfa, hardwoods and hybrid poplar. Although many crops can potentially be used as a bioenergy feedstock, hybrid poplar has been specifically identified as a promising energy crop for spray irrigation systems in Delaware.

[5] Sites larger than 50 acres with more than 50% or at least 50 acres of their mapped soil units rated "somewhat limited" were considered as potential spray irrigation sites.

The UD study also demonstrated, via cost estimations for typical systems at flow rates ranging from 0.5 to 15.0 MGD, that both capital and operation and maintenance costs for membrane bioreactor technologies were higher than for other advanced treatment (nutrient removal) technologies including spray irrigation.

Finally, the UD study, through a survey of state property and natural resource managers, determined that most state entities had no guidelines or regulations prohibiting the dispersal of wastewater effluent on state lands, although representatives of several entities (Division of Fish and Wildlife, Division of Parks and Recreation, and Coastal Management) were not in favor of dispersing wastewater effluent on state lands under their purview. Other state land managers (e.g., Delaware Department of Agriculture) may be more amenable to wastewater effluent irrigation on their managed lands, particularly as a method to increase forest or agricultural yields.

Chesapeake Bay TMDL Impacts

The Bay and many streams that drain to the Bay from each state suffer from excess pollution and must be cleaned up. Delaware has already established TMDLs for impaired waters in the Chesapeake Bay, but the multi-state TMDL prepared by EPA, calls for additional reductions.

Table 2-16. Summary of Treatment Plants Indicating Infrastructure Needs for Upgrading to Reuse

Wastewater System	Upgrades Needed	Costs ($)
New Castle County		
Town of Middletown - Middletown WWTP	Continued expansion (2 filters) and treatment/infrastructure to concrete plant.	$2,000,000
Wilmington WWTP	Tertiary treatment.	
Kent County		
City of Harrington WWTP	Storage lagoon.	
Kent County Regional WWTP	N/A, funding is in place.	
Sussex County		
City of Rehoboth Beach STP	Minor plant upgrades would be required for agricultural reuse.	
City of Seaford WWTP	Infrastructure (lines, pumping, etc.).	
Delmar WWTP	Pipeline and spray equipment.	
Sussex County - Wolfe Neck WWTF	Filters.	$1,000,000
Town of Georgetown WRF	Tertiary treatment and additional land and transmission infrastructure.	
Town of Bridgeville WWTF	None, but plant needs to be majorly upgraded/repaired.	
Town of Laurel STP	Infrastructure (pipes, pumps, etc.).	
Town of Millsboro WWTF	None in plant and currently permitting transmission and infrastructure for spray.	
Town of Selbyville WWTF	Piping and equipment and land acquisition.	
Private		
Tidewater - Breeder's Crown	Filtration, disinfection (plant has no disinfection).	
Tidewater - Milton Regional	Infrastructure (pipes/pumps/etc.) to get plant to unlimited access standard.	

Delaware's Wastewater Treatment Systems in the Chesapeake Bay Basin

Delaware's Phase I Watershed Implementation Plan (WIP) was prepared by an Interagency Workgroup made up of representatives from DNREC, the Delaware Department of Agriculture, the Delaware Department of Transportation, the Office of State Planning Coordination, County Conservation Districts, the U.S. Department of Agriculture agencies, the U.S. Geological Survey, representatives from the

farming and development communities and other stakeholders. Nine subcommittees were formed to address agriculture, stormwater, wastewater, land use and comprehensive plans, restoration, public lands, funding, information technology and communications.

Four municipal wastewater treatment facilities in Sussex County are listed in Delaware and Maryland Phase I WIPs for the Chesapeake Bay TMDL. Table 2-17 shows these four facilities, the target concentrations and resulting WLAs for TN, TP, and TSS. Room for growth is allowed in these limits so that for Laurel and Seaford, the proposed loads are higher than the current loads for all three parameters, as is the case for Bridgeville with TSS loading. Current loading information was not included for the Delmar WWTP.

Mobile Home Park and Cluster Systems

The Statewide Wastewater Assessment included visiting and reporting on a representative set of on-site (individual) septic systems in clustered areas, and cluster (shared community) systems are summarized in Tables 2-18, 2-19 and 2-20. The locations of the facilities are shown on Map 4-1 in Appendix C. The purpose was to take a snapshot of various systems; see how they compare to other regional areas in terms of size, location, treatment type, age, and socioeconomic issues; then provide further recommendations regarding Delaware's Chesapeake Bay TMDL WIPs, the Inland Bays Pollution Control Strategy plus general recommendations on treatment system compliance, enforcement and funding.

Table 2-17. Four facilities with target concentrations and loadings from the Chesapeake Bay TMDL

NPDES	Facility	Flow (MGD) [a]	Total Nitrogen			Total Phosphorus			TSS		
			Conc. (mg/L)	Proposed Load (lb/yr)	Current Load (lb/yr)	Conc. (mg/L)	Proposed Load (lb/yr)	Current Load (lb/yr)	Conc. (mg/L)	Proposed Load (lb/yr)	Current Load (lb/yr)
DE0020249	Town of Bridgeville WWTF	0.8	4.0	9,747	19,237	1.0	2,437	3,918	15	365,000	5,630
DE0020125	Town of Laurel STP	0.7	4.0	8,529	6,653	1.0	21,332	1,256	15	32,210	3,335
DE0020265	City of Seaford WWTP	2.0	4.0	24,367	18,065	1.0	6,092	4,562	8.0	49,275	5,165
MD0020532	Delmar WWTP[b]	0.65	4.0	5,504	-	0.3	413	-	-	41,279	-

Notes:

[a] Flow is current design. TN and TP are based on current flow limit and proposed concentrations of 4.0 mg/L TN and 1.0 mg/L TP in DE and 0.3 mg/L TP in MD.

[b] Proposed loads are end-of-stream 2017 interim loads as listed in the Maryland Phase I Watershed Implementation Plan. 2020 loads are 10,355 lb/yr TN, 777 lb/yr TP, and 77,662 lb/yr TSS.

Table 2-18. MHP/Cluster System Representative Sample—General Information

System or Community	Permit ID	Major Basin	Size/EDUs	Design Capacity
Kent County				
Chelesa Villa	A) 359045-02; B) 209478	Chesapeake Bay	69 dwellings, 23 connected as of December 2010	A) 3,600 gal; B)16,800 gal (see permit)
Hill Top and Spoonbill Drive	Individual Septic	Delaware Bay	~20 EDUs (Hilltop); ~30 EDUs (Spoonbill)	1 to 2 EDUs per tank (240 to 300 gpd/EDU)
Paris Investments (M&S Mobile Home Park)	359216-02	Delaware Bay	13 EDUs (5 original; 8 "A" 1994)	2,400 for "A" system; 2,400 for original
St. Jones Reserve	175355-R (R=Renewal)	Delaware Bay	10 EDU on one renewal permit (combines all permits); individual systems; ~ 50 EDU total (46 lots occupied)	2,400 gpd (this permit only)
Twin Maples	176431	Delaware Bay	21 mobile home EDUs plus 1 single family EDU (at 100% capacity)	6,600 gpd (Systems A, B, C, D)
Sussex County				
Briarwood Manor	Multiple permits (individual or dual units)	Chesapeake Bay	~ 50 EDUs	1 to 2 EDUs per tank (240 to 300 gpd/EDU)
County Seat Gardens (Garden Estates)	Multiple permits; 175103	Chesapeake Bay	16 EDUs on 3 shared systems (A - 4 lots, B - 4 lots, & C - 8 lots), other are individual or dual systems. About 100 occupied lots total plus unused open space lots	System A - 1,200 gpd; System B - 1,440 gpd; System C - 2,400 gpd
Fishermill Trailer Park	Multiple permits	Chesapeake Bay	~80 dwellings plus community center	1 to 2 EDUs per tank (240 to 300 gpd/EDU)
Grants Way (Moore-Grant Subdivision Sanitation)	C4005-96R	Delaware Bay	80 EDUs, well maintained community collection and treatment system about 16 years old (~1996), (Permit Expires 2017)	22,640 gpd (283 gpd/EDU)
Layton's Riviera	Multiple permits, c~1970's	Chesapeake Bay	~40 lots, most filled	1 to 2 EDUs per tank (240 to 300 gpd/EDU)
Mobile Gardens MHP (Hollyview)	213428, Discharge NPDES DE 0050725	Chesapeake Bay (Nanticoke)	277 units (built-out, ~100% full)	60,000 gpd
Morningside Village (Wheatley Farms)	204178; C401393S; C400096S	Chesapeake Bay	~ 47 EDU's on community system (PhI: 21 tanks - 1993; PhII: 26 tanks - 1996)	5,397 + 9,360 = 14,757 gpd (from inspection report)
Pepper Ridge	Multiple permits	Inland Bays/ Atlantic Ocean	About 60 lots total, 75% occupied	1 to 2 EDUs per tank (240 to 300 gpd/EDU)

System or Community	Permit ID	Major Basin	Size/EDUs	Design Capacity
Scottsdale MHP	192162, 2 more permits, a few individual permits	Chesapeake Bay	100 full build-out dwellings, on comm. system, no individual permits on this site	22,200 gpd total (10,300 for rear mounds)
Walkers Meadow	181864	Chesapeake Bay	40 EDU @ Walkers Meadow (24 Occupied); (100+ EDU at Walkers Mill)	10,280 gpd @ Meadow

Note: EDU = estimated dwelling unit; gpd = gallons per day

Delaware has more than 80,000 septic systems, including about 24,000 in the Chesapeake Bay watershed. There are more than 200 "large systems" (~3,000 gpd or greater), which include shared community cluster systems, municipal systems and commercial/industrial groundwater or spray discharge systems. DNREC tracks large groundwater/spray discharge systems using a database called the Environmental Navigator, which has GIS capabilities, and DNREC maintains GIS shapefiles of parcels with individual systems (points and polygons). The Environmental Navigator is updated following routine inspections, although not all systems have assigned or accurate GIS coordinates. The individual systems map is updated semi-regularly as municipalities, utilities, and authorities update their boundaries or sewer service areas. DNREC also keeps a draft "mobile home park" (MHP) GIS shapefile, although it appears to be missing MHPs when compared with the septic point map and aerial photographs. While all three tracking systems are considered GIS "drafts," the ability to identify clusters of individual or community systems by combining the three systems in GIS was adequate for this review.

For the representative sample, four systems in Kent County, and 10 systems in Sussex County were reviewed (no systems in New Castle County were reviewed). Each system used some type of groundwater discharge. Only one reviewed system (Mobile Gardens) has an NPDES permit, which is a dual permit alongside RIBs groundwater discharge system. Individual NPDES permits (for private, commercial or industrial dischargers) or small-discharge NPDES wastewater permits were not studied because the overwhelming majority of residential or cluster systems are groundwater discharges.

Unlike the municipal/private WWTP survey, information was gathered only internally within DNREC through permit research and from site visits. Park owners or system owners were not contacted to participate in the survey, but in several instances an owner or their representative was on-site to discuss the survey or provide a demonstration of a community system. Because of the limited scope of the survey, some desired information could not be obtained.

Summaries of the survey findings are presented in the tables below, and the narrative descriptions for individual sites are located in Section 7 – Mobile Home Park and Cluster System Survey.

Table 2-19. MHP/Cluster System Representative Sample—Collection, Treatment, and Discharge

System or Community	Collection	Pump Stations or Dosing Chambers	Treatment/ Discharge
Kent County			
Chelesa Villa	Gravity plus some pump	2 dosing chambers (4' each)	Multi-septic w/dosing chamber to large drip irrigation field, 2 systems (14 total zones)
Hill Top and Spoonbill Drive	All individual or shared dual septic systems w/tile fields	0	Individual Systems
Paris Investments (M&S Mobile Home Park)	Gravity to tanks then pumped to fields	2 dosing tanks for shared septics (~6 units each)	Septic to pressure-dose sand beds (cap and fill) – 9280 s.f.
St. Jones Reserve	Unsure (most likely gravity)	??	Shared septic to pressure and low pressure beds/ mounds/ fields
Twin Maples	Gravity	~2 each x 4 = ~8 dosing chambers	Septic to dosing tank to incised mound (gravel bed/sand), 3 drain fields
Sussex County			
Briarwood Manor	Individual or dual septic/tile field systems (most functioning OK, but some failing)	0	Individual Systems
County Seat Gardens (Garden Estates)	Gravity to dosing tank then pumped; individual systems may have pumps for mounds	Dosing tank for each community system (3)	Individual septics to elevated sand mounds (or individual drain fields)
Fishermill Trailer Park	All individual or shared dual septic systems w/tile fields	0	Individual systems
Grants Way (Moore-Grant Subdivision Sanitation)	Common gravity to PS wet well ~27' deep	1 PS, 2 dosing chambers	41 shared septics to 4 elevated sand mounds and dosing beds (pressurized tile fields, 8)
Layton's Riviera	Individual or dual septic systems/tile fields	0	Individual Systems
Mobile Gardens MHP (Hollyview)	Gravity	0 or unknown	Purestream secondary BNR "package plant" to dosing chamber (for 5 RIBs) or NPDES
Morningside Village (Wheatley Farms)	Gravity, pressure mix	1 dosing chamber, (various pump stations)	Drainfield (2 infiltrator seepage beds) 12,326 s.f.
Pepper Ridge	All individual or shared dual septic systems w/ tile fields	0	Individual Systems
Scottsdale MHP	Gravity/pressure mixed (late 1980's, good condition)	3 lift stations, 3 dosing chambers	Individual or dual septics with 2 elevated sand mound areas (18 to 26 zones, not confirmed) 78,360 s.f.

System or Community	Collection	Pump Stations or Dosing Chambers	Treatment/ Discharge
Walkers Meadow	Walkers Meadow: Shared septic to shared subsurface trenches (~3-4 homes each); (Walkers Mill: individual or dual septic / tile field)	0	See Collection.

Table 2-20. MHP/Cluster System Representative Sample—Current/Anticipated Permit Limits, Monitoring, Violations

System or Community	Current Permit Limits/Reqs.	Anticipated Permit Limits/Reqs.	Monitoring Details	Violations
Kent County				
Chelesa Villa	Influent flow plus monitoring	Chesapeake TMDL, ~2017	Quarterly reporting, standard WW items	None
Hill Top and Spoonbill Drive	Unknown – Individual Systems	Unknown	None	None
Paris Investments (M&S Mobile Home Park)	No limits, no monitoring	Unknown	No limits, no monitoring	Currently undersecretary's order to come into compliance (admin. penalty, etc. $30k)
St. Jones Reserve	Influent flow plus monitoring	Unknown	Flow monitoring to each bed, otherwise none	None
Twin Maples	Influent flow plus monitoring	Chesapeake TMDL, ~2017	Quarterly reporting, standard WW items	None
Sussex County				
Briarwood Manor	Unknown – Individual Systems	Unknown	None	None
County Seat Gardens (Garden Estates)	Flow only plus monitoring wells (community systems only)	Not anticipating TMDL	Quarterly reporting, standard WW items (community systems only)	A, B, & C - none (checking comm. only); not checking individual system
Fishermill Trailer Park	Unknown – Individual Systems	Unknown	None	None
Grants Way (Moore-Grant Subdivision Sanitation)	Flow plus monitoring (mostly annual reporting)	N/A - Broadkill not subject to Chesapeake or IB TMDL	Monitoring wells, standard WW items (no Phosphorus)	None
Layton's Riviera	Unknown – Individual Systems		None	None
Mobile Gardens MHP (Hollyview)	10 BOD / 10 TSS / 10 TN / 200 fecal on RIBs; Nanticoke TMDL for NPDES	Ground Exp. 2008, NPDES Exp. 2011 (may be subject to additional TMDL)	Monitoring wells and per NPDES permit, standard WW items	Historical, but not recent
Morningside Village (Wheatley Farms)	Flow plus monitoring	Chesapeake TMDL, ~2017	Not stated in permit	Historical, none recent
Pepper Ridge	Unknown – Individual Systems	Unknown	None	None

System or Community	Current Permit Limits/Reqs.	Anticipated Permit Limits/Reqs.	Monitoring Details	Violations
Scottsdale MHP	Flow plus monitoring only	Chesapeake TMDL, ~2017	Monitoring wells w/standard WW items (mostly quarterly)	Historical (see notes), none recent
Walkers Meadow	Flows, not monitored	Chesapeake TMDL, ~2017	None stated in permit (no N, P, Cl, etc.)	No (since 2007)

Section 3 – Facilities in New Castle County

New Castle County Overview

Of the 10 wastewater systems in New Castle County, 7 provide treatment and 3 are collection systems that transport waste to other municipalities for treatment, as seen in Table 3-1.

New Castle County owns and operates the Delaware City and Port Penn collection systems and treatment plants, the Middletown-Odessa-Townsend Regional collection system and WWTP (referred to as Water Farm #1) and the Lea Eara Farms WWTP. New Castle County also owns and operates two collection-only systems: the Water Farm #2 collection system, which discharges to and is treated by the Middletown WWTP, and the "North of the C&D Canal" collection system, which accepts wastewater from the City of Newark and discharges to and is treated by the Wilmington WWTP. The Town of Middletown operates the Frog Hollow WWTP and the Middletown WWTP and receives waste as mentioned above, from the New Castle County owned and operated Water Farm #2 collection system. The City of Wilmington operates the Wilmington WWTP, which receives waste from the City of Newark Sewer Authority collection system via New Castle County's "North of the Canal" collection system.

All treatment plants in New Castle County reported influent strength within the normal range (150–250 mg/L BOD and TSS) except for the Delaware City WWTP, which reported concentrations below normal (< 150 mg/L BOD and TSS).

All but two of the seven publicly owned treatment plants in New Castle County are equipped with on-site auxiliary backup power supply generators or portable generators. The three plants with on-site generators (Delaware City, Port Penn and Water Farm #1) use diesel fuel or gasoline. The Lea Eara Farms and Wilmington WWTPs rely on portable generators, although the Wilmington plant also has a secondary power feed from the grid. The Frog Hollow and the Town of Middletown Wastewater Treatment Facility (WWTFs) have no backup power supplies.

Table 3-1. Wastewater System Responsibilities

Wastewater System	Collection	Treatment
New Castle County - Delaware City WWTP	✓	✓
New Castle County - Lea Eara Farms WWTP	✓	✓
New Castle County - Port Penn STP	✓	✓
New Castle County - Water Farm #1 aka MOT Regional WWTP	✓	✓
Town of Middletown - Frog Hollow WWTF	✓	✓
Town of Middletown - Middletown WWTP	✓	✓
New Castle County - Water Farm #2 treated by Middletown WWTP - CS	✓	-
Wilmington WWTP	✓	✓
New Castle County - North of the C&D treated by Wilmington WWTP - CS	✓	-
City of Newark Sewer Authority treated by Wilmington WWTP - CS	✓	-

Capital Project Costs and Financing Options for New Castle County-owned Systems

New Castle County reported $245M in capital project costs from 2011-2016. Of these capital project costs, $92.8M (37.8%), $142M (58%), $6.13M (2.5%) and $4.28M (1.7%) are related to capital costs for collection, conveyance, treatment and disposal, respectively. For the projects reported, New Castle County reported an additional $313M in capital project costs prior to 2011 and $61.3M after 2016.

To address capital project costs from 2011-2016, New Castle County expects approximately $245M from municipal bond issuance.

Table 3-2 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 3-2. New Castle County 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$51.5M	$38.1M	$47.8M	$35.3M	$56.1M	$16.6M	$245M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$245M	$0K	$0K	$0K	$0K	$0K

Delaware City WWTP

The Delaware City WWTP is owned and operated by New Castle County. The Delaware City system consists of a 5-square-mile service area composed of two sewer districts with three pump stations serving 902 households. The Delaware City WWTP provides secondary and tertiary treatment and has a surface water discharge that flows into the C&D Canal East portion of Delaware Bay (Watershed #11). The NPDES permit for this discharge (DE0021555) expires on December 31, 2013. The plant's current design flow is 0.57 MGD, and the average daily flow is 0.33 MGD, or about 58 percent of design flow. Average flow is 0.33 and anticipated flow is 0.38 for 2020 and 0.45 for 2030. The permit does not have effluent limits for nutrients (not subject to typical nitrogen-phosphorus TMDL requirements), but it has adopted BOD limits per DRBC recommendations. No industrial wastes are discharged to this facility. Flow data from EPA's Permit Compliance System database (0.55 MGD) does not match permit (0.57 MGD). The facility would be subject to potential upcoming DRBC TMDLs regarding PCBs.

Peak flow at the plant is 1.2 MGD, and infiltration and inflow (I/I) has been identified in the collector sewers. The Delaware City Sewer Rehabilitation capital improvement project has been a multi-year and multi-project program to reduce existing I/I in the collector and trunk lines. The current population served is 2,621, and future (2030) population served is expected to be 2,781.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $242,638 within the Delaware City service area. Fees currently meet the operating budget.

New Castle County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 20 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average computed by averaging metered water use, and commercial/industrial contracts are based on flow, BOD and suspended solids with billing multipliers.

New Castle County's MHI is $62,293 using the 2009 NCC ACS. It does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010, and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

New Castle County's general view is that it is interested in, but not actively pursuing, reuse at the Delaware City WWTP. It does not appear that the installation costs justify a project because permit limits are being met and population growth is slow.

Capital Project Costs and Financing Options

New Castle County owns and operates the Delaware City collection system and treatment plant. Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

Lea Eara Farms WWTP

The Lea Eara Farms WWTP is owned and operated by New Castle County. The WWTP has a 0.5-square-mile service area consisting of one sewer district with two pump stations that serve 279 households. New Castle County provides secondary and tertiary treatment at the Lea Eara Farms WWTP, which is in the C&D Canal East portion of the Delaware Bay Watershed (#11). The facility has lagoon storage for spray irrigation and has a groundwater discharge permit (LTS 3035-92-08), which expired on June 23, 2010. The permit has effluent limits for TN of 300 lbs/acre/year and a requirement to perform a PSI study of the site if phosphorus levels become excessive.

The County reported that one of the monitoring wells was out of compliance for nitrates because of a lagoon leak. The plant's current design flow is 0.098 MGD, and the average daily flow is 0.05 MGD, or 51 percent of design flow. Peak flow at the plant is 0.07 MGD, and there are no reported I/I problems because the system is new. The current population served is 492, and future (2030) population served is expected to be 512. New Castle County is considering abandonment of this plant and integrating it into the Water Farm #2 system.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $75,051 within the Lea Eara Farms service area. Fees currently meet the operating budget. New Castle County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 193 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average, and some individuals are billed off metered water use. Commercial/industrial contracts are based on flow, BOD, and suspended solids with billing multipliers. New Castle County's MHI is $62,293 using the 2009 NCC ACS. It does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010, and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

Treated effluent from the plant is being spray irrigated onto crops used for livestock feed.

Capital Project Costs and Financing Options

New Castle County owns and operates the Lea Eara Farms WWTP. Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

Port Penn STP

The Port Penn STP is owned and operated by New Castle County. The Port Penn system is a 0.5-square-mile service area with one sewer district and one pump station that serves 164 households. The Port Penn STP provides secondary treatment and has a surface water discharge that flows into the C&D Canal East portion of Delaware Bay (Watershed #11). The NPDES permit for this discharge (DE0021539) expires on December 31, 2013. The plant's current design flow is 0.05 MGD, and the average daily flow is 0.04 MGD, or 80 percent of design flow. The permit does not have effluent limits for nutrients. Peak flow at the plant is 0.19 MGD and I/I has been identified in the Port Penn collector system. The system is subject to potential upcoming TMDLs regarding DRBC PCBs and is currently not subject to typical nitrogen or phosphorus TMDL requirements, but it adopted BOD per the DRBC recommendations. Manhole frames and covers have been replaced under the Countywide Manhole rehabilitation capital improvement program (evaluation of effectiveness has yet to be reviewed). The current population served is 676, and future (2030) population served is expected to be 988.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $44,116 within the Port Penn service area. Present fees currently meet the operating budget, and the county is working on an asset management program.

New Castle County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 20 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average, and some individuals are billed off metered water use. Commercial/industrial contracts are based on flow, BOD, and suspended solids with billing multipliers.

New Castle County's MHI is $62,293 using the 2009 NCC ACS. It does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010, and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

New Castle County's general view is that it is interested in, but not actively pursuing, reuse at the Port Penn STP. It does not appear that the installation costs justify a project because permit limits are being met and population growth is slow.

Capital Project Costs and Financing Options

New Castle County owns and operates the Port Penn STP. Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

Middletown-Odessa-Townsend (MOT) WWTP (Water Farm #1)

The MOT Regional WWTP, also known as Water Farm #1, is owned and operated by New Castle County. New Castle County provides secondary and tertiary treatment and nitrogen and phosphorus removal at the MOT Regional WWTP. This 22-square-mile service area consists of 4 sewer districts with 18 pump stations and 5 holding tanks with a total capacity of 61,000 gallons and serves 2,388 households. The service area includes properties in the Town of Townsend and specific sections of the Southern Sewer service area. The MOT Regional WWTP also receives a small portion of the Town of Middletown's collection system, for which New Castle County bills the town.

The plant is equipped with an aerobic digester for handling solids and has a surface water discharge that flows into the Appoquinimink River in the Delaware Bay (Watershed #12). The NPDES permit for that discharge (DE0050547) expired on June 30, 2011. Nutrient effluent limits include removal of ammonia nitrogen, seasonal limits (May-November) for total Kjehldahl nitrogen of 10.4 lbs/day average (15.6 lbs/day maximum) and 3,796 lbs/year average, and TP limits of 2.1 lbs/day average (4.2 lbs/day maximum). The facility also has a groundwater discharge permit (LTS 3005-93-06) that expired on July 27, 2011. The plant's current design flow is 2.5 MGD, and the average daily flow is 0.57 MGD, or about 23 percent of design flow. Peak flow at the plant is 1.5 MGD, and no I/I issues were reported. The current population served is 11,786 for residents and 200 for non-residents; future (2030) population served is expected to be 23,287 for residents.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $642,372 within the Water Farm #1 service area. Fees currently meet the operating budget.

New Castle County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 20 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average, and some individuals are billed off metered water use. Commercial/industrial contracts are based on flow, BOD, and suspended solids with billing multipliers.

New Castle County's MHI is $62,293 using the 2009 NCC ACS. It does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010, and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

Treated effluent from the Water Farm #1 plant is being spray irrigated onto crops used for livestock feed. The plant is currently meeting its groundwater permit limits, and its NPDES permit for winter discharges when frozen conditions preclude spray irrigation for effluent management.

Capital Project Costs and Financing Options

New Castle County owns and operates the MOT Regional WWTP. Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

Town of Middletown – Frog Hollow WWTF

In addition to the Middletown WWTP (discussed below), the Town of Middletown owns another collection system and WWTP, serving the Frog Hollow/The Legends Golf Course Community in

northeastern Middletown. The Frog Hollow WWTP is operated by Artesian Utility Development, Inc. This 0.5-square-mile service area consists of one sewer district with three pump stations and serves 468 households. The Frog Hollow WWTF provides secondary and tertiary treatment and is in the Appoquinimink River subwatershed in the Delaware Bay Watershed (#12). The facility has lagoon storage for spray irrigation and has a groundwater discharge permit (LTS 3015-99-10) that expires on August 4, 2015.

The current and future (2030) population served by the Frog Hollow WWTP is 1,254. The plant's current design flow is 0.25 MGD, and the average daily flow is 0.12 MGD, or 48 percent of design flow. The permit includes a TN limit of 250 lbs/acre/year but no TP limit (nor is one anticipated). Peak flow at the plant is 0.16 MGD, and no I/I issues were reported. Influent strength is assumed to be normal because the service area is entirely residential, although below-normal concentrations of influent BOD and TSS were recorded because it is measured after the side stream flow from the filter building (30 percent recycle rate). The plant does not test for ammonia nitrogen influent. All planned capital projects at the plant have been completed, and only O&M is occurring because the plant is relatively new.

Financial Analysis

The average annual sewer rate in the Town of Middletown is $184.83 yielding $86,500 in total annual residential revenue. Water consumption is billed according to water metering; there is no sewer metering for commercial and industrial users. New Castle County has a sewer meter at a pump station ($43.74/1000 gallons including an impact fee; the user fee alone is $2.65 per 1,000 gallons).

Middletown's MHI is $54,129 according to the 2010 CPI. The Town keeps 20 percent of annual operating revenue in a restricted reserve account. The Town is also currently holding an amount that is 193 percent of operating revenues composed of collected impact fees slated for use in capital expenditures (in effect resulting in $2.6M in reserve versus the $1.37M annual budget).

Wastewater Reuse Analysis

The Town is currently reusing treated effluent from the plant for golf course irrigation.

Capital Project Costs and Financing Options

The Town of Middletown (Middletown and Frog Hollow) reported $3.54M in capital project costs from 2011-2016 (although no project costs were reported for 2011). Of these capital project costs, $750K (21.2%), $860K (24.3%), $1.06M (29.9%) and $870K (24.6%) are related to capital costs for collection, conveyance, treatment and disposal, respectively. For the projects reported, the Town of Middletown (Middletown and Frog Hollow) reported an additional $21M in capital project costs after 2016.

To address capital project costs from 2011-2016, the Town of Middletown (Middletown and Frog Hollow) expects approximately $478K to be funded through municipal sinking funds or other asset replacement cost savings. Municipal bond issuance and municipal bank finance account for $3M and $60K in funding during the 2011-2016 time period, respectively.

Table 3-3 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 3-3. Town of Middletown 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$0K	$3.02M	$170K	$302K	$22K	$24K	$3.54M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$60K	$3M	$0K	$0K	$478K	$0K	$0K

Town of Middletown WWTP

The Town of Middletown owns the Middletown WWTP, which is operated by Artesian Utility Development, Inc. The Middletown WWTP service area consists of an 11.8-square-mile collection system composed of two sewer districts with 19 pump stations serving 5,618 households. The plant also treats wastewater from the 17-square-mile collection system owned and operated by New Castle County, known as Water Farm #2, which consists of one sewer district with three pump stations, a 1,000-gallon holding tank, and serves 33 households. In addition, as noted previously, a small portion of the Town of Middletown's sewer, about 0.15 MGD, runs to the New Castle County-owned MOT Regional WWTP aka Water Farm #1.

The plant provides secondary and tertiary treatment and has groundwater discharge points in the Appoquinimink River subwatershed in the Delaware Bay Watershed (#12) and the Sassafras River subwatershed in the Chesapeake Bay Watershed (#27). The facility has lagoon storage for spray irrigation and has a groundwater discharge permit (LTS 3020-02-07) that expires on August 1, 2012. The permit has a TN limit of 400 lbs/acre/year but no TP limit (nor is one anticipated). The plant reported having a non-compliance issue with respect to pH caused by algae bloom in lagoons.

The plant's current design flow is 2.5 MGD, and the average daily flow is 0.99 MGD, or about 40 percent of design flow. Peak flow at the plant is 1.61 MGD (according to monthly average) and only minimal I/I issues were reported as of November 2010. Permit influent flow limit is 1.6 MGD (1.8 MGD with the addition of the Park Spray Field). The main spray fields are Ford/VonCroy; secondary (i.e., as-needed fields) are Clay, Jester and Park. Plant and spray upgrades were completed in 2010. Industrial flow is about 5 percent, commercial flow is about 10 percent, and all flows meet permitted maximums. The current population served is 15,056 for residents and 100 for non-residents; future (2030) population served is expected to be 25,000 for residents and 7,500 for non-residents. Middletown is planning to serve the Town of Odessa in the future.

The current population served by New Castle County's Water Farm #2 collection system is 7,870, and future (2030) population served is expected to be 16,553. Average daily flows in the system are 0.02 MGD. Planning for constructing a treatment plant to serve the unincorporated area northeast of Middletown is on hold. The collection system currently connects into the Town of Middletown collection system near Frog Hollow.

Financial Analysis

The average annual sewer rate in the Town of Middletown is $184.83, which yields $1,038,375 in total annual residential revenue. The Town reported that its revenues are not sufficient at current rates

because of contract costs for plant O&M, because the number of customers is lagging behind projections; the breakeven date for revenues to meet the current operating budget will be dependent on the pace of growth.

Water consumption is billed according to water metering, and there is no separate metering for commercial and industrial users. New Castle County has a sewer meter at a pump station ($43.74 per 1,000 gallons including an impact fee; the user fee alone is $2.65 per 1,000 gallons).

Middletown's MHI is $54,129 according to the 2010 CPI. The Town keeps 20 percent of annual operating revenue in a restricted reserve account. The Town is also currently holding an amount that is 193 percent of operating revenues composed of collected impact fees slated for use in capital expenditures (in effect resulting in $2.6M in reserve versus the $1.37M annual budget).

Wastewater Reuse Analysis

The Town is currently reusing treated effluent from the plant but is not being allowed to count it toward its disposal capacity. It is in final permitting to use treated wastewater to irrigate parks and has additional plans for irrigation. Reuse is also being planned for irrigation on golf courses and commercial and industrial reuse (e.g., a concrete pipe and mix plant) is being considered. The Town has indicated that it would need to spend $2M for plant expansion and adding treatment and related infrastructure.

The Town reported that it has had some additional interest in agricultural reuse expressed by farmers, but the Town is concerned that it may not be able to meet the demands for this potential reuse. The Town expressed a desire to receive more clearly stated regulatory guidance and the ability to pursue creative reuse options from DNREC.

Capital Project Costs and Financing Options

Information on capital project costs and financing for the Middletown WWTP is included within the discussion about the Town of Middletown presented above in Table 3-3.

Water Farm #2

Water Farm #2 is a 17-square-mile collection system that is owned and operated by New Castle County, consists of one sewer district with three pump stations and a 1,000-gallon holding tank, and serves 33 households. While originally planned to discharge to MOT Regional WWTP (Water Farm #1), a transmission pipe was never installed because of the cost. Currently, this system discharges into the Town of Middletown's collection system near Frog Hollow. The sewer service area is also referred to as the "Inner Core" of NCC's Southern Sewer service area. The current population served by the Water Farm #2 collection system is 7,870, and future (2030) population served is expected to be 16,553. Average daily flows in the system are 0.02 MGD. Planning for constructing a treatment plant to serve the northeast of Middletown is on hold.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $8,877 within the Water Farm #2 service area. Fees currently meet the operating budget.

New Castle County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 20 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average, and some individuals are billed off metered water use. Commercial/industrial contracts are based on flow, BOD, and suspended solids with billing multipliers.

New Castle County's MHI is $62,293 using the 2009 NCC ACS; the County does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010, and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

Reuse for irrigation is currently under consideration. New Castle County is working on a 900-acre set-aside for Water Farm #2. The original planning effort identified a need for implementation within 15 years, but currently a 30-year implementation horizon seems adequate because of a slower than projected population growth.

Capital Project Costs and Financing Options

New Castle County owns and operates Water Farm #2. Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

City of Wilmington WWTP

The City of Wilmington owns an 8.5-square-mile service area consisting of two sewer districts with three pump stations and a WWTP that serves 18,898 households, operated under contract by Veolia. The plant provides primary and secondary treatment, solids handling, and has a surface water discharge that flows into the mouth of Shellpot Creek at the Delaware River in the Piedmont Watershed (#2). The NPDES permit for this discharge (DE0020320) expired on June 30, 2005. No nutrient limits are in the permit and none are anticipated. Both the New Castle County collection system north of the C&D Canal and the City of Newark Sewer Authority collection system are contract users of the Wilmington WWTP.

The plant's secondary treatment current design flow is 105 MGD, and the average daily dry-weather flow is 75 MGD, including contract user flows, or about 71 percent of design flow. The plant also has two holding tanks with 3MG of capacity, which are used to provide the equivalent of primary treatment for peak flows of up to 340 MGD during wet weather. The collection system is a combined sewer system. The collection system captures 90 percent of wet-weather flows though real-time control and there are no plans to separate the system. The Draft CSO Long Term Control Plan submitted in Sept 2010 indicated that CSOs occur in tributaries of the Delaware River (Brandywine, Christina, Little Mill and Shellpot). The current and future (2030) population served is 70,850 for residents and 500,000 for non-residents.

Financial Analysis

Water and sewer are handled as a combined fund, and the average sewer rate in the City of Wilmington's service area is $189.36 per year, which yields $3,578,525 in annual revenue. The City reported that these revenues are not sufficient at current rates but expects to be on track by FY2012. The City does not have a reserve account but is considering adopting a new reserve policy.

The City's sewer service area MHI is $45,623 according to the 2010 CPI. Customer billing is computed from metering using the 15,000 gal/quarter water usage. There is also a residential stormwater charge that averages $40.30/year (it is a tiered system based on lot size/type). About 26,000 parcels are affected by this charge, including approximately 3,000 properties that have stormwater contribution charges only (i.e., not connected to sewer).

Most commercial/industrial bills are computed the same way as residential customers, although about 40 "high-strength" customers are billed according to a sewer surcharge equation that takes into account flow, BOD, and TSS. Five industrial users are Noramco, ICI, Amtrak, Cherry Island (DSWA) and IPC. New Castle County is the biggest contract user.

The City does not have funding adequate to pay cash and must finance capital projects. It has no borrowing limit, and capital projects are primarily funded through state revolving fund (SRF) loans, grants, or long-term GO bonds.

Wastewater Reuse Analysis

The City reported that it does not consider reuse viable, in part because of long distance to agricultural areas, additional treatment requirements for urban use, and that all its effluent is chlorinated (although it should be noted that chlorination would not preclude certain other non-agricultural reuses). The City reported interest/consideration in industrial/commercial partnerships for wastewater reuse, but it does not have any plans.

Other innovative sustainability efforts reported by the City include working with DSWA Landfill to start a $40M methane capture project from its digester, planning a thermal dryer for solids at a "Thermal Dryer Renewable Energy Facility," and installing solar panels at the Rock Manor WTP and a new Public Works Administration Building.

Capital Project Costs and Financing Options

The City of Wilmington reported $36.2M in capital project costs from 2011-2016. Of these capital project costs, $10.8M (29.8%), $16.6M (45.9%), and $8.79M (24.3%) are related to capital costs for collection, conveyance and treatment, respectively, including real-time control for CSOs, and plant headworks improvement projects. For the projects reported, the City of Wilmington reported an additional $16.9M in capital project costs after 2016.

To address capital project costs from 2011-2016, the City of Wilmington anticipates requesting $15.9M from the Clean Water State Revolving Fund. Municipal bond issuance accounts for $20M in funding during the 2011-2016 time period, while $240K in other financing methods (STAG grant) were reported.

Costs and finances are best current estimates and are subject to change as the City reviews and updates its Capital Improvement Plan and pursues a low cost funding mix of Clean Water SRF loans, grants, and other cost effective financing options. Table 3-4 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 3-4. City of Wilmington 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$4.68M	$2.15M	$4.9M	$10.2M	$8.9M	$5.4M	$36.2M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$20M	$15.9M	$0K	$0K	$240K	$0K

The City of Newark Sewer Authority

The City of Newark Sewer Authority owns and operates a 15-square-mile service area consisting of one sewer district with three pump stations serving 7,899 households. This collection system discharges into the New Castle County's "North of the C&D Canal" collection system and is ultimately treated at the City of Wilmington's WWTP.

The current population served by the City of Newark Sewer Authority's collection system is 30,230, and future (2030) population served is expected to be 30,947. The population count does not include the approximately 20,000 UD students that are serviced by the system, as about 36 percent of the service area is the UD.

Average daily flow in the system is 3.5 MGD, and the average monthly flow from October 2007 through September 2010 was 106 MG/month, determined by the flow meter records at the point wastewater is turned over to the New Castle County collection system (see attachments for BOD or TSS information). Metals are tested at Capital Trail station by the City of Wilmington. The City is currently quantifying its I/I problem, and it has confirmed that it has no combined sewers.

The City reported that it has no plans for sewer service area expansion, but the Authority has a manhole rehabilitation and lid replacement project underway and an infiltration study planned. One of the biggest projects is purchasing a combination truck to complement the sewer jet it currently owns.

Financial Analysis

The average sewer rate in the City of Newark Sewer Authority's service area is $350 per year, which yields $2,764,650 in annual revenue. These revenues are thought to be sufficient at current rates. The Authority has a reserve account that is restricted to wastewater but has no internal restrictions. The reserve account is 180 percent of operating revenue (operating revenue is $4.1M and the reserve is $7.4M).

Customer billing is computed using water use metering, and commercial/industrial contracts are based on wastewater characteristics and strength (flow/BOD/TSS) with billing multipliers. The Authority has no municipal contract users.

The City of Newark's MHI is $53,357 using the 2009 NCC ACS (according to the 2000 census with the 2010 CPI it is $63,347). The current sewer rate is $6.753 per 1,000 gallons. The Authority does not have the ability to borrow for wastewater services, although it does for other public works services.

Wastewater Reuse Analysis

The City of Newark Sewer Authority reported that it would consider localized water reuse systems using package treatment plants within its collection system if there was sufficient interest. Because the Authority does not currently treat wastewater, it is not reusing water.

Capital Project Costs and Financing Options

The City of Newark Sewer Authority reported $3.33M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $1.59M (47.7%) and $1.74M (52.3%) are related to capital costs for collection and conveyance, respectively. For the projects

reported, the City of Newark Sewer Authority reported an additional $1.33M in capital project costs prior to 2011.

To address capital project costs from 2011-2016, the City of Newark Sewer Authority expects approximately $3.33M to be funded through municipal sinking funds or other asset replacement cost savings. All city funding is from current resources. No loans are taken for capital or equipment purchases.

Table 3-5 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 3-5. City of Newark Sewer Authority 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$500K	$925K	$400K	$750K	$750K	$0K	$3.33M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$3.33M	$0K	$0K

New Castle County's Service Area North of the C&D Canal (excluding Delaware City)

New Castle County owns and operates a 250-square-mile service area north of the C&D Canal (i.e., the County's "Wilmington Service Area") consisting of 9 sewer districts with 127 pump stations and 12 holding tanks with a total capacity of 75,000 gallons serving 118,001 households. This collection system connects to the City of Wilmington's collection system and is ultimately treated at the City of Wilmington's WWTP.

The current population served by this collection system is 379,717 for residents and 30,230 for non-residents, and future (2030) population served is expected to be 379,717 for residents and 30,947 for non-residents. The 30,230 non-residents account for the City of Newark Sewer Authority, which routes its collection system through this service area. Average daily flows in the system are 50 MGD with peak flows of 150 MGD. The County reported that I/I in the service area is acceptable, with localized cases of excessive I/I. Several projects in the County's CIP are actively investigating, identifying, and correcting excessive I/I.

Financial Analysis

The average annual sewer rate in New Castle County is $269, and the total annual residential revenues are $31,742,269 in the service area. The County has two reserve accounts: (1) a Sewer Fund Budget Reserve Account; and (2) a Sewer Rate Stabilization Reserve Account. Those reserve accounts are 20 percent of operating revenue, and current fees meet the present operating budget.

Customer billing is a countywide average, and some individuals are billed off metered water use. Commercial/industrial contracts are based on flow, BOD, and suspended solids with billing multipliers.

New Castle County's MHI is $62,293 using the 2009 NCC ACS. It does not have a set borrowing limit on wastewater enterprises, although it is one performance measure acknowledged by its bond rating agencies. Debt was 18 percent in FY2010 and the County's policy limit is 20 percent.

Wastewater Reuse Analysis

New Castle County's general view is that it is interested in, but not actively pursuing, reuse. No treatment plant managed is by the County in this service area, so it does not appear that the installation costs justify a project. Population density in this part of the County is high, permit limits are being met, and population growth is slow.

Capital Project Costs and Financing Options

New Castle County owns and operates the collection system referred to as the Wilmington Service Area (i.e., north of the C&D Canal). Information on capital project costs and financing is included within the discussion about New Castle County and presented in Table 3-2.

Section 4 – Facilities in Kent County

Seven municipally owned wastewater systems were included as part of the survey in Kent County, as seen in Table 4-1. Those include two treatment facilities—the Kent County Regional WWTP and the City of Harrington WWTP. The Kent County Regional WWTP treats wastewater from the following collection-only systems: Camden-Wyoming Sewer and Water Authority, the Dover Sewer Authority, the Milford Sewer Authority, the Town of Clayton, and the Town of Smyrna.

Both of the treatment plants in Kent County are equipped with on-site auxiliary backup power supply generators using diesel fuel or gasoline. The Kent County Regional WWTP also generates 1.2 megawatts of solar power that is either used or put into the local grid.

The Harrington plant reported influent strength in the normal range (150–250 mg/L BOD and TSS), but the Kent County Regional plant reported its influent strength above normal (> 250 mg/L BOD and TSS) because of food processing wastes.

Table 4-1. Wastewater System Responsibilities

Wastewater System	Collection	Treatment	Municipal	Authority
City of Harrington WWTP	✓	✓	✓	-
Kent County Regional WWTP	✓	✓	✓	-
Camden-Wyoming Sewer and Water Authority treated by Kent County WWTP - CS	✓	-	-	✓
Dover Sewer Authority treated by Kent County WWTP – CS	✓	-	✓	-
Milford Sewer Authority treated by Kent County WWTP – CS	✓	-	✓	-
Town of Clayton treated by Kent County WWTP - CS	✓	-	✓	-
Town of Smyrna treated by Kent County WWTP - CS	✓	-	✓	-

City of Harrington WWTP

The City of Harrington's service area is 3.62 square miles consisting of two sewer districts (Harrington and Farmington) with eight pump stations serving 1,350 households. The City of Harrington WWTP provides primary and secondary treatment and has a surface water discharge that flows into the Murderkill River and then into Delaware Bay (Watershed #19). The NPDES permit for this discharge (DE0020036) expired on December 31, 2011, and has been administratively expended by DNREC, although it will not be reissued because Harrington has tied into the forcemain for Kent County and therefore will not need an NPDES permit. The permit included effluent limits of 140 lbs/day and 9,125 lbs/year for TN and 0.75 lbs/day and 55 lbs/year for TP, and the plant had experienced non-compliance with both of those limits. The existing facility is inadequate to remove sufficient quantities of nitrogen and phosphorus. The plant also indicated that it experienced instantaneous exceedances of limits for BOD, TSS and fecal coliform caused by a system overload during a major storm.

The plant's current design flow is 0.75 MGD, and the average daily flow is 0.5 MGD, or about 67 percent of design flow. The Murderkill River Watershed TMDL, finalized in December 2001 and amended in August 2004, includes WLAs for nitrogen, phosphorus, and 5-day carbonaceous BOD. Solids are trucked to the Kent County Regional WWTP, and influent BOD and TSS concentrations are below normal during wet weather, indicative of I/I.

Peak flow at the plant is 0.8 MGD, and major I/I issues, which can double the flow received by the plant, have been reported. Studies have been performed to find suspect areas (about 25 percent of the City has been studied so far); the City has applied for grants to continue the studies. Problems are mostly inflow, and recent rehabilitation efforts include inserts, slip lining and full replacements.

The City's high-priority needs are pump station and additional collection system maintenance and upgrades, including a 10.5-mile force main to the Kent County Regional plant, other miscellaneous upgrades and a long-term I/I strategy. The City is also planning to update its ordinances and is conducting engineering studies for USDA and SRF funding, which will focus on repair/replacement of pipes for I/I and related capacity issues.

Financial Analysis

The average annual sewer rate in the Harrington service area is $571.11, and total annual residential revenues are $771,000 in the service area. The City reported that sufficient revenues are being generated at the current rates. The City of Harrington has a reserve account that is restricted to wastewater that must be 23 percent of operating revenues. It also has an escrow account for future debt service and an impact reserve account for future installations or major repairs. It has used $5M of its $5.2M debt service allocation for force main upgrades to the Kent County Regional WWTP.

The City of Harrington bills customers on a flat fee with different in-town and out-of-town rates. Its MHI is $40,204 according to the 2010 CPI (Farmington's MHI is $53,863 with 10 percent of the flow; the City contributes 90 percent of the flow).

Wastewater Reuse Analysis

Kent County performed a cost analysis on connecting the City of Harrington's service area to the Kent County Regional WWTP versus using spray irrigation. The study suggested that spray irrigation would be a viable option except that the cost for a storage lagoon was excessive. The City of Harrington's service area is 8 miles to the Kent County Regional WWTP in Frederica (not including Farmington), so running treated effluent back to the City for residential reuse appears to be cost-prohibitive.

Capital Project Costs and Financing Options

The City of Harrington reported $8.04M in capital project costs from 2011-2016. Of these capital project costs, $2.76M (34.3%), $3.96M (49.3%), $660K (8.2%), and $660K (8.2%) are related to capital costs for collection, conveyance, treatment and disposal, respectively.

To address capital project costs from 2011-2016, the City of Harrington anticipates requesting $4.2M from the Clean Water State Revolving Fund and $400K from USDA. No funding source was indicated for $3.44M.

Table 4-2 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-2. City of Harrington 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.72M	$1.72M	$1.9M	$1.5M	$600K	$600K	$8.04M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$4.2M	$400K	$0K	$0K	$3.44M

Kent County Regional WWTP

The Kent County Regional WWTP service area is 47.5 square miles and consists of 33 sewer districts with 85 pump stations, serving 16,191 households. The plant also treats wastewater from the following collection-only systems: Camden-Wyoming Sewer and Water Authority, the Dover Sewer Authority, the Milford Sewer Authority, the Town of Clayton and the Town of Smyrna.

The Kent County Regional WWTP provides primary, secondary, and tertiary treatment and nitrogen and phosphorus removal. The facility is equipped with downflow filtration, ferric injection before filtration, supplemental carbon addition to remove phosphate and biosolids handling. The plant is near the Town of Frederica and has a surface water discharge that flows into the Murderkill River and then into Delaware Bay (Watershed #19). The NPDES permit for this discharge (DE0020338) expired on October 31, 2011, and has been administratively extended pending its reissuance by DNREC. The permit includes seasonal (May-September) effluent limits of 751 lbs/day average (1,126 lbs/day maximum) and 274,115 lbs/year for TN and seasonal (May-September) limits of 62.5 lbs/day average (93.7 lbs/day maximum), and 22,812 lbs/year for TP. The plant has not had non-compliance for two consecutive months but reported occasional problems with washout and toxic shock.

The plant's current design flow is 16.3 MGD, and the average daily flow is 12.19 MGD, or about 75 percent of design flow. BOD and TSS influent strength were reported to be at the top end of normal (250 to 300 mg/L) in November 2010. Permit non-compliance for the plant has included being temporarily above its TN limit because of plant modifications and construction. Flow and solids handling capacity was reported as having been exceeded in March 2010 because of I/I.

Peak flow at the plant is 18.6 MGD and I/I problems are thought to be from towns contributing to system, especially from the City of Dover (e.g., Pump Station #3 had 1.5 MGD in September 2010 [dry] versus 3.25 MGD in March 2010 [wet]).

Financial Analysis

The average annual sewer rate in the Kent County Regional WWTP service area is $319.25, and the total annual residential revenues are $5,169,004. The County reported that sufficient revenues are being generated at the current rates. The County has a restricted working capital reserve fund that allows funds to be shared/overlapped, and it has a restricted capital emergency reserve fund. Operating revenue and the 7 percent reserve do not include debt service.

Customer billing varies per service area and is computed according to EDUs. All commercial, industrial, and MHP contract users pay $2.34 per 1,000 gallons. Rates are the same (residential service is billed monthly and commercial is billed quarterly).

Kent County's MHI is $48,073 according to the 2010 CPI, and its debt borrowing limit is about 12 percent of assessed value. The debt borrowing limit is $382M; $52M has been used.

Wastewater Reuse Analysis

Plans are underway for spray irrigation of treated effluent at a rate of 100,000 gpd. The plant's effluent will meet the quality required for unrestricted access spray irrigation upon completion of a project to upgrade the plant to tertiary treatment, which is funded and should be completed in 2013. (The County reports strong farmer interest in reclaimed water provided that the farmers have adequate control of the quantities of water delivered. The County has questions about cost and the ability to maintain adequate service pressure in such a reuse system.

New and innovative technologies at the Kent County Regional WWTP include 1.2 MW solar panels that supply 100 percent of the plant's electricity needs on sunny days, an HVAC system that uses effluent (for heat exchangers and heat pumps), three passive solar greenhouses for biosolids drying (one-quarter acre each with heated floors). The plant is not pursuing methane capture because of a perceived lack of expertise and only marginal estimated cost savings.

Capital Project Costs and Financing Options

Kent County reported $52.5M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $2.66M (5.1%), $10.7M (20.4%), $39.1M (74.5%) and $25K (<0.1%) are related to capital costs for collection, conveyance, treatment and disposal, respectively. For the projects reported, Kent County reported an additional $23.8M in capital project costs prior to 2011.

To address capital project costs from 2011-2016, Kent County anticipates requesting $24M from the Clean Water State Revolving Fund and $5.27M from USDA. Approximately $22.8M is expected to be funded through municipal sinking funds or other asset replacement cost savings, while $420K in other financing methods (U.S. Department of Energy - Energy Efficiency and Conservation Block Grant (EECBG) Program) was reported.

Table 4-3 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-3. Kent County 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$18.4M	$7.3M	$13.3M	$10.3M	$3.25M	$0K	$52.5M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$24M	$5.27M	$22.8M	$420K	$0K

Camden-Wyoming Sewer and Water Authority

The Camden-Wyoming Sewer and Water Authority owns and operates a 3.75-square-mile service area composed of three sewer districts with seven pump stations, serving 2,332 households. This collection system discharges to the Kent County Regional WWTP.

Average daily flows in the system are 0.7 MGD with peak flows of 0.98 MGD. I/I causes an approximately 40 percent increase over average flow for the predominant (mostly pre-1995) system of vitrified clay pipe) and only a 10 percent increase from post-1995 installations. Exfiltration is also an issue, and repairs are made when problems occur or known trouble areas are targeted.

The 1998 Sewer Master Plan was updated in 2008, and it includes yearly budget information. The most recently updated CIP was 2010. Development is ongoing, and routine O&M and I/I issues are addressed as needed when they are found. Fifty percent of impact fees are earmarked for improvements of the existing collection and conveyance system.

Financial Analysis

The average annual sewer rate in Camden-Wyoming Sewer and Water Authority service area is $313.35, and the total annual residential revenues are $730,732. Current fees meet the present operating budget of the Authority. The Authority has a policy that revenues must be 120 percent of expenditures. The Authority has a reserve account that is restricted to wastewater that must be 10 percent of operating revenues.

Customer billing is computed according to EDUs and is $0.24 per 1,000 gallons on top of the Kent County Regional WWTP fees. Rates are the same (residential service is billed monthly and commercial is billed quarterly).

The population-weighted average MHI is $62,069 (Camden is $61,189, and Wyoming is $62,949 per the 2010 CPI). The Authority does not have a set borrowing limit on wastewater enterprises; it is whatever can be supported by fees.

Wastewater Reuse Analysis

The Authority indicated that it has no plans for reuse in this collection-only system and noted that it is 10 miles to the Kent County Regional WWTP so running treated effluent back to the service area for residential reuse would be cost-prohibitive.

Capital Project Costs and Financing Options

The Camden-Wyoming Sewer and Water Authority reported $5.46M in capital project costs from 2011-2016. Of these capital project costs, $3.35M (61.3%) and $2.11M (38.7%) are related to capital costs for collection and conveyance, respectively. These projects are not yet planned, and the Camden-Wyoming Sewer and Water Authority does not currently have funding for any of these projects, but reported that it would desire $5M from the Clean Water State Revolving Fund and the remaining balance from municipal bank financing to be able to go forward with these projects.

To address capital project costs from 2011-2016, the Camden-Wyoming Sewer and Water Authority anticipates requesting $5M from the Clean Water State Revolving Fund. Municipal bank financing accounts for $456K in funding during the 2011-2016 time period.

Table 4-4 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-4. Camden-Wyoming Sewer and Water Authority 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.51M	$1.02M	$1.02M	$633K	$633K	$633K	$5.46M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$456K	$0K	$5M	$0K	$0K	$0K	$0K

Dover Sewer Authority

The Dover Sewer Authority has a 23.4-square-mile service area composed of one sewer district with 41 pump stations that serves 10,125 households. The Authority's collection system relies on the Kent County Regional WWTP for treatment. Average daily flows in the system are 5.4 MGD with peak flows of 8.3 MGD. Kent County mandates/manages industrial pre-treatment systems. The Authority entered into a 10-year contract user agreement with the Kent County WWTP in 2006. I/I issues are present, and the Authority purchased a truck and is doing "as you go" as a more cost effective approach to addressing these issues. Capital projects include smoke testing/video and GIS to identify the I/I issues.

Financial Analysis

The average annual sewer rate in the Dover Sewer Authority's service area is $491.31, and total annual residential revenues are $4,974,514. Water and wastewater are accounted for in the same fund, which is currently meeting all debt covenants and financial obligations. The Authority has a restricted reserve account that must keep a minimum of 8 percent plus 2 percent for capital improvements, and$0.5M for emergencies. There are two restrictions; one set by the City Council and one by ordinance.

The Authority has no municipal contract users and bills all customers based on flow only. It also marks up customer's Kent County charges with a $1.05 surcharge for addressing I/I issues.

MHI in the service area is $50,239, and the Authority is not allowed to issue general obligation bonds so must rely on revenue bonds. There is no maximum borrowing limit, but the Authority must meet its debt covenant. The Authority also has used American Recovery and Reinvestment Act funds to leverage the SRF if that rate stays lower than bond market.

Wastewater Reuse Analysis

The Authority does not provide treatment for this collection-only system and therefore is not currently reusing wastewater since the service area is 12 miles from the Kent County Regional WWTP. Running treated effluent back to the service area for residential reuse would be cost-prohibitive. The Authority reports that it is interested in learning more about "helper" solutions such as pretreatment, waste-stream characterization/separation/reuse options for industries and the use of holding tanks.

Capital Project Costs and Financing Options

The Dover Sewer Authority reported $10.3M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $2.89M (28.2%) and $7.36M (71.8%) are related to capital costs for collection and conveyance, respectively. For the projects reported, the Dover Sewer Authority reported an additional $6.79M in capital project costs prior to 2011.

To address capital project costs from 2011-2016, the Dover Sewer Authority anticipates requesting $5.41M from the Clean Water State Revolving Fund and $240K from USDA, while $4.61M in other financing methods (transfers from the operating fund and impact fee reserves) were reported.

Table 4-5 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-5. Dover Sewer Authority 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.56M	$1.65M	$1.89M	$3.28M	$1.87M	$0K	$10.3M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$5.41M	$240K	$0K	$4.61M	$0K

Milford Sewer Authority

The Milford Sewer Authority has a 10.3 square mile service area consisting of three sewer districts with 17 pump stations serving 3,986 households. This collection system discharges to the Kent County Regional WWTP. Average daily flows in the system are 2.5 MGD with peak flows of 4 MGD. I/I issues are a concern in this wastewater system with increases in average flow of 32 percent in 2009, 43 percent in 2010 and 26 percent in 2011 as a result of I/I. A formal I/I report was completed in April 2011, which estimated $15-20M to repair outstanding problems caused by the old system with brick and terra cotta and some flooding issues, mostly in the "old town" center of Milford. Milford reported that it thinks the current approach to addressing I/I issues results in lots of unnecessary pumping (electrical waste and wear on equipment). There is no limit on flow, but an agreement requires an updated flow estimate to be made every two years with Kent County Regional WWTF. Future flows are unknown, but growth is anticipated by 2020/2030. Kent County does periodic tests and monitors industrial pre-treatment systems within the Authority's collection system.

The improvements in Milford are being funded under development loans and grants through the SRF program plus bond issues.

Financial Analysis

The average annual sewer rate in the Milford Sewer Authority service area is $407.86, and the total annual residential revenues are $1,625,747 within the service area. The Authority reported that sufficient revenues are being generated at current rates. The Authority has a reserve account that is

restricted to wastewater and cannot exceed 39 percent of operating revenues. Expenditures from the account must be approved by the Town Council. The Town does not have a borrowing limit, but debt is subject to referendum.

The Milford Sewer Authority service area's MHI is $42,257 according to the 2010 CPI. Most of the Authority's customer billing is computed on the basis of water metering, although some have separate sewer meters. In the Town of Milford, the rate is a $10 base + $2.43 per 1,000 gallons (the Kent County fee); outside the Town, the rate is 1.5 times Town's rate + $2.34 per 1,000 gallons. The same rates apply to non-residential users and are only flow-based.

Wastewater Reuse Analysis

The Milford Sewer Authority does not provide treatment (i.e., operates a collection-only system) and therefore is not currently reusing wastewater. The Milford service area is 7 miles to the Kent County Regional WWTP, so running treated effluent back to the service area for residential reuse would be cost-prohibitive. The Authority reported that it would consider localized reuse using packaged wastewater treatment systems in high-growth areas; however, there is not a strong driver for this because the Kent County Regional WWTP has sufficient capacity. Reuse has been discussed for new facilities, but nothing specific is in the works. The Authority has also undertaken some innovative efficiency upgrades in partnership with its electrical utility.

Capital Project Costs and Financing Options

The Milford Sewer Authority reported $11.8M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $4.8M (40.9%) and $6.95M (59.1%), are related to capital costs for collection and conveyance, respectively. For the projects reported, the Milford Sewer Authority reported an additional $1.99M in capital project costs prior to 2011.

No funding source was indicated for all project costs from 2011-2016 ($11.8M).

Table 4-6 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-6. Milford Sewer Authority 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.8M	$4.3M	$2.2M	$1.7M	$1.75M	$0K	$11.8M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$11.8M

Town of Clayton

The Town of Clayton's service area is a 2-square-mile system consisting of one sewer district with six pump stations and two holding tanks with a total capacity of 300,000 gallons that serves

1,131 households. The Town's collection system relies on the Kent County Regional WWTP for treatment. Average daily flows in the system are 0.23 MGD with peak flows of 0.35 MGD. Half of the system flow is directed into Kent County's new collection system (0.058 MGD) and the other half goes through the Smyrna collection system and into Kent County's main collection system (0.173 MGD).

Excessive peak flows into Smyrna's system are thought to be due to I/I in Clayton's "Old Town." There are no known I/I issues in Clayton's new system, which feeds direct to the County. Although there is no limit for the Kent County collection system, the limit through Smyrna is 0.4 MGD. Clayton's Old Town received a planning grant for conducting an I/I study. There are no combined sewers. The Town believes it is an inflow problem, and infiltration has been resolved. The Town has no upcoming capital projects (i.e., O&M and only minor upgrades). Some phases of three developments are under construction, and a fourth development is under review, which might require increasing the main pump station capacity. Funding to serve new development is provided by developers and by impact fees. The ongoing I/I studies will identify specific projects to be included in future 5-year CIPs. Otherwise, the Town makes repairs when an issue is observed.

Financial Analysis

The average annual sewer rate in the Town of Clayton service area is $373.20, and total annual residential revenues are $422,089. The Town recently increased rates, which it reported generate sufficient revenues. The Town does not have a reserve account, although part of the rate increase is to be used to create a dedicated reserve account.

The Town bills its customers according to metering water use, although some of unincorporated Kent County customers' billing is estimated. All customers are billed according to flow; no distinction is made between residential and non-residential. The Town is billed by Smyrna at a metering station maintained by the Town of Clayton. Customers connected to the new sewer are billed quarterly, and those connected to the old sewer are billed monthly.

The Town of Clayton's MHI is $56,466. The Town has a borrowing limit of $1M and has already used $800,000 on a new drinking water treatment plant.

Wastewater Reuse Analysis

The Town of Clayton does not provide treatment (i.e., it operates a collection-only system) and therefore is not reusing wastewater. The Town of Clayton's service area is about 25 miles from the Kent County Regional WWTP, so running treated effluent back to the service area for residential reuse would be cost-prohibitive.

Capital Project Costs and Financing Options

Capital project costs of$3.43M were assumed for the Town of Clayton from 2011-2016. Of these capital project costs, $1.71M (50%) and $1.71M (50%) are capital costs assumed to be related to collection and conveyance, respectively. An additional $571K in assumed capital project costs after 2016 is included.

No funding source was indicated for all project costs from 2011-2016 ($3.43M).

Table 4-7 provides a list of reported project costs by year from 2011-2016 and presents the source of financing for these projects.

Table 4-7. Town of Clayton 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$667K	$952K	$952K	$286K	$286K	$286K	$3.43M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$3.43M

Town of Smyrna

Average daily flows in the system are 0.64 MGD, and the flow includes about half of Clayton, measured at Pump Station #1. The Town of Smyrna's collection system relies on the Kent County Regional WWTP for treatment. Kent County does not regularly test Smyrna for strength, nutrients, and such. The Town did not report an I/I problem, and peak flow in the system was not reported. The Town is committed to providing adequate preventive maintenance to ensure that I/I does not become an issue.

The Town has developed a general comprehensive plan for ongoing collection and conveyance with new (current) development. Phase 1 of a downtown rehabilitation project is complete. The Town has nine projects funded by SRF loans, including rehabilitation, I/I, pump station upgrades and the North Duck Creek Extension.

Financial Analysis

The average annual sewer rate in the Smyrna service area is $303, and total annual residential revenues are $1,128,372 in the service area. The Town has an unrestricted reserve account (i.e., not reserved for wastewater). It has a $3M rainy day fund that can be used for capital construction, but the Town Council must authorize its use.

The Town bills all its customers according to metering water use and bases its billing of the Town of Clayton at a separate metering station maintained by Clayton. Kent County bills Smyrna for the full flow at Pump Station #1, which is maintained by Kent County.

The Town of Smyrna's MHI is $66,853 according to the Kent County Economic Study but is only $47,047 per the 2010 CPI); however, the Town's sewer rates are not based on MHI. The Town has a borrowing limit that is 12 percent of its total assessed value of $900M and has only used $4.5M of its $108M debt allocation.

Wastewater Reuse Analysis

The Town of Smyrna does not provide treatment (i.e., it operates a collection-only system) and therefore is not reusing wastewater. The Town of Smyrna's service area is about 25 miles from the Kent County Regional WWTP, so running treated effluent back to the service area for residential reuse would be cost-prohibitive.

Capital Project Costs and Financing Options

The Town of Smyrna reported $4.51M in capital project costs from 2011-2016 (although no project costs were reported for 2015 and 2016). Of these capital project costs, $1.76M (39%) and $2.75M (61%) are related to capital costs for collection and conveyance, respectively.

To address capital project costs from 2011-2016, the Town of Smyrna anticipates $4.51M from the Clean Water State Revolving Fund.

Table 4-8 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 4-8. Town of Smyrna 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$375K	$1.06M	$2.63M	$449K	$0K	$0K	$4.51M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$4.51M	$0K	$0K	$0K	$0K

Section 5 – Facilities in Sussex County

Sussex County Overview

Fifteen municipally owned wastewater systems were included as part of the survey in Sussex County, as shown in Table 5-1. Those 15 systems include 13 treatment plants and two collection systems (Town of Greenwood treated by Bridgeville WWTP and Sussex County collection systems). Sussex County owns and operates four WWTPs and the associated collection systems (Inland Bays Regional WWTF, Piney Neck Regional WWTF, South Coastal Regional WWTF, and Wolfe Neck WWTF. Additional collection systems operated by Sussex County consist of six separate systems (Blades, Dewey Beach, Ellendale, Henlopen Acres, Woodlands of Millsboro, and Golf Village) that connect to other systems for treatment and are summarized for this report. In addition the Town of Bethel is in the process of connecting or has connected to central systems but is not included in this assessment.

All publicly owned treatment plants in Sussex County with the exception of the City of Rehoboth Beach are equipped with on-site auxiliary backup power supply generators (all generators use diesel or gasoline except for the Wolfe Neck WWTF, which operates on natural gas or propane). The City of Rehoboth Beach has a second power feed from the same substation using a different transformer. All plants in Sussex County reported influent strength within the normal range (150–250 mg/L BOD and TSS) except for Selbyville, the City of Seaford and the Town of Delmar. Selbyville reported the cause of its above normal influent strength as food processing wastes.

Three wastewater systems are in Sussex County with sewer rates higher than 1.5 percent of MHI, indicating that those systems may have challenges raising additional revenue because rates are already relatively high compared to median income (Town of Georgetown WRF – 1.586 percent; Town of Greenwood CS – 1.505 percent; and Town of Laurel STP – 1.843 percent).

Table 5-1. Wastewater System Responsibilities

Wastewater System	Collection	Treatment	Municipal	Authority
City of Lewes STP	✓	✓	-	✓
City of Rehoboth Beach STP	✓	✓	✓	-
City of Seaford WWTP	✓	✓	✓	-
Delmar WWTP	✓	✓	✓	-
Sussex County - Inland Bays Regional WWTF	✓	✓	✓	-
Sussex County - Piney Neck Regional WWTF	✓	✓	✓	-
Sussex County - South Coastal Regional WWTF	✓	✓	✓	-
Sussex County - Wolfe Neck WWTF	✓	✓	✓	-
Town of Georgetown WRF	✓	✓	✓	-
Town of Bridgeville WWTF	✓	✓	✓	-
Town of Greenwood treated by Bridgeville WWTF - CS	✓	-	✓	-
Town of Laurel STP	✓	✓	✓	-
Town of Millsboro WWTF	✓	✓	✓	-
Town of Selbyville WWTF	✓	✓	✓	-
Sussex County Collection Systems - CS	✓	-	✓	-

Capital Project Costs and Financing Options for Sussex County-owned Systems

Sussex County reported $190M in capital project costs from 2011-2016. Of these capital project costs, $56.1M (29.5%), $80.8M (42.6%), $52.6M (27.7%) and $334K (0.2%) are related to capital costs for collection, conveyance, treatment and disposal, respectively.

To address capital project costs from 2011-2016, Sussex County anticipates requesting $21.6M from federal grants (USDA). Approximately $46M is expected to be funded through municipal sinking funds or other asset replacement cost savings. Municipal bond issuance accounts for $69.3M in funding during the 2011-2016 time period, while $3.02M in other financing methods (21st Century Fund State Grants) were reported. No funding source was indicated for 2011 project costs of $49.8M. Funding is estimated from total funding that included drinking water funding.

Table 5-2 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-2. Sussex County 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$49.8M	$50.4M	$6.19M	$19.4M	$29.5M	$34.5M	$190M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$69.3M	$0K	$21.6M	$46M	$3.02M	$49.8M

City of Lewes STP

The City of Lewes STP Authority, under contract with Severn Trent, owns and operates a collection system and treatment plant. The service area is 4.63 square miles and has two sewer districts with 32 pump stations, serving 2,430 households. The plant provides secondary and tertiary treatment and nitrogen and phosphorus removal and has a surface water discharge that flows into the C&D Canal (as part of the Broadkill River Watershed) and then into Delaware Bay (Watershed #22). The NPDES permit for this discharge (DE0021512) expired on August 31, 2009. The current NPDES permit is under administrative extension. The permit includes a TN limit of 100 lbs/day and 8 mg/L and a TP limit of 25 lbs/day and 2 mg/L. The plant's current design flow is 1.5 MGD, and the average daily flow is 0.675 MGD, or 45 percent of design flow. Recent studies conclude average effluent distribution is 2.5 percent to Rehoboth Bay and 97.5 percent to Delaware Bay, so a nutrient offset is potentially feasible. The previous clarifier is now acting as 0.5-MG emergency storage.

Peak flow at the plant is 1.15 MGD, and all I/I and combined sewer issues have been resolved since the last survey. The plant is able to handle coastal flooding. Priority needs have been identified on the basis of studies undertaken for updating the Sewer Master Plan in 2012 and various comparison and feasibility reports prepared between 1997 and 2003 for the plants' NPDES permit and a TMDL. These include upgrading or replacing aging infrastructure (plant components, pump station, force main, laterals and house services). The City also has an ongoing manhole renewal project to replace five percent of them each year. Plant expansions are financed or cost shared with land developers.

Financial Analysis

The average annual sewer rate in the City of Lewes STP service area is $795.06, and total annual residential revenues are $1,931,988. Revenues were reported to be sufficient according to recently raised rates. The City has a restricted reserve account valued at 59 percent of operating revenues. The

cash reserve policy is 25 percent for O&M and 2 percent for net asset cost and risk management. Also, 15 percent of the current capital budget is for future project funding, and 15 percent is set aside for the 5-year CIP.

The City bills all its customers according to metering water use and has no industry or contract users and no pretreatment systems. Commercial customers are billed the same way as residents, but commercial users' fees are higher.

The City of Lewes service area MHI is $63,281 according to 2010 CPI and uses some bonds, although most debt is for recent plant upgrades using SRF loans. The City has a debt-borrowing limit of $20M; an allocation of the limit to wastewater is $14M and $12M of the limit has been used.

Wastewater Reuse Analysis

The City of Lewes STP is planning for residential wastewater reuse and currently reuses treated biosolids and treated wastewater effluent internally within the treatment plant. A recent upgrade to the secondary treatment processes at the plant allows the treated effluent quality to meet unlimited public access limitations. Agricultural reuse is generally not viable because of a lack of available farmland near the plant. The City is interested in shallow injection of effluent to provide a barrier to saltwater intrusion and is actively pursuing alternatives for achieving nutrient offsets (trading) to meet Inland Bays nutrient reductions. Examples include reforestation, wetland buffers and BMPs, relocating livestock manure, and effluent storage. Other innovations at Lewes include installing a solar thermal water heater and optimizing process controls at the plant to improve energy efficiency.

Capital Project Costs and Financing Options

The City of Lewes reported $2.35M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $849K (36.2%), $1.13M (48.2%), $359K (15.3%) and $8.75K (0.4%) are related to capital costs for collection, conveyance, treatment and disposal, respectively.

To address capital project costs from 2011-2016, the City of Lewes expects all project costs ($2.35M) to be funded through municipal sinking funds or other asset replacement cost savings.

Table 5-3 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-3. City of Lewes 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.33M	$544K	$91.1K	$96.3K	$286K	$0K	$2.35M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$2.35M	$0K	$0K

City of Rehoboth Beach STP

The City of Rehoboth Beach STP service area is one square mile, consists of four sewer districts with seven pump stations, and serves 2,489 households. The plant provides primary, secondary, and tertiary treatment and nitrogen and phosphorus removal and has a surface water discharge to Rehoboth Bay, part of the Inland Bays/Atlantic Ocean Watershed (#39). Two Sussex County-owned collection systems (Dewey Beach and Henlopen Acres) are treated by the Rehoboth Beach STP. The plant provides solids handling; the NPDES permit for that discharge (DE0020028) expired on September 30, 2010. The permit includes a TN limit of 24,300 lbs/year and a TP limit of 5,308 lbs/year. The plant's current design flow is 3.4 MGD, and the average daily flow is 1.08 MGD, or about 32 percent of design flow.

The City of Rehoboth Beach STP is planning to pursue an ocean outfall because of issues related to nutrient loadings to the Inland Bays. Nutrient trading and various discharge options were studied, and an ocean outfall is considered to be the only viable option since it eliminates the current discharge to Inland Bays, thereby achieving compliance with the consent order. TN and TP removal may not be required for the planned ocean outfall; there is no ammonia nitrogen limit at the plant, but there is a TN limit based on a WLA of total Kjeldahl nitrogen set at 40 mg/L.

Peak flow at the City of Rehoboth Beach STP is 3.06 MGD, and there are no major I/I issues; however, there are coastal flooding inflow issues. The plant can temporarily divert excess flow to a 1 MG steel storage tank or into oxidation ditches during flooding. Priority needs according to the 2010 CIP are cloth-type disc filtration, funding for School View sewer re-routing, and construction of a new pump station and force main for the planned ocean outfall.

Financial Analysis

The average annual sewer rate in the City of Rehoboth Beach STP service area is $360.79, and total annual residential revenues are $898,001. Revenues were reported to be sufficient according to recently raised rates, and the City reported that rates will increase in the future to finance the cost of the planned ocean outfall. The City has a restricted reserve account valued at 2 percent of operating revenues that is earmarked for the treatment plant.

The City bills all customers the same way, which is based on metering water use. The City of Rehoboth Beach service area MHI is $66,817 according to the 2010 CPI; its debt-borrowing limit is $18.2M, with $16M allocated to wastewater. The City's current treatment plant has been paid off, and the City has applied for a $32M grant for improvements (total estimated cost for transmission line, plant and outfall).

Wastewater Reuse Analysis

The City of Rehoboth Beach STP reported that only minor plant upgrades would be required to produce treated effluent suitable for agricultural reuse. However, because of location and limited land, agricultural land application and residential/commercial/industrial reuse does not appear to be a viable option. The plant reported that it is planning to upgrade its biosolids treatment processes from Class B to Class A.

The City of Rehoboth Beach also considered pursuing nutrient trading initiatives to comply with Inland Bays nutrient reduction requirements, but a study concluded that it was not feasible.

Capital Project Costs and Financing Options

The City of Rehoboth Beach reported $25.1M in capital project costs from 2011-2016 (although no project costs were reported for 2015, 2016). Of these capital project costs, $1.05M (4.2%), $8.14M (32.4%) and $15.9M (63.4%) are related to capital costs for conveyance, treatment and disposal, respectively. For the projects reported, the City of Rehoboth Beach reported an additional $6.28M in capital project costs prior to 2011.

To address capital project costs from 2011-2016, the City of Rehoboth Beach anticipates requesting $13.4M from the Clean Water State Revolving Fund and $8.49M from USDA. Municipal bank financing accounts for $3.23M in funding.

Table 5-4 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-4. City of Rehoboth Beach 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$6.28M	$6.28M	$6.28M	$6.28M	$0K	$0K	$25.1M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$3.23M	$0K	$13.4M	$8.49M	$0K	$0K	$0K

City of Seaford WWTP

The City of Seaford WWTP service area is 5 square miles and consists of two sewer districts (Blades and Seaford) with 15 pump stations, serving 1,819 households. The plant provides primary, secondary, and tertiary treatment; nitrogen and phosphorus removal; and has a surface water discharge that flows into the Nanticoke River and then into the Chesapeake Bay (Watershed #31). The Sussex County-owned Blades collection system is treated by the Seaford STP and has an allotted capacity of 144,000 gpd. The plant provides solids handling; the NPDES permit for that discharge (DE0020265) expires on May 31, 2013. The permit includes a seasonal (May-November) TN limit of 135 lbs/day and 49,086 lbs/year and a TP limit of 34 lbs/day average (50 lbs/day maximum) and 2 mg/L average (3 mg/L maximum). The plant's current design flow is 2 MGD, and the average daily flow is 1 MGD, or 50 percent of design flow.

Peak flow at the plant is 3 MGD, and I/I issues occur during rain events (increasing flow to the plant by up to 2 MGD). Funding is ongoing for the various I/I issues related to different sewer types. The worst area is Seaford's "Old Town" (central area). The combined sewer system was eliminated in early 2000s. Priority needs according to the City's 2010 CIP are addressing I/I as found via TV and smoke testing, evaluating capacity upgrades to accommodate growth (increase to 3 MGD in 5 years and to 4 MGD in 10 years) and meeting WLAs under the Chesapeake Bay TMDL. The City is considering impact and user fees, SRF and local bonds as funding sources.

Financial Analysis

The average annual sewer rate in the City of Seaford WWTP service area is $446.88, and total annual residential revenues are $812,875. Revenues generated were reported to be sufficient according to current rates. The City relies on breakeven enterprise funds for O&M, but it has no major set-aside to start major capital improvements. The City has a restricted reserve account with 5 percent of the value of operating revenue that can be used for emergencies or minor capital improvements.

The City bills its residential customers according to EDUs. Most non-residential customers are billed according to metered water use, including BASF, Orient Chemical, Proceno Plating (in Blades), Nanticoke Memorial, Allen's Hatchery, Seaford High School, three elementary schools, and one middle school. Some are billed using sewer meters (including Blades). The surcharge rates are based on TSS, BOD and nutrients, per individual agreements.

The City of Seaford WWTP service area's MHI is $49,275. The City has a $248.9M debt borrowing limit; $5.5M of that allocation is currently being used. By charter, the City's debt cannot exceed $2M without going to referendum. The borrowing limit is set in the charter at 25 percent.

Wastewater Reuse Analysis

The City of Seaford WWTP is planning for water reuse at the Hoopers Landing Golf Course, which is 0.25 mile from the plant. The City has purchased 90 acres out of a total of 200 available acres for irrigation, the remainder of which could be leased. It reports having performed soil evaluations for approximately the past year to estimate allowable nutrient loadings. The tertiary treated effluent from the Seaford WWTP meets unlimited public access limitations, the plant is close to State-owned forest land, and some agricultural lands are also available. Farmers have expressed interest, but the City has not evaluated agricultural reuse in detail or made any agreements with farmers.

The City also reported that it would be interested in RIBs if it can find land. Sussex County owns a large amount of undeveloped land, and the City would consider reciprocal agreements to potentially use County sites.

With respect to innovation and sustainability, the City is looking into solar power at the plant and access to green credits for green projects.

Capital Project Costs and Financing Options

The City of Seaford reported $361K in capital project costs from 2011-2016 (although no project costs were reported for 2014, 2015 and 2016). Of these capital project costs, $145K (40.1%), $83.6K (23.2%) and $133K (36.7%) are related to capital costs for conveyance, treatment and disposal, respectively. Due to known I/I and unreported planned upgrades, an additional undocumented $8M may be needed over an unknown timeframe.

The City of Seaford has other larger projects in motion for which accurate cost estimates are not available. These projects include:

- Providing spray irrigation to Seaford's 90 acre golf course. Funding is needed for design and construction of the pump station, conveyance piping and irrigation system to distribute the effluent onto the course.
- Implementation of the Phase II WIP and more stringent Chesapeake Bay TMDL limits. It is possible that Seaford will have to do some sort of upgrade or modification to the plant to gain back lost capacity (2.0 MGD) due to the more stringent nitrogen limits.

- Elimination of two smaller lift stations by converting the piping to gravity flow.
- Total upgrade of septage receiving system. The last budgetary cost estimate was received in April 2011 in the amount of $1.2M, which includes engineering and construction costs.
- A study evaluating the current process used to dewater sludge and the current composting operation for sludge disposal is in process. The feasibility of keeping the current composting operation for disposal as flows increase or switching to a different operation such as EnVessel Pasteurization is being evaluated.

No funding source was indicated for all project costs from 2011-2016 ($361K).

Table 5-5 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-5. City of Seaford 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$145K	$53K	$163K	$0K	$0K	$0K	$361K

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$361K

Town of Delmar WWTP (Maryland)

The Delmar WWTP services the Delmar municipal limits (partly in Maryland and Delaware) and two small residential areas and MHPs in Wicomico County, Maryland. The Town of Delmar, Maryland, service area is 7 square miles and consists of two sewer districts with 11 pump stations, serving 1,821 households. The Delmar WWTP provides secondary and tertiary treatment and has a surface water discharge that flows into the Wicomico River and then into the Chesapeake Bay (Watershed #31). The plant provides solids handling; the NPDES permit (MD0020532) for this discharge expires on June 30, 2012. The permit includes ammonia nitrogen limits of 16 lbs/day (85 lbs/day maximum) and 2.5 mg/L (12 mg/L maximum) and TP limits of 2.7 lbs/day (4.1 lbs/day maximum) and 0.93 mg/L (1.41 mg/L maximum). The Delmar WWTP has experienced non-compliance issues with those limits and reported non-compliance with its TSS limit because of design and operational issues and equipment failure.

The Delmar WWTP's current design flow is 0.65 MGD, and the average daily flow is 0.35 MGD, or about 54 percent of design flow. The plant is being upgraded with ENR/BNR and increased capacity of 0.85 MGD. Limitations listed in the system inventory are interim (the interim TN goal is stated in the permit text).

Peak flow at the Delmar WWTP is 2.2 MGD, and the system experiences I/I because of old lines and manholes. Critical areas have been identified, and small upgrades such as inserts have been accomplished. The Town has conducted some studies and smoke testing, but it has not done a comprehensive study. Other priority needs according to the 2010 CIP are meeting WLAs under the Chesapeake Bay TMDL, projects such as ENR/BNR upgrades, two new pump stations, an I/I study and

subsequent correction. The Town relies on Maryland Department of Environment and DNREC for SRF loans, issues local bonds and has received federal stimulus grants under the American Recovery and Reinvestment Act.

Financial Analysis

The average annual sewer rate in the Town of Delmar WWTP service area is $276.85, and total annual residential revenues are $504,151. Revenues generated were reported to be sufficient according to the recently adjusted rates. The Town has an unrestricted reserve account with 9 percent of the value of operating revenue. The water and sewer reserve fund is combined and can be used for emergency repairs or to fund a portion of a major project.

The Town bills all its customers using a combination of metered water use, non-metered MHP (Breckenridge), and flat fee per EDU. Commercial use is metered and converted to EDU using flow only.

MHI in the Town of Delmar WWTP service area is $34,842 according to 2010 CPI. The Town has a $33M debt borrowing limit; just $0.2M of that allocation is currently being used. The Town's debt cannot exceed 25 percent of assessments.

Wastewater Reuse Analysis

The Town of Delmar reported that there is no local industry for industrial reuse, and reuse is not feasible for residential applications. Treated biosolids are not reused; solids are instead processed using belt filter press, aerobic digestion and drying beds with disposal via landfill. Effluent from the Delmar WWTP will meet unlimited public access limitations once the new ENR/BNR system is installed. Agricultural land is available in Maryland; however, the Town indicates that farmers do not want to assume responsibility for nutrient, water or solids management.

Capital Project Costs and Financing Options

The Delmar Sewer Authority reported $11.3M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $2.22M (19.6%), $3.1M (27.4%) and $6.01M (53%) are related to capital costs for collection, conveyance, and treatment, respectively. Costs provided did not include a major WWTP upgrade with BNR/ENR that has an estimated cost of $6M for 2011-2013. In addition, these costs do not include an estimated $5M that may be needed over an unknown timeframe for I/I issues.

No funding source was indicated for all project costs from 2011-2016 ($11.3M).

Table 5-6 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-6. Delmar Sewer Authority 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$5.75M	$2.31M	$2.38M	$425K	$475K	$0K	$11.3M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$11.3M

Inland Bays Regional WWTF

Sussex County owns and operates the Inland Bays Regional WWTF, which has a 15.87-square-mile service area consisting of three sewer districts with 87 pump stations, serving 7,767 households. The plant provides secondary and tertiary treatment; nitrogen removal; and is in Rehoboth Bay/Inland Bays/Atlantic Ocean Watershed (#39). The facility is equipped with storage lagoons for spray irrigation and has a groundwater discharge permit (LTS 5004-90-06A), which expired on September 4, 2011. The permit has a TN limit of 250 lbs/acre per year, and the plant has experienced non-compliance by exceeding its annual load in 11 months (i.e., by November). The plant anticipates receiving TP limits in the future.

The Inland Bays Regional WWTF's current design flow is 2.13 MGD reflecting three phases of planned expansion through 2030. The average daily flow is 0.55 MGD, or about 26 percent of design flow. The plant's groundwater permit was amended in 2009 to add another spray field. Peak flow at the plant is 0.8 MGD, and a study showed that the system did not meet EPA's definition of having excessive I/I.

Priority needs, according to the 2010 CIP, include standard collection system and pump station rehabilitation and upgrades. The plant is being retrofitted with a Biolac™ system for a new storage lagoon, two retrofit lagoons for nutrient removal with the Biolac™ system, two new spray sites totaling 50 acres, additional clarifiers, and a chlorine contact tank. The new Biolac™ system should resolve the TN compliance issues (proposed effluent is 10 mg/L).

Financial Analysis

The average annual sewer rate in the Inland Bays service area is $631.49, and total annual residential revenues are $4,904,804. Revenues generated were reported to be sufficient according to current rates. The Inland Bays Service WWTP has a restricted reserve account with no requirement for it to be a certain percentage of operating revenue.

Sussex County bills all its customers according to EDUs; there is no difference between residential and commercial/industrial billing. The MHI in the Inland Bays service area is $48,442 according to 2010 CPI. Sussex County declined to disclose debt information or reserve amount.

Wastewater Reuse Analysis

The Inland Bays WWTP applies treated sludge on 175 County-owned acres at the WWTP site. Additionally, the Inland Bays WWTP spray irrigates treated effluent on 2,188 acres of County-owned agricultural land and is actively looking for more spray sites. The plant effluent does not meet unlimited

public access limitations. The County reported that the current plant upgrades include lime treatment of biosolids, which will enable it to meet requirements for a Class "A" product that local farmers can use.

Capital Project Costs and Financing Options

Sussex County owns and operates the Inland Bays WWTP. Information on capital project costs and financing is included within the discussion about Sussex County and presented in Table 5-2.

Piney Neck Regional WWTF

Sussex County owns and operates the Piney Neck Regional WWTF, which has a 3.66-square-mile service area consisting of one sewer district with seven pump stations serving 556 households. The plant provides secondary treatment and is located in the Indian River Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#42). The plant is equipped with storage lagoons for spray irrigation; the groundwater discharge permit for this facility (LTS-5003096-08) expires on July 21, 2013. The permit includes a TN limit of 300–350 lbs/acre/year for field and spray irrigation and a requirement to perform a PSI study of the site.

The Piney Neck Regional WWTF's current design flow is 0.2 MGD, and the average daily flow is 0.085 MGD, or about 43 percent of design flow. Because the plant experiences seasonal flow variations, it has seasonal flow limits of 0.166 MGD (summer) and 0.141 MGD (winter). It is trying to determine how to meet Performance Standard Nitrogen level 2 and Performance Standard Phosphorus level 1 from the Inland Bays Pollution Control Strategy regulations for new permitting because the data are not yet available for phosphate mobility in soil. Peak flow at the plant is 0.1 MGD, and the system reports no excess I/I problems.

Priority needs according to the 2010 CIP include standard collection system and pump station upgrades, although there are no planned plant upgrades in the near term.

Financial Analysis

The average annual sewer rate in the Piney Neck Regional WWTF service area is $412.48, and total annual residential revenues are $229,339. Revenues generated were reported to be sufficient according to current rates; the Piney Neck Regional WWTF has a restricted reserve account with no requirement for it to be a certain percentage of operating revenue.

Sussex County bills all its customers according to EDUs; there is no difference between residential and commercial/industrial billing. The Piney Neck WWTF service area MHI is $47,375 according to 2010 CPI. Sussex County declined to disclose debt information or reserve amount.

Wastewater Reuse Analysis

Sussex County reports that the Piney Neck Regional WWTF currently reuses effluent via spray irrigation of agricultural lands. The plant effluent does not meet unlimited public access limitations because of excessive BOD and TSS concentrations. The County owns 158 acres for spray expansion and sprays treated effluent on adjacent property owned by a contract farmer who has expressed interest in expanding the effluent spray application to 23 acres.

Capital Project Costs and Financing Options

Sussex County owns and operates the Piney Neck Regional WWTP. Information on capital project costs and financing is included within the discussion about Sussex County and presented in Table 5-2.

South Coastal Regional WWTF

Sussex County owns and operates the South Coastal Regional WWTF, which has a 33.17-square-mile service area consisting of 14 sewer districts with 106 pump stations serving 22,578 households. The plant provides secondary and tertiary treatment; it is in the Little Assawoman Bay/Inland Bays/Atlantic Ocean Watershed (#45) but discharges directly to the Atlantic Ocean via an ocean outfall at (N38.524007, W74.95669) (lat/longs are approximate). The NPDES permit for this discharge (DE0050008) expired on December 31, 2009. The permit does not include nutrient effluent limits nor does the plant anticipate them in the future. The plant's current design flow is 9 MGD; the average daily flow is 2.3 MGD, or about 26 percent of design flow. The plant experiences significant seasonal variation as a result of servicing beach resort communities. Winter flows average 2.0 MGD, while summer flows average 4.5 MGD. The plant can handle a flow of 14 MGD, whereas the ocean outfall is designed for a maximum flow of 22 MGD. Selbyville is using 1.5 MGD of the outfall capacity (Selbyville says it is authorized up to 2 MGD); the plant also treated more than 5 MG of septage from private haulers in 2010.

South Coastal completed upgrades in 2007, including additional treatment capacity, new aeration, clarifiers, grit treatment, surge control, odor control, and new solids handling equipment. Peak flow at the plant is 6.8 MGD, and the system reports that all I/I issues have been resolved by slip lining all concrete pipes and using inserts. The facility completed its master plan in 2004. Priority needs identified in the 2010 CIP include standard collection system O&M items (pump station upgrades and collection system rehabilitation). The plant needs new headworks filters and rehabilitation or replacement of the section of the facility that was constructed in 1975 (two 1.5-MGD treatment systems).

Financial Analysis

The average annual sewer rate in the South Coastal service area is $512.92, and total annual residential revenues are $11,580,762. Revenues generated were reported to be sufficient according to current rates; the South Coastal Regional WWTF has a restricted reserve account with no requirement for it to be a certain percentage of operating revenue.

Sussex County bills all its customers according to EDUs; there is no difference between residential and commercial/industrial billing. The South Coastal service area MHI is $50,537 according to 2009 ACS. Sussex County declined to disclose debt or reserve amount information.

Wastewater Reuse Analysis

The South Coastal Regional WWTF reported that it is recycling effluent for in-plant processes. No local farmers have shown interest or indicated that land is available for agricultural spray irrigation, but the facility is interested in residential, commercial/industrial reuse opportunities. The plant effluent does not meet unlimited public access limitations because of excessive BOD and TSS concentrations. Plant personnel reported that the current plant upgrades include lime treatment of biosolids, which will enable it to meet requirements for a Class "A" product that local farmers can use.

Capital Project Costs and Financing Options

Sussex County owns and operates the South Coastal Regional WWTF. Information on capital project costs and financing is included within the discussion about Sussex County and presented in Table 5-2.

Wolfe Neck WWTF

Sussex County owns and operates the Wolfe Neck WWTF, which has a 19.94-square-mile service area consisting of one sewer district with 89 pump stations serving 13,485 households. The plant provides secondary treatment and is in the Lewes-Rehoboth Canal subwatershed in the Inland Bays/Atlantic Ocean Watershed (#38). The plant is equipped with storage lagoons for spray irrigation; the groundwater discharge permit for the facility (LTS 5005-95-05) expired on October 18, 2010. The Wolfe Neck WWTF permit includes a TN limit of 396 lbs/acre/year and a requirement to perform a PSI study of the site.

The Wolfe Neck WWTF's current design flow is 4 MGD, and the seasonal average peak flows are 2.3 MGD (summer) and 1.9 MGD (winter). Average daily flow is 1.52 MGD, or 38 percent of design flow. The plant is in the process of trying to determine how to meet the Performance Standard Nitrogen level 2 and Performance Standard Phosphorus level 1 from the Inland Bays Pollution Control Strategy regulations for the new round of permitting since data are not yet available for phosphate mobility in soil.

Annual average peak flow at the Wolfe Neck WWTF is 2.1 MGD, and a study performed in 2010 showed that the facility did not have excessive I/I according to EPA standard of 275 gallons per capita per day. The system had a maximum daily per capita flow of 75.5 gallons per capita per day for the 5-year period of the study. Additional studies are in place to gauge the 5-year order-of-magnitude flows.

Priority needs identified in the 2010 CIP include headworks rehabilitation and typical collection system/pump station rehabilitation.

Financial Analysis

The average annual sewer rate in the Wolfe Neck WWTF service area is $705.80, and total annual residential revenues are $9,517,713. Revenues generated were reported to be sufficient according to current rates; the Wolfe Neck WWTF has a restricted reserve account with no requirement for it to be a certain percentage of operating revenue.

Sussex County bills all its customers according to EDUs; there is no difference between residential and commercial/industrial billing. The Wolfe Neck WWTF service area MHI is $50,537, according to 2009 ACS. Sussex County declined to disclose debt or reserve amount information.

Wastewater Reuse Analysis

The County reported that the Wolfe Neck WWTF is reusing treated wastewater by spray irrigation for agriculture. The plant has a permit for Class B biosolids, but there is no use for it. The plant effluent does not meet unlimited public access limitations because of excessive BOD and TSS concentrations. Because land availability is limited, expansion of land application is not considered viable. The County is analyzing wastewater handling options, including RIBs.

Regarding other sustainability initiatives, the County is installing solar voltaic cells at one plant in the near future and recently completed a study to evaluate the potential for wind energy.

Capital Project Costs and Financing Options

Sussex County owns and operates the Wolfe Neck WWTP. Information on capital project costs and financing is included within the discussion about Sussex County and presented in Table 5-2.

Town of Georgetown WRF

The Town of Georgetown WRF has a service area of 4.5 square miles and consists of three sewer districts with 21 pump stations, serving 1,938 households. The plant provides secondary treatment plus nitrogen and phosphorus removal and is in the Indian River subwatershed in the Inland Bays/Atlantic Ocean Watershed (#40). The plant receives waste from Georgetown proper and the Sussex County-owned and operated Ellendale system including the force main to Georgetown. The plant provides some solids handling and is equipped with storage lagoons for spray irrigation. The groundwater discharge permit for the facility (LTS-5014-91-09) expires on February 4, 2014. The permit includes a TN limit of 400 lbs/acres/year and does not have a TP limit; one is not anticipated in the future either. The plant's current design flow is 1.3 MGD, and the average daily flow is 0.85 MGD, or about 65 percent of design flow. It relies on spray Irrigation because of the Inland Bays restrictions. Phosphorus is reduced through sodium alum chemical addition for crop control during the summer. In the winter, caustic soda is used so no phosphorus control occurs during cold weather. The Town is seeking funding for a heated building for using sodium alum for chemical addition during the winter.

Peak flow at the plant is 1.6 MGD. The Town experiences I/I mostly in Georgetown's "Old Town." The eastern side (Kimmytown) consists of brick manholes and terra cotta pipes dating from the 1930s and 1940s experiences infiltration during storms creating pipeline backups resulting in 50 percent instantaneous peak increases. Most inflow problems have been fixed and some funding for additional studies has been received. The Town is planning for spray irrigation expansion into the Pettyjohn Woods. It has conducted TV inspections of its collection system to assess I/I issues. Other priority needs according to the most recent CIP (2002) include biosolids removal, pump station upgrades and O&M.

Financial Analysis

The average annual sewer rate in the Town of Georgetown WRF service area is $656.89, and total annual residential revenues are $1,273,047. Revenues generated were reported to be sufficient according to current rates, and the Town Council recently approved a rate increase. The Town does not have a reserve account, although it holds two years of impact fees for future projects and is establishing a reserve account as part of a new plan.

The Town bills all its customers using a combination of metered water use (some commercial customers have sewer meters and some have water meters) and EDUs by agreement with Sussex County (Ellendale).

The Town of Georgetown WRF service area MHI is $41,412. The sewer rate as a percentage of MHI is 1.586 percent, indicating that the Town may have challenges raising additional revenue because rates are already relatively high compared to median income. The Town has a $33.9M debt-borrowing limit; $14.8M of that allocation is being used by the Town. Per the Town charter, debt cannot exceed 75 percent of assessed value. The Town is also using past grants and SRF loans.

Wastewater Reuse Analysis

The Town of Georgetown WRF reuses treated effluent for spray irrigation and is planning to spray irrigate on a wooded site. No other landowners have shown interest in effluent reuse. Additionally, treated sludge is land applied every 5–10 years. The Town reported that the WRF effluent could probably meet unlimited public access limitations but that it does not officially have tertiary treatment (filtration).

Capital Project Costs and Financing Options

The Town of Georgetown reported $11.4M in capital project costs from 2011-2016. Of these capital project costs, $2.81M (24.7%), $2.95M (25.9%), $2.81M (24.7%) and $2.81M (24.7%) are related to capital costs for collection, conveyance, treatment and disposal, respectively. Due to known I/I and unreported planned upgrades, an additional undocumented $8M may be needed over an unknown timeframe.

To address capital project costs from 2011-2016, the Town of Georgetown expects approximately $11.4M to be funded through municipal sinking funds or other asset replacement cost savings. Reported funding was in excess of project costs by $446K. As funding was all through municipal sinking funds, only funding for project costs listed were included as sources of financing.

Table 5-7 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-7. Town of Georgetown 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.41M	$1.92M	$1.94M	$1.99M	$2.04M	$2.08M	$11.4M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$11.4M	$0K	$0K

Town of Bridgeville WWTF

The Town of Bridgeville owns and operates a collection system and treats its wastewater at its WWTF, and it treats wastewater from the Town of Greenwood. The Bridgeville service area is 2.38 square miles and consists of two sewer districts with two pump stations serving 916 households. The Town of Greenwood has a service area of 0.69 square miles consisting of one sewer district with two pump stations serving 450 households.

The Town of Bridgeville WWTF provides secondary and tertiary treatment and has solids-handling equipment. In addition to serving Bridgeville, the plant receives 0.085 MGD of wastewater from the Town of Greenwood's collection system (before a 1989 agreement, the plant received 0.086 MGD; and the agreement is for flow only, no BOD or TSS). Greenwood is seeking an additional 15 percent capacity from the Bridgeville WWTF. The current design flow of the Town of Bridgeville WWTF is 0.8 MGD, the average daily flow is 0.23 MGD, or about 29 percent of design flow, and the peak flow is 1 MGD. In addition to having an on-site auxiliary generator for backup power, the plant is also equipped with a portable generator.

The plant has a surface water discharge (as well as a groundwater discharge) that flows into the Nanticoke River and then into the Chesapeake Bay (Watershed #31). The facility's NPDES permit (DE0020249) expires on January 31, 2012, and its groundwater discharge permit (LTS 5006-07-09) expires on February 12, 2014. The NPDES permit includes effluent limits of 52.9 lbs/day (seasonal limit from May-November) and 19,312 lbs/year for TN and 13.4 lbs/day (seasonal from May-November) and

4,909 lbs/year for TP; the plant has experienced non-compliance with both of these limits. The groundwater permit has a limit for TN of 300 lbs/acre/year. Current projections show ultimate build-out at 5,646 EDUs, which equates to 1.167 MGD. The plant currently has WLAs from TMDLs for BOD5, TN, TP, and bacteria (enterococcus). The Town has been advised that BNR and biological or chemical phosphorus removal will be necessary to meet WLAs under the Chesapeake Bay TMDL.

The Town acknowledges having an I/I problem that is not fully quantified, although an I/I study indicated the need for repairs that will cost $586,100. Nothing specific is currently being done to address the I/I problem. The plant's 15-year upgrade in treatment and capacity to meet the Nanticoke River TMDL is in process but is not going well. I/I was reported as an issue, causing a 33 percent increase in wet-weather flow (instantaneous only). Camera studies are being performed, but all sources have not yet been identified. Some repairs have been made, although future collection system needs are mostly O&M and I/I. Furthermore, the Town reports that the effluent lines to both the stream (for winter NPDES discharge) and the sprayfield are damaged. A grant-funded I/I study was conducted in 2009. The Town of Bridgeville's latest CIP update was in 2011, and the Town intends to have a sewer budget by 2012. To date, the Town has relied on SRF loans, USDA grants and EPA State and Tribal Assistance Grants for funding and developer financing.

Financial Analysis

The average annual sewer rate in the Town of Bridgeville WWTF service area is $336, and total annual residential revenues are $307,776. Revenues generated were reported to be sufficient according to current rates (last raised in July 2010). The Town has a restricted reserve account with a requirement for it to be at least 15 percent of operating revenue. There are no formal restrictions other than expenditures must be for repairs only. Also, the Town of Greenwood pays into a sinking fund (1 percent per year) for repairs in Bridgeville that the Town Council must approve.

The Town bills its customers according to metered flow (for commercial and contract users), or by self-reporting via a pretreatment ordinance for industrial users. Flow-based rates consider BOD, nutrients and TSS. The Town of Bridgeville WWTF service area MHI is $34,532, according to 2010 CPI. The Town has no debt borrowing limit, and debt service is $350,000 per year. Total current debt is $5.8M; and 80 percent ($4.6 M) of that is for sewer using GO bonds.

Wastewater Reuse Analysis

The Town of Bridgeville reported current reuse of effluent via spray irrigation. The wastewater treatment process has been designed to meet the Regulatory effluent requirements for Restricted Public Access, and irrigation on Restricted Public Access currently exists. If Bridgeville can modify its treatment method to meet Unlimited Public Access standards, residential irrigation for nearby residents may be a feasible reuse option.

The Town recently received $120,000 to implement energy conservation upgrades (light bulbs, doors, windows, pump motors, and such) at the plant.

Capital Project Costs and Financing Options

Capital project costs of $840K were assumed for the Town of Bridgeville from 2011-2016 according to a list of short and long-term projects (although no projects were reported for 2016). Of these capital project costs, $25K (3%), $25K (3%), $765K (91.1%) and $25K (3%) are related to capital costs for collection, conveyance, treatment and disposal, respectively.

No funding source was indicated for all projects costs from 2011-2016 ($840K).

Table 5-8 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-8. Town of Bridgeville 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$168K	$168K	$168K	$168K	$168K	$0K	$840K

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$840K

Town of Greenwood

The Town of Greenwood owns and operates a collection system that is treated by the Bridgeville WWTP. The Town of Greenwood has a service area of 0.69 square miles consisting of one sewer district with two pump stations serving 450 households. The Town of Greenwood collection system serves 1,125 residents and future (2030) population served is expected to be 1,489.

The Bridgeville WWTF receives 0.085 MGD of wastewater from the Town of Greenwood's collection system (before a 1989 agreement, the plant received 0.086 MGD; the agreement is for flow only, no BOD or TSS). Greenwood is seeking an additional 15 percent capacity from the Bridgeville WWTF. The current design flow of the Town of Greenwood collection system is 0.086 MGD, with an average daily flow of 0.085 MGD, and a peak flow of 0.12 MGD.

The Town acknowledges having an I/I problem that accounts for a 33 percent increase in instantaneous wet-weather discharges. Camera studies are being performed and some areas have been fixed, but all I/I problem areas have not yet been identified. The Town of Greenwood also manages the force main connection to the Bridgeville WWTP.

Financial Analysis

The average annual sewer rate in the Town of Greenwood service area is $696, and total annual residential revenues are $313,200. Revenues generated were reported to be sufficient according to current rates. The Town has a restricted reserve account with a requirement for it to be at least 15 percent of operating revenue. There are no formal restrictions other than expenditures must be for emergency repairs only. Also, the Town of Greenwood pays into a sinking fund (1 percent per year) for repairs in Bridgeville that the Town Council must approve.

The Town bills its customers according to EDUs. The Town has no industrial contracts, while commercial billing is flow-based (1 meter unit/200 gallons/day). The Town has been experiencing customers not paying their bills in recent years because of the poor economy. The Town of Bridgeville WWTF service area MHI is $46,236, according to 2010 CPI. Sewer rate as a percentage of MHI, is 1.505 percent, indicating that the Town may have challenges raising additional revenue because rates are already

relatively high compared to median income. The Town has no debt-borrowing limit and currently has no debt for its sewer system, but $1.4M for water.

Wastewater Reuse Analysis

The Town of Greenwood does not provide treatment (i.e., it is a collection-only system) and therefore is not reusing wastewater. The Town noted the availability of nearby agricultural lands, but no pipeline infrastructure is present.

Capital Project Costs and Financing Options

No project costs or financing information was reported by the Town of Greenwood, although the Town indicated a potential need to replace the 8" force line to Bridgeville. This potential project is not currently in the Town's 5-year plan.

Town of Laurel

The Town of Laurel STP has a service area of 2.73 square miles that consists of one sewer district with three pump stations, serving 1,327 households. The plant provides secondary and tertiary treatment as well as nitrogen and phosphorus removal, and has a surface water discharge that flows into the Broad Creek and then into the Chesapeake Bay (Watershed #35). The NPDES permit for this discharge (DE0020125) expires on May 31, 2014. The permit includes a TN limit of 33 lbs/day (May-Nov) and 12,045 lbs/year and a TP limit of 8.4 lbs/day. The plant's current design flow is 0.7 MGD and the average daily flow is 0.35 MGD, or 50 percent of design flow. TMDL WLAs include BOD5, TN, TP and enterococcus. There is no longer a flow limit in the permit. The new plant went online in 2008 (an $11M facility).

Peak flow at the Town of Laurel STP is 0.8 MGD; I/I problems have been identified, including a 200 percent instantaneous short-term peak increase (not prolonged), which is assumed to be due to the combined system. The Town is undertaking code enforcement on roof leader disconnections and is addressing infiltration and other repair issues, as necessary.

The Town has no current CIP, but sewer annexation is occurring in growth areas, and undeveloped lots are in town. Priority needs include typical O&M, miscellaneous I/I repair and meeting WLAs under the Chesapeake Bay TMDL. Longer term (i.e., 10 years) needs include solids handling (filter press), partial separation and reducing inflow to the combined sewer, and plant capacity upgrades.

Financial Analysis

The average annual sewer rate in the Town of Laurel STP service area is $678, and total annual residential revenues are $899,706. Revenues generated were reported to be sufficient according to current rates. The Town has an unrestricted reserve account that is 1 percent of operating revenue. The reserve is a water and wastewater capital reserve for projects from leftover impact fees, and such. There is no active O&M enterprise reserve fund.

The Town bills all its customers according to metered water use. Commercial and industrial customer billing is metered like residential customers but at a different water-use rate (there are no sewer meters).

The Town of Laurel STP service area MHI is $36,795, according to the 2010 CPI. The sewer rate as a percentage of MHI, is 1.843 percent, indicating that the Town may have challenges raising additional revenue because rates are already relatively high compared to median income. The Town has a $19M

debt-borrowing limit, and the Town is using $4.1M of that allocation. Anything greater than $15M goes to referendum. The remaining principal of the new STP is $4M and is about to increase by an additional $2M.

Wastewater Reuse Analysis

The Town of Laurel is planning to use treated effluent for agricultural spray irrigation and RIBs. The Town reports that its effluent meets unlimited public access limitations because it is meeting TMDL requirements. The Town reports having found several nearby farms for spray irrigation totaling about 800 acres and a 50–60 acre RIBs site about 400 yards from the plant. The Town is seeking guidance on land purchase versus controlling the rights.

The Town recently conducted an energy efficiency audit and is implementing energy conservation measures at the plant.

Capital Project Costs and Financing Options

The Town of Laurel reported $7.07M in capital project costs from 2011-2016 (although no project costs were reported for 2016). Of these capital project costs, $1.09M (15.4%) and$5.98M (84.6%) are related to capital costs for conveyance and treatment, respectively. These costs are engineer's estimates for large projects only, no Capital Improvement Plan was provided. Due to known I/I and unreported planned upgrades, an additional undocumented $8M may be needed over an unknown timeframe.

No funding source was indicated for all project costs from 2011-2016 ($7.07M).

Table 5-9 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-9. Town of Laurel 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.41M	$1.41M	$1.41M	$1.41M	$1.41M	$0K	$7.07M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$0K	$0K	$0K	$0K	$7.07M

Town of Millsboro WWTF

The Town of Millsboro has a service area of 2 square miles and consists of one sewer district with nine pump stations, serving 2,810 households. The Millsboro WWTF provides secondary and tertiary treatment plus nitrogen removal and discharges to Indian River Bay in the Inland Bays/Atlantic Ocean Watershed (#40). The plant was recently upgraded to include ultra-filtration membrane bioreactors and solids-handling equipment. The NPDES permit for this discharge (DE0050164) expired on May 31, 2005. The permit includes TP limits of 4.56 lbs/day average (9.22 lbs/day maximum) and 2 mg/L, and the plant has experienced non-compliance issues with those limits and with pH, TSS fecal coliform and BOD that were related to the membrane bioreactor startup. Once the plant switched to poly aluminum chloride,

it came into compliance. The plant is currently monitoring ammonia nitrogen and TN but has no limits, although it expects to receive a TN limit in the future.

The plant's current design flow is 1.15 MGD, and the average daily flow is 0.45 MGD, or about 39 percent of design flow. The recent plant and discharge modifications for anticipated growth are not yet reflected in the [expired] permit. Peak flow at the plant is 0.58 MGD, and the Town has no I/I issues. However, the collection system serving Stockley Hospital has I/I issues (permitted at 0.3 MGD, but flows doubled during late winter 2009/2010). This private system is working on long-term upgrades (immediate upgrades have been completed).

The Town's Wastewater Master Plan was revised in June 2004 and projects needs extended to 2020. The plan indicates that, in addition to the membrane bioreactors (now installed), the plant should purchase land for spray irrigation/RIBs. A transmission line has been designed and is being permitted. Deep-well injection was studied but determined to not be feasible. The Town anticipates that various repairs and upgrades will be needed to meet future TMDL treatment standards.

Financial Analysis

The average annual sewer rate in the Town of Millsboro WWTF service area is $475.20, and total annual residential revenues are $1,335,312. Revenues generated were reported to not be sufficient according to current rates (last raised in July 2010). Current O&M is covered, but new plant depreciation and interest on loans exceeds income from wastewater revenues. The plant was constructed for Plantation Lakes using 80 percent impact fees and 20 percent from the townspeople, but development is stalled. The Town has a restricted reserve account that is 20 percent of operating revenue.

The Town bills all its customers according to metered water use; some residents have separate meters for irrigation use. Commercial and industrial customers billing is based on flow only, although there are pretreatment requirements and standards in the ordinance, and testing is done at laboratories. The Stockley Hospital, the school and the Woodlands have sewer meters.

The Town of Millsboro WWTF service area's MHI is $35,571. The Town has a $36M debt borrowing limit, $33M of which can be allocated to wastewater. The amount of that allocation being used by the Town is $25.9M. The Town also has used a $4.2M SRF loan for treatment plant upgrades, received a $1.9M State and Tribal Assistance Grant for transmission and disposal and used development fees.

Wastewater Reuse Analysis

The Town of Millsboro reported that it is installing lines to deliver reclaimed water to spray irrigation and RIBs sites that are in final design. The Town reported that its effluent meets unlimited public access limitations because of recent plant upgrades, and infrastructure will be in place for pumping reclaimed wastewater to middle school fields and little league fields in the fall of 2011. A local golf course (Plantation Lakes) has expressed interest in reclaimed water, but there is nothing official at this time. Deep-well injection was studied and determined to be infeasible, because it could not find a formation in a suitable aquifer to discharge to, and costs were prohibitive.

Capital Project Costs and Financing Options

The Town of Millsboro reported $21M in capital project costs from 2011-2016 (although no project costs were reported for 2015 and 2016). Of these capital project costs, $280K (1.3%), $6.35M (30.2%), $280K (1.3%) and $14.1M (67.2%) are related to capital costs for collection, conveyance, treatment and disposal, respectively.

To address capital project costs from 2011-2016, the Town of Millsboro anticipates requesting $6.34M from the Clean Water State Revolving Fund and $14.3M from USDA, while $400K in other financing methods ($250K from an SRF ARRA loan and $150K from a Delaware 21st Century Fund Grant) were reported.

Table 5-10 provides a list of reported project costs by year from 2011-2016 and presents the reported source of financing for these projects.

Table 5-10. Town of Millsboro 2011-2016 capital project costs by year and financing option

Year	2011	2012	2013	2014	2015	2016	2011-2016
Project Costs	$1.38M	$6.2M	$9.85M	$3.61M	$0K	$0K	$21M

Financing Option	Municipal Bank Financing	Municipal Bond Issue	Municipal Request to the Clean Water State Revolving Fund (SRF)	Municipal requests to USDA	Municipal Sinking Fund, other asset replacement cost savings	Other Financing Method	No funding Source Indicated
2011-2016	$0K	$0K	$6.34M	$14.3M	$0K	$400K	$0K

Town of Selbyville WWTF

The Town of Selbyville WWTF has a service area of 5 square miles and consists of two sewer districts with 12 pump stations with 2 holding tanks with a total capacity of 20M gallons, serving 1,337 households. The treatment plant provides secondary and tertiary treatment and is in the Little Assawoman Bay/Inland Bays/Atlantic Ocean Watershed (#45), although the effluent is discharged to the Atlantic Ocean via a connection to Sussex County's South Coastal ocean outfall approximately 17 miles from the facility (post-treatment). The NPDES permit for that discharge (DE0020010) expires on December 31, 2015. The permits do not include effluent limits for nutrients nor does the Town anticipate them. The plant reported an equipment failure-related non-compliance incident with excursions of its TSS, total residual chlorine and BOD limits. Mountaire poultry processing plant and other commercial businesses account for about 77 percent of flow into the Selbyville WWTF.

The plant's current design flow is 1.25 MGD, and the average daily flow is 1.11 MGD, although it just finished upgrades to 1.5 MGD (and it is allowed 2.0 MGD by Sussex County via the South Coastal Ocean Outfall). Peak flow at the plant is 1.3 MGD, and I/I was reported to be less than 10 percent, although it has not been studied.

The Town has no CIP but has a Comprehensive Plan with preliminary designs completed for its Needs Report. Highlights of the plan are that it focuses on new development and elimination of failing on-site septic systems. Recent plant and pump station upgrades have been completed using SRF loans, while impact fees and user fees (including industry/developer contributions) are being envisioned to fund future improvements. No major new projects are being considered.

Financial Analysis

The average annual sewer rate in the Town of Selbyville WWTF service area is $652.03, and total annual residential revenues are $871,764. Revenues generated were reported to be sufficient according to

current rates. The Town has an unrestricted reserve account that is 84 percent of operating revenue (not required).

The Town bills its customers according to metered water use (commercial is the same as residential), although the Town has a separate, special agreement with on large industrial user (Mountaire). Flow-based rates consider BOD, nutrients and TSS. The Town of Selbyville WWTF service area's MHI is $47,096, according to 2010 CPI. The Town has a $12.3M debt-borrowing limit that is based on the ability to borrow up to 50 percent of property assessments; it has used $7.4M of the limit.

Wastewater Reuse Analysis

The Town of Selbyville cited a 1986 study finding that the nearby land has a high water table, restricting the potential for irrigation reuses. One large industrial user, Mountaire, has its own internal water and WWTPs and recycles its water. The Town reported that its effluent does not meet unlimited public access limitations because of excessive nitrogen and phosphorus concentrations. The Town may be interested in water recycling for future projects such as commercial and residential irrigation after its existing infrastructure is upgraded.

Basic energy efficiency improvements have been accomplished at Selbyville, such as switching to T8 bulbs. However, renewable energy projects (e.g., solar) would require a referendum and matching funds for competitive grants.

Capital Project Costs and Financing Options

No project costs or financing information was reported by the Town of Selbyville. The Town indicated that they currently have no plans for any capital improvement projects for their wastewater treatment facilities.

Other Sussex County Collection Systems

Sussex County also operates its collection system in six other sewer districts (Blades, Dewey Beach, Ellendale, Henlopen Acres, Woodlands of Millsboro, and Golf Village). Combined, those service areas encompass 5.6 square miles and have 20 pump stations serving 4,153 households[6]. The Blades district is treated by the Seaford WWTP, Ellendale is treated by Georgetown WRF, and Dewey Beach and Henlopen Acres are treated by the Rehoboth STP. The collection system for the Town of Bethel is also owned and operated by Sussex County, but was not included in this report. No I/I issues were reported in any of these four districts.

Financial Analysis

The average annual sewer rate in these service areas is $396.23, and total annual residential revenues are $1,645,529. Revenues generated were reported to be sufficient according to current rates; these systems have a restricted reserve account with no requirement for it to be a certain percentage of operating revenue.

Sussex County bills all its customers according to EDUs; there is no difference between residential and commercial/industrial billing. The MHI in these service areas is $50,537, according to 2009 ACS. Sussex County declined to disclose debt or reserve amount information.

[6] This count includes 46 households in Woodlands of Millsboro and 37 households in Golf Village, however no area or estimate of pump stations for these two districts were available.

Wastewater Reuse Analysis

The County does not provide treatment for this collection-only system and therefore is not reusing wastewater.

Capital Project Costs and Financing Options

Sussex County owns and operates its collection system in Blades, Dewey Beach, Ellendale, Henlopen Acres, Woodlands of Millsboro, and Golf Village. Information on capital project costs and financing for these sewer districts is included within the discussion about Sussex County and presented in Table 5-2.

Section 6 - Private Facilities

The two largest private purveyors of collection and treatment in Delaware are Artesian Wastewater Management, Inc. (Artesian) and Tidewater Environmental Services, Inc. (Tidewater), and were included in the survey. Other private service providers are

- Chapel Green Homeowners Association
- Excel Property Management, LLC
- The Hamlet at Dirickson Pond, LLC
- Inland Bays Preservation Company
- Moore Grant Sanitation, Inc.
- Oak Crest Farms
- Utility Systems, Inc.
- Wastewater Utilities, Inc.
- YMG Corporation

Fifteen private systems operated by Artesian and Tidewater were included in the survey. Artesian owns five systems, all in eastern Sussex County. Tidewater owns seven systems, one in Kent County and the rest in Sussex County. The survey also included two of Tidewater's proposed wastewater systems in Sussex County, and although not surveyed, Artesian proposed that its Artesian North Sussex Regional Wastewater Recharge Facility (ANSWRF) planning area be demonstrated in GIS.

Table 6-1. Private Facilities Summary

Private Wastewater Systems	Service Area (square miles)	Pump Stations	Holding Tanks	Hold Tank Capacity (gallons)	Sewer Districts	Households
Artesian - Beaver Creek	0.64	2	0	0	1	163
Artesian - Heron Bay	0.58	2	0	0	1	176
Artesian - Reserves at Lewes Landing	0.14	1	0	0	1	51
Artesian - Stonewater Creek	1.00	2	0	0	1	325
Artesian - Villages at Herring Creek	0.20	1	0	0	1	43
Tidewater - Bay Front Regional	0.40	3	0	0	1	77
Tidewater - Breeder's Crown	0.10	1	0	0	1	56
Tidewater - Country Grove	0.16	1	0	0	1	59
Tidewater - Hart's Landing	0.15	2	0	0	1	142
Tidewater - Milton Regional	1.65	11	0	0	1	1,285
Tidewater – Retreat	0.22	2	0	0	1	86
Tidewater - The Ridings *In Process of Acquiring*	0.34	1	0	0	1	49
Tidewater - Trussum *Proposed*	22.90	-	-	-	1	950
Tidewater - Wandendale *Proposed*	22.50	-	-	-	1	1,900
Total	**51.0**	**29**	**0**	**0**	**14**	**5,362**

Most of the private facilities are relatively new and do not experience problems, although Tidewater's Milton Regional facility reported I/I issues that have at least partly been addressed. All the privately owned and operated facilities reported having on-site generators as an auxiliary treatment plant backup power supply, except for the Tidewater – Breeder's Crown facility and the Tidewater – Wandendale Proposed facility, which has multiple electrical feeds available. Four facilities also have portable generators including the Tidewater – Breeder's Crown facility.

All the private facilities receive 100 percent of average daily flow from domestic sources, except for the Tidewater – Milton Regional facility, which receives 5 percent from a brewery and other commercial/industrial sources. The Tidewater – Milton Regional facility is also the only privately owned municipal NPDES permitted surface water discharger in Delaware. Ten of the twelve systems have TN numeric limits in their groundwater permits, and one facility, Artesian's Villages at Herring Creek, has a TP limit. Four of the five Artesian-owned facilities reported above normal (> 250 mg/L BOD and TSS) influent strength; all the others reported normal influent strength (150–250 mg/L BOD and TSS).

Ten of the twelve private wastewater systems have sewer rates as a percentage of MHI above 1.50 percent, indicating that the systems may have challenges raising additional revenue because rates are already relatively high compared to median income. Ten of the twelve private systems also report that revenue is not sufficient at current rates and that the build-out that was expected did not occur. Billing for all facilities is based on EDU, except for Tidewater – Milton Regional, which is based on water meters.

Artesian – Beaver Creek

Artesian's Beaver Creek facility has a service area of 0.64 square miles and consists of one sewer district with two pump stations serving 163 households. The facility provides secondary treatment plus nitrogen removal and is in the Broadkill River subwatershed in the Delaware Bay Watershed (#22). The groundwater discharge permit for this facility (202902-OP) expires on January 18, 2017. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.05 MGD, and the average daily flow is 0.21 MGD, or about 43 percent of design flow. Peak flow at the plant is 0.036. No I/I issues were reported. Influent strength was reported to be above normal (> 250 mg/L BOD and TSS).

Financial Analysis

The average annual sewer rate in the Artesian service areas is $900.00, and total annual residential revenues are $146,700. Revenues generated were reported to not be sufficient according to current rates.

Artesian bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $65,773.

Wastewater Reuse Analysis

This facility does not have enough flow for agricultural spray, but it does practice reuse through RIBs.

Artesian – Heron Bay

Artesian's Heron Bay facility has a service area of 0.58 square mile and consists of one sewer district with two pump stations serving 176 households. The facility provides secondary treatment plus nitrogen

removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (199889-OPB) expires on April 30, 2017. TN limits of 0.01843 lbs/day and 10 mg/L are included in the facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.05 MGD, and the average daily flow is 0.11 MGD, or about 22 percent of design flow. Peak flow at the plant is 0.02. No I/I issues were reported.

Financial Analysis

The average annual sewer rate in the Artesian service areas is $900.00, and total annual residential revenues are $158,400. Revenues generated were reported to not be sufficient according to current rates.

Artesian bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $49,484. The sewer rate as a percentage of MHI is 1.819 percent, indicating that Artesian may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility does not have enough flow for agricultural spray, but it does practice reuse through RIBs.

Artesian – Reserves at Lewes Landing

Artesian's Reserves at Lewes Landing facility has a service area of 0.14 square mile and consists of one sewer district with one pump station serving 51 households. The facility provides secondary treatment plus nitrogen removal and is in the Broadkill River subwatershed in the Delaware Bay Watershed (#22). The groundwater discharge permit for this facility (207815-OPB) expires on February 21, 2016. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.03 MGD, and the average daily flow is 0.005 MGD, or about 17 percent of design flow. Peak flow at the plant is 0.02. No I/I issues were reported. Influent strength was reported to be above normal (> 250 mg/L BOD and TSS).

Financial Analysis

The average annual sewer rate in the Artesian service areas is $900.00, and total annual residential revenues are $45,900. Revenues generated were reported to not be sufficient according to current rates.

Artesian bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $50,074. The sewer rate as a percentage of MHI is 1.797 percent, indicating that Artesian may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility does not have enough flow for agricultural spray, but it does practice reuse through a drip system.

Artesian – Stonewater Creek

Artesian's Stonewater Creek facility has a service area of 1.00 square mile and consists of one sewer district with two pump stations serving 325 households. The facility provides secondary treatment plus nitrogen removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (202221-OP-C) expires on October 3, 2015. A TN limit of 10 mg/L is included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.225 MGD, and the average daily flow is 0.028 MGD, or about 12 percent of design flow. Peak flow at the plant is 0.05. No I/I issues were reported. Influent strength was reported to be above normal (> 250 mg/L BOD and TSS).

The facility is built to handle 750 EDU, but it is permitted for 1,500 EDU. However, it is limited by disposal area. Artesian is looking into future disposal areas to handle around 1 MGD of additional flow.

Financial Analysis

The average annual sewer rate in the Artesian service areas is $900.00, and total annual residential revenues are $292,500. Revenues generated were reported to not be sufficient according to current rates.

Artesian bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $49,484. The sewer rate as a percentage of MHI is 1.819 percent, indicating that Artesian may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility does not have enough flow for agricultural spray, but it does practice reuse through RIBs.

Artesian – Villages at Herring Creek

Artesian's Villages at Herring Creek facility is either being turned over to Sussex County or tied into the Sussex County Wolfe Neck WWTF. The facility has a service area of 0.20 square mile and consists of one sewer district with one pump station serving 43 households. The facility provides secondary treatment and is equipped with a storage lagoon for spray irrigation. It is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (LTS 5009-04-09) expires on March 1, 2012. A TN limit of 380 lbs/acre/year is included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.03 MGD and the average daily flow is 0.009 MGD, or about 29 percent of design flow. Peak flow at the plant is 0.016. No I/I issues were reported. Influent strength was reported to be above normal (> 250 mg/L BOD and TSS).

Financial Analysis

The average annual sewer rate in the Artesian service areas is $900.00, and total annual residential revenues are $38,700. Revenues generated were reported to not be sufficient according to current rates.

Artesian bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $52,878. The sewer rate as a percentage of MHI is 1.702 percent, indicating that

Artesian may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility practices reuse through irrigation of agriculture.

Artesian – ANSWRF (proposed planning area)

Artesian is in the planning/permitting process of the Artesian North Sussex Regional Wastewater Recharge Facility (ANSWRF). It encompasses Georgetown, Ellendale and Milton and extends east to the Delaware Bay. Artesian did not wish to include ANSWRF as part of the survey, but it provided spatial information for its incorporation into GIS.

Tidewater – Bay Front Regional

Tidewater's Bay Front Regional facility has a service area of 0.40 square mile and consists of one sewer district with three pump stations serving 77 households. The facility provides secondary and tertiary treatment plus nitrogen removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit (204435-OPC) for this facility expires on August 27, 2017. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.054 MGD, and the average daily flow is 0.023 MGD, or about 43 percent of design flow. Peak flow at the plant is 0.049. No I/I issues were reported.

A 150-home development, Woods on Herring Creek, was expected to disconnect in May 2011. As a result, average daily flow is expected to drop to 0.012 MGD, nearly half of the current average daily flow.

Financial Analysis

The average annual sewer rate in this service area is $960.00, and total annual residential revenues are $73,920. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $47,727. The sewer rate as a percentage of MHI is 2.011 percent, indicating that Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income. Tidewater has applied for a rate increase through the Public Service Commission.

Wastewater Reuse Analysis

This facility uses RIBs. Clean Delaware does land application of biosolids.

Tidewater – Breeder's Crown

Tidewater's Breeder's Crown facility has a service area of 0.10 square mile and consists of one sewer district with one pump station serving 56 households. The facility provides secondary treatment and is in the Murderkill River subwatershed in the Delaware Bay Watershed (#19). The groundwater discharge permit for this facility expires (188061-OPB) on March 17, 2017. No TN or TP permitted limits are applicable.

The plant's current design flow is 0.019 MGD, and the average daily flow is 0.006 MGD, or about 32 percent of design flow. Peak flow at the plant is 0.01. No I/I issues were reported.

The plant reported BOD excursions for two consecutive months because of design issues. DNREC recently inquired and is aware that Tidewater is investigating options to address the issues, but no violations had yet been issued. The clarifier is not designed to remove solids adequately. Tidewater is investigating possible fixes with additional sampling and looking at filter designs or clarifier modifications.

Financial Analysis

The average annual sewer rate in this service area is $1,125 and total annual residential revenues are $63,000. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $55,179. The sewer rate as a percentage of MHI is 2.039 percent, indicating that Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility uses RIBs because not enough flow is available for spray irrigation. Clean Delaware does land application of biosolids.

Tidewater – Country Grove

Tidewater's Country Grove facility has a service area of 0.16 square mile and consists of one sewer district with one pump station serving 59 households. The facility provides secondary treatment plus nitrogen removal and is in the Broad Creek sub watershed in the Chesapeake Bay Watershed (#35). The groundwater discharge permit for this facility (204220-OPB) expires on November 5, 2017. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.054 MGD, and the average daily flow is 0.009 MGD. Peak flow at the plant is 0.02. No I/I issues were reported. Build-out capacity is estimated to be 1.4 MGD, while 0.350 MGD is the current hydraulic capacity. Tidewater is also studying treatment capacity and TN treatment upgrades. The plant serves a single subdivision southwest of Laurel and is surrounded by residences and farms with individual septic systems.

Financial Analysis

The average annual sewer rate in this service area is $1,025, and total annual residential revenues are $60,475. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $47,727. The sewer rate as a percentage of MHI is 2.148 percent, indicating that Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility uses RIBs. Clean Earth does land application of biosolids.

Tidewater – Hart's Landing

Tidewater's Hart's Landing facility has a service area of 0.15 square mile and consists of one sewer district with two pump stations serving 142 households. The facility provides secondary and tertiary treatment plus nitrogen removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (205963-OP) expires on May 29, 2017. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.039 MGD, and the average daily flow is 0.012 MGD, or about 17 percent of design flow. Peak flow at the plant is 0.017. No I/I issues were reported. The sewer rate as a percentage of MHI is 2.085 percent, indicating that Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income.

Financial Analysis

The average annual sewer rate in this service area is $995.00, and total annual residential revenues are $141,290. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $47,727.

Wastewater Reuse Analysis

This facility uses drip irrigation for reuse. Clean Delaware does land application of biosolids.

Tidewater – Milton Regional

Tidewater's Milton Regional facility has a service area of 1.65 square miles and consists of one sewer district with 11 pump stations serving 1,285 households. The facility provides primary, secondary, and tertiary treatment and some solids handling. It has a surface water discharge to the Broadkill River and then to Delaware Bay (Watershed #22). The NPDES permit for this discharge (DE0021491) expired on December 31, 2009. No TN or TP permitted limits are applicable. The plant reported having had an instantaneous chlorine non-compliance incident because of equipment failure.

The plant's current design flow is 0.35 MGD, and the average daily flow is 0.16 MGD, or about 46 percent of design flow. Peak flow at the plant is 0.301.

Tidewater – Milton Regional facility has experienced I/I issues. Tidewater has conducted assessments of bowls in manholes and repaired cleanouts; however, during a heavy rain event, flows may still increase by 50 percent. Tidewater is investigating manhole repairs, as needed and portions of the system have been evaluated using a video camera.

Financial Analysis

The average annual sewer rate in this service area is $350.00, and total annual residential revenues are $449,750. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $40,313.

Wastewater Reuse Analysis

This facility uses residential reuse and is looking into spray irrigation on 500 acres of nearby farms.

Tidewater – Retreat

Tidewater's Retreat facility has a service area of 0.22 square mile and consists of one sewer district with two pump stations serving 86 households. The facility provides secondary treatment plus nitrogen removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (197427-OPC) expires on November 15, 2015. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included.

The plant's current design flow is 0.048 MGD, and the average daily flow is 0.008 MGD, or about 16 percent of design flow. Peak flow at the plant is 0.021 MGD. No I/I issues were reported.

Financial Analysis

The average annual sewer rate in this service area is $850.00, and total annual residential revenues are $73,100. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $47,727. The sewer rate as a percentage of MHI is 1.781 percent, indicating that Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility uses groundwater recharge as a residential reuse. Clean Delaware does land application of biosolids.

Tidewater – The Ridings

The Ridings facility (still being acquired by Tidewater) has a service area of 0.34 square mile and consists of one sewer district with one pump station serving 49 households. The facility provides secondary and tertiary treatment plus nitrogen removal and is in the Rehoboth Bay subwatershed in the Inland Bays/Atlantic Ocean Watershed (#39). The groundwater discharge permit for this facility (208353-OP) expires on March 18, 2014. TN limits of 0.01843 lbs/day and 10 mg/L are included in this facility's groundwater permit; no TP limit is included. The plant reported having experienced a temporary issue with meeting its TSS limit because of low temperature and low flows creating algae in the chlorine dosing tank.

The plant's current design flow is 0.07 MGD, and the average daily flow is 0.006 MGD, or about 8 percent of design flow. Peak flow at the plant is 0.031. No I/I issues were reported.

Financial Analysis

The average annual sewer rate in this service area is $1,245, and total annual residential revenues are $61,005. Revenues generated were reported to not be sufficient according to current rates.

Tidewater bills its customers according to EDU using a monthly flat impact fee per connection. The MHI in this service area is $47,727. The sewer rate as a percentage of MHI is 2.609 percent, indicating that

Tidewater may have challenges raising additional revenue because rates are already relatively high compared to median income.

Wastewater Reuse Analysis

This facility uses drip irrigation for reuse. Clean Delaware does land application of biosolids.

Tidewater – Trussum *Proposed*

Tidewater is also proposing two future systems—Trussum and Wandendale. Tidewater's Trussum is being designed for 0.4 MGD to serve 950 households and will provide secondary treatment plus nitrogen removal. No I/I issues were reported. MHI in this service area is $49,484. As proposed, this facility is planning on using RIBs.

Tidewater – Wandendale *Proposed*

Tidewater's Wandendale is being designed for 1.45 MGD to serve 1,900 households and will provide secondary and tertiary treatment plus nitrogen and phosphorus removal. No I/I issues were reported. The MHI in this service area is $54,881. As proposed this facility is planning on using RIBs.

Section 7 – Mobile Home Park and Cluster System Survey

The following is a brief summary of several MHPs and cluster systems (individual and shared systems). The locations of these facilities are depicted on Map 4-1 in Appendix C. DNREC selected these facilities (a representative sample of all MHPs in the State of Delaware).

Summary of Kent County Mobile Home Park and Cluster Systems Survey

Chelesa Villa

Chelesa Villa is on Route 10 west of Camden-Wyoming. It is a typical example of a rural, middle-class subdivision that began construction in the mid-2000s when construction ceased during the housing crisis, and is slowly making its way toward build-out. It is made up of mid-sized homes on planned, individual lots, and new asphalt roads, with an active homeowner's association. Existing residents are currently paying $75/month for sewer, but are expecting an increase when Artesian takes over at build-out. They are currently operated by the developer (Canterbury). The community wastewater system is a multi-septic system with shared dosing chamber/drip fields with considerable unused area/capacity available. There are many similar situations throughout Delaware in all three counties, mostly Kent and Sussex.

Hill Top and Spoonbill Drive

Hilltop/Spoonbill operates an MHP near Camden, off State Street near CR362, which has individual on-site septic systems, many of which are failing. The mobile homes vary in condition, but most are fair. The homes are tightly spaced, accessed by broken asphalt/gravel roads; there is not much room for expansion or system replacements. There is a school across the street that is sewered, and DNREC stated that the owner is proactively looking to connect (unsure if service is CWSWA, Dover or Kent County Regional). The technical situation described is a common theme throughout Delaware, although interest in resolving failing systems varies widely by park owners/managers at other sites.

Paris Investments (M&S Mobile Home Park)

Paris/M&S is an MHP east of Dover on North Little Creek Road (SR8) that has a shared community septic system (gravity flow to separate shared septic tanks pumped to a pressurized sand bed). The system is past its service life and needs to either be upgraded/expanded with proper permits or abandoned and connected to central sewer. The MHP is facing fines from DNREC for system failure. The mobile homes vary in condition, mostly fair, and the roads are gravel. The MHP is on the edge of Dover/Kent County's wastewater service area, and the development across the street (Lexington Glen) is sewered. There is an adjoining MHP called Grand View with about 20–30 units (both cluster and individual systems) that is in a similar situation as Paris regarding the system being able to adequately treat the wastewater. This situation demonstrates that even when sewer is available, there are socioeconomic concerns such as annexation, sewer service without water or other municipal service, or payment concerns. Such concerns are a common theme at throughout Delaware, although the degree of severity varies widely.

St. Jones Reserve

St. Jones Reserve is the owner-operator of an MHP southwest of Dover Air Force Base and Little Creek Wildlife Area that is served by both clustered and individual systems. DNREC stated that the systems are functioning, and that the owner/manager is planning to connect to central sewer when it comes through to serve other nearby developments. The mobile homes are in good condition, and the roads are asphalt. This is an example of a functioning system with an active/proactive manager, which is a common situation throughout Delaware.

Twin Maples

Twin Maples is an MHP south of Kenton that is on a community system. The system appears well maintained and was repaired in 2001/2002. DNREC, however, stated that the permit requires the system to connect to central sewer when it becomes available, intending it to be temporary in nature. The mobile homes are in good condition, and the roads are asphalt. This is an example of a functioning system that DNREC wants connected to central sewer once it becomes available.

Summary of Sussex County Mobile Home Park and Cluster Systems Survey

Briarwood Manor

Briarwood Manor is an MHP southeast of Laurel that is served by individual or shared (dual) septic systems. DNREC stated that most of the systems are functional, but some are failing. The MHP is adjacent to Sandy Ridge, which is on a functioning community system. There is a single owner with leased lots. During a site visit, there appeared to be some room for a clustered treatment system, though some lots would likely be lost. The mobile homes are in good condition, and the roads are maintained gravel. DNREC stated that this may a good candidate for conversion to a cluster system. This is an example of individual systems that are beginning to age, which may warrant conversion to a community system or connection to central sewer if available.

County Seat Gardens

County Seat Gardens is an MHP north of Georgetown that includes both individual and clustered systems. The condition of the conventional cluster systems is acceptable, but there are some complaints about individual systems. Most of the mobile homes are in fair to poor condition, and the roads are mixed asphalt/gravel in fair condition. Because of the site's high groundwater table, elevated mounds are used for repair/replacement of individual units. These new elevated mounds are in front or on the side of the home, and appear disproportionately large compared with the lot/house size. The cluster systems are at capacity, and there is little room for replacement or cluster systems. This is another example of a development with aging individual systems that could either be converted to cluster systems (perhaps an off-site system) or connected to central sewer if it becomes available. Because lots in this MHP are leased to low-income families, an affordability and payment strategy may need to be considered when assessing rehabilitation options.

Fishermill Trailer Park

Fishermill is an MHP off Coverdale Road (off 404) southeast of Bridgeville and consists of individually owned lots, which hold single-family homes and mobile homes (some single lots having multiple homes). Each lot has individual septic/cesspool systems and water wells. Many of the septic systems/cesspools were installed before current regulations and are severely failing or have completely failed; the adjacent water supply wells may also be compromised. Many of the houses are dilapidated or destroyed, and there is scattered trash and debris throughout the park. The loop road (Mill Park Drive) is asphalt in fair condition, and there are pockets of the neighborhood where houses or mobile homes have been replaced or are maintained in good condition. There is an active community center in the loop road. Although Fishermill is more similar to a traditional neighborhood than an MHP, it fits into the survey by demonstrating enforcement and management issues where there is little to no maintenance agreement, functional homeowner's association, or deed restrictions. This is an example of a development having a need to convert individual lots with unmanaged individual systems to a community system, connect to central sewer if available, or implement some other managed system. The existing community center may provide an opportunity to provide residents with outreach and education about wastewater issues and solutions.

Grants Way (Moore-Grant Subdivision Sanitation)

Grant's Way is an MHP about 4.5 miles away from Milton and is made up of well-maintained individual lots, asphalt roads, and a strong homeowner's association. The community wastewater system is well maintained and about 16 years old. Grant's Way is between Milton's municipal wastewater system and Broadkill Beach, a non-sewered community that is requesting sewer. This is an example where even though the system is functioning well, regional planning needs should be taken into consideration.

Layton's Riviera

Layton's Riviera is an MHP southwest of Blades that has individual or shared (dual) septic units and a single shared community drinking well. It is in a wooded area next to the Woodland Ferry, and is far from any centralized sewer system, along the bank of a large waterway. The site has dirt roads, and the park as a whole is in fair to poor condition. There have been several citations regarding the individual systems, and four failing systems were recently replaced. This would be a candidate for a community system, but there does not appear to be room on-site without removal of multiple mobile home lots. Other neighborhoods, farms, and unused lands are nearby, so while technically this may a good opportunity for a small, shared package plant, a funding, planning, and payment system would need to be established.

Mobile Gardens MHP (Hollyview)

Mobile Gardens is a large MHP southeast of Seaford/Blades. It has a functional, BNR package WWTP with a part-time operator. It has a dual NPDES/RIBs permit. The homes are in fair to good condition, the roads are asphalt, and overall the park is maintained well. Although there have been historical issues, there are no recent major complaints about this site, except its proximity to Blades' wastewater collection system. Considering the goal of wastewater regionalization, water reuse and the WIP strategy, this site and the life cycle of its current system should be considered during long-term regional planning. One should not, however, make the assumption that a cluster system is unable to efficiently/affordably meet environmental and human health goals if maintained properly (as with other sites of similar nature).

Morningside Village (Wheatley Farms)

Morningside Village is a neighborhood southeast of Bridgeville with individual lots on a maintained, functioning community wastewater system. The neighborhood in general is in good to fair condition with asphalt roads, and resembles a typical medium-sized, planned neighborhood with a planned centralized sewer system (manholes in the centerline of roads, and such). The lots are large and spread out, and the home types vary (single family, modular, mobile home). The drinking water system is maintained by Tidewater. The neighborhood adjoins several other neighborhoods of similar nature, and is near a proposed spray expansion area for Bridgeville's municipal wastewater system. Although the system is functioning, this neighborhood and the neighborhoods around it, along with their wastewater systems, should be considered in long-term regional planning.

Pepper Ridge

Pepper Ridge is an MHP between Dagsboro/Frankford and Selbyville. It is a low-income MHP, and most of the trailers are in poor condition with unmaintained dirt roads. These are leased lots with individual septic systems, many of which are failing. There is one community lot/trailer hosting a day care facility. DNREC believes the lease agreements require the lessee to be responsible for the septic system, and because of the low-income and transient nature of the renters, the systems are not maintained and failing. There appears to be room for an on-site cluster system, and Selbyville and Piney Neck

(Dagsboro-Frankford) are the nearest municipal wastewater collection systems; Piney Neck being about 1 to 2 miles away. This is an example "target" MHP for DNREC regarding enforcement or management issues, and some type of action is warranted—enforcement, assistance, or otherwise.

Scottsdale MHP

Scottsdale is a mid-sized MHP northeast of Delmar. It has a functioning, on-site community system. The park in general is adequately maintained and is in fair/good condition, and the roads are asphalt. It has had historical violations (2005, since repaired), but it is otherwise acceptable in its current condition. The nearest municipal wastewater collection systems are Delmar and Laurel, and Scottsdale MHP is within Tidewater's Trussum wastewater planning area. Scottsdale is yet another example of a functioning, maintained system that still needs to be considered in long-term planning, whether for regionalization or for the WIP.

Walkers Meadow (and Walker's Mill)

Walkers Meadow is a small, relatively new neighborhood southeast of Bridgeville that has multiple small clustered wastewater systems. Although the property has one owner who leases lots, the lots are larger than a typical MHP, and it resembles more of a neighborhood of individual lots with modular or mobile homes and asphalt roads that is typical throughout Sussex County.

Just north of Walkers Meadow is Walkers Mill, which is a typical large MHP with individual septic systems that appears to have been built in the 1980s. The homes are in fair/good condition, the roads are asphalt, and for the most part, the park is maintained with occasional issues regarding septic systems.

These two sites are just south of Morningside Village (discussed above), and the same recommendations and findings apply regarding long-term wastewater planning around Bridgeville. Furthermore, DNREC stated that Walkers Meadow's community wastewater permits require hookup to central sewer once it becomes available.

Section 8 – Conclusions

This section consolidates and summarizes the important findings, correlations, conclusions and recommendations based on observations of the information presented in this report.

General Findings

Most wastewater service providers are concerned about the costs associated with managing their long-term investments while trying to meet increasingly stringent performance standards. Wastewater system owners and operators often need to decide between plant abandonment (regionalization) versus existing plant upgrades or new plant installations. These decisions require the owner or operator to determine how well upgrades or new installations are expected to perform against unknown future standards—and furthermore, making judgment calls on whether upgrades or installations will themselves be upgradable later.

Specific Topics

A. Treatment Plants

Findings

1.) Treatment level and treatment type vary throughout the State and plants vary widely in age, discharge type, permit limits, facility size and flow rate.

2.) Better coordination is needed between private and public treatment facilities.

3.) Enhanced nutrient removal to meet the Chesapeake Bay TMDL and other effluent requirements is a major focus. Most plants are meeting their current permit limits, but they are concerned over future limits.

4.) Some plants do not have backup power supply.

Recommendations

a.) Develop a long-term projection of effluent requirements/treatment levels throughout the State to help decision makers compare plant abandonment versus upgrading existing plants (or collection systems) versus considering regionalization.

b.) Reevaluate the plant capacities and revise growth projections for overdesigned/oversized plants (e.g., private plants in new, underdeveloped communities). Consider whether "right-sizing" plants (e.g., mothballing certain elements, phasing in treatment capacity) is viable for controlling costs. Look for opportunities to treat municipal wastewater at private

plants, which may both improve the operation and finances at the private plants and alleviate excess flows at municipal plants.

c.) Backup power should be mandatory for treatment plants and other critically important wastewater system components (e.g., lift stations adjacent to surface waters). The availability of backup power and the sensitivity of the receiving environment should determine the amount of emergency storage needed. The emergency storage essentially serves as a buffer between when power is lost and when the unit may begin to overflow. CWAC should consider establishing as State policy, the following standby power requirements (adapted from the Recommended Standards for Water Works i.e., Ten State Standards, 2007):

> *Dedicated standby power should be required by the reviewing authority so that water may be treated and/or pumped to the distribution system during power outages to meet the average day demand. Alternatives to dedicated standby power may be considered by the reviewing authority with proper justification.*

B. Collection Systems, Service Areas and Ownership

Findings

1.) Collection systems require nearly continuous maintenance and upgrades, particularly systems with force mains and pump stations. In addition, force main/pump station systems generally require a substantial amount of electricity to function.

2.) Several types of service area ownership and contract agreements exist in Delaware.

3.) Most systems in Delaware have eliminated their combined sewer systems or have completed a long-term control plan.

4.) Many older systems have I/I issues; most have a long-term maintenance/asset management plan, but some do not.

5.) The presence of several small systems interspersed with private facilities in eastern Sussex County suggests that better coordination is necessary between the various service providers.

6.) Some of the survey results regarding flows and population served (particularly in transient, tourist, or second-home areas such as eastern Sussex County) could not be reconciled.

7.) Current GIS files are inconsistent throughout the State (e.g., CPCN versus municipal boundaries versus service area versus planned growth areas).

Recommendations

a.) Because I/I can be a major factor causing flows that exceed treatment capacity and can lead to other issues such as sanitary sewer overflows, CWAC should consider establishing policies that comprehensively address I/I, as well as prioritize and incentive I/I projects.

b.) DNREC should use its discretion in evaluating loan and grant applications to encourage that I/I issues get resolved before approving other loans or grants for increased treatment plant capacity (compare cost-feasible I/I projects to "no action"). For example, points could be given in the evaluations for "flow-based" project requests to encourage I/I reduction and better asset management (CMOM).

c.) CWAC and DREC should develop policy that universally addresses the notion of how a regional plant can influence a contract user to resolve I/I issues. As an example, implementation of a progressive rate structure could be used to accomplish this, whereby a rate surcharge could be levied for flow beyond an I/I-based threshold (e.g., anything more than 100 percent).

d.) Facilitate development of satellite user contract agreements, where applicable, especially where nutrient regulations are becoming more stringent (Chesapeake, Inland Bays).

e.) Consider performing a study of industrial discharges into municipal sewers, especially in areas where PCBs are an upcoming TMDL concern for municipal WWTPs. Look into wastestream characterization opportunities, pollution prevention, pretreatment requirements and industrial wastewater reuse.

f.) Consider meeting with Sussex County, Rehoboth, Lewes, Tidewater, Artesian, other municipalities, other government branches (such as DNREC Parks and Recreation), and private landowners/farmers to discuss regionalization efforts, infrastructure sharing, broad-scale land planning, and other integration/collaboration opportunities in eastern Sussex County.

g.) Enhance data quality of future studies by modifying survey questions to resolve flow/population reporting issues, particularly in transient/resort areas.

h.) Resolve lack of generalized sewer mapping for the few remaining unmapped municipalities, and establish standards for "mapping upkeep"

that are coordinated with the Public Utilities Commission and municipal comprehensive plans.

C. Finance and Future Capital

Findings

1.) Rates vary among municipal and private wastewater across the state. In areas where anticipated growth projections have not been realized, fewer rate payers are available to share the cost burden necessitating higher rates (the average household user rate for public facilities ranged from 0.34 to 1.84 percent of the MHI, whereas private facilities ranged from 0.87 percent to 2.61 percent of the MHI).

2.) The internal information collection and reporting practices, capabilities and organizations of municipal service providers varies, from no reporting mechanisms to extreme detail, resulting in inadequate data quality available for the survey. Examples include:

- The survey results were difficult to determine when small replacements/enhancements go from being O&M to "a project"

- How should a provider report minor capital improvement project funding (e.g., a 3-year plan to do small projects throughout multiple plants or collection systems)?

- How long-term strategies such as I/I or major plant upgrades are reported.

- Inconsistent timeline-reporting (some municipalities have a 0-2 year outlook; some have a 20 year outlook).

- Some municipalities reported ongoing or previous expenses that are yet to be paid for as part of their future funding needs.

3.) Some municipalities stated that it is easier to take advantage of private loans or to issue bonds than to apply for SRF loans or competitive grants

Recommendations

a.) Consider available options for optimizing the use of public-private partnerships if/when the base assumptions under which many of the private or small systems were developed never come to pass (i.e., what to do if growth projections are not met so that small facilities can still be part of a sustainable, long-term approach?).

b.) The finance questions on the next 5-year assessment survey should be modified as follows:

(1) Solicit a better understanding of break-even on short-term or annual O&M/small projects budgets compared to long-term planning budgets

(2) Standardize and require a reporting procedure for capital improvements (typically a 5-year outlook) before the next 5-year survey

(3) Consider whether next 5-year survey should identify non-residential revenues to help balance/QA the revenue versus future needs, and not just address residential users and affordability.

(4) Try to improve the survey questions asked about reserve accounts and expenditure information (CIPs and also whether costs associated with basic O&M expenditures are within budget or are being borrowed) and solicit a better break-out of capital reserve types

(5) Collect non-residential revenue data so that better projections can be developed [for example, it might be useful to be able run a first-order "model" of projected revenues that would show whether increasing revenues to 1.0, 1.5, 2.0 and 2.5 MHI would be enough to cover the cost of a loan, with considerations of growth and retirement of old debt, and such (see Table 2-8 for some of this information)]

c.) Constantly track rates (annually or otherwise deemed appropriate), and have better rates coordination between the PSC and DNREC.

D. Water Reuse

Findings

1.) Many WWTPs are already implementing agricultural reuse or are planning agricultural reuse.

2.) Many WWTPs are not able to implement agricultural reuse for various reasons, particularly in urbanized or densely populated areas.

3.) Guidance and policy for residential, industrial or other types of reuse is lacking, unclear or unknown.

4.) Regionalization of Wastewater is not always appropriate and can discourage reuse.

Recommendations

a.) Clarify guidance and develop state policies or incentives further promoting reuse options.

b.) Develop guidance and provide outreach targeted to collection system-only utilities about the potential for localized reuse systems.

c.) Consider policies that create incentives for pilot or demonstration projects that include preparation of detailed case studies to help inform subsequent projects/efforts.

d.) Standardize policies regarding the provision of reclaimed water to agricultural users and/or develop incentives that alleviate farmer concerns about their risks and liability.

e.) Provide focused education and outreach about water reuse to farmers and other agricultural constituencies.

f.) Work with private utilities operating in Delaware to identify new opportunities for public-private partnerships to develop and manage innovative water reuse systems.

g.) Provide education and outreach, and develop policies and/or regulations, as applicable, for other potential reuses.

h.) Establish a policy to encourage studies and market analyses as needed to ascertain the viability of various reuse alternatives, including land application of effluent, wetland restoration/creation, greenhouse irrigation, residential and commercial lawn watering and graywater systems.

E. Mobile Home Parks, Clustered Individual Systems, and Community Systems

Findings

1.) Upon review of the data generated by this limited study, it was found that the technical, managerial, financial, legal, program and enforcement issues facing individual and decentralized systems in Delaware are similar to elsewhere in the mid-Atlantic Region.

2.) Some MHPs are well-operated, but a glaring issue with some systems is the lack of proper management (e.g., homeowner associations that operate systems, lack of clear ownership or legal access to on-lot system components).

Recommendations

a.) Appendix D includes typical recommendations for decentralized systems and provides program-level guidance and recommendations to assist in making various case-by-case decisions, such as connection of a decentralized system to central sewer, implementing community systems and advancing treatment of individual septic systems.

Overarching Policy-Level Recommendations

A. DNREC and CWAC should continue to meet their statutory requirements to coordinate directly with municipalities regarding long-term planning for existing and future treatment standards, and identify/create funding mechanisms to fund projects or technical transfer efforts and further guidance to help municipalities to meet the standards, including future nutrient effluent limits based on TMDLs.

B. CWAC should explore policies to encourage consideration of additional public-private partnerships beyond the three existing partnerships that rely on infrastructure sharing to address collection and conveyance systems issues, such as I/I, treatment and water reuse.

C. Regionalization: CWAC, with appropriate community outreach and public involvement, should develop policies that recognize that there are substantially different issues facing the counties, by establishing separate goals for each county. To postpone or delay some capital investments, CWAC may wish to consider programs or policies that promote water conservation, noting that regionalization may discourage reuse. Some example issues follow:

1. In New Castle County, the City of Wilmington's combined sewer system receives flow from collection systems owned and operated by the City of Newark and New Castle County; the City of Wilmington is already proceeding with an approach to managing its CSOs that does not include full separation (does CWAC or DNREC consider this approach to be viable, particularly in light of the contributions from the two collection-system-only entities?)

2. Kent County has nearly completed the transformation to a fully regionalized system, with generally very good results, according to the survey results, but the City of Harrington remains apart.

3. Sussex County has a number of issues that relate to regionalization and private utilities; for example, several of the towns in Sussex County have high rates that still appear to not generate sufficient revenues to be sustainable compared to the systems operated by the County.

D. DNREC should continue to coordinate CIP funding cycles with municipalities; DNREC and CWAC should continuously monitor the following:
    1. Indicators of new development
    2. Changes in available existing capacity
    3. Changes in per capita flow rates.

E. Future surveys could be enhanced by verifying if O&M manuals exist and other O&M information is being used by plant operators.

F. Asset management and/or capacity management, operation and maintenance (CMOM) should be considered for future action.

G. Biosolids issues should be considered for inclusion in future surveys.

H. Improved public education and outreach should be a part of all wastewater activities undertaken by CWAC and DNREC.

Section 9 – Acknowledgements

This report required a major dedication to coordinate and compile the information in it. This would not have been possible without the help and commitment of many individuals from both the public and private sectors.

Survey participants from each entity are listed on the following pages, including date of interview. Interviews were conducted between December 2010 and March 2011, and some time-sensitive information may have changed since the issuance of this report such as completion of construction projects, rate restructuring, or status of officials. The [NP] denotes that the participant was "Not Present" during the physical interview or follow-up phone calls, but was either initially contacted to participate in the survey or had some level of contribution to the survey responses.

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William Ritter, Scott Andres

Tetra Tech Key Staff:
Harish Mital, Jim Collins, Jon Harcum, Casey Grabowski, Vic D'Amato, Alex Trounov and Alex DeWire

Table 9-1. Survey Participants

Entity Name	Contact Person	Title	Date of Interview
Artesian Wastewater Management, Inc.	Brian Carbaugh	Director of Engineering	03/23/11
	Mark Kondelis	Manager of WW Services	
Camden-Wyoming Sewer & Water Authority	Harold L. Scott	Superintendent	03/11/11
	Soheil Gharebaghi	Authority Engineer	
City of Harrington	John Schatzschneider	City Manager	02/02/11
	Scott Cahall [NP]	Public Works Supervisor	
	John Rathje	Plant Operator-Supervisor	
	Chris Curran [NP]	URS	
	Debbie Pfeil [NP]	URS	
City of Lewes	Ken Meachem	BPW Manager	02/15/11
	Darrin Gordon [NP]	Assist. Gen. Manager of Public Works	
	Walt Balmer	Severn Trent Services - PM	
City of Newark Sewer Authority	Roy A. Simonson	Director of Water and Wastewater	12/21/10
City of Rehoboth Beach	Greg Ferrese [NP]	City Manager	02/11/11
	Sam Cooper	Mayor	
	Rip Copithorn	GHD	
	Bob Stenger	Wastewater Plant Supervisor	
City of Seaford	Dolores Slatcher [NP]	City Manager	02/03/11
	Bryant Tifft	Operations Coordinator	
	Berley Mears	Director of Public Works	
	Charles Anderson	Asst. City Manager	
City of Wilmington	Kash Srinivasan [NP]	Public Works Director	02/14/11
	Colleen Arnold	Assistant Water Division Director	
	Sean Duffy	Water Division Director	
	Alex Reznik	Veolia Water LA, North America	
	Prabha Kumar	Black & Veatch	
Delmar Sewer Authority	Jerome Reid	Public Works	01/26/11
	Kimberly Layton	Financial Officer	
	Alonzo Hardy	Wastewater Treatment Plant Superintendent	
	Georgia Tate [NP]	Jerome Reid's Assistant	
Dover Sewer Authority	Scott Koenig [NP]	Director of Public Works	02/04/11
	Sharon Duca	Water-Wastewater Manager	
	Donna S. Mitchell	Controller/Treasurer	
Kent County Department of Public Works	Hans Medlarz	Director of Public Works	12/10/10
Milford Sewer Authority	David Baird	City Manager	02/22/11
	Eugene Helmick	Superintendent of Wastewater	
	Steve Ellingsworth	W-WW Operator	
	Brad Dennehy	Director, Public Works	
New Castle County	Pat Creedon	General Manager, Special Services	12/09/10
	Jonathan Husband	Engineering and Environmental Services Manager	
	Jason P. Zern	Operations Engineer	
Sussex County	Mike Izzo	County Engineer	01/20/11

Entity Name	Contact Person	Title	Date of Interview
	Michael Winters	District Manager	
	Heather Sheridan	Director of Environmental Services	
Sussex County	Holly Brittingham	District Manager	
	Loran George	District Manager	
	Gordy Serman	District Manager	
Tidewater Environmental Services, Inc.	Bruce Patrick	Vice President of Engineering	03/09/11
	Jerry Esposito	President	
Town of Bridgeville	Jeff Collins	Wastewater Treatment Plant Superintendent	01/31/11
	Merit Burke [NP]	Town Manager	
	Jesse Savage	Financial Director	
Town of Clayton	Jeff Hurlock	Town Foreman	01/10/11
	Thomas E. Horn [NP]	Mayor	
Town of Georgetown	Gene Dvnornick	Town Manager	02/15/11
	Keith Hudson	Superintendent Wastewater Treatment Facilities	
	Laura Givens	Finance Manager	
Town of Greenwood	Willard T. Russell [NP]	Mayor	01/31/11
	John McDonnell	Town Manager	
	Terri Hignutt	Admin. Asst.	
	Roger Breeding [NP]	Public Works Manager	
Town of Laurel	Jamie Smith [NP]	Ops Manager, Acting Town Manager	02/03/11
	Wood Vickers	Director of Public Works	
	Mark Frye [NP]	Wastewater Superintendent	
	Linda Lewis [NP]	Wastewater Lab Technician	
	Mary Introcaso	Finance Manager	
Town of Middletown	Morris Deputy	Town Manager	02/18/11
	Lou Vitola [NP]	Finance Manager	
	Wayne Kersey	Plant Manager	
	Brian Carbaugh	Artesian - Director of Engineering	
	Mark Kondelis, Sr.	Artesian - Manager of WW Services	
Town of Millsboro	Faye Lingo [NP]	Town Manager	02/09/11
	Kenny Niblett, Jr.	Director of Public Works	
	Bill Sauer	Finance Officer	
	Mark Downes [NP]	Cabe Associates	
	Steve Lewandowski	Cabe Associates	
	Matt Schifano	Assistant Town Manager	
Town of Selbyville	Robert Dickerson	Town Administrator	01/26/11
	F. James Burk, Jr.	Wastewater, Manager of Operations	
Town of Smyrna	Dave Hugg	City Manager	02/10/11
	Daryl Jester	Director of Public Works	
	Marke Gede [NP]	Finance Director	

NP = Non-participant