

# Annual Review and Update of Strategic Trends and Utility Planning Issues for Fiscal Year 2019

OCTOBER 2019

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Orange Water and Sewer Authority

Carrboro, North Carolina



**Orange Water and Sewer Authority**

OWASA is Carrboro-Chapel Hill's not-for-profit public service agency delivering high quality water, wastewater, and reclaimed water services.

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## Purpose and Summary

This report summarizes observed trends for several indicators – such as customer growth and demands, water supply and drinking water treatment, wastewater treatment, use of reclaimed water, and environmental regulations – which are important factors that influence the need for, timing, and scope of our facilities planning and investment decisions. Through the process of regularly reviewing and updating this report, we strive to anticipate and proactively prepare for change so that we are better positioned to provide high quality and reliable water, wastewater, and reclaimed water services for the long-term. Some of the key messages are:

- Our customers have reduced peak day drinking water demands by 39 percent since Fiscal Year (FY) 1999 despite a 31 percent increase in customer accounts over that same period. Similarly, demands on our raw water supply have decreased substantially. These reduced demands result from:
  - Increased water use efficiency and conservation by our customers;
  - Conservation pricing and conservation ordinances including year-round water restrictions; and
  - Implementation of the reclaimed water system in partnership with the University of North Carolina at Chapel Hill (UNC) in 2009, which now meets over 11 percent of the community’s water needs.
- These reductions in drinking water demand – and the associated reductions in wastewater flows – help defer the need for costly expansion of the capacities of our raw water supplies, water treatment plant, and wastewater treatment plant. More efficient use of water also helps reduce costs for energy and chemicals for water supply, drinking water treatment and water distribution, and wastewater collection and treatment.
- Based on current demands, we believe we have sufficient raw water supply for the next few decades under most conditions. Our allocation of Jordan Lake water supply, which we can access through our mutual aid agreements with the City of Durham and Town of Cary, serves as an insurance policy to meet demands during extended droughts or operational emergencies.
- Based on current demands and projections, we anticipate no need to expand the hydraulic capacity of the water or wastewater plant for several decades.
- OWASA is committed to providing high quality and reliable services to our customers. We have an asset management program to evaluate our infrastructure and risks and guide our investments in our ongoing maintenance and system renewal programs. The trends listed in this report are one mechanism to evaluate how well we meet our core mission.

## Acronyms

AMI	advanced metering infrastructure
AMWA	Association of Metropolitan Water Agencies
AWIA	America’s Water Infrastructure Act
AWWA	American Water Works Association
BG	billion gallons
CIP	Capital Improvements Program
CY	calendar year
DEQ	NC Department of Environmental Quality
EMC	NC Environmental Management Commission
EPA	US Environmental Protection Agency
ERP	Emergency Response Plan
FY	fiscal year (July – June)
GPR	ground penetrating radar
JLP	Jordan Lake Partnership
kWh	kilowatt-hour
KWh/MG	kilowatt-hour per million gallons
lb/yr	pounds per year
LRWSP	Long-Range Water Supply Plan
LT2	Long-Term 2 Enhanced Surface Water Treatment Rule
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
ME	meter equivalent
MG	million gallons
mgd	million gallons per day
NCSU	North Carolina State University
OWASA	Orange Water and Sewer Authority
PFAS	per and poly-fluoroalkyl substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid
RCW	reclaimed water

RRA	Risk and Resilience Assessment
SCADA	Supervisory Control and Data Acquisition
TAWSMP	Triangle Area Water Supply Monitoring Project
TN	total nitrogen
TP	total phosphorus
TWP	Triangle Water Supply Partnership
µg/l	micrograms per liter
UCMR3	Unregulated Contaminant Monitoring Rule 3
UCMR4	Unregulated Contaminant Monitoring Rule 4
UNC	University of North Carolina at Chapel Hill
WHO	World Health Organization
WRF	Water Research Foundation
WSMPBA	Water and Sewer Management, Planning and Boundary Agreement
WTP	water treatment plant
WWTP	wastewater treatment plant

## Background

Orange Water and Sewer Authority (OWASA) publishes this annual report to evaluate how well we are meeting our mission of providing our customers with high quality and reliable water, wastewater, and reclaimed water services through responsible and creative stewardship of the resources we manage.

This report summarizes observed trends for several indicators – such as customer growth and demands, water supply and drinking water treatment, wastewater treatment, use of reclaimed water, and environmental regulations – which are important factors that influence the need for, timing, and scope of our facilities planning and investment decisions. Thus, the information in this document is one item that shapes our Capital Improvements Program (CIP). Through the process of regularly reviewing, updating, and publishing this report, we strive to anticipate and proactively prepare for change so that we are better positioned to engage the community as we consider and decide on how best to sustainably meet service requirements for the foreseeable future.

The OWASA Board of Directors adopted a Strategic Plan in March 2014 and an update to the [Strategic Plan](#) in June 2016. The Strategic Plan identifies the key initiatives and corresponding actions OWASA will take to address the issues we believe are most important for the customers and community we serve. The June 2016 Strategic Plan stated that this Annual Review and Update of Strategic Trends and Utility Planning Issues (Strategic Trends report) would be modified to serve as a companion document to the Strategic Plan. The information provided in this report may be used to update or add initiatives to future updates of the Strategic Plan.

This Strategic Trends report begins with an overview of OWASA's planning environment which includes a description of those items which may impact the timing and scope of our facilities planning and investment decisions. It then includes a description of OWASA's main management areas beginning with source water protection; then raw water supply and treatment; distribution of drinking water to our customers; wastewater collection, treatment, and disposal or reuse. Each topic includes information on regulations, technology and research, energy management, links to the Strategic Plan, and follow-up actions.

# OWASA's Planning Environment

This section describes the items in OWASA's planning environment that would impact the timing and scope of our facilities planning and investment decisions. Understanding these items ensures that we provide our customers with high quality and reliable water, wastewater, and reclaimed water services through responsible and creative stewardship of the resources we manage.

## Service Area

The local governments in Orange County have developed several agreements to determine who has jurisdiction over certain areas and what areas are to be served by municipal water and sewer. These agreements help concentrate growth in compact municipal areas, preserve the rural character of the County, and limit urban sprawl. The area that OWASA can provide service to is shown in Figure 1 and is from the [Water and Sewer Management, Planning and Boundary Agreement](#) (WSMPBA) which was adopted in 2001 and amended in 2010 and 2017. The 2017 amendments included minor changes to the boundary along Smith Level Road. If changes are made to OWASA's service area, OWASA will need to ensure its resources and infrastructure will reliably meet the demands of those new areas along with the projected development within our current service area.

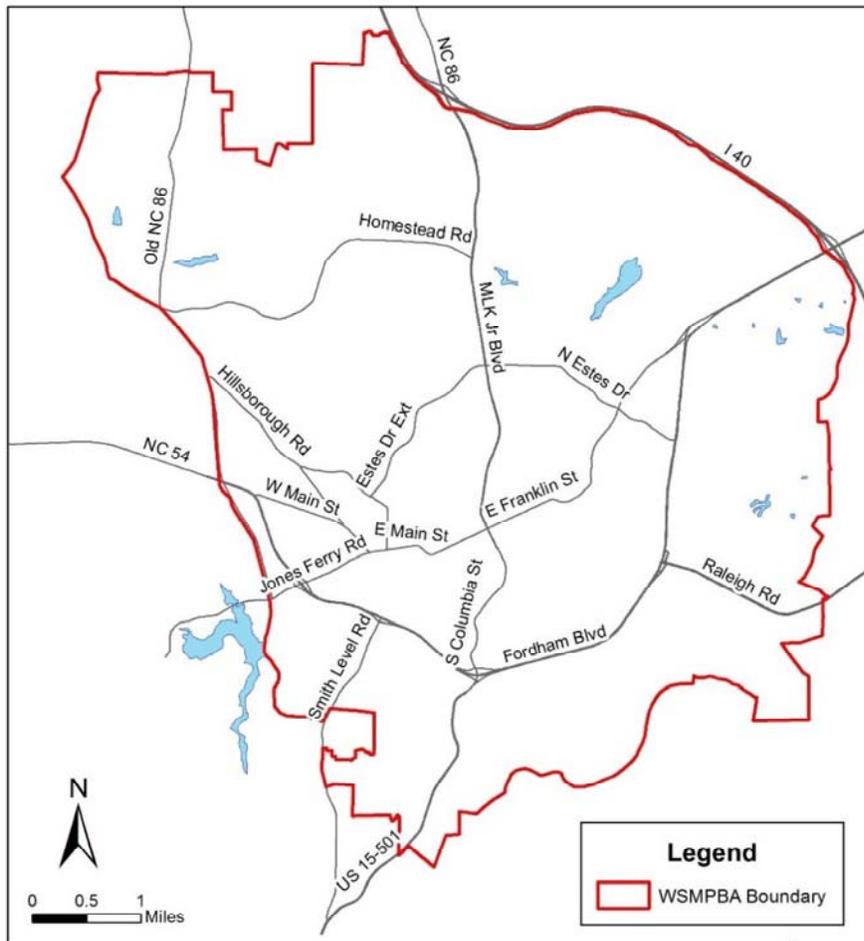


Figure 1. WSMPBA Boundary

## Growth and Development

It is important to project when, where, and how much growth will occur, and what the subsequent demands will be on our water, wastewater, and reclaimed water services to ensure we have adequate capacity to meet the community's future needs. Figure 2 illustrates past population numbers for the Towns of Carrboro and Chapel Hill as well as the 2045 projected population based on regional transportation planning and the 2070 projected population as presented in the report titled *Long-Range Water Demand Projections Through 2070 for the Long-Range Water Supply Plan Update* presented to the Board of Directors in March 2019. These projections are similar to those provided during the [State of the Community Report](#) in September 2019; the projected 2050 population in Chapel Hill and Carrboro based on linear models is anticipated to be between 103,564 and 128,755. The projected 2050 population shown by the orange line in Figure 2 is 117,726 and 124,565 shown by the blue dotted line. These projections are all very similar.

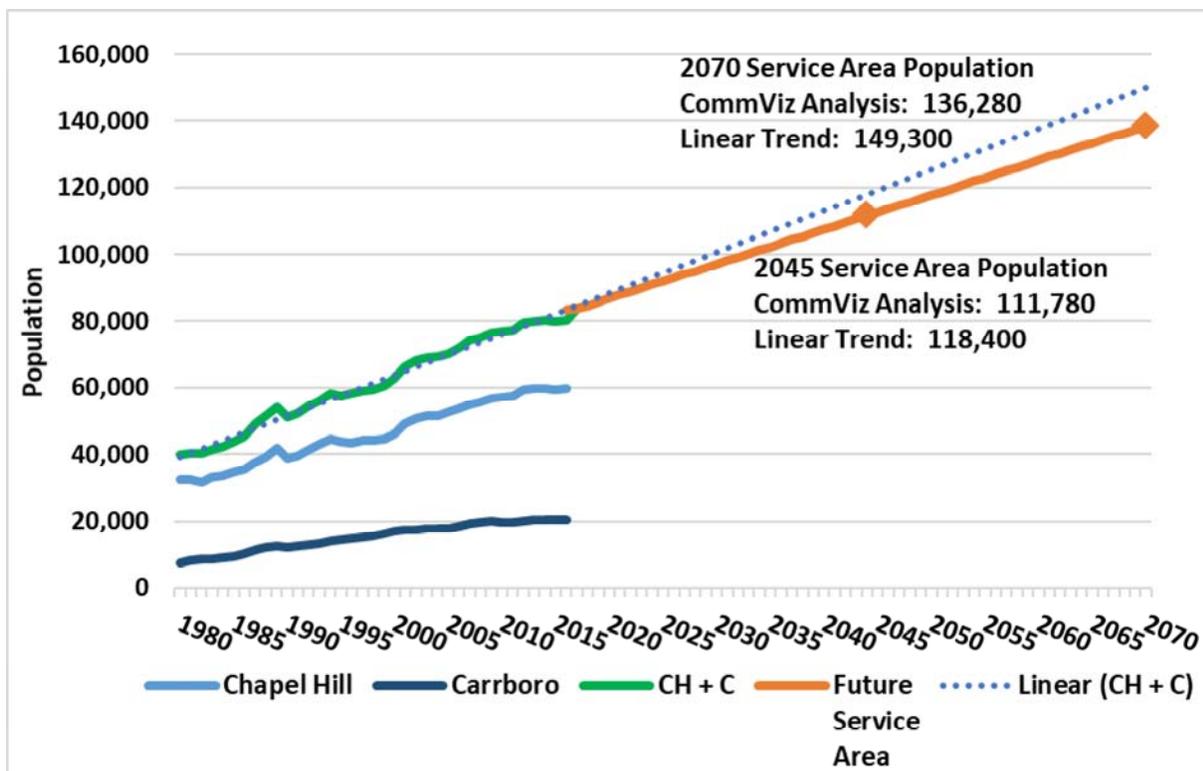


Figure 2. Population Projections - UNC is included in Town of Chapel Hill population projections

We anticipate that growth will continue to be higher density, with redevelopment and infill projects such as the Blue Hill District, Carolina Square, and Shelton Station, and with new development projects such as Carraway Village. Higher density development tends to result in lower per capita demands and may make better use of existing water and wastewater infrastructure. OWASA will use local government future growth information to ensure that the capacity of our water distribution system and wastewater collection system is sized appropriately.

## Climate Change

OWASA's operations are intricately linked with the environment and weather, and climate change has the potential to significantly and directly impact various aspects of our business. Additionally, extreme weather events like drought and hurricanes have the potential to indirectly affect the supply of resources that we need to conduct business (i.e. power and chemicals), as well as the demand for our services. OWASA must be prepared to adapt to a changing climate, and we are incorporating climate change adaptation into various aspects of our operations.

While experts believe the southeastern United States will receive about the same amount of rainfall on average in the future, that rainfall will likely be provided in more severe storms and flooding events with more severe and prolonged droughts in between. This new pattern of rainfall will impact the yield of OWASA's and the region's reservoirs and the patterns of water demand including the water used for irrigation and cooling. As a result, OWASA and our utility neighbors must address the resiliency of water supply and storage, especially for periods of severe and extended droughts as well as the capacity of our reclaimed water system, which may face higher peak demands.

OWASA worked with our utility neighbors through the [Jordan Lake Partnership](#) (JLP) to develop the Triangle Regional Water Supply Plan to ensure all Partners have sufficient and reliable water supply through 2060. The JLP also contracted a regional interconnection study to evaluate the interconnection capacity of our drinking water systems and to identify needed infrastructure improvements to meet future needs. The JLP has been reorganized as the [Triangle Water Supply Partnership](#) (TWP). The TWP plans to build on the work of the JLP and use the interconnection model to run planning scenarios to identify strategies to improve the region's resiliency to planned and unplanned water supply challenges. OWASA is updating its Long-Range Water Supply Plan (LRWSP) to ensure we have water to meet our needs through 2070.

Our climate change planning to date has focused on drought management planning and natural disaster emergency preparedness. However, high rain events could result in greater flooding of our infrastructure. While our infrastructure has been designed to meet certain flood events, the frequency of those events could increase in the future. Recognizing this change in rainfall, OWASA is currently evaluating recent rainfall data and identifying a new design storm as part of our wastewater collection system model update. Hurricanes and other storms could damage critical infrastructure. OWASA plans for forecasted events, and coordinates emergency planning with our neighboring communities and other utility partners in North Carolina.

Climate change also has potential implications on the quality of the water in our reservoirs. With temperature change and impacts on rainfall, we could experience more frequent algal blooms in our reservoirs and potential increases in taste and odor events and cyanotoxin concentrations. (Cyanotoxins are toxins produced by blue-green algae and were responsible for the City of Toledo's "Do Not Use" warning in 2014.)

OWASA continues to monitor climate change science, and we participate in applied research projects with universities, other utilities, and other agencies where applicable, to proactively plan to meet the

community's water and wastewater needs in the face of increasing climate variability. Nonetheless, we would benefit as an organization and community to take a strategic approach to the impact of climate change on our overall mission that considers compounding situations and those that might fall just outside of obvious consideration. The Board of Directors may want to consider using climate change as a theme for its next Strategic Plan to prioritize the resources necessary to take a comprehensive approach to updating plans and procedures to be resilient against a changing climate.

## Regulations

OWASA monitors the regulatory arena closely so we proactively ensure we can meet all legal requirements applicable to the provision of water, wastewater, and reclaimed water services to our customers. Many of these potential regulations would impact our drinking water supplies and treatment facilities. Potential regulations are included for trends where they are applicable in this Strategic Trends report.

## Technology and Research

OWASA stays informed about advancements in technology and research, their capital and operating costs, and ability to better position us to provide services to our customers in a more sustainable manner. OWASA often partners with local university researchers, professional associations, and our consultants to obtain information on how emerging technologies may apply specifically to OWASA. Technologies that OWASA is monitoring are described in applicable sections with this Strategic Trends report. General information on our use of university research, professional associations, and consultants is provided below.

## University Partnerships

OWASA often partners with our local universities to evaluate emerging technologies. We have provided water and wastewater samples to local universities to test emerging technologies. We have supported university classes by providing data. One effective use of university research is through our membership in the Urban Water Consortium, a group of twelve of the largest water utilities in the state. Together these twelve utilities pool their funds to bridge our research needs with university expertise. Some of the current research funded through this consortium is included in applicable sections of this report.

## Professional Associations

OWASA is a member of various water and wastewater organizations, and our employees review their publications and attend their conferences. Staff regularly meet with other utility staff locally, throughout the southeast region, and nationally through these memberships; these contacts with other utility staff enable us to stay abreast of the latest technologies that work in our region to better meet our water, wastewater, and reclaimed water needs. Some of the industry trends noted by attending these conferences and interacting with staff from other utilities are:

- Renewal and replacement of aging infrastructure
- Asset management
- Conservation and reclaimed water to meet the needs of growing populations with existing water resources

- Public understanding of the value of water
- The need to attract, train, and retain staff and utility management and leadership
- Excellence in customer service and public awareness of water issues
- Cybersecurity
- Climate risk and resiliency
- Energy management
- Compounds of emerging concern

Several of the national organizations develop annual reports that often reiterate these industry trends and that we use to evaluate OWASA's practices:

- [AWWA's State of the Water Industry Report](#) – this report is based on an annual survey of utilities to identify and track challenges facing the water industry, provide data and analysis to support water professionals, and inform decision makers and the public of challenges facing the water industry
- [AWWA's Benchmarking Report](#) – AWWA summarizes performance results provided by water and wastewater utilities in quartiles. OWASA participates in AWWA's benchmarking surveys and has used the results of the Benchmarking Report as goals in several of the trends presented in this report.
- Association of Metropolitan Water Agencies (AMWA) [Annual Report](#) - this report is focused on regulatory and security issues, but AMWA also supports scientific research, collaboration, and sustainable utility practices
- The National Association of Clean Water Agencies, Water Environment Federation and Water Environment Research Foundation [Water Resources Utility of the Future](#) – this report was first developed in 2013 to recognize that water and wastewater utilities were identifying themselves as resource managers rather than waste managers. One trend that the latest Utility of the Future (2015) recognizes is that utilities in the United States are beginning to expand their use of technologies used in other countries. This 2015 report also notes how partnerships between utilities, consulting engineers, government, and finance are used to move utilities forward. This report has been replaced by the Utility of the Future Today Recognition Program. OWASA was recognized by this program for its organizational culture and energy efficiency programs.

The American Water Works Association (AWWA) sponsors the [Partnership for Safe Water](#) and the [Partnership for Clean Water](#). The Partnership for Safe Water is a voluntary effort for water utilities to optimize their treatment and distribution system processes to help ensure the production and delivery of safe water to all users that go beyond regulatory measures. The OWASA Jones Ferry Water Treatment Plant was the ninth plant in the nation and first in North Carolina to achieve the highest level of recognition with the Phase IV Excellence in Water Treatment Award. This level of excellence has been maintained for seven years running. In 2016, OWASA received the Presidents award under the Partnership for Safe Water for its distribution system. The Partnership for Clean Water is a parallel program that focuses on wastewater treatment plant optimization, effluent quality and energy savings. This program was established in 2016 and is still under development. The OWASA Mason Farm

Wastewater Treatment Plant has begun the initial self-assessment phase with the goal of being one of the first plants in the nation to achieve the first level recognition with the Phase III Directors Award.

The Water Research Foundation (WRF) also maintains a [website](#) that summarizes current research on topics important to water utilities including per and poly-fluoroalkyl substances (PFAS), cyanotoxins, fluoride, and taste and odor.

The U.S. Environmental Protection Agency (EPA) and six major water and wastewater associations developed a Primer on [Effective Utility Management](#) which was written to guide utility managers to make effective changes to achieve excellence in meeting their core missions.

The [State Water Infrastructure Authority](#) was created by the North Carolina General Assembly in 2013 to assess and make recommendations about the water and wastewater infrastructure across the state. The Authority finalized the [Infrastructure Master Plan](#) in 2017. The report notes that in order for a water utility to be viable, it must exhibit best practices around infrastructure management, organizational management, and financial management. Staff regularly attend meetings with staff of the State Water Infrastructure Authority to stay updated on their recommendations.

### Engineering Consultants

OWASA hires engineering firms to plan, design, and construct our infrastructure. These engineering firms design and construct similar infrastructure throughout the region and nation. We hire them for their expertise; based on our specific requirements and circumstances and their experiences with different technologies, they recommend technologies that will best meet our needs.

### Other Important Utility Planning Issues

This section includes a brief overview of other utility planning issues in which OWASA is currently engaged which support our mission and the values included in the Strategic Plan. This section is not intended to be a comprehensive overview of utility planning issues.

### Energy Management

Strategic Initiative Number 4 in OWASA's Strategic Plan is to implement an Energy Management Program. OWASA uses a lot of energy to operate our water, wastewater and reclaimed water facilities, protect the environment, and provide service to about 83,000 residents in the Carrboro-Chapel Hill community. In Calendar Year 2018, our facilities used about 67 billion BTUs of energy – enough to power about 1,800 homes for a year. That energy came at a cost of \$1.2 million, comprising about 5% of our annual operating expenses in Fiscal Year 2019

1. In a move to improve our environmental impact, reduce a significant operating cost, and increase the resiliency of our organization, the OWASA Board of Directors established the following energy management goals and objectives. Reduce use of purchased electricity by 35 percent by the end of Calendar Year (CY) 2022 compared to CY 2010 baseline;
  - a. Progress: In FY19, OWASA used 29% less electricity than in Calendar Year 2010.
2. Reduce use of purchased natural gas by 5 percent by CY 2020 compared to CY 2010 baseline;
  - a. Progress: In FY19, OWASA used 43% less natural gas than in Calendar Year 2010.

3. Beneficially use all wastewater treatment plant (WWTP) biogas, provided the preferred strategy is projected to have a positive payback within the expected useful life of the required equipment and formally engage local governments and partners in discussion about potential development of a biogas-to-energy project at the Mason Farm WWTP
  - a. Progress: We have determined that there is no cost-effective strategy that we can pursue on our own at this time. We are currently using half of the biogas in a boiler that heats anaerobic digesters (see progress on natural gas goal).

OWASA has an active Energy Management Program designed to systematically identify and evaluate energy management to achieve our objectives. We consider the social cost of carbon in evaluating economic efficiency. Our progress is a result of our investment in energy efficient equipment (blowers, pumps, drives, and motors), lighting, and HVAC units. It is also a result of our community's enhanced commitment to water conservation and efficiency. Less water use equals less energy use.

This Strategic Trends report includes information on electricity and natural gas use for OWASA's operations for trends where it is appropriate. We are not tracking vehicle fuel use by functional area and are not reporting that energy use in this Strategic Trends report.

In September 2019, the Board of Directors approved moving forward in a design process for the installation of solar panels on OWASA facilities to generate and use renewable energy. This project will help OWASA achieve its goal of reducing purchased electricity use by 35 percent by 2022 and reduce greenhouse gas emissions by over 800 metric tons per year. For further information on OWASA's Energy Management Program, please see our [website](#).

## Safety

Safety is the number one priority of every member of the OWASA team. We are dedicated to reducing injuries, accidents and ensuring compliance. We achieve this by fostering a culture focused on awareness and safe work methods and by providing high-quality training, comprehensive workplace evaluation and emergency response.

Staff continually evaluate methods to improve our processes. We routinely perform after action reviews following small and large events. The after action review process identifies what happened, what we set out to accomplish, what worked well, and where we can improve.

Much of the information contained in this Strategic Trends report helps us make sure that we are providing the community with safe drinking water and protecting both public health and the environment through proper conveyance, treatment, and disposal of wastewater.

# Source Water Protection

## Description

Our community has a long history of taking progressive actions to ensure the health and safety of our drinking water supplies. Since it began operations in 1977, OWASA has understood that to protect the water source, you must protect the watershed, and we have been actively involved in a wide range of watershed protection efforts, such as:

- Limits on the extension of water/sewer service into the Cane Creek Reservoir and University Lake watersheds;
- Support for comprehensive protection through zoning and land use controls;
- Restrictions on in-lake recreational activities;
- Special technical studies and educational activities; and
- **Land acquisition through the strategic purchase of property or conservation easements in areas determined to be critical for water quality protection.**
- Managing healthy forests

It is the land acquisition effort which is the focus of this section of the report. OWASA spent \$7.8 million on land protection between 1991 and 2006 through purchase and conservation easements and grant funds covered \$3.0 million of these costs. (Note: these costs have not been adjusted for inflation and do not reflect ancillary expenses for legal, survey, appraisals, other site work, or administrative costs of OWASA staff time).

Land acquisition was among the options evaluated in the University Lake watershed management study and plan commissioned in the late 1980s. Water quality modeling indicated that permanently protecting 2,900 acres (approximately 15 percent) of the watershed would have only slight water quality benefits and not justify the multi-million-dollar cost, but that selected land acquisition in critical areas of the watershed may be appropriate. This recommendation was later confirmed in a follow-up analysis, which found that land acquisition would probably not be effective, but a possible exception may apply to undeveloped land very near the lake, and that conservation easements along stream buffers would be particularly valuable near the downstream ends of tributaries as they approach University Lake.

Based on these technical recommendations, OWASA elected not to pursue a program of land or easement acquisition in the University Lake watershed, but to consider land preservation opportunities on a case-by-case basis. In 2006, OWASA purchased a 73-acre property along Morgan Creek immediately upstream of University Lake (with the help of a \$1.2 million NC Clean Water Management Trust Fund grant). This property was placed under a permanent restrictive conservation easement that protects all riparian areas and greatly limits future development; subdivided into two large tracts; and re-sold on the open market in 2011 – with all restrictions in place.

The primary recommendations in a 1996 study of the Cane Creek Reservoir watershed included large lot (5 acres or greater) residential re-zoning and the permanent protection of 1,265 additional acres of

watershed land either through purchase of land or acquisition of conservation easements to limit development and protect critical riparian buffers. OWASA adopted those recommendations as goals for the protection of Cane Creek Reservoir and subsequently protected an estimated 1,075 acres of additional Cane Creek Reservoir watershed land through purchase or acquisition of conservation easements. Since 1997, Orange County's Land Legacy Program and other groups also acquired protective conservation easements on an additional 370 acres in the Cane Creek Reservoir watershed. Together, OWASA and Orange County's land protection efforts have exceeded OWASA's original goal. OWASA and Orange County staff continue to work closely in coordinating the needs of our respective programs as the County protects additional land in the watershed and elsewhere.

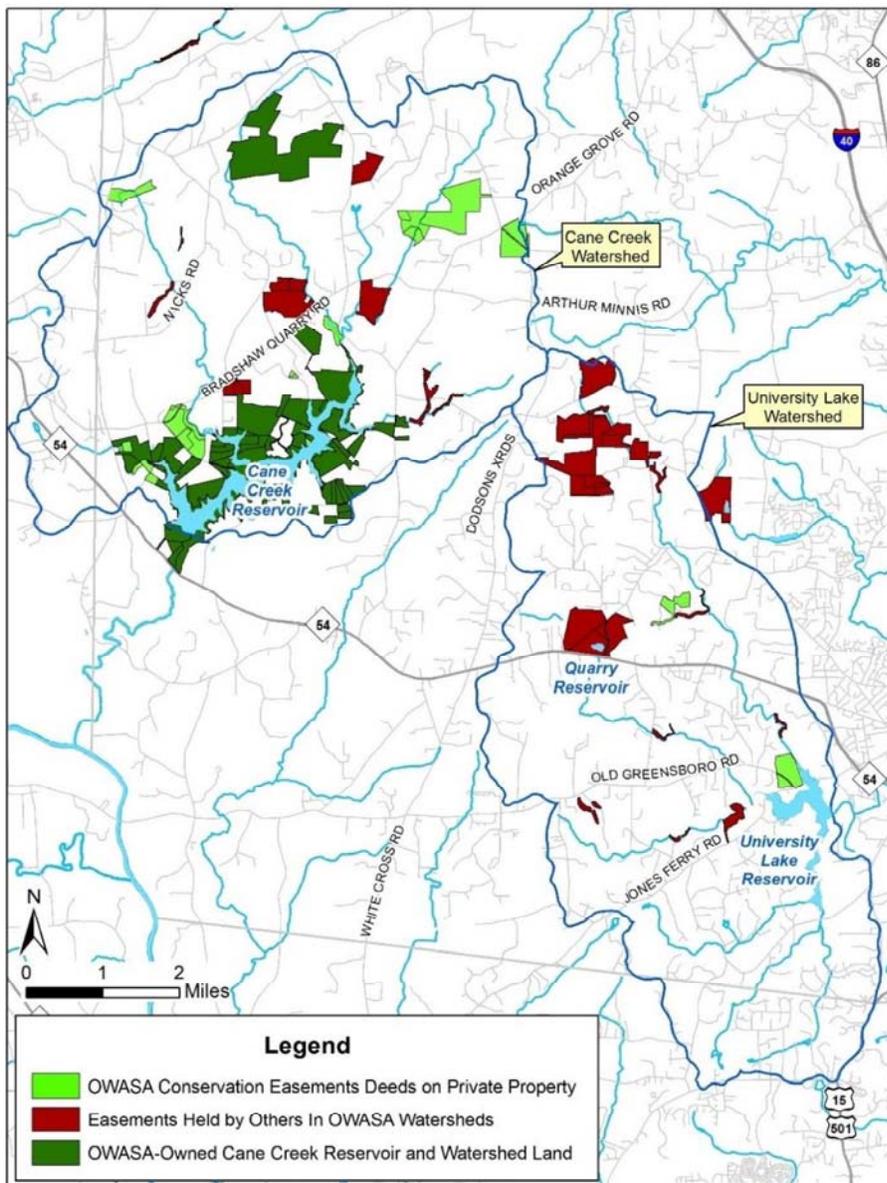


Figure 3. Protected Land in OWASA's Watersheds – Approximately 10 percent of our watershed lands are located outside Orange County, where less stringent controls apply.

## Water Quality Monitoring

OWASA is a founding member of and actively participates in the [Triangle Area Water Supply Monitoring Project](#) (TAWSMP), which is an interlocal water quality monitoring and research implemented in collaboration with the US Geological Survey (USGS). This Partnership began in 1988. The TAWSMP samples area water supply reservoirs and some of their key tributaries to monitor water quality and parameters of emerging concern. The robust continuous dataset enables analysis and identification of trends in water quality. TAWSMP operates in multi-year phases. Scopes of work were developed for each phase of the TAWSMP which include parameters which remain the same from phase to phase such as nutrients, chlorophyll *a*, major ions, and total suspended solids as well as parameters of interest for that particular phase.

The USGS published [Trends in Water Quality of Selected Streams and Reservoirs Used for Water Supply in the Triangle Area of North Carolina, 1989-2013](#) in July 2018. The USGS evaluated land cover, nutrients, and other parameters for statistical trends over the 25-year period. The results of that trend analysis were summarized in OWASA's [2018 Strategic Trends Report](#).

An important consideration for long-term watershed protection is how a changing climate may impact water supply water quality and potential treatment needs. Warmer temperatures and changing hydrology will impact the frequency, type and extent of algal blooms in our drinking water reservoirs, but there are several key unanswered questions. Will we need to install advanced treatment technologies in our WTP to reduce public health risk from algal toxins? Are there any effective in-lake management measures (such as mixing) that will reduce the frequency and severity of algal blooms and other water quality problems? What are the costs, effectiveness, and energy requirements of those measures? How are future declines in water quality likely to keep us from maximizing the reliable yield of our water supply reservoirs? Unfortunately, these are not questions that can be addressed by quickly evaluating water quality monitoring data on an annual basis. Staff have been in communication with university researchers who have expertise in characterizing algal blooms, and in particular, cyanobacteria (also sometimes called blue-green algae). These questions are not unique to OWASA, so we are reaching out to other utilities and agencies to explore opportunities to collaborate on targeted research to better understand and address these issues, perhaps through one or more of our existing partnerships, such as the Urban Water Consortium or the Triangle Water Supply Monitoring Program. The Board of Directors may also want to consider including these types of studies as an initiative in the next update of the Strategic Plan.

## Regulations

- There is ongoing research at the federal and state level regarding per- and poly-fluoroalkyl substances (PFAS) in drinking water. PFAS are present throughout the environment because they are highly persistent and have been widely used for decades, including in industrial applications, household and consumer products, food packaging, and firefighting foams. GenX is one of the PFAS compounds that was found in the City of Wilmington's water supply. EPA has developed an Action Plan to address PFAS, which includes making a regulatory determination for two PFAS

(perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA)). The North Carolina General Assembly appropriated \$5 million in Summer 2018 to test raw water at public water supplies across the state for PFAS and included air quality sampling since air emissions can transport PFAS in the environment. OWASA completed special monitoring for PFAS in our raw water, drinking water, Morgan Creek, and in our wastewater treatment plant effluent when researchers from Duke University found some of those substances in our drinking water. Further [information](#) was provided to the Board of Directors on February 22 and March 8, 2018. OWASA's Natural Resources and Technical Services Committee discussed PFAS and source water protection in November 2018 and recommended that staff monitor PFAS at our raw water intake at Cane Creek Reservoir and in the drinking water leaving our Jones Ferry road WTP quarterly for one year. A mid-year update of results was provided to the Board in June 2019.

- The Long Term 2 Enhanced Surface Water Treatment Rule (LT2) builds upon the 1996 amendment to the federal Safe Drinking Water Act to strengthen protection against microbial contaminants, especially *Cryptosporidium*. OWASA completed the first round of monitoring for *Cryptosporidium* and *E. coli* in our source waters in 2009. As a result of this monitoring, OWASA was placed in the lowest treatment category, which requires no additional treatment. Staff completed the second round of two years of monthly monitoring of Cane Creek Reservoir and University Lake in August 2017. Based on the round 2 results, OWASA remains in the lowest treatment category and will not be required to provide additional filtration treatment. Staff are in the process of conducting a round of monthly sampling of the Quarry Reservoir; this round will be completed January 2020.
- The EPA is requiring monitoring for some cyanotoxins by all large utilities and some small utilities. This monitoring is part of the Unregulated Contaminant Monitoring Rule (UCMR), which is the primary way the EPA gathers occurrence data on compounds it is considering regulating. OWASA will begin this monitoring in April 2020. Although this monitoring is occurring in the treated drinking water, raw water is the source of these compounds. Since 2016, OWASA has monitored for three cyanotoxins in our raw water, treated drinking water, and within our treatment process.
- OWASA follows developments regarding pharmaceuticals and personal care products in drinking water, wastewater, and reclaimed water. These products enter wastewater systems through excretion, disposal of unused medicine in sinks or toilets, and personal care products washed from skin and hair. They can also be present in runoff from livestock operations and subsurface discharges from-site wastewater systems (septic tanks). Cane Creek Reservoir and University Lake watersheds are highly protected, and no treated municipal or industrial wastewater is discharged within our local water supply watersheds. However, there are livestock operations, private septic systems, and biosolids applications in both watersheds. A [2007 study](#) by the U.S. Geological Survey of local untreated (or raw) water sources including Cane Creek Reservoir and University Lake tested for pharmaceuticals. In this study, one pharmaceutical (acetaminophen) was detected in one sample from Cane Creek Reservoir; all other results from OWASA reservoirs were below the detectable levels. OWASA does participate in EPA monitoring efforts of unregulated contaminants. This tool is used to improve drinking water quality standards by collecting data on compounds that are suspected to be present in drinking water, but do not yet have health-based

standards set under the Safe Drinking Water Act. Pharmaceuticals and personal care products have not been included in this program to date, and there are no federal requirements for them.

- In accordance with direction from EPA, the North Carolina Department of Environmental Quality (DEQ) is developing draft nutrient criteria for surface waters in the state. If nutrient levels in one or more of our water supply reservoirs, Morgan Creek, and/or other surface waters in our area exceed future nutrient-related water quality limits, we and/or other parties could be required to take action to reduce the discharge of nutrients into those water bodies. The technical, economic, and environmental feasibility of complying with such requirements can only be determined once proposed criteria are issued.
- The North Carolina General Assembly ratified House Bill 894 to improve Source Water Protection in August 2014 in response to the accidental release of 4-methylcyclohexanemethanol in West Virginia and the coal ash spills in North Carolina. Subsequently, the North Carolina Environmental Management Commission (EMC) adopted rules that require all public water supplies which use surface water to develop a source water protection plan. OWASA is well positioned to meet the requirements of these rules; our plan is due on January 1, 2023.
- America's Water Infrastructure Act (AWIA) requires water systems to prepare a risk and resilience assessment (RRA) and a subsequent emergency response plan (ERP). The RRA is to evaluate risks from natural hazards and malevolent acts, the resilience of source water, treatment, and conveyance facilities, monitoring, and financial infrastructure. The ERP evaluates strategies to improve the resiliency of the system including physical and cyber security, requires procedures to implement to respond to natural hazard or malevolent act, and practices that can reduce the impact of an event. The requirements of North Carolina's Source Water Protection program roll into these federal requirements. OWASA is required to prepare its RRA by December 31, 2020 and the ERP must be developed and certified within six months of submitting the RRA certification.

### **Technology and Research**

- We are a partner in a recently completed study to evaluate the effectiveness of artificial mixing as a strategy to improve reservoir water quality. Current research suggests this technology may work well for some smaller reservoirs and lake areas near intake structure. Researchers at North Carolina State University (NCSU) evaluated the effectiveness of artificial mixing in Piedmont reservoirs accounting for factors such as depth, temperature, wind, and nutrient concentrations. OWASA supported this research and provided data from University Lake as a control (does not employ artificial mixing) for the study. This study will help staff evaluate whether in-lake mixing may reduce algal blooms and the resulting increases in taste and odor events and potential cyanotoxin concentrations. The City of High Point employs artificial mixing in its two water supply reservoirs City Lake and Oak Hollow Lake to improve treatability of its drinking water. The Town of Cary recently began mixing Jordan Lake water near its intake. OWASA staff just received the final report from this research and are evaluating its potential application to OWASA.
- OWASA worked with researchers at NCSU to monitor cyanotoxin trends in both reservoirs using a method that integrates cyanotoxin levels over two to four week periods of time. This method allows for constant monitoring of cyanotoxin trends at the intake structures and will provide valuable

baseline data on the cyanotoxin concentrations coming into the plant. This work is being coordinated with the research into artificial mixing described above. Together these efforts will provide OWASA with valuable information about the frequency and concentration of cyanotoxins and potentially the conditions in our lake where they may be a concern. Occurrence and abundance data for algae and cyanobacteria, paired with grab sample data for cyanotoxins and removal through the treatment process will inform future treatment technology enhancements. A final report is expected soon.

- The 2016 General Assembly directed the [UNC Collaboratory](#) to evaluate water quality and nutrient management strategies in the Jordan and Falls Lake watersheds. These studies could result in new management strategies in the Jordan Lake watershed which could impact OWASA operations. Staff stay updated on the work of the Collaboratory and have provided data to some of the researchers.

### **Energy Management**

Energy use to manage OWASA's lands is minimal and consists of fuel needed for travel and equipment to manage the land.

### **Strategic Plan Elements**

Strategic Initiative 6 includes a goal that states "Land assets provide the expected value to fulfill OWASA's mission and the assets are effectively managed". The Board of Directors recently approved an incremental approach to managing our forests; healthy forests help protect long-term water quality in the reservoir.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Since OWASA met its watershed protection goals for land acquisition, we are not actively seeking or funding additional land conservation. However, we will continue to evaluate cost-effective land acquisition opportunities through conservation easements or purchase when available.	Ongoing	X	
2. Consider updating 1996 Cane Creek Reservoir Watershed Study	After completion of LRWSP and as part of next Strategic Plan	X (as part of budget)	
3. Inspect conservation easements on private land to make sure owners are following the terms of the easement	Annually		X
4. Develop AWIA RRA and ERP	Dec 2020 for AWIA and approx. June 2021 for ERP		X
5. Develop Source Water Protection Plan as required by DEQ	Due 1/1/2023	X	
6. Evaluate data from NCSU studies when completed and identify any follow up steps or recommendations for future.	CY 2019		X
7. Complete quarterly sampling for PFAS at Cane Creek Reservoir intake and in drinking water leaving plant. Evaluate data and identify any next steps.	CY 2019		X

## Raw Water Supply and Long-Range Water Supply Plan

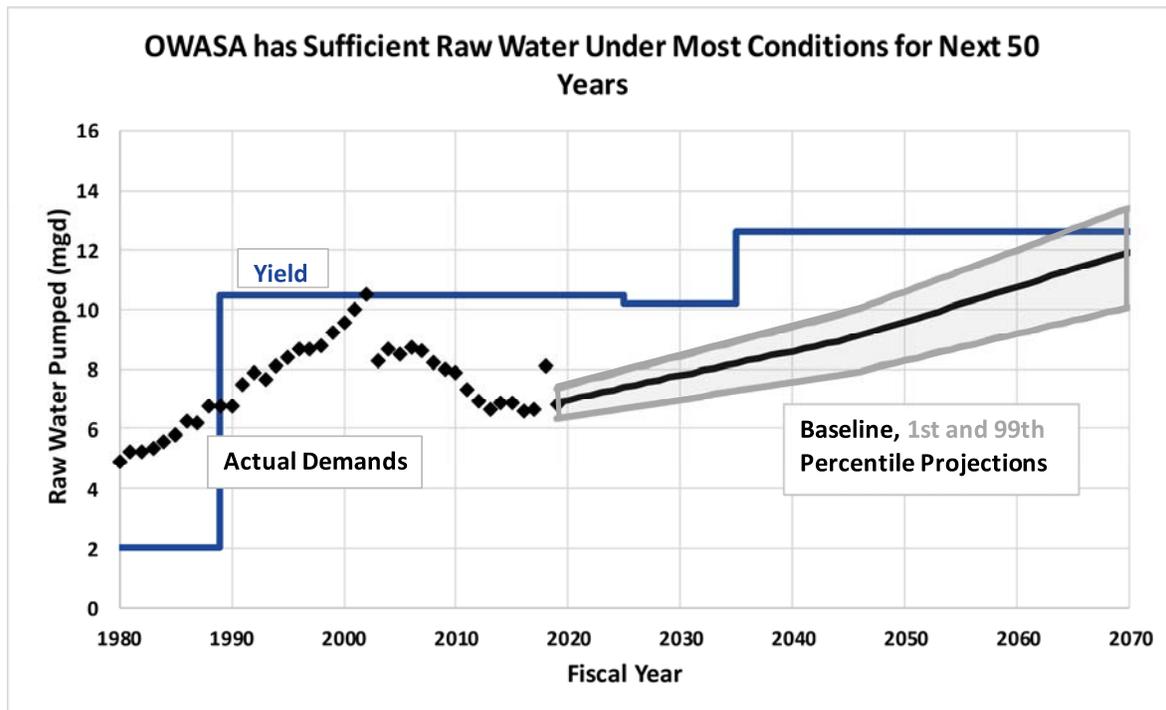


Figure 4. OWASA's Water Supply Yield and Demands

**Description:** This trend evaluates the supply (reliable yield) of our locally-owned upland water sources – Cane Creek Reservoir, University Lake, and the Quarry Reservoir – and historic raw water demands and estimated future raw water demands. (Since we do not have permanent facilities and/or agreements in place to access Jordan Lake, Figure 4 does not include our Level I Jordan Lake water storage allocation of about 5 million gallons per day (mgd). We can access this allocation through Town of Cary and City of Durham on a limited, emergency basis.)

### Key Observations:

- Raw water demand increased in 2018, but we provided water to the City of Durham while they were working on their WTPs. If we had not transferred this water, our average raw water demand would have been approximately 6.9 mgd, the same level it was in FY 15 and FY 19.
- The annual average-day amount of water we pumped from reservoirs has declined substantially since peaking in FY 2002.
- Annual average-day raw water demands are now at the same level they were in the early-1990s, shortly after Cane Creek Reservoir was placed into service. This has occurred despite over a 60 percent increase in the number of customer accounts during that period.
- Key factors in the reduction in water withdrawal rates include:
  - Increased water use efficiency and conservation by our customers;
  - Conservation pricing and conservation ordinances, including year-round restrictions;

- Implementation of a process water recycling system at the drinking water treatment plant (2002), which reduced annual average-day raw water withdrawals by about seven percent;
- Implementation of the reclaimed water system in partnership with UNC (2009), which now meets over eleven percent of the community's annual average-day water needs.
- Higher density development which typically results in lower per capita demands.
- OWASA is updating its Long-Range Water Supply Plan (LRWSP), and Figure 4 shows the updated raw water demand projections developed as part of that project. Because we know that there is a lot of uncertainty when projecting growth and water demands 50 years, we developed a range of projections as shown by the grey lines in Figure 4; these represent the 1<sup>st</sup> and 99<sup>th</sup> percentile projections that resulted when we varied assumptions and ran the model 5000 times.
- We anticipate that OWASA's current and planned locally-controlled water supply sources will meet most customer demands through the next thirty to forty years and under most circumstances over the next 50 years.
- We anticipate that Jordan Lake, an alternative source, and/or additional demand management measures are expected to be needed to reduce risk to acceptable levels.

### **Regulations**

Regulations concerning our raw water supply are described in the Source Water Protection section.

### **Technology and Research**

Information on technology and research concerning our raw water supply is included in the Source Water Protection section of this report.

### **Energy Management**

As shown in Figure 5, total kilowatt-hours (kWh) of electricity used to pump our raw water to the treatment plant was 13 percent less in 2018 than in 2010. Energy use for raw water pumped increased between 2016 and 2017, and again between 2017 and 2018. This increase is a result of providing the City of Durham with over 495 million gallons of finished drinking water (120 million gallons in 2017 and another 375 million gallons in 2018). OWASA provided this finished drinking water to the City of Durham at their request while they conducted maintenance on their two drinking water plants. 375 million gallons is equivalent to about two months of OWASA's typical demand. The additional energy required to pump an additional 375 million gallons of raw water increased our energy use for raw water pumping by an estimated 464,000 kWh. Without this additional demand, our energy use to pump raw water to the treatment plant would have been 29% less in 2018 than in 2010.

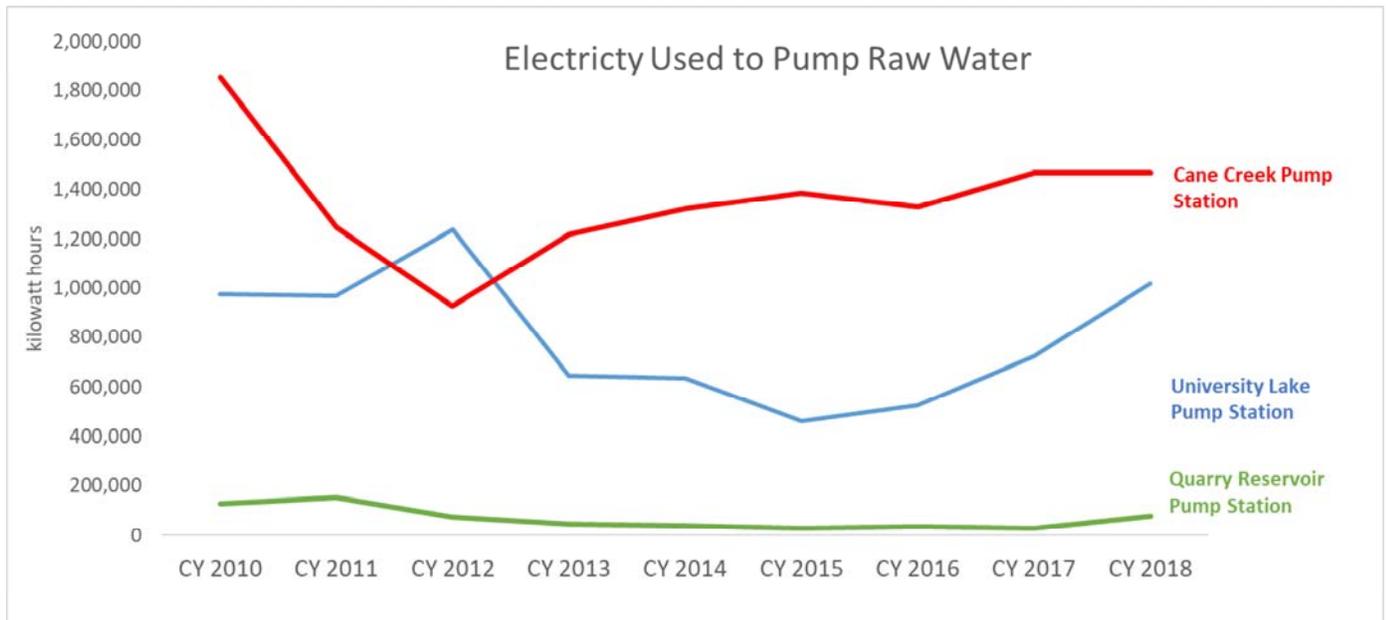


Figure 5. Electricity Used to Pump Raw Water

The 2019 Energy Management Plan Update identified three upcoming Capital Improvement Projects that have potential to further decrease the amount of energy used for raw water pumping: University Lake Pump Station Improvement project (270-11; expected completion date in FY 2020), the Cane Creek Raw Water Transmission Main study (271-05; expected completion date in FY 2021), and the Cane Creek Pump Station Improvement project (270-16; expected completion date in FY 2023).

### Strategic Plan Elements

This trend is directly related to updating the LRWSP, Strategic Initiative 1. Updating the LRWSP will also engage the community (Strategic Initiative 2), and the technology of advanced metering infrastructure (AMI, Strategic Initiative 5) may help detect and address leaks sooner which would reduce raw water demand. It also is related to Strategic Initiative 3 in that we want to invest in any new water supply at the right time to sustain the community's drinking water supply.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. In future years, update calculations to estimate yield and estimate raw water demand projections when warranted (e.g., when new drought of record occurs [impacts yield], service area boundaries change, local governments or UNC revise growth projections).	Review when warranted – likely every 5 to 10 years	X (as part of LRWSP update)	
2. Continue to proactively plan and account for uncertainty, including increasing climate variability, through a diversified water supply and demand management portfolio.	Ongoing – currently evaluating supply and demand management alternatives as part of LRWSP update	X (as part of LRWSP update)	
3. Continue to partner with neighboring utilities to evaluate a potential new intake and WTP on the west side of Jordan Lake.	Ongoing (Participated in Jordan Lake West Facilities Feasibility Study in 2015 and Economic Feasibility Study in 2018)	X	
4. Once we have a better understanding of the potential cost to ensure access to our Jordan Lake water allocation, review and reconsider the advantages and disadvantages of other feasible supply and demand management alternatives as part of update of the LRWSP.	Now through spring 2020	X (as part of LRWSP update)	
5. Identify potential energy savings opportunities for raw water pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	

## Quarry Reservoir Storage Volume

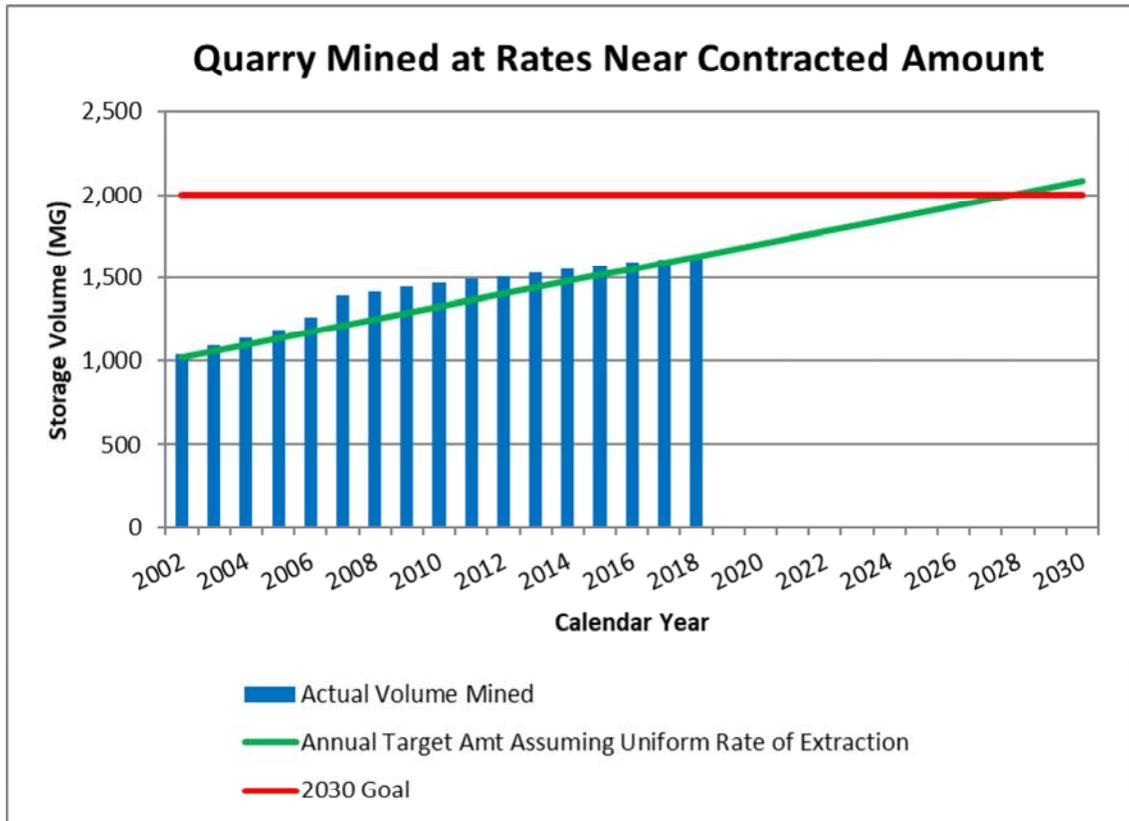


Figure 6. Quarry Mining Rates

**Description:** In accordance with an agreement with OWASA, Martin Marietta (formerly American Stone Company) is mining rock from OWASA-owned land adjacent to our Quarry Reservoir. Per that agreement and the requirements of Orange County’s Special Use Permit that authorized expansion of the quarry, mining operations must cease by 2030, after which OWASA will begin to fill the expanded quarry with water. Martin Marietta is required to remove enough stone to ensure the expanded quarry (including OWASA’s existing Quarry Reservoir at 0.2 billion gallons (BG)) will store at least 2.2 BG of water. This trend evaluates whether the quarry is being mined at rates which will meet that minimum water storage capacity requirement.

**Key Observations:**

- The quarry is being mined at rates which meet the contractual requirements.

**Regulations**

There are no regulations to report for the quarry. However, OWASA will perform microbial monitoring on the expanded Quarry Reservoir as soon as it is put into service, and DEQ may need to approve it as a water supply source. Staff is in the process of conducting LT2 monitoring of the Quarry Reservoir.

## Technology and Research

There are no updates in technology to report for the quarry.

## Energy Management

The existing Quarry Reservoir is used only during extreme droughts or other emergencies. We periodically test the pumps to ensure they are ready in time of need. As a result, our energy use at the Quarry Reservoir is negligible (see Raw Water Supply and Long-Range Water Supply Plan trend).

## Strategic Plan Elements

The Quarry Reservoir is an essential part of OWASA's water supply portfolio and is tied to Strategic Initiative 1, "Provide reliable and high quality supply of water for the next 50 years".

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor the annual rate of rock excavation at the quarry to ensure contractual requirements are met.	Annual		X
2. Maintain and follow the Quarry Reservoir implementation checklist in order to ensure timely implementation of the Quarry Reservoir water storage project once mining ceases in 2030.	Ongoing		X
3. As part of LRWSP update, evaluate the benefits and costs of various Quarry Reservoir alternatives (e.g., developing permanent pump station to withdraw deeper water).	4 <sup>th</sup> qtr CY 2019 – early CY 2020	X <small>(as part of LRWSP update)</small>	
4. Begin draining existing Quarry Reservoir to enable Martin Marietta to connect the current mine site with the existing Quarry Reservoir.	CY 2025		X

# Water Treatment Plant: Peak-Day Drinking Water Demands

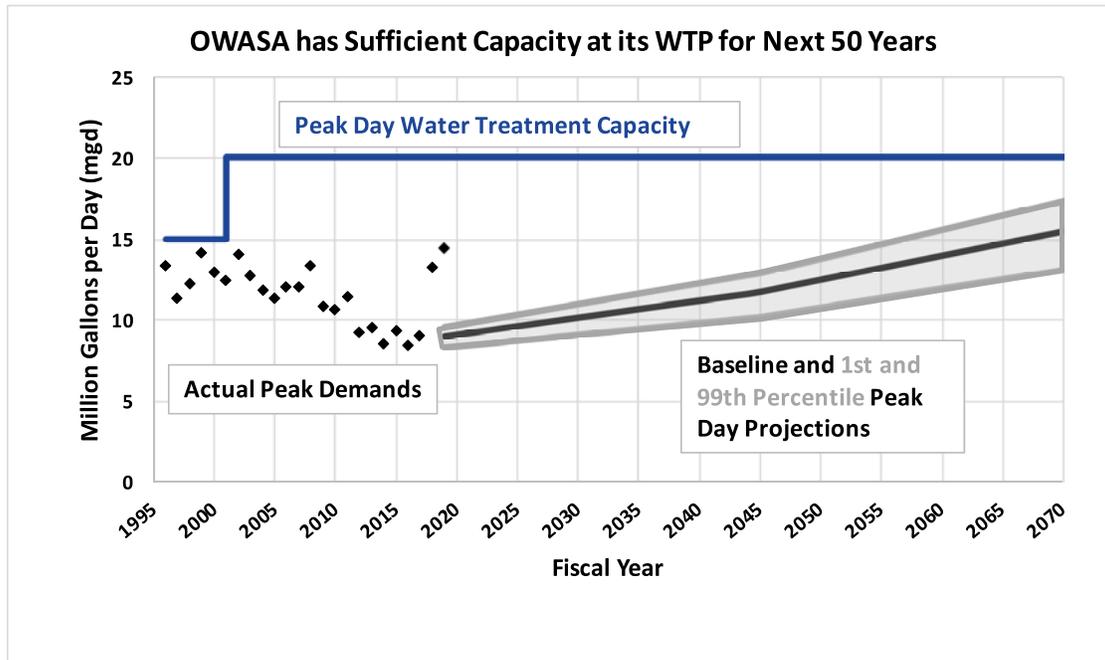


Figure 7. WTP Capacity and Peak Day Drinking Water Demands

**Description:** This trend evaluates peak-day drinking water demands and compares those demands to the 20 mgd rated capacity of the Jones Ferry Road Water Treatment Plant (WTP).

**Key Observations:**

- There was a significant increase in peak day drinking water demands in FY 2018 and FY 2019 compared to the recent past. OWASA provided drinking water to Durham while they had one WTP offline in FY 2018 and were making improvements at their second WTP; we provided some water to Durham in FY 2019 as well. The reason for the increased peak day in FY 2019 was the water main break on November 5, 2018. If OWASA had not had the main break, our peak day demand would have been 8.6 mgd, comparable to earlier years.
- Since FY 1999, the year with the highest peak-day demand, peak-day drinking water demands have declined by 39 percent (when accounting for the water main break) despite a 31 percent increase in customer accounts over that same period.
- This decline has resulted from the following primary factors: (1) our customers are using water more efficiently, (2) we have adopted conservation pricing and conservation ordinances including year-round water use restrictions, and (3) since March 2009, reclaimed water has been used instead of drinking water to meet certain non-drinking water needs at several UNC facilities that have high summer season demands (cooling towers and irrigation).
- The peak day drinking water demands indicate that we have adequate capacity in our WTP for the next 50 years even when accounting for uncertainty in our demand projections.

(NOTE: The observations presented above assume that the reclaimed water system is in service throughout the peak-day demand season. Peak-day drinking water demands would be considerably greater if the reclaimed water system is out-of-service.)

## Regulations

- The 1996 amendments to the federal Safe Drinking Water Act require that monitoring be completed for a list of unregulated contaminants every five years. EPA will use the data collected to determine if any of these contaminants should be regulated. In May 2012, EPA published the rule to complete the third round of this monitoring (UCMR3); monitoring was staggered among facilities and all monitoring was completed by December 2015 with all results reported to EPA by summer 2016. OWASA participated in the Assessment Monitoring of 21 contaminants under the UCMR3 and completed monitoring in August 2014. Some larger utilities also monitored other emerging contaminants such as human and veterinary hormones. [OWASA UCMR3](#) monitoring results consistently detected the following three unregulated contaminants: Chromium-6, Strontium, and Chlorate (see next bullets). In December, 2016 the EPA published the rule for the 4<sup>th</sup> round of this monitoring (UCMR4) requiring monitoring for 30 parameters including cyanotoxins, pesticides, and disinfection by-products. UCMR4 monitoring is occurring between 2018 and 2020. OWASA began monitoring in August 2019.
- EPA has set the maximum contaminant level (MCL) of total chromium (i.e., all forms of chromium) at 100 µg/L but has not yet published a drinking water standard for Chromium-6. The State of California adopted a Chromium-6 MCL of 10 µg/L, which became effective on July 1, 2014; but on May 31, 2017 the Superior Court of Sacramento County issued a judgment invalidating the MCL and ordering the State to adopt a new MCL. During the UCMR3, OWASA's monitoring for Chromium-6 detected levels between < 0.03 - 0.06 µg/L, which are well below the now invalid California standard. OWASA and other members of the TAWSMP identified Chromium-6 as a focus area for the current phase of water supply monitoring (see Source Water Protection section for a brief overview of the TAWSMP). As such, the US Geological Survey collected bi-monthly samples in our raw water supply beginning in August 2017. This monitoring was discontinued in August 2019 due to the very low number of detects and decision of the group that the resources could be better allocated. Analysis of data are ongoing.
- EPA has not yet published a drinking water standard for Strontium, but has established a health advisory level of 1,500 µg/L. A health advisory level is a non-enforceable, non-regulatory federal guidance which describes the concentration which can be consumed with little or no risk to health. OWASA's monitoring for Strontium detected levels between 53 - 75 µg/L, well under the health advisory level.
- EPA has not yet published a drinking water standard for Chlorate. The health advisory level for Chlorate is 210 µg/L. OWASA's monitoring for Chlorate during UCMR3 detected levels between 160 – 650 µg/L. The State of California has not set an MCL for Chlorate but has set a notification level of 800 µg/L. The World Health Organization (WHO) guideline for Chlorate is 700 µg/L. Chlorate is known to occur in drinking water as a result of the disinfection process and as a result of sodium hypochlorite (bleach) degradation. Concentration, long storage times, and temperature all

contribute to the degradation of sodium hypochlorite. Following UCMR3, OWASA changed the concentration and reduced storage times of our bulk sodium hypochlorite. OWASA completed a two-year study to test the Chlorate levels of our treated drinking water leaving the WTP and in the distribution system quarterly since implementing these changes and Chlorate levels have decreased by an average of 64 percent compared to levels measured as part of UCMR3. OWASA will continue to follow this issue to ensure its drinking water continues to be safe for its customers.

- EPA has not yet published a drinking water standard for Perchlorate, but in June 2019 published a notice of proposed rulemaking seeking public comment on a proposed MCL and maximum contaminant level goal (MCLG) of 56 µg/L as well as three alternative regulatory options (18 µg/L, 90 µg/L, and withdrawal of the agency's 2011 determination to regulate perchlorate). Based on litigation involving the Natural Resources Defense Council, there is a court-ordered deadline to have a standard by December 2019; EPA recently filed a motion seeking a six-month extension of that deadline. The EPA health advisory for Perchlorate is 15 µg/L, effective October 2008, and California adopted a standard of 6 µg/L, effective October 2007. Massachusetts adopted a drinking water standard of 2 µg/L. OWASA has tested for Perchlorate several times. Perchlorate was not detected in samples collected in 2001-2 as part of UCMR1, but the detection limit was 4 µg/L. In 2011, the level of Perchlorate was 0.33 µg/L in the finished water and in 2019 the level was below the detectable level of 0.05 µg/L in the finished water, well below the proposed regulatory limit and alternative limits as well as the advisory level and California and Massachusetts standards.
- PFAS are a family of compounds containing fluorine and carbon. In 2016, EPA published a new lifetime health advisory for two of these compounds, Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS), of 0.07 µg/L for a combined concentration of PFOA and PFOS in drinking water. This level of 0.07 µg/L was set to protect the most sensitive populations over a lifetime of exposure to the two contaminants. OWASA monitored for these substances in our treated drinking water as part of UCMR3; PFOA concentrations ranged from <0.02 µg/L to 0.03 µg/L, and PFOS was not detected. OWASA subsequently tested all our water supplies and our treated drinking water for a suite of PFAS in 2018. In light of these results, OWASA is continuing to sample our treated drinking water and raw water from Cane Creek Reservoir quarterly in 2019. Our use of powdered activated carbon in our treatment process remains effective at removing some but not all of these compounds. Levels of PFOS and PFOA remain well below the health advisory level. The EPA has committed to making a regulatory determination for these two compounds by the end of 2019.
- OWASA has historically met all disinfection by-product criteria applicable to finished drinking water provided to our customers. Monitoring data indicates that we should continue to meet any criteria developed for disinfection by-products. Additionally, two groups of currently unregulated disinfection by-products are included in UCMR4.
- Cyanotoxins are toxins produced by cyanobacteria (also sometimes called blue-green algae) under certain conditions. These toxins can be harmful to the environment, animals, and human health; one was responsible for the City of Toledo's "Do Not Use" warning in summer 2014. In June 2015, EPA issued health advisories for two cyanotoxins: microcystin (1.6 micrograms per liter [µg/L] for children 6 and up and adults and 0.3 µg/L for children less than 6 years old) and cylindrospermopsin (3.0 µg/L for children 6 and up and adults and 0.7 µg/L for children less than 6 years old).

Establishing a monitoring program and benchmarks for when source and/or finished water should be analyzed for toxins provides a solid foundation for a cyanotoxin management approach. OWASA has proactively been monitoring algal cyanotoxins since 2007 in our finished drinking water using a contract laboratory when our cyanobacteria counts rise above 100,000 units/mL in the blend of University Lake and Cane Creek Reservoir being treated. Additionally, beginning in the summer of 2016 staff began monitoring cyanotoxin levels at the intakes and through the treatment process on a weekly basis to gather baseline data on occurrence and removal. To date, OWASA has not exceeded the health advisory levels in our finished drinking water. In addition to microcystin and cylindrospermopsin, OWASA also monitors for anatoxin-a. Staff will continue to evaluate algal toxins (additional information provided in Treatment Technology section). OWASA will be required to monitor for some cyanotoxins as part of UCMR4 beginning in April 2020.

- Manganese is being monitored as part of UCMR4 and may be regulated in the future. At this time, there is a secondary MCL, which is based on aesthetic concerns such as taste and discoloration not health effects, of 0.05 mg/L. Additionally, there is a non-regulatory 10-day health advisory limit (based on short-term exposure for infants) for manganese of 0.3 mg/L. OWASA has tested annually for manganese and results are consistently below the detection limit of 0.01 mg/L. Manganese does occur naturally in our reservoirs and the levels can be quite high. Because there are high levels in our source water, it would be possible for our treated water to exceed regulations. However, our treatment process is effective at removing this metal. Manganese is insoluble in its oxidized form. Both permanganate and chlorine are strong oxidants that help remove manganese from our water during the treatment process.

### **Technology and Research**

- In 2017, there were several incidents where OWASA's drinking water had taste and odor issues. While taste and odor compounds in the drinking water are not harmful, they are not pleasant. OWASA purchased and started using a gas chromatograph/mass spectrometer in March 2019 which enables staff to test for the compounds in-house and receive results the same day or next morning. This has enabled us to swiftly adjust our treatment in response to higher levels of taste and odor compounds in our reservoir thereby assuring aesthetically pleasing drinking water for our customers. This equipment will also be useful for screening for other compounds of emerging concern.
- OWASA evaluates the treatment technologies at our WTP to ensure we can meet any potential upcoming standards with current treatment technologies. OWASA can meet most of the potential standards discussed in the Regulations section. Staff continues to follow on-going research on this topic to ensure safe drinking water for our customers.
- Staff periodically evaluate the chemicals we use at the plant to ensure we are using the best available in terms of meeting our treatment goals in the most sustainable manner as well as to ensure that we do not foresee shortages in chemicals we use which could impact treatment or their price. At this time, staff believe we are using the correct blend of chemicals and no shortages are foreseen in their supply.

## Energy Management

In 2018, we used five percent less electricity at the Jones Ferry Road Water Treatment Plant (WTP) than we did in 2010. As with the energy use for raw water pumping, we used more electricity than we would have because we treated and pumped an additional 375 million gallons of treated drinking water for the City of Durham. Ultimately, this increased our use of electricity by over 213,000 kWh in 2018.

Without this additional water demand, we would have used 11 percent less electricity at the WTP than in 2010. This is in large part due to the conservation and efficiency of our customers, as well as UNC's use of reclaimed water. In addition, in early 2018, we completed an almost complete retrofit of all lighting to LED technology.

Natural gas is used at the WTP to heat buildings, and our use of natural gas is largely driven by weather. The use of natural gas (therms) was about five percent higher in 2018 than it was in 2010, largely attributable to weather and operational changes.

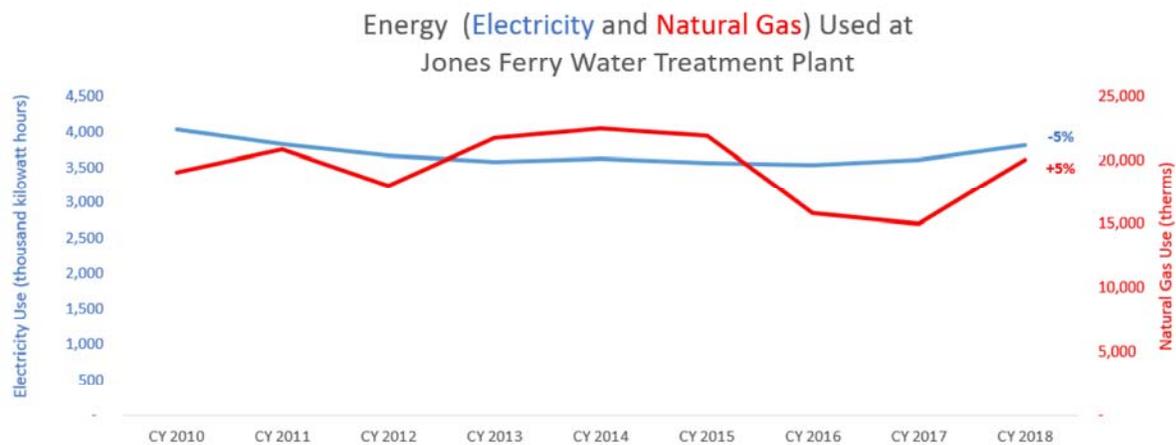


Figure 8. Energy Use at the Jones Ferry Road WTP

## Strategic Plan Elements

Strategic Initiative 1 includes preparing a Water Conservation Plan. Conserving water will help reduce peak day and average day demands. Ultimately, the Water Conservation Plan will serve as a compilation of water conservation strategies identified in three separate OWASA plans:

- Strategies that effectively and efficiently delay or prevent the need for supply side expansion in order to meet the demands of a growing community (as evaluated and identified in the forthcoming Long-Range Water Supply Plan)
- Strategies that extend limited water supplies in times of drought (as identified in the Water Shortage Response Plan)
- Strategies that promote a community-wide water conservation ethos (as identified in the Strategic Communications Plan)

In addition, Strategic Initiative 3 includes a goal to invest at the right time in our community’s water assets. Understanding the capacity of our WTP, the demands placed on it, and the potential implications of future treatment requirements will inform our CIP.

**Actions Needed**

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor peak-day demands at the Jones Ferry Road WTP and identify cost-effective practices that could be implemented to further reduce peak-day demands.	Underway	X (as part of LRWSP)	
2. Continue to identify and pursue cost-effective opportunities for additional conservation or reclaimed water use, which help reduce peak demands.	Underway	X (as part of LRWSP)	
3. Continue to monitor potential growth in our service area by working closely with Carrboro, Chapel Hill, and UNC to ensure we have sufficient drinking water treatment, pumping and storage capacity.	Ongoing		X
4. Continue to monitor our water and stay current with the potential new drinking water standards to ensure we can meet future requirements. Identify any studies or technologies needed to ensure we provide safe, high quality drinking water to our customers.	Ongoing		X
5. Continue to monitor treatment technologies and chemical use for potential to improve our level of service.	Ongoing		X
6. Identify potential energy savings opportunities for water treatment and pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	
7. Maintain certification by Partnership for Safe Water (see chapter on “OWASA’s Planning Environment”) for Phase IV Excellence in Water Treatment	Ongoing		X

## Cumulative Number of Water Meter Equivalents (MEs)

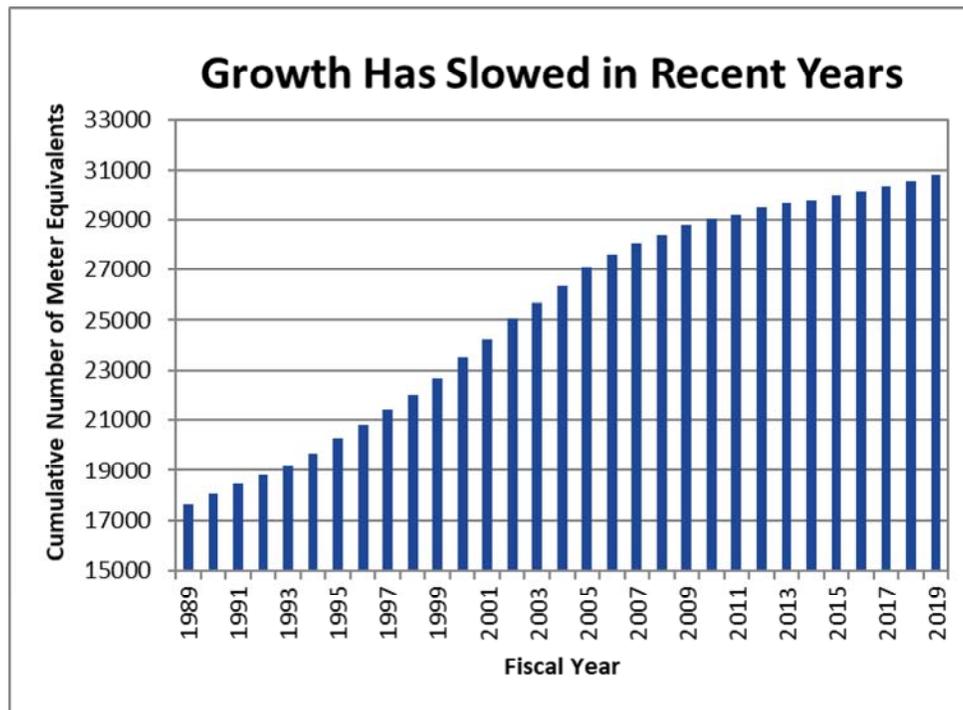


Figure 9. Number of Meter Equivalents Served by OWASA

**Description:** This trend evaluates the number of meter equivalents (MEs) served by OWASA. The smallest meters (5/8-inch) serve single family homes and small non-residential customers, while larger meters are used to serve locations with larger water demands. The capacities of larger meters are expressed in hydraulic capacity proportional equivalents of a 5/8-inch meter, or “meter equivalent”. (For example, a 2-inch meter has a meter hydraulic capacity ratio of 8 MEs, and a 6-inch meter has an equivalency of 50 MEs.) The number of meter equivalents is an indicator of the potential rate of growth in customer demands the service area.

### Key Observations

- Growth in the service area is slower in recent years than in past.
- The number of meter equivalents has grown 36 percent since FY 1999, the year with our highest peak-day drinking water demands (see Peak-Day Drinking Water Demands Trend).

### Regulations

There are no regulations to report for meter equivalents.

### Technology and Research

There are no updates in technology to report for meter equivalents.

## Energy Management

There is no energy use to report for meter equivalents.

## Strategic Plan Elements

Understanding how growth is occurring in our service area allows us to plan for our water supply needs and treatment and conveyance capacity needs (as well as our wastewater collection and treatment capacity needs). These are related to Strategic Initiatives 1 (provide reliable and high quality supply of water for next 50 years) and 3 (adopt budget decision processes to ensure affordable services).

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor growth in service area by tracking new meter equivalents.	Monthly (for Dashboard report)		X

## Drinking Water and Reclaimed Water Sales

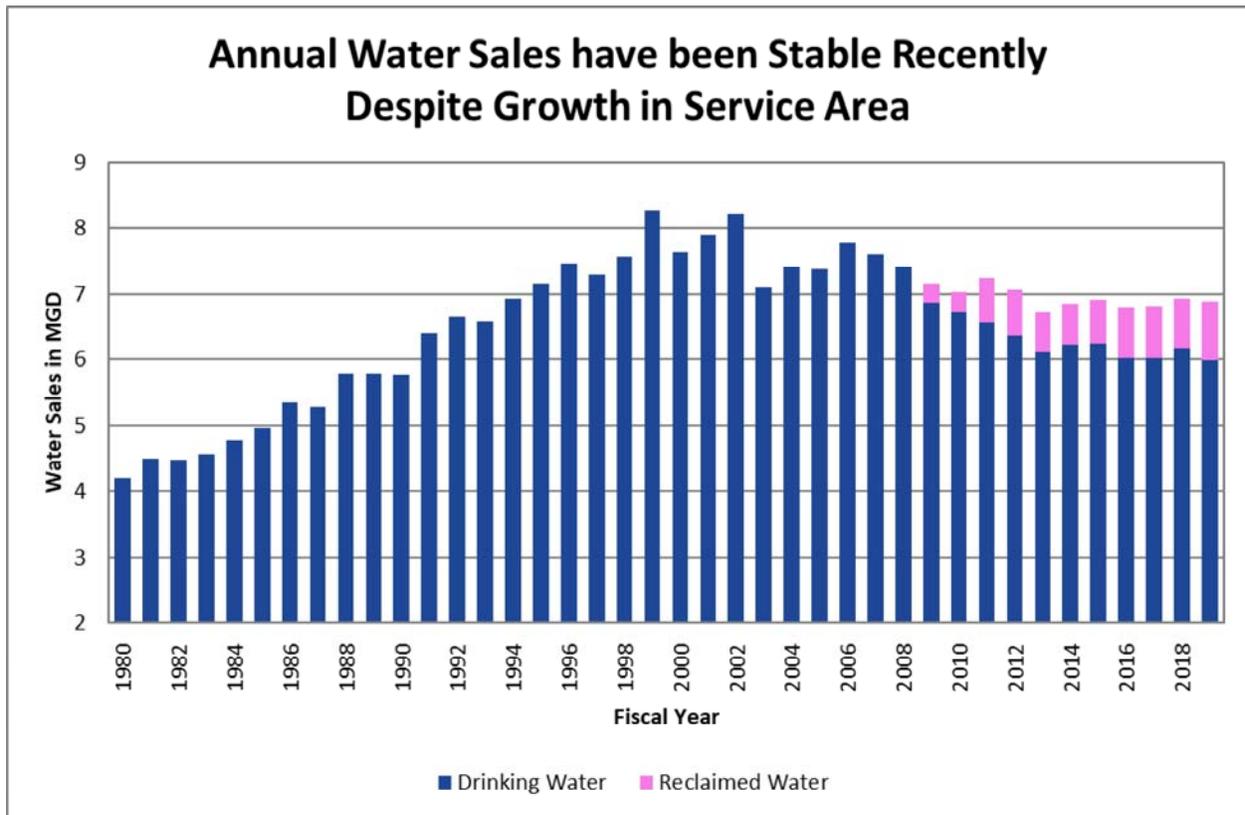


Figure 10. Annual Water Sales

**Description:** This trend evaluates average-day sales of drinking water and reclaimed water (in mgd) since 1980. (The reclaimed water system began operating in March 2009.)

### Key Observations:

- OWASA's annual average drinking water sales have declined despite growth in the service area as shown in the Meter Equivalents trend. Drinking water sales are currently at about the same level they were 30 years ago.
- Total annual water sales (including reclaimed water) are 17 percent less from when they peaked in FY 1999, despite a 31 percent increase in customer accounts during that same time period. Drinking water sales declined 28 percent over that same period.
- Reclaimed water sales met over 11 percent of the community's water needs in FY 2019.

### Regulations

There are no regulations to report for drinking water sales. For regulations on reclaimed water, see Reclaimed Water section.

## Technology and Research

In accordance with Strategic Initiative 5, OWASA installed advanced metering infrastructure (AMI) with early leak detection. Since May 1, 2019, the Agua Vista Web Portal has provided alerts of over 4,000 potential leaks. Of those notifications, customers have confirmed leaks in 460 instances. In these cases, leaks were repaired within about a week of starting. The average leak was 69 gallons per hour. If allowed to continue for 35 days until a customer received a bill, each one of these leaks would have wasted tens of thousands of gallons. If these trends continue, the early leak notification services provided by AMI will help avoid a measurable, but modest amount of wasted water use.

## Energy Management

Energy used to pump drinking water is shown in the Peak-Day Drinking Water Demands section.

## Strategic Plan Elements

The Water Conservation Plan or demand management strategies evaluated in the update to the LRWSP (Strategic Initiative 1) may result in reduced drinking water sales. This in turn would impact revenue, which would be addressed through the financial management policies included in Strategic Initiative 3. Financial reserves help OWASA meet its financial obligations during times of reduced water sales such as may occur during drought conditions.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to identify cost-effective opportunities to expand the reclaimed water system which will help reduce our community's risk to drought, extend the capacity of the WTP, and optimize the use of our locally-controlled water supplies.	As opportunities arise; also evaluating some options as part of LRWSP update (early CY 2020)	X (as part of LRWSP update)	
2. Continue to identify cost-effective and customer-accepted opportunities for additional conservation.	Ongoing	X (as part of LRWSP update)	
3. Continue to monitor potential growth in our service area by working closely with Carrboro, Chapel Hill, and UNC to ensure we have adequate water treatment capacity for the future.	Annual with ongoing communication		X

# Average Monthly Water Use and Billed Amount

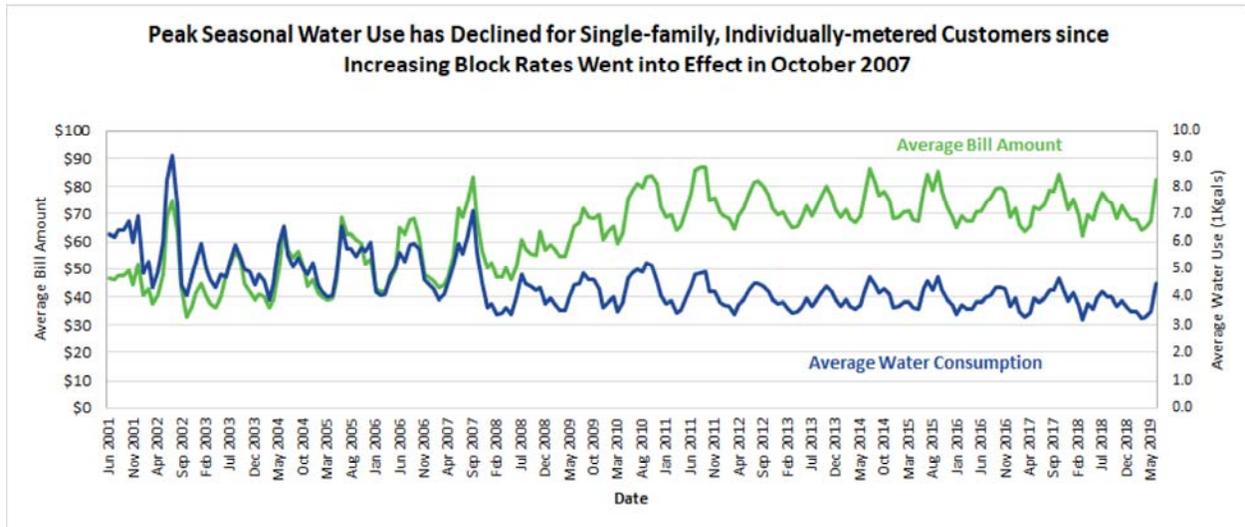


Figure 11. Single Family Residential Water Use

**Description:** This trend evaluates average monthly water use and the average monthly water and sewer charges for single-family, individually-metered residential customers.

## Key Observations:

- Peak seasonal water use by this group of customers has declined, particularly after OWASA’s increasing block rates went into effect in October 2007. This indicates that outdoor water use for single-family, individually-metered residential customers has diminished and implies a relationship with the change in our water rate structure.

## Regulations

There are no regulations to report for water use.

## Technology and Research

In accordance with Strategic Initiative 5, OWASA installed advanced metering infrastructure (AMI) throughout our service area. AMI allows OWASA and our customers to detect leaks earlier and is likely to have a measurable, but modest impact on overall system demand.

## Energy Management

Energy used to pump drinking water is shown in the Peak-Day Drinking Water Demands section.

### Strategic Plan Elements

The Water Conservation Plan and demand management strategies evaluated as part of the LRWSP (Strategic Initiative 1) may result in reduced drinking water sales. This in turn would impact revenue, which would be addressed through the financial management policies included in Strategic Initiative 3. Financial reserves help OWASA meet its obligations during times of reduced water sales such as may occur during drought conditions.

### Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to track this trend to determine whether water use is increasing.	Annual		X

## Physical Interconnection Capacity and Average Annual WTP Demands

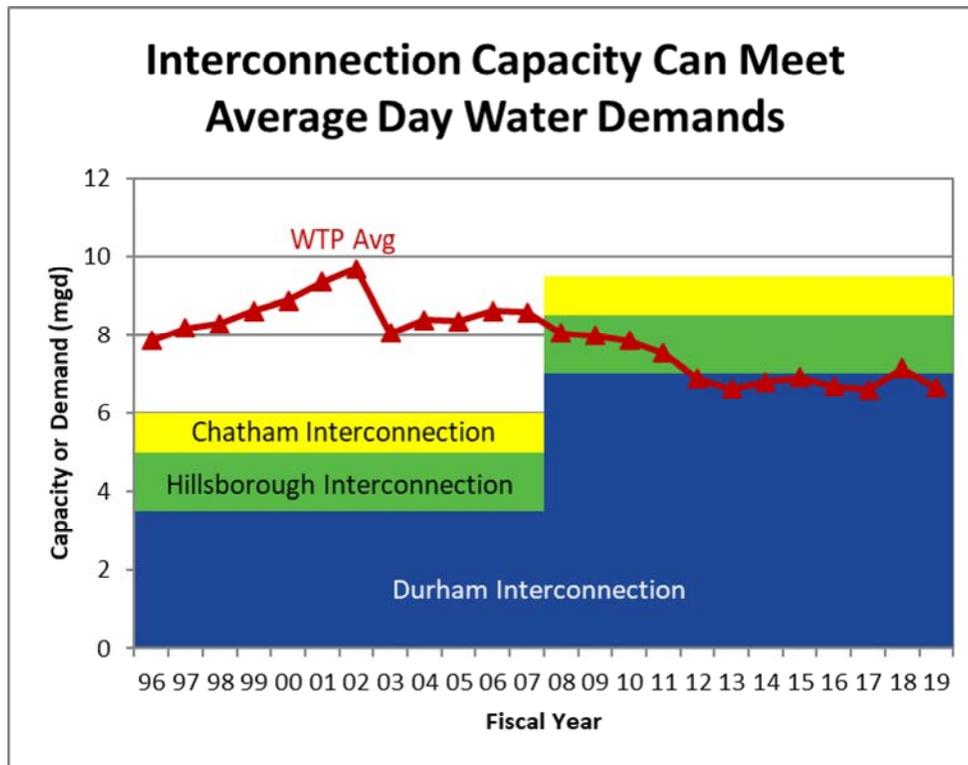


Figure 12. OWASA's Interconnection Capacity

**Description:** This trend evaluates the ability of OWASA's drinking water system interconnections with neighboring communities to meet average-day drinking water demands during planned or unplanned events that could affect our ability to treat and deliver water to our customers.

### Key Observations:

- OWASA's existing physical interconnections are of sufficient capacity to meet average-day drinking water demands.
- Our drinking water system interconnections with the City of Durham have a combined capacity of about 7 mgd.
- We can receive about 1.5 mgd through our interconnection with the Town of Hillsborough, which was confirmed during recent testing.
- OWASA also has an interconnection with Chatham County. OWASA can receive approximately 1 mgd through this connection based on modeling analyses; during the November 2018 water emergency we received approximately 1.3 mgd from Chatham County.

- The combined capacity of our interconnections is about 9.5 mgd, which is about 143 percent of our FY 2019 average-day drinking water demands and about 126 percent of our FY 2019 water demands including reclaimed water.

### Regulations

There are no regulations to report for interconnections.

### Technology and Research

There are no updates in technology to report for interconnections.

### Energy Management

Energy used to pump water at our interconnections is negligible under most conditions; however, it would increase considerably if, when, and in what amounts we are obtaining drinking water from a neighboring utility. In 2018, we provided 375 million gallons of water to Durham which flowed by gravity into their system. If that water had been returned, it would have had to be pumped into our system from Durham’s distribution system.

### Strategic Plan Elements

While Strategic Initiative 1 does not directly include operational emergencies, our interconnections help us meet our water supply needs for short periods if something happened to our raw water supply, treatment plant or distribution system.

### Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. OWASA should continue to monitor this trend to ensure that average-day drinking water demands could be met through water system interconnections with our neighboring utilities.	Annual		X
2. Re-evaluate the capacity of system interconnections to ensure changes in system facilities and demands have not adversely affected our ability to import an adequate supply of drinking water to meet average-day demands during an emergency.	Periodically as needed		X
3. Perform field tests on all interconnections to ensure proper operation, train staff, and confirm capacity.	Routinely, in coordination with utility neighbors		X
4. Continue to work with Triangle Water Supply Partnership to use regional interconnections model for planning purposes to improve regional reliability and resiliency.	Ongoing		X

## Drinking Water Distribution System Integrity

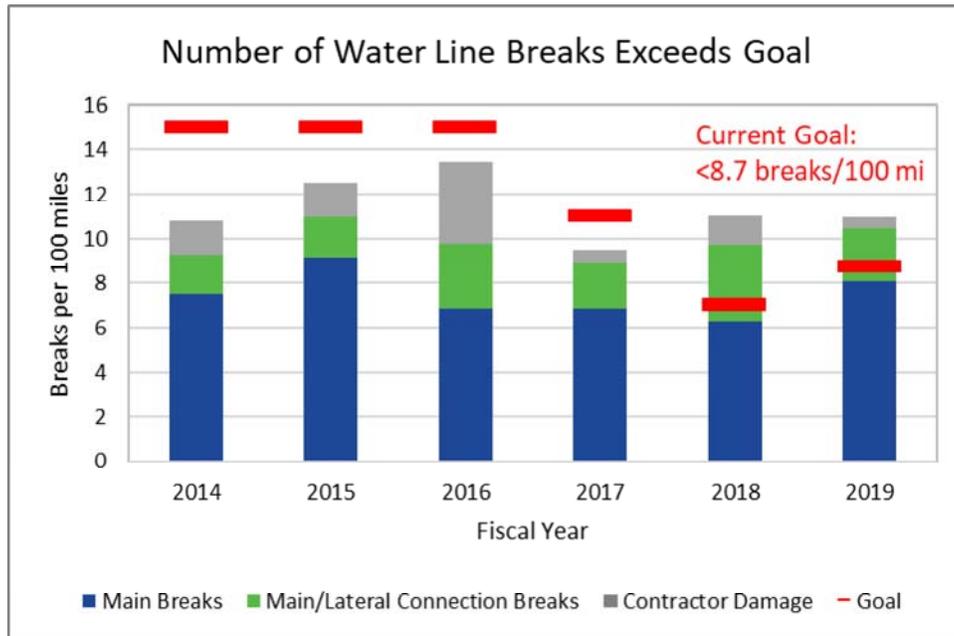


Figure 13. Historic Water Line Breaks

**Description:** This trend evaluates the number of water main breaks per 100 miles of water mains and connections with service lateral lines. These are important indicators of the integrity of our drinking water distribution system. It also includes information on lines damaged by contractors; while that metric does not impact the integrity of our water distribution system, there is an impact on our customers and thus we include contractor damage in this trend.

### Key Observations:

- We have had more water main breaks than our goal of 8.7 main breaks or less per 100 miles of pipeline, which is based on median of value included in the most recent American Water Works Association (2019) Benchmarking report. (Note: In prior reports we used goals of 11, 15, and 7 main breaks or less per 100 miles of pipeline based on earlier Benchmarking reports).
- OWASA experienced a water main break outside its Jones Ferry Road WTP on November 5, 2018 resulting in a system-wide do not use advisory. To improve the reliability and resiliency of our water system, OWASA is undertaking a major update of our risk-based water main prioritization model; collaborating with UNC, UNC Hospitals and other key stakeholders on resiliency solutions; inspecting all valves; and investing in rehabilitation and replacement projects through the capital improvements program.

## Regulations

Federal and State testing requirements require public water systems such as OWASA to test for lead in drinking water collected from customers' homes as part of the Lead and Copper Rule. Samples must be collected from homes that meet criteria set by the EPA; these criteria identify "high priority" homes that are most likely to have elevated lead levels. OWASA tests for lead in drinking water in 30 homes built from 1983 to 1985 that have copper pipes with lead solder every three years. In the previous four rounds of monitoring, we have had only one sample with a measurable level of lead and the result was below the regulatory limit. The most recent round of monitoring for lead and copper in the distribution system was completed September 30, 2017; only one sample had a measurable level of lead and the result was below the regulatory limit. The EPA will be publishing new draft lead and copper rules in the federal register shortly; staff is monitoring the proposed changes to ensure we will meet any new requirements. OWASA also provides testing of our drinking water for lead at no charge when requested by a customer.

## Technology and Research

Technologies exist to assess the condition of pipe, monitor system pressure and detect leaks. The ongoing Water Main Prioritization Study, in conjunction with the update of the risk framework for distribution system pipes, will evaluate the applicability of currently available technology and will develop a programmatic strategy for the optimal use of condition assessment technologies and procedures, system monitoring, and leak detection to help refine our understanding of system integrity and ultimately inform investment decisions about pipe replacement and other actions.

Due to the cost and complexity of performing assessments on in-service pressurized pipes, water main condition assessment is typically focused on pipes identified as high risk by a prioritization model. However, OWASA's options are limited due to the prevalence of asbestos cement (AC) pipe, which does not lend itself to non-destructive condition assessment technologies. The condition of AC pipe can only be assessed by removing sections of pipe and having those analyzed. Done as a standalone activity, this assessment process can be very costly, can disrupt service to customers, and runs the risk of degrading the integrity of the pipe. Therefore, we will likely be implementing an opportunistic condition assessment program that will capitalize on events where our pipes are exposed during construction activities or when repairing breaks and leaks. Pipe samples, soil samples, and corrosion potential measurements will be taken during these events and will inform a database of information staff can use to assess the general condition of adjacent pipes.

For metallic pipes, insertion of a camera is the simplest method; however, the resulting assessment is qualitative (i.e. good, fair, poor). Typically, a visual inspection does not provide sufficient information on pipe condition because it does not provide information on the strength of the pipe or on external conditions which may lead to pipe failure (e.g. external corrosion, bedding condition, or utility crossings). This method of assessment tends to cost more per linear foot and has a lower accuracy than other assessment methods.

Detecting leaks can help identify conditions that may cause breaks; however, not every leak will cause a break (i.e. complete structural failure) and not every break is caused by a leak. Furthermore, water loss is not a significant issue in our system, so identifying and repairing leaks will not appreciably reduce unaccounted for water. Leak detection tends to have a moderate cost and accuracy, relative to other technologies.

### Energy Management

As reported in the Peak-Day Drinking Water Demands section, over half of the energy used at the WTP is actually for pumping drinking water into the distribution system and for maintaining system storage levels to maintain pressure and meet peak demands. In addition, we use energy to pump finished drinking water into a higher pressure zone. Combined, these two uses of energy account for approximately 13% (2.2 million kWh) of the energy we used in 2018. Other energy is fuel for vehicles and equipment used to maintain our drinking water distribution system.

### Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Maintaining and replacing our infrastructure when needed enables us to maintain high levels of service to our customers over the long-term.

### Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Use OWASA’s water main prioritization model and risk framework to inform investment decisions for the condition assessment and rehabilitation of the drinking water distribution system.	Annual		X
2. Continue the programmatic replacement of aging galvanized water mains throughout the distribution system.	Through FY 2024		X
3. Update the prioritization model’s risk framework to account for current data sources and statistical trends in main break history.	Through FY 2020		X
4. OWASA inspected all critical and previously uninspected valves in CY 2019. Staff has a goal of inspecting all valves every four years and inspecting all critical valves annually.	Ongoing		X
5. Continue to fund our water main renewal/replacement program to ensure system sustainability.	Annual	X	
6. Develop risk mitigation and emergency response procedures with key customers such as UNC, UNC Hospitals for water supply resiliency.	Ongoing		X
7. Maintain Presidents Award status by the Partnership for Safe Water (see chapter on “OWASA’s Planning Environment”) for Distribution System Operation.	Ongoing		X

# Water System Audit

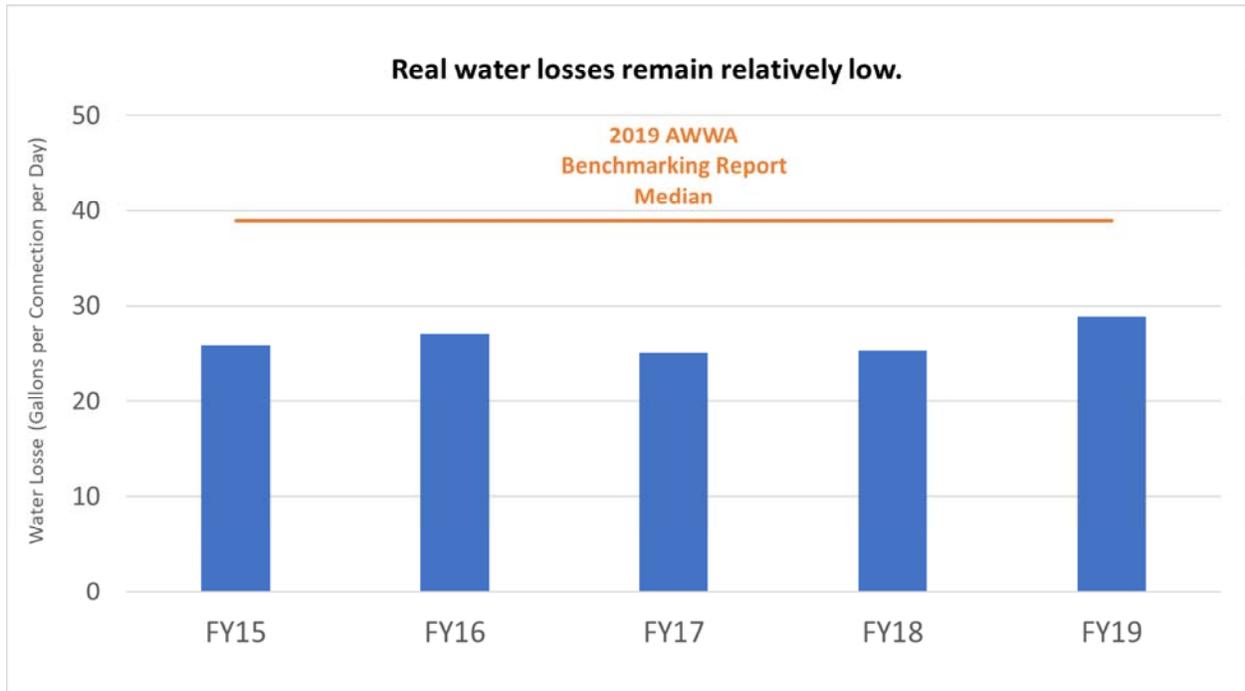


Figure 14. Historic Real Water Loss

**Description:** This trend evaluates the annual volume of water lost through leaks in the distribution system. Real loss is the difference between water supplied and authorized consumption; utilities also subtract out apparent losses associated with inaccuracies in metering, data errors, and estimated water theft.

### Key Observations:

- Although OWASA experienced a moderate increase in real water loss last year, our water loss remains less than other utilities. In years past, the median water loss for water utilities in Georgia (a state where all water providers that serve a population of 3,300 or more conduct annual, validated water system audits) was about 40 gallons per connection per day. The median water loss reported in this year’s AWWA Benchmarking survey was 38.87 gallons per connection.

### Regulations

There are no regulations to report for real water loss.

### Technology and Research

The Drinking Water Distribution System Integrity trend includes information on acoustic leak detection.

## Energy Management

Energy used to pump drinking water is shown in the Peak-Day Drinking Water Demands section.

## Strategic Plan Elements

Strategic Initiative 1 includes the development of a Water Conservation Plan, an important element of our updated Long-Range Water Supply Plan. Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Understanding the amount of water loss in our system helps make investment decisions. Maintaining and replacing our infrastructure when needed enables us to maintain high levels of service to our customers over the long-term.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Update water audit information	Annual		X

## Wastewater Collection System Integrity

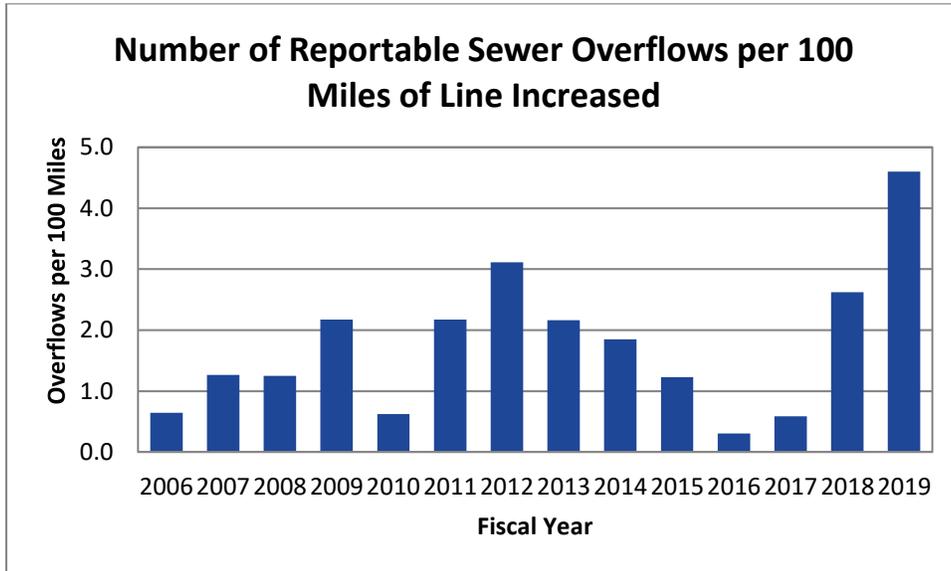


Figure 15. Historic Reportable Sanitary Sewer Overflows

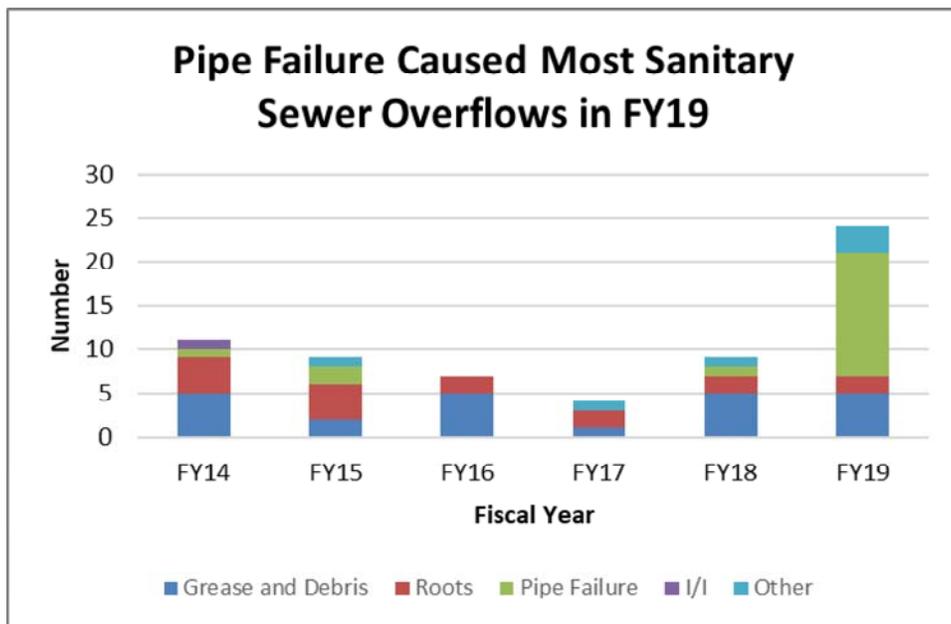


Figure 16. Historic Causes of All Sanitary Sewer Overflows

**Description:** This trend evaluates the number of reportable sewer overflows, which is an important indicator of the integrity of our wastewater collection system. It also evaluates the causes of all sewer overflows.

## Key Observations:

- On April 12, 2019, the Rogerson Drive Force Main which collects wastewater from a large portion of OWASA's service area broke near Raleigh Road during a heavy rain event. Several sanitary sewer overflows occurred as a result of the break over the next 36 hours. OWASA immediately began emergency repair activities, installed a temporary bypass to convey flow across Raleigh Road, constructed new pipe that resists corrosion, and built a parallel line under Raleigh Road that can be used as a bypass in case it is needed in the future.
- The number of overflows increased in FY 2019, but it should be noted that the Rogerson Drive pipe failure accounted for 14 of a total of 16 reportable sanitary sewer overflows. These overflows occurred as a result of our need to limit the pumping capacity at the station to manage the leak and address the failure in the force main. If we consolidate these overflows into a singular event, there would have been 0.86 breaks per 100 miles in FY 2019.
- The number of reportable overflows is more than 1.9 per 100 miles of pipeline, which is the national median per the American Water Works Association 2019 Benchmarking report. The 25<sup>th</sup> percentile in that report was 3.2 overflows per 100 miles of pipeline. Per DEQ guidance, OWASA strives to have no overflows. (Note: We used the median value of 2.7 per 100 miles of pipeline from the 2012 Benchmarking report in 2016 and prior Strategic Trends reports).
- In FY 2019, pipe failure was the primary cause of overflows, but this is due to the Rogerson Drive force main break. Typically, grease, debris, and roots are the primary causes of overflows; if you only counted one overflow for Rogerson Drive, the primary cause in FY 2019 would have been grease and debris. Reducing grease will require proactive, recurring education of our customers – especially those in the food service sector. Customers can also help minimize potential root intrusion by not planting trees near our sewer lines.

## Regulations

There are no upcoming regulations to report for our wastewater collection system.

## Technology and Research

- Advanced, automated flow measurement technologies are available for real-time monitoring of wastewater collection systems. These flow monitors may be connected to our SCADA system. When monitors indicate that water levels inside a pipe increase, it may be an indication that the line is blocked downstream or there is substantial inflow and infiltration (I&I) during rain events. Recent work with consultants on our hydraulic model has indicated that a permanent flow monitoring system may have merit in identifying areas susceptible to I&I. We intend to more thoroughly investigate the feasibility of such a system in the near future.
- Acoustic monitoring to detect sewer line blockages is available. A device sends a sound down a line to help find obstructions. A pilot test of this type of technology indicated that it was not yet reliable and cost-effective.

- Robotic Pipeline Monitoring and Maintenance Systems which can complete robotic inspections of pipelines are also being developed. This method is still in its early stages and still not cost effective to deploy throughout the collection system. Historically, this technique has been used by other utilities to assess the wastewater constituents rather than the pipeline condition.

### Energy Management

Wastewater is primarily conveyed through the force of gravity; however, wastewater pumping stations are necessary to transport wastewater when gravity flow is not possible. All of our wastewater pumping stations are powered by electricity, with diesel fuel or natural gas being used to power emergency standby generators when electrical service is unavailable. Electricity use by OWASA’s wastewater pumping stations has been relatively consistent over the last six years, with the Rogerson Drive Pump Station accounting for about 65 to 70 percent of the electricity used for collection system pumping.

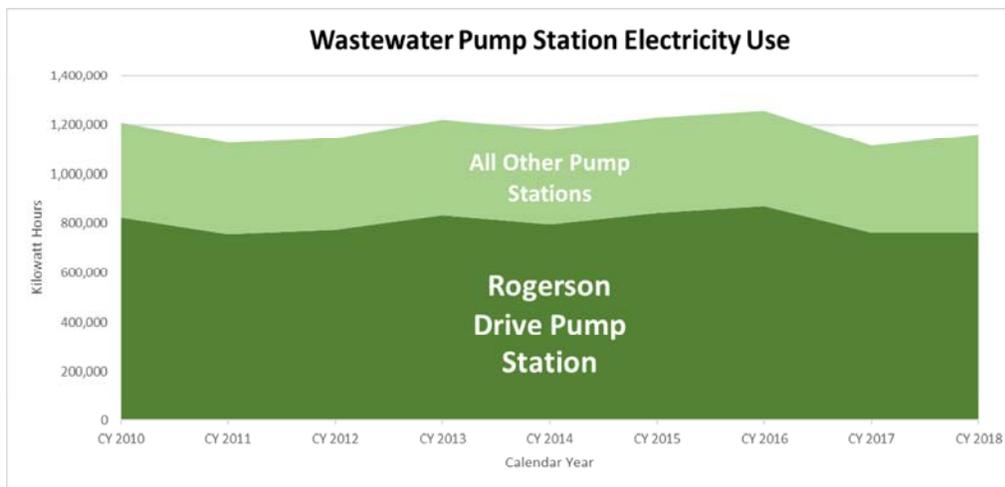


Figure 17. Wastewater Pump Station Electricity Use

### Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Maintaining and replacing our infrastructure when needed helps us meet the community’s wastewater needs.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to use the findings and recommendations from the 2011 Sewer System Master Plan and subsequent Sewer Evaluation Reports as a guide for prioritizing funding for sewer system evaluation, rehabilitation and replacement. Update the Master Plan's modeling efforts periodically as flow demand patterns change. The goal of these actions is to reduce inflow and infiltration.	Ongoing		X
2. Integrate the results of the sewer system modeling and field condition assessment work into the comprehensive asset management program so that the trade-offs of different capital improvements investment decisions can be consistently evaluated and prioritized.	Annual		X
3. Investigate the feasibility of installing flow monitoring equipment in the collection system to identify areas susceptible to I&I.	TBD depending on other priorities		X
4. Continue to inspect, clean, and rehabilitate our sewer lines and wastewater pumping stations as needed to prevent overflows, reduce infiltration and inflow, and ensure adequate capacity.	Ongoing		X
5. Continue to monitor and maintain sewer easements to ensure our equipment and personnel can access the sewer system for maintenance and repair work, and to ensure tree root intrusion into sewers is minimized and corrected.	Ongoing		X
6. Continue to educate the public on the importance of not pouring fats, oils and grease, medications, etc. down the drain and not flushing items other than toilet paper.	Ongoing		X
7. Continue to fund the sewer system renewal/replacement program and operations and maintenance activities to ensure system sustainability.	Annual	X	
8. Identify potential energy savings opportunities for wastewater collection in Energy Management Program	Ongoing	X (as part of Energy Mgmt Plan)	

# Mason Farm Wastewater Treatment Plant Maximum Month Flows

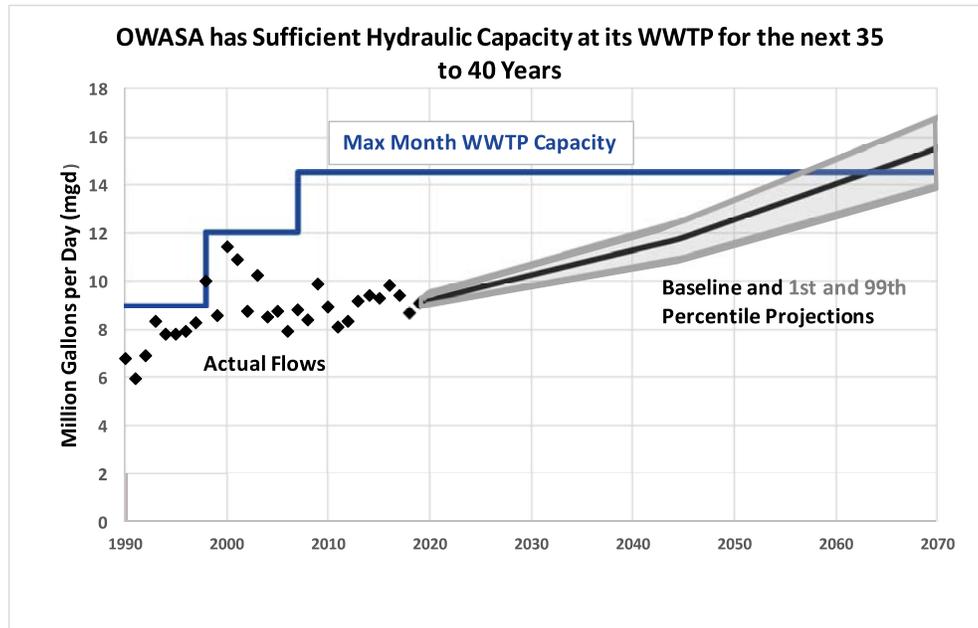


Figure 18. Mason Farm WWTP Capacity and Demands

**Description:** The Mason Farm Wastewater Treatment Plant (WWTP) has a permitted capacity of 14.5 mgd, which is the maximum average daily flow which can be treated in any given month. This trend tracks historical annual maximum month of flow and compares those against the permitted capacity of the WWTP.

## Key Observations:

- OWASA’s maximum month wastewater flows have declined from a peak of 11.5 mgd in FY 2000. This corresponds to reduced drinking water demands by our customers, as well as our continuing investments in the rehabilitation and replacement of sewer lines and manholes.
- In FY 2019, the maximum month flow was 9.1 mgd, which is about 63 percent of the WWTP’s permitted flow capacity.
- The projected maximum month flows indicate that we have adequate hydraulic capacity in our treatment plant for the next 35 to 40 years assuming inflow and infiltration rates do not increase.

## Regulations

- Important regulations pertaining to wastewater treatment are related to nutrient removal at the WWTP, which is described in the Mason Farm WWTP Nutrient Capacity section of this report.

- As mentioned previously in this report, PFAS are emerging compounds of concern. Drinking water and wastewater are not sources of PFAS. PFAS are present throughout the environment because they are highly persistent and have been widely used for decades, including in industrial applications, household and consumer products, food packaging, and firefighting foams. The North Carolina Division of Water Resources (DWR) is implementing several projects associated with emerging compounds. Studies were done in 2018 to characterize the presence of these compounds in various water supply reservoirs. The results from these studies indicated that the Cape Fear River Basin was of concern in the occurrence of these emerging compounds. An effort is underway to develop an overall management strategy to reduce the levels of these compounds in the Cape Fear River Basin. As part of this strategy, DWR is requiring utilities in the Cape Fear River Basin with significant industrial dischargers to begin investigative monitoring of their wastewater influent for PFAS. Depending on those results, utilities may be required to perform further monitoring to identify the potential sources of PFAS in their system. Once these sources are identified, the utility would be required to work with the dischargers to reduce/eliminate the PFAS compounds. While OWASA does not have any significant industrial dischargers, therefore not required to participate, we do believe it is important for us to know what is in our wastewater. OWASA completed initial investigative monitoring of our wastewater influent for PFAS throughout the Summer of 2019. These results are being evaluated and next steps are under development.

### **Technology and Research**

- Staff is beginning a CIP project to replace our gravity belt thickeners with rotary drum thickeners which thicken solids prior to anaerobic digestion. The rotary drum thickeners have two advantages: (1) better odor control which also extends the life of equipment in the solids thickening building and (2) better control of the solids concentration and reduced operating costs.
- Staff has completed implementation of a new Supervisory Control and Data Acquisition (SCADA) system with “high performance SCADA system design”. The high performance SCADA system simplifies the graphics on-screen to improve operators’ situational awareness of plant operations. It also enables the operators to look at and evaluate data in real time for a wide variety of plant information from the operators’ terminals without requiring any specialized programming, database management or outside assistance.
- Staff at the WWTP periodically evaluate the chemicals used at the plant to ensure we are using the best available in terms of meeting our treatment goals in the most sustainable manner as well as to ensure that we do not foresee shortages in chemicals we use which could impact treatment or their price. At this time, staff believe we are using the correct blend of chemicals and no shortages are foreseen in their supply.
- Staff is closely following advancements in technology and actual industry experience for resource recovery at the WWTP. This includes energy generation such as the biogas to energy alternatives being evaluated as part of the Energy Management Program, nutrient recovery for beneficial reuse, and direct and indirect potable reuse. Biogas recovery strategies are being evaluated as part of the

Energy Management Plan, and opportunities for greater reuse will be evaluated as part of the Long-Range Water Supply Plan.

### Energy Management

The Mason Farm WWTP is our largest energy-using facility. Since 2010, our electricity use at the WWTP has decreased by about 38 percent. This is largely attributable to a \$10.4 million capital improvement project that reduced electricity use, further reduced off-site odor releases, improved plant performance, and prepared us to meet future standards for treated wastewater quality. In 2018, our use of natural gas declined significantly because we restored our biogas-to-boiler system. Primarily natural gas is used mostly as a supplemental fuel for running the two boilers that heat anaerobic digesters for solids treatment. Methane – or biogas – is produced as a by-product of the digestion process, and under normal operations, is used as the primary fuel in our boilers at the plant. However, from 2015 through March 2018, we had to rely almost exclusively on natural gas to heat the boilers while two digesters and our gas storage unit were undergoing major rehabilitation. In restoring the biogas-to-boiler system in March 2018, we reduced our natural gas use at the WWTP by about 70,000 therms.

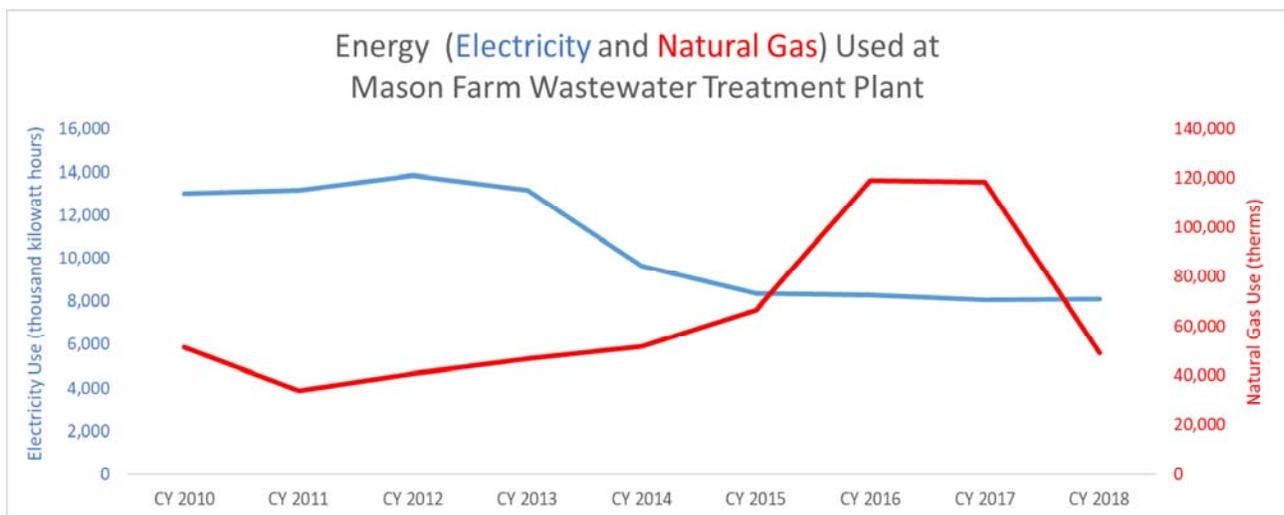


Figure 19. Energy Use at the Mason Farm WWTP

### Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our wastewater treatment capacity is adequate, and timing expansions properly, helps us meet the community’s wastewater needs.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor growth and development activity and projections in our service area by working closely with the Towns of Carrboro, Chapel Hill, and UNC to ensure we have adequate wastewater treatment capacity for the future.	Annually with ongoing communication		X
2. Continue to inspect, rehabilitate, and replace our sewer lines when necessary to reduce infiltration and inflow.	Ongoing		X
3. Identify potential energy savings opportunities for wastewater treatment and pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	
4. Complete Partnership for Clean Water (see chapter on "OWASA's Planning Environment") Phase III self-assessment process pursuant to Directors Award status for Excellence in Wastewater Treatment.	Ongoing		X

## Mason Farm WWTP Nutrient Capacity

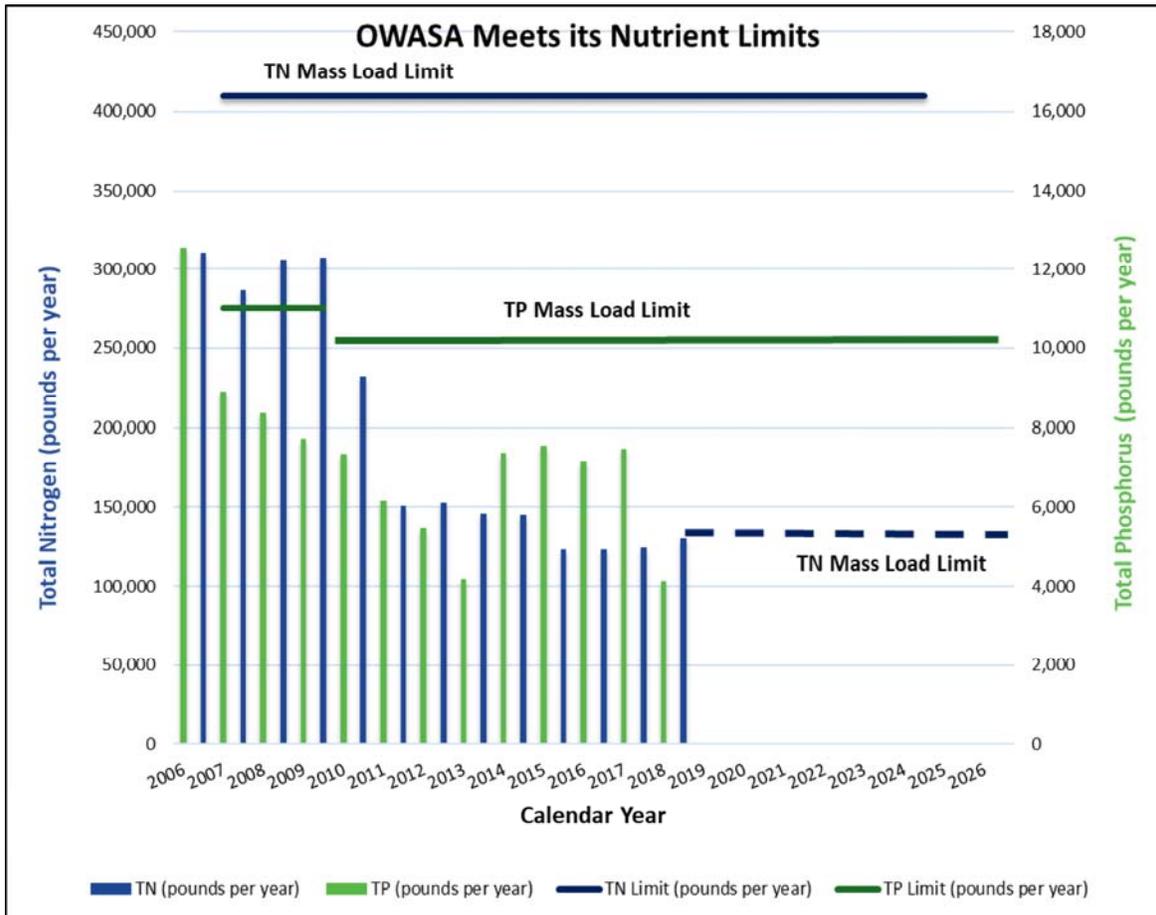


Figure 20. Mason Farm WWTP Annual Nutrient Loading

**Description:** The State’s Jordan Lake nutrient management rules require point sources to reduce their discharge of Total Phosphorus (TP) and Total Nitrogen (TN). OWASA has interpreted legislation along with feedback from DEQ that the new TN limit would apply in 2024. DEQ recently informed us that it will apply in 2019. OWASA is in communication with DEQ regarding the TN requirement, and the new TN mass load limit is shown as a dashed line in the figure to reflect the uncertainty in the permit date. We report nutrient loading on a calendar year basis rather than a fiscal year basis since our permit limits for TN and TP are on a calendar year.

**Key Observations:**

- OWASA has met its TP limit since the annual mass load limit was first incorporated into our permit in 2007. We expect to continue to meet the limit within the 20-year planning horizon without the need for additional major capital improvements for TP removal.

- OWASA better optimized its biological phosphorus removal process which is reflected in the decrease in TP in 2018.
- OWASA has consistently met its current TN limit, but we will have to operate our filters in denitrification mode and incur considerably greater energy and chemical costs to meet the more stringent limits whenever those go into effect. Installation of sidestream treatment facilities may reduce operating costs and energy use for TN compliance and have a positive payback compared to relying primarily on the denitrification in the filters at the WWTP.

## **Regulations**

The NC General Assembly enacted legislation (House Bill 97) that defers the effective date for implementation of more stringent TN mass load limits for WWTPs in the Jordan Lake watershed to 2021 or 2024. We recently received a letter from DEQ that indicated that the nitrogen limit would apply in 2019. OWASA is in communication with DEQ regarding the permit compliance date. As part of OWASA's participation in the Partnership for Clean Water, OWASA will be trying to meet 95 percent of the nutrient limits that will be in effect. Staff will continue to closely follow Jordan Lake nutrient issues, and we will inform the Board if any changes are needed in the timing or scope of major anticipated capital or operational improvements required to ensure compliance with the new limit.

## **Technology and Research**

- OWASA evaluates the treatment technologies we have at our WWTP to ensure we can meet upcoming standards with current treatment technologies. OWASA can meet all applicable permit limits, but we will need to operate our filters in denitrification mode to remove nitrogen when revised limits become effective. (Based on 2015 action by the NC General Assembly, the new expected date for a much more stringent TN limit is 2024). Carbon must be added to achieve denitrification in the WWTP filters, and there are different operational, safety, financial, and environmental considerations associated with different carbon sources. We will evaluate the advantages and disadvantages of alternative carbon sources, and conduct pilot and plant-scale testing as needed, to inform our decisions regarding the preferred source.
- Sidestream treatment for greater nutrient removal is a process that may be considered for the Mason Farm WWTP if we decide to dewater a greater portion of our biosolids. Sidestream treatment would help to reduce nitrogen loading in the liquid treatment process. Modeling studies indicate that if we dewater all of our biosolids, sidestream treatment could provide annual chemical and energy cost savings of approximately \$200,000 and have a payback of less than ten years. Sidestream treatment could also provide additional process flexibility in meeting TN limits; it may also allow a rerating of the plant to a higher treatment capacity, thereby providing substantial cost savings for our customers. The City of Durham uses side stream treatment at one of its WWTPs.

## Energy Management

See the section titled Mason Farm Wastewater Treatment Plant Maximum Month Flow Projections for energy use information at the WWTP. As noted above, certain advanced nutrient recovery technologies may have the potential to further reduce energy use for the liquid wastewater treatment process.

## Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our wastewater treatment technology can meet permit requirements and incorporating changes in operations to meet limits helps us meet the community's wastewater needs.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor nutrient loadings at the plant.	Monthly		X
2. Continue to optimize denitrification performance in the aeration basins.	Ongoing		X
3. Evaluate ability of existing filters (and advantages and disadvantages of alternative carbon sources) to meet TN permit limits.	2019 - 2020		X
4. Evaluate benefits and costs of different nutrient removal strategies as part of Mason Farm WWTP Master Plan update.	FY 2022		X

## Reclaimed Water

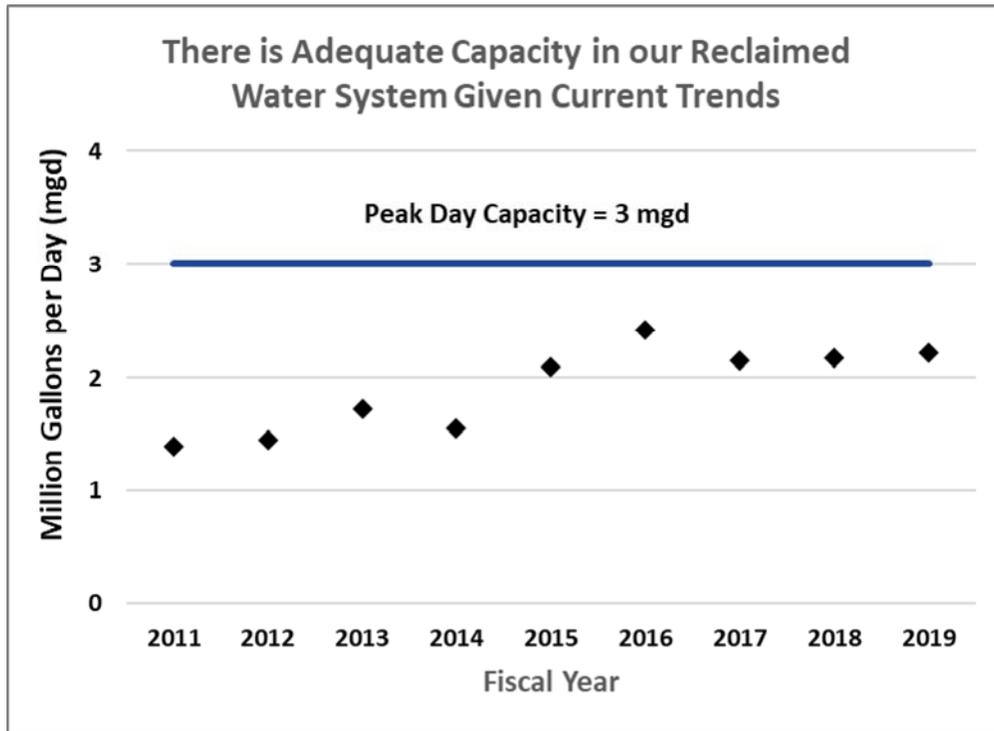


Figure 21. Reclaimed Water System Capacity and Demands

**Description:** This trend tracks historical annual peak-day reclaimed water (RCW) demands and compares those against the peak day capacity of the Mason Farm WWTP’s RCW system.

### Key Observations:

- The majority of RCW is used for chilled water and irrigation of landscaping and athletic fields and these demands peak during warm months (April-October). Demands are typically lower during cold months (November-March).
- Peak daily demand of 2.4 mgd occurred in August 2016 when it was very hot and humid. The RCW system is currently configured to meet a total peak day demand of 3 MGD (average daily demand of 1.2 MGD); however, the system is designed and constructed to allow cost-effective expansion to 5.2 MGD by adding only an additional transfer pump and additional chemical feed system capacity (if that feed system is deemed necessary).
- There is no anticipated significant change in demand for the next 15 years, and therefore the RCW system can meet projected RCW demand for the foreseeable future.

### Regulations

In 2014, the NC General Assembly ratified Senate Bill 163 (Session Law 2014-113) to allow for indirect potable reuse, provided that a pretreatment mixing basin is created and used to mix raw source water

and reclaimed water, and that reclaimed water does not comprise more than 20 percent of the total combined supply. OWASA will evaluate the costs and benefits of this potential water supply source as one of the options considered during the update of our Long-Range Water Supply Plan. More information on RCW and reuse is provided in the Technology and Research section below.

### **Technology and Research**

One aspect of reuse is recycling water within a building, which has been done in other parts of the country. One example (Solaire) is a high rise building in New York City which uses various filtration (membranes) and disinfection (ultraviolet light) technologies to produce reclaimed water that is beneficially recycled within the building and used for flushing toilets, cooling tower make-up water, and irrigating the green roof. The WaterHub at Emory University is an onsite wastewater reclamation system which uses ecological processes and stormwater capture to meet the campus's nonpotable water demands. A similar stormwater capture and treatment system is being planned for Chatham Park in Chatham County.

### **Energy Management**

In February 2015, we began sub-metering and monitoring the energy uses of a few specific processes at the WWTP, including the RCW system. The RCW system is not just important for its impact on our use of raw water resources, but it is a more energy-efficient way to meet demands. The energy required to treat and deliver reclaimed water is about 20% less than that is required to treat and deliver raw water to the community. In 2018, on average, we used 2.37 kWh to treat and deliver 1,000 gallons of raw water; we used 1.84 kWh to treat and deliver 1,000 gallons of reclaimed water throughout the year.

### **Strategic Plan Elements**

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our RCW system capacity is adequate will help meet the community's water needs. This also ties to Strategic Initiative 1; the use of RCW reduces the demand on our drinking water supplies which will help meet our community's long-term water supply needs. Finally, the use of RCW uses less energy than treating and delivering raw water, which ties to Energy Management Program in Strategic Initiative 4.

## Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Verify RCW meters are properly calibrated and recording flows accurately.	Annual		X
2. Closely monitor RCW demands in order to ensure RCW system capacity expansion is planned, designed, and funded in time to meet future demands.	Ongoing		X
3. Pursue cost-effective opportunities to expand the RCW system to serve non-drinking water demands of non-UNC customers as new growth and development/redevelopment occurs.	Ongoing – evaluating some options as part of LRWSP update	X	
4. Work with UNC to identify actions to mitigate potential risk factors to the RCW system.	FY 2020		X

## Biosolids

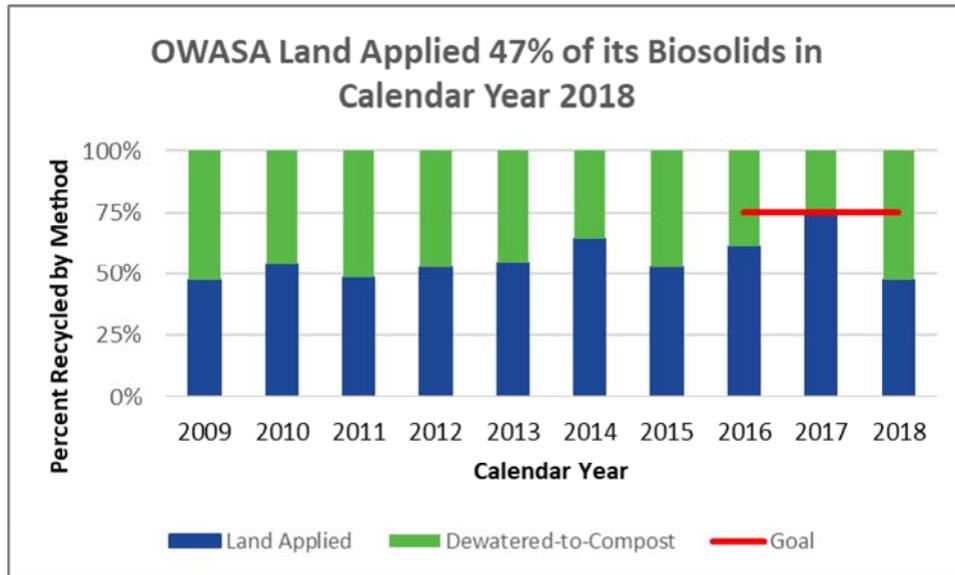


Figure 22. Historic Biosolids Application

**Description:** This trend evaluates the amount of biosolids which OWASA applies to land and the amount it dewateres for composting. The WWTP produces about four dry tons of biosolids each day. Most of this is applied in liquid form to agricultural land and a portion is dewatered to the texture and consistency of moist soil and transported to a private composting facility in Chatham County. For the liquid form, OWASA has 1,146 acres of farm land in Orange, Chatham and Alamance counties available for its Class A land application program (see Figure 23). 86 percent (992 acres) is privately owned. The remaining 154 acres are owned by OWASA as part of a 700-acre tract west of Orange Grove Road in Orange County. At its October 8, 2015 work session, the Board of Directors agreed that OWASA’s goal is to apply 75 percent of our biosolids in liquid form, and to dewater 25 percent of our biosolids. The Board of Directors understands that there are factors including weather conditions which may keep staff from meeting the goal.

**Key Observations:**

- Prior to CY 2014, OWASA consistently land applied about half of its biosolids and dewatered and composted the remaining half.
- In CY 2018, OWASA land applied 47 percent of its biosolids and did not meet the goal. Our ability to meet this goal is dependent in part on weather and staffing. Our opportunities to land apply biosolids were limited in 2018 due to wet conditions and short-staffing which limited our ability to land apply. Instead, we dewatered higher amounts of biosolids while meeting all applicable regulatory requirements for our biosolids treatment and recycling program.

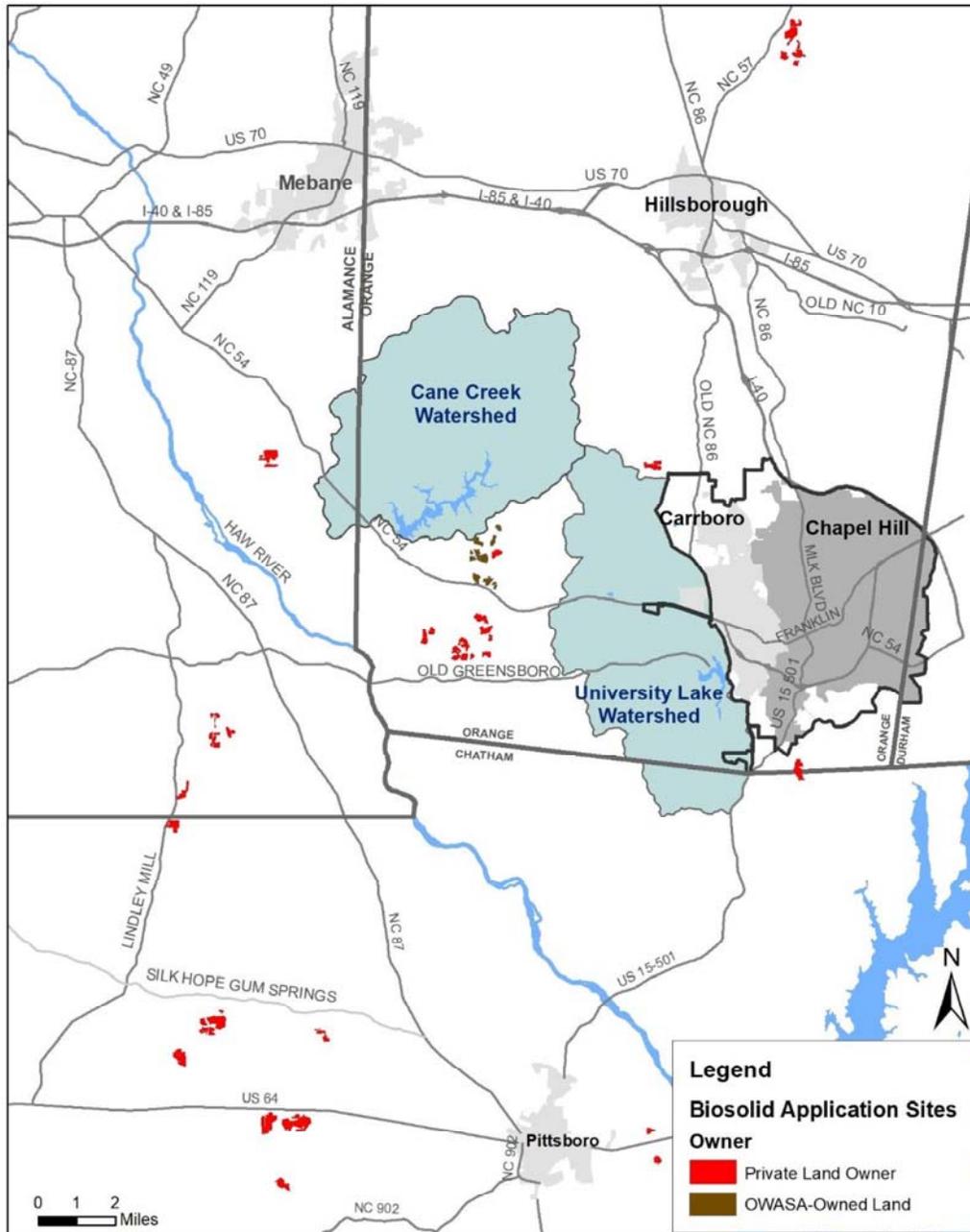


Figure 23. OWASA Biosolids Application Sites

### Regulations

Federal and state regulations specify the agronomic rates at which biosolids may be land applied for designated crops (the maximum amount of biosolids that can be applied to a given field is currently determined by the nitrogen content of the biosolids and is limited to the nitrogen requirements of the particular crop to which it is being applied). OWASA closely monitors the application rates on each individual field and historically has applied at rates well below the maximum allowed by regulation. Some states also limit land application of biosolids based on the phosphorus content of the biosolids and the soil; however, North Carolina does not have such a loading limit. If North Carolina adopts this

approach, the amount of land needed to support our land application program would increase considerably.

The NC Department of Environmental Quality (DEQ) modified its regulations concerning biosolids in September 2018. The modifications reduced the set back from streams for Class B biosolids from 100 feet to 32.8 feet, and Class A setbacks remained at 100 feet. The State indicated that General Statute 150B-19.3(a) prohibits agencies from adopting a rule that imposes a more restrictive standard, limitation, or requirements than those imposed by federal law or rule. There is no federal setback requirement for Class A residuals and hence the existing 100-foot State requirement remains.

**Technology and Research**

Information on technology concerning our solids thickening process is provided in the Mason Farm WWTP section.

**Energy Management**

The primary energy uses of OWASA’s biosolids management program are for vehicle fuel, biosolids loading, running the rotary press for dewatering, treating the nutrient-rich dewatering filtrate loads returned to the aeration process, and mixing the biosolids holding tanks.

**Strategic Plan Elements**

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our biosolids program meets federal and state requirements and protects public health, helps us meet the community’s wastewater needs.

**Actions Needed**

Action Items	Timing	Board Action?	
		Yes	No
1. Evaluate the 75 percent liquid land application goal and report our performance to the Board	Annually as part of this report		X
2. Evaluate the amount of land in our biosolids program to ensure it is adequate to meet liquid land application goal	As needed (if farmers drop out of program)		X