




# ORANGE WATER AND SEWER AUTHORITY

*A public, non-profit agency providing water, sewer and reclaimed water services  
to the Carrboro-Chapel Hill community.*

## MEMORANDUM

**TO:** Board of Directors  
**THROUGH:** Ed Kerwin   
**FROM:** Ed Holland  
**DATE:** October 25, 2011  
**SUBJECT:** Annual Review and Update of Strategic Trends and Master Plan Issues

### Summary

Thanks to ongoing conservation efforts by all customer groups and the University's increased use of reclaimed water, demands have remained well below the historical highs of a decade ago. Drinking water sales during Fiscal Year 2011 were 25 percent less than in FY 2002 and lower than in any year since 1993. Reclaimed water met 9 percent of our customers' total needs in FY 2011. Total sales (drinking water + reclaimed water) indicate that the long-term decline in demand may have "bottomed out," as a slight upward trend in total demand appears to be emerging.

OWASA's *2010 Long-Range Water Supply Plan* determined that University Lake, Cane Creek, and Quarry Reservoir can meet our expected water needs under most conditions for the foreseeable future, but will become increasingly vulnerable to drought before the Expanded Quarry Reservoir is available in 2035. Recent modeling indicated that the likelihood of having to impose mandatory water use restrictions will increase to approximately 10 to 12 percent in any given year by the time the Expanded Quarry is available, but that this risk can be moderated through two strategies: (1) the continued emphasis and promotion of conservation and water use efficiency, and (2) permanent and reliable access to OWASA's Jordan Lake's water supply storage allocation. Our focused efforts will continue in both areas.

Three major engineering studies completed during the past year revisited critical elements of the *2001 Master Plan*. One of these projects determined that the wastewater treatment plant can meet Jordan Lake nutrient removal requirements with only modest changes to the existing treatment configuration, which will also help optimize plant performance and reduce operating costs. Two other studies found the drinking water distribution and sewage collection systems to be in generally good condition and OWASA's current repair and replacement program to be adequate.

A key conclusion from this recent work is that we do not expect to need to increase the capacity of our water or wastewater treatment plants within the next 15 years, and we can defer certain water distribution and sewer system improvements further into the future than previously thought. OWASA's ongoing technical work and investments will focus primarily on maintaining, optimizing, and repairing/replacing our existing assets, rather than on expanding capacities or building new facilities to accommodate growth.

University Lake continues to exhibit high levels of blue-green algae during hot and dry summer weather, but these conditions have resulted in no reports of taste or odor problems in treated drinking water, affected the lake's recreational benefits, or in any way comprised University Lake water quality with respect to drinking water and public health standards. We are continuing to monitor this closely and may engage further technical expertise to better understand the nutrient/algae issues in University Lake.

In November 2010 the Board of Directors approved a *Water Shortage Response Plan*, which was subsequently approved by the NC Division of Water Resources. The Plan describes the actions that OWASA will take to reduce drinking water consumption during water supply shortages due to drought or operational emergencies.

### **Introduction and Background**

OWASA completed a *Comprehensive Water and Sewer Master Plan* in 2001, combining previously separate elements of planning and operations information into a single "road map for the future." Overall findings of the *Master Plan Final Report* and related *Technical Memoranda* were highlighted in the December 2001 *Capstone Report*.

Annual review and update reports have been provided to the Board of Directors in subsequent memoranda dated:

- September 19, 2003
- October 22, 2004 (revised)
- October 21, 2005
- October 20, 2006
- October 19, 2007
- October 17, 2008
- October 16, 2009
- October 22, 2010

This memo presents the results of our most recent work relating to long-range system planning and it updates previous annual reports with other data and commentary where appropriate.

### **Assumptions**

#### **What basic assumptions about future growth were used in OWASA's Master Plan?**

The *2001 Master Plan* projections, as well as updated projections in the *2010 Long-Range Water Supply Plan*, were based on the underlying assumptions of several important policies and principles. It has been noted that if any of these are changed significantly – either by circumstance or intent – the *Master Plan* and subsequent reports could require substantial adjustments. The major assumptions and policies applied in the original *Master Plan* and the *2010 Long-Range Water Supply Plan Update* are listed below.

- OWASA's long-term service area, defined by the urban services boundaries of Carrboro, Chapel Hill, and Orange County, will remain unchanged during the 50-year planning period.
- OWASA will serve only the current service area over the next 50 years. Water demand forecasts do not anticipate any retail or wholesale water or wastewater service outside of this area.
- The water and sewer demand projections presented in the *2001 Master Plan* were comprehensively revised for the *2010 Long-Range Water Supply Plan*. These were developed from historical and recent OWASA consumption data among major user groups; historical, recent, and anticipated development trends as documented by local building permit and certificate of occupancy data, OWASA service connection records, published planning documents of Carrboro, Chapel Hill, and UNC; and consultation with planning and economic development staff of Carrboro, Chapel Hill, Orange County, UNC, and UNC Hospitals. OWASA's current demand projections have also incorporated the most up to date information available about development plans for Carolina North.

### **Recent and Anticipated Development Trends**

Several trends in the Carrboro-Chapel Hill Urban Services Area that became apparent after the publication of OWASA's *2001 Master Plan* were validated in the *2010 Long-Range Water Supply Plan* and remain evident today:

- A decreasing supply of raw land available for new residential and commercial development is causing a shift from traditional development patterns toward more infill and redevelopment at higher densities than in the past.
- The number of detached single family (SF) homes constructed on large undeveloped lots has declined from the stable rate of about 350-400 new homes per year that was typical from the early 1980s until the early 2000s. The overall rate of SF residential construction has decreased to less than 100 units per year and is occurring on smaller lots; a greater number of older homes are being renovated and/or expanded; and, more requests are being filed for tear-down redevelopment and/or subdivision of existing in-town lots.
- Consistent with these observations is an increasing proportion of new attached, townhouse style residential construction as well as the development of higher density mixed use residential/commercial projects, such as Greenbridge, East 54, and 140 West.
- The shift toward smaller residential lot sizes and more townhouse/multi-family construction, as well as OWASA's conservation rate incentives implemented during recent years, have resulted in decreased demands per housing unit for water and wastewater service.
- New residential and non-residential development is substantially more water efficient

than in the past, and the existing building stock in our service area is being gradually retrofitted with more efficient plumbing fixtures and technologies. This trend is projected to result in further water use reductions by existing customers.

### **Individual Metering of Multi-Family Residential Units**

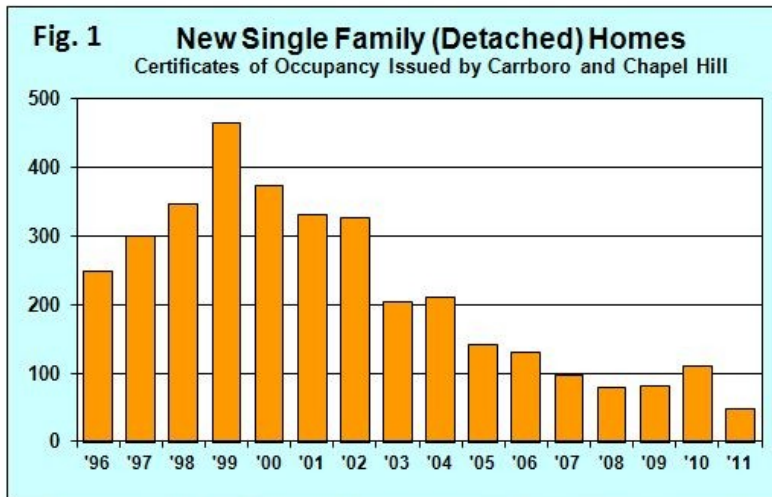
Another emerging trend is the installation of private sub-meters and on-site re-billing arrangements at multi-family residential developments. With this approach, a property or building owner continues to receive a monthly water and sewer bill from OWASA, but then bills each individual tenant for an appropriate portion of the total bill. Tenants' bills are based on their respective water use as measured through a privately-owned and maintained meter that serves each unit.

The *National Multiple Family Submetering and Allocation Billing Program Study* reported that sub-metering achieved statistically significant water savings of 15.3 percent (21.8 gal/day/unit) compared to traditional master-metered properties.

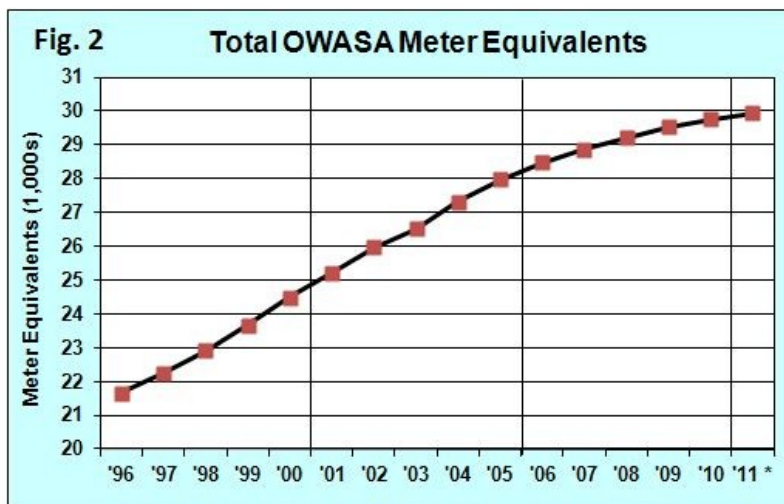
Most apartment complexes and other high density residential developments in OWASA's service area are served by one or more large "master" meters from which all water use and associated sewer services are billed. Individual occupants do not receive an OWASA bill, but a monthly bill for the entire complex is sent to the property owner or manager. As of 2011, more than 30 apartment complexes in our service area representing more than 5,700 apartment units have received NC Utilities Commission approval to pass through OWASA charges to their tenants. These include a number of older apartment complexes that have been retrofitted with sub-meters in each unit, as well as some new developments (Chapel Watch and the Apartments at Meadowmont), where sub-meters were installed during initial construction.

This trend is expected to continue in new multi-family developments, but it is likely that most of the existing developments that could be cost-effectively converted to sub-metering have already done so.

Examples of this and the other trends discussed above and their relation to water and sewer demands are illustrated on the following pages. Figure 1 illustrates the declining rate of traditional SF housing construction in OWASA's service area, and Figure 2 shows recent trends in customer growth, expressed as "5/8-inch meter equivalents." Single family homes are typically served through 5/8-inch water meters, while larger buildings are served through larger meters. Relative capacities are expressed in proportional "meter equivalents" (MEs) of a 5/8-inch meter. Figure 2 indicates a decreasing rate of overall customer growth in recent years.



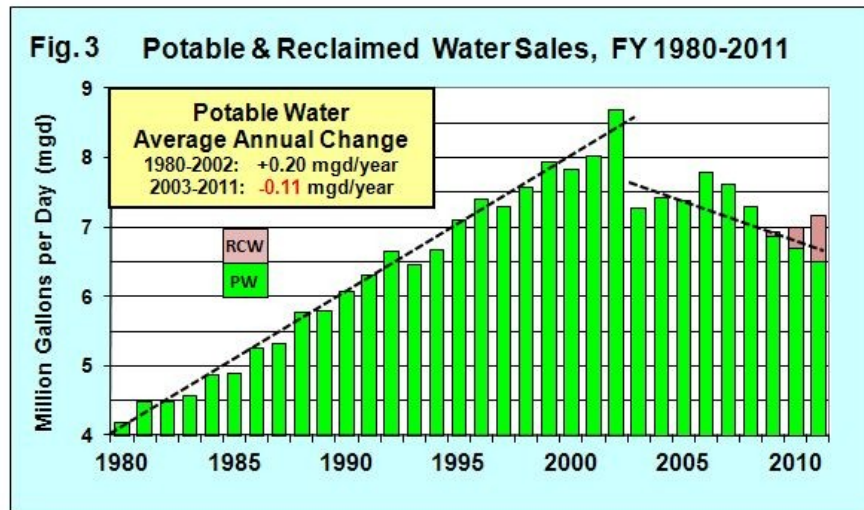
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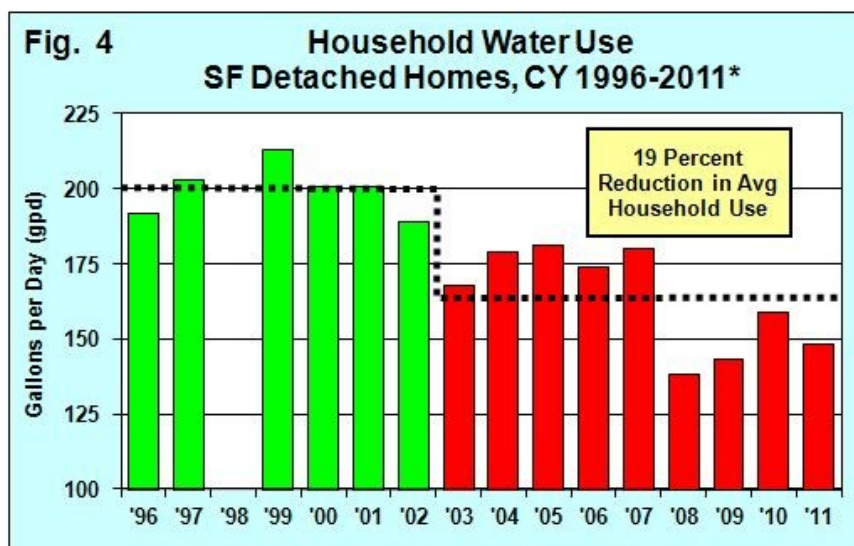
## Water Demand Trends

Figure 3 illustrates the significant reduction in drinking water consumption during the past nine years compared to the prior two decades. Drinking water sales during Fiscal Year 2011 were 25 percent less than in FY 2002 and lower than in any year since 1993. Reclaimed water met 9 percent of our customers' total needs in FY 2011. Total sales (drinking water + reclaimed water) indicate that the long-term decline in demand may have "bottomed out," as an upward trend in total demand appears to be emerging.



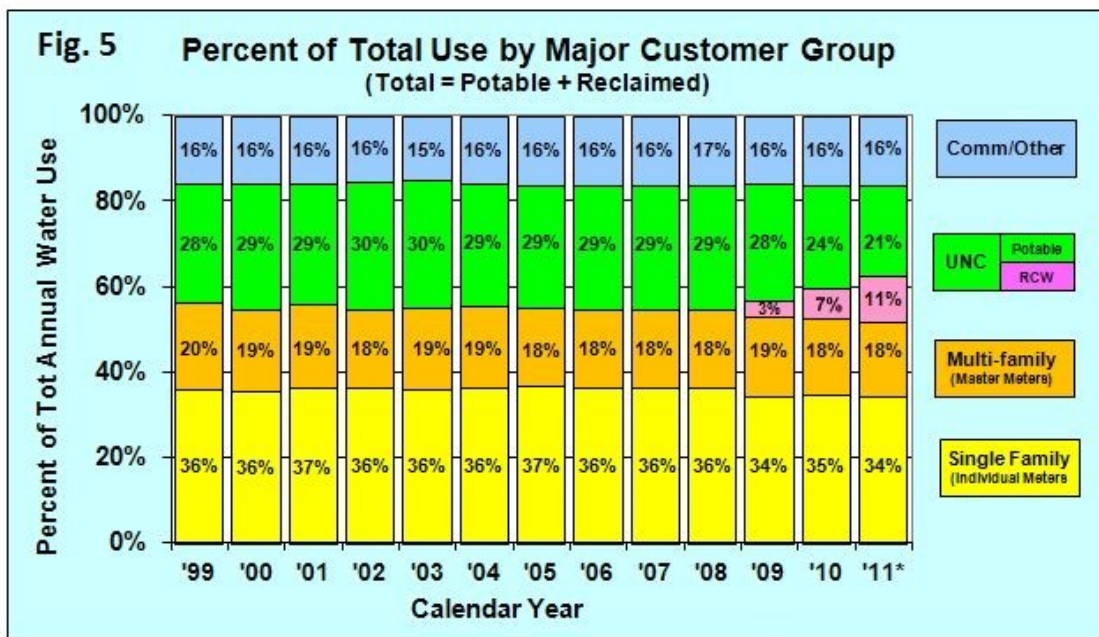
*Even though the total number of OWASA meter equivalents grew by nearly 13 percent from 2003 through 2011, the average potable water demand of 7.2 million gallons per day (mgd) during the past nine years has been almost 14 percent less than the 2000-2002 average of 8.2 mgd. As noted in the 2010 Long-Range Water Supply Plan, these reductions are considered to represent a permanent shift in customer demand, including the University’s increasing use of reclaimed – rather than potable water – for non-drinking purposes.*

Figure 4 illustrates the ongoing reduction in average household water use since 2003. *Average consumption in SF detached homes decreased 19 percent from 200 gallons per day (gpd) in the 1996-2002 period to about 163 gpd during the past nine years. The 2011 average of 148 gpd per household is consistent with residential usage patterns assumed in the future demand forecasts of the 2010 Long-Range Water Supply Plan.*



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Overall reductions have occurred among all OWASA customer classes, as indicated by the generally consistent pattern of proportional use among the four major customer sectors (Figure 5). The relative proportion of UNC’s potable water use has recently declined as the University’s use of reclaimed water (RCW) has increased. This trend is expected to continue as UNC expands its use of RCW and other non-potable sources.



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## Raw Water Supply

### How will community growth affect water and sewer demands?

Demographic and service area development assumptions – and the corresponding demand projections – were re-examined and revised in OWASA’s *2010 Long-Range Water Supply Master Plan*. Notably, the water demands projected through **2060** are now substantially less than the **2050** projections of the original *2001 Master Plan*. This is due to three main factors:

- **Increased water use efficiency among all sectors of OWASA customers during recent years:** These changes are now considered to be permanent. As noted previously, new development projects are substantially more water efficient than in the past, and the existing building stock in OWASA’s service area is gradually being retrofitted with more efficient plumbing fixtures.
- **UNC/OWASA RCW system:** The RCW system began operating in April 2009 and is projected to replace about 0.83 mgd of potable water demand (nearly 12 percent of total demand) in Fiscal Year 2012. Experience during the past two summers has validated the RCW system’s importance and future value by

reducing the community's vulnerability to drought and by further deferring water supply and treatment facility expansions that might otherwise be needed.

- **Slower pace of development activity:** The number of new OWASA service connections has declined steadily since 2004, reflecting the overall economic recession and lower development rate in Carrboro and Chapel Hill. Community growth is expected to continue at this reduced pace for several more years, but our long-rand demand projections assume that growth rates will gradually return to pre-recession levels.

The combined effects of these trends are reflected in the low rate of water demand increases projected for the next 10 years as shown in Figure 6, and in 2060 demands that are considerably lower than the 2050 demands projected in the original *2001 Master Plan*.

The significant demand reductions described earlier reflect a series of OWASA actions that have influenced raw water demands since the record drought of 2001-2002:

- Seasonal water rates (2002).
- New conservation standards, including year-round requirements, and new local water conservation ordinances adopted by the Towns and County (2003).
- Implementation of a permanent process water recycling system at OWASA's water treatment plant (2005).
- Introduction of increasing block water rates with drought surcharges for all individually-metered residential customers (2007).
- Development and implementation (with UNC) of the RCW system (2009).
- Additional revisions to OWASA's conservation standards and local ordinances that implemented the experience gained and "lessons learned" during the 2007-2008 drought (2009).
- Substantial increases in overall OWASA water and sewer charges during the past several years.

### **Can future water and sewer needs be reduced through more water conservation?**

Yes, but the timing and extent of further reductions will depend on the degree to which existing and new development projects implement additional water use efficiency measures.

Estimated costs and benefits of potential OWASA-funded conservation measures were generally examined in the *2010 Long-Range Water Supply Plan*, which concluded that:

*Investing in an expansion of OWASA's reclaimed water system or establishing financial incentive programs, such as plumbing fixture rebates, to promote*

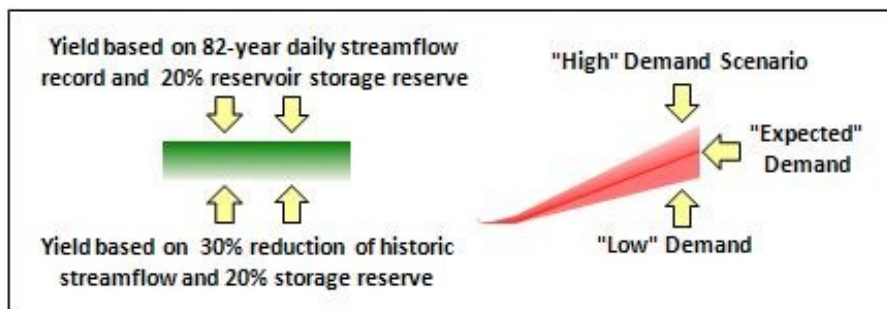
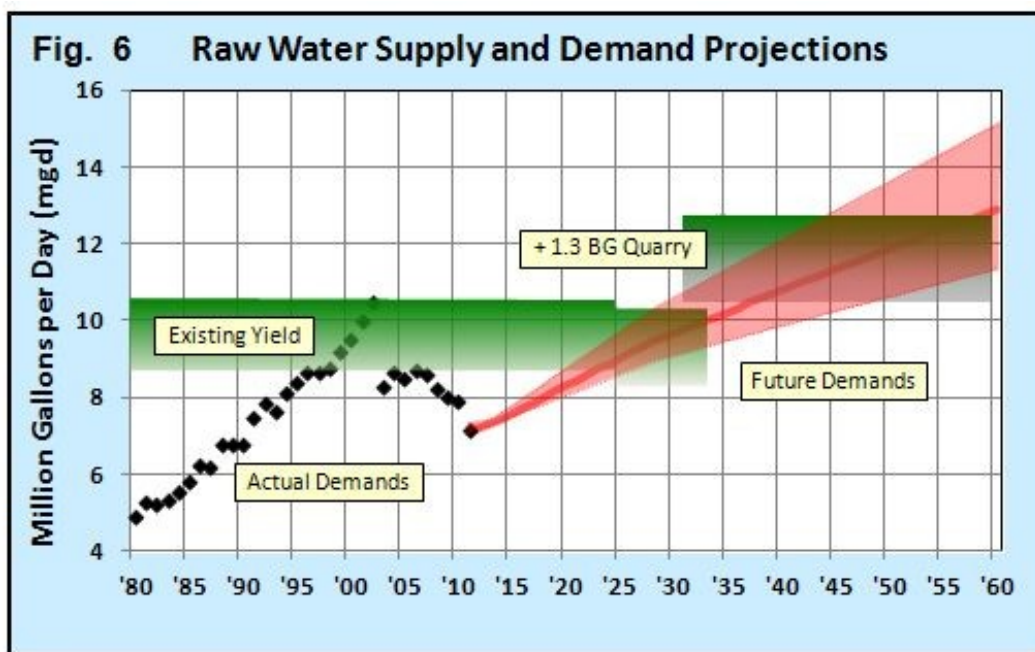
*additional water conservation is substantially less cost-effective than other options with additional benefits, and is not recommended at this time.*

**How much more raw water will be needed in the future?**

A significant finding of the *Long-Range Water Supply Plan* was that under most conditions, OWASA’s existing Cane Creek/University Lake/Quarry Reservoir supply system can meet the community’s water supply needs substantially further into the future than previously thought.

Hydrological modeling conducted for the study determined that the existing system can provide 10.5 million gallons per day (mgd) while still maintaining a 20 percent storage reserve during a recurrence of the 2001–02 record drought. (Previous yield estimates of 11.7 mgd calculated for the same drought conditions were based on complete reservoir drawdown; that is, with no water left in reserve.) Figure 6 shows system yield (supply) in relation to our long-range demand projections.

**Figure 6. Supply and Demand Projections through 2060**



The green bar extending from the left represents the yield of OWASA's existing University Lake/Cane Creek/Quarry Reservoir system, and the right hand bar extending from 2035 to 2060 represents additional yield that would be available with 1.3 billion gallons (BG) of expanded Quarry Reservoir storage. The upper margin of each bar represents total system yield based on 85 years of historic streamflow data. The lower margins were calculated on the basis of a hypothetical 30 percent reduction of actual streamflow in order to approximate future conditions that might result from major changes in weather patterns (climate change) and/or changes in watershed land use that might affect streamflow.

***A key finding is that the existing system can provide 10.5 mgd while still maintaining a 20 percent storage reserve during a recurrence of the 2001–02 drought.***

For operational purposes, the report recommended that OWASA maintain sufficient water in storage so that the risk of depletion (“critical drawdown”) to 20 percent or less of total storage during any succeeding 12-month period does not exceed a risk of 2.5 percent.

**What’s the risk of another water shortage in which mandatory use restrictions would be declared?**

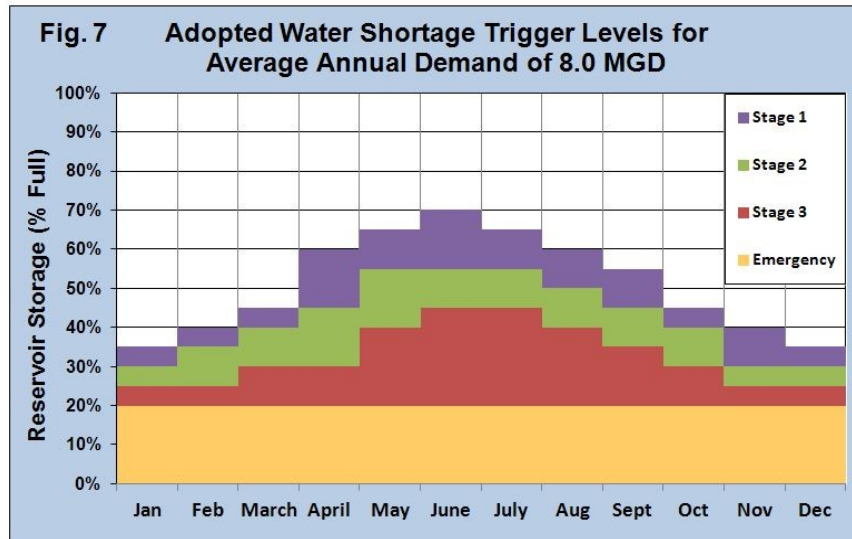
Based on more recent modeling, which applied the 85 years of historical streamflow data to our reservoir system under a range of demand conditions, the likelihood that total storage will decline to OWASA's currently adopted Stage 1 drought triggers (described below) in any given year is less than 4 percent (3 years out of 85) at average raw water demands of 7 mgd, and approximately 10 – 12 percent (8 years out of 85) at average demands of 10 mgd. These estimates were based, however, on historical data which may not accurately represent future streamflow conditions due to the uncertainty of climate change.

**How is this information used for responding to a water shortage?**

In accordance with OWASA's State-approved *Water Shortage Response Plan* (November 2010), our drought strategy is linked to the risk in any given month of drawing our reservoirs down to below the 20 percent storage reserve within the next 12 months. Water use restrictions become more stringent as the level of risk increases.

Figure 7 illustrates the mandatory trigger levels – per OWASA's adopted *Water Shortage Response Plan* – that apply to each Water Shortage stage assuming an annual average-day raw water demand of 8 mgd.

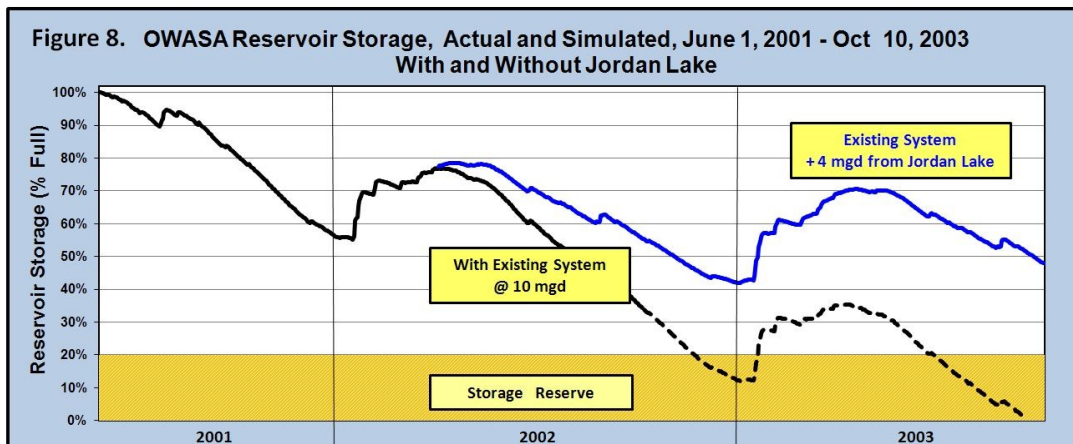
**Figure 7. Water Shortage Trigger Levels at Annual Demand Level of 8.0 MGD**



**How long can the existing supply meet projected needs?**

As noted previously, our existing system is generally expected to meet projected needs under most conditions until the expanded Quarry Reservoir is available in the mid 2030s; however, our vulnerability to higher than expected demands and/or the recurrence of severe drought conditions will increase, indicating the need for additional “insurance” before the expanded Quarry is in service. The most cost-effective option identified in the *2010 Long-Range Water Supply Plan* is permanent and reliable access to OWASA’s Jordan Lake’s water supply storage allocation.

Recent analyses determined that total water in our existing Cane Creek/Universty Lake/ Quarry Reservoir system would have declined to the 20 percent emergency level within less than two months if the record drought of 2001-02 had not ended abruptly in mid-October, 2002. That critical condition could be avoided if supplemental water were available from Jordan Lake (Figure 8).



### **What are OWASA's plans for obtaining additional water in the future?**

Expansion of OWASA's Quarry Reservoir west of Carrboro offers the most cost-effective increment of additional supply and will provide a substantial amount of high quality water with minimal capital investment, but this will not be available until 2035. Until that time, temporary water purchases offer the most cost-effective option for a supplemental supply.

Per the *2010 Long-Range Water Supply Plan*, OWASA will seek to modify existing mutual aid (emergency) agreements with neighboring utilities to secure the permanent ability to purchase or sell treated water when it is needed (parties to the existing agreements are only required to provide water *if or when it is available*). OWASA's continued participation in the Jordan Lake Partnership is providing important opportunities to develop these arrangements to gain secure and cost-effective access to our Jordan Lake allocation.

### **When will the larger quarry be available?**

The American Stone Company's ongoing operation at OWASA's Quarry Reservoir (Figure 9) is expected to produce a total storage capacity of 2.2 – 3.0 billion gallons (BG) when mining is completed in 2030. The final volume will depend on production through 2030, but American Stone is contractually committed to a rate of rock extraction that will result in a final volume of at least 2.2 BG. Between 1.3 and 1.8 BG of this new storage capacity will be readily accessible with existing OWASA pumping facilities, which can withdraw water from a maximum depth of 100 feet. Withdrawals from greater depths would require additional facilities.

**Figure 9. Existing Quarry Reservoir**



*Existing reservoir is on the left. Active quarry pit is advancing from the right.*

### **How clean is OWASA's water supply?**

Routine water quality monitoring and special projects completed since 2001 have confirmed earlier findings cited in the *2001 Master Plan*: "OWASA's reservoir water quality is excellent in terms of public health and safety, but is not pristine." Efforts in University Lake and the Cane Creek Reservoir since the early 1990s have focused on reducing nutrient inputs (nitrogen and phosphorus) to minimize objectionable algae conditions. Subsequent feasibility analyses determined that the potential benefits of any in-lake water quality manipulation via mechanical aeration or other techniques were too uncertain to justify their capital and operating costs. OWASA continues to participate in the Triangle Area Water Supply Monitoring Program, through which the United States Geological Survey (USGS) has compiled systematic data from University Lake, Cane Creek, and their principal tributaries since 1988.

The USGS released a special report in 2007 about the occurrence of so-called "emerging contaminants" in Triangle Area water supply reservoirs, including both University Lake and Cane Creek. Water samples from 7 local supply sources were analyzed for 126 chemicals, including a wide range of pharmaceuticals, antibiotics, ingredients in personal-care products, fire retardants, plasticizers, pesticides, and other chemicals used by households, industries, and agricultural enterprises. Trace amounts, generally in concentrations of less than 0.5 parts per billion, of at least one chemical were detected at all sampling locations, but none exceeded Federal or State water quality standards. Few standards exist, however, for the chemicals analyzed in that study. Concentrations were generally within the ranges observed in other USGS studies across the nation and provide useful background information about our own water supplies.

***Routine water quality monitoring required by Federal and State regulations continues to confirm that University Lake and Cane Creek Reservoir consistently meet all public health-related water quality standards.***

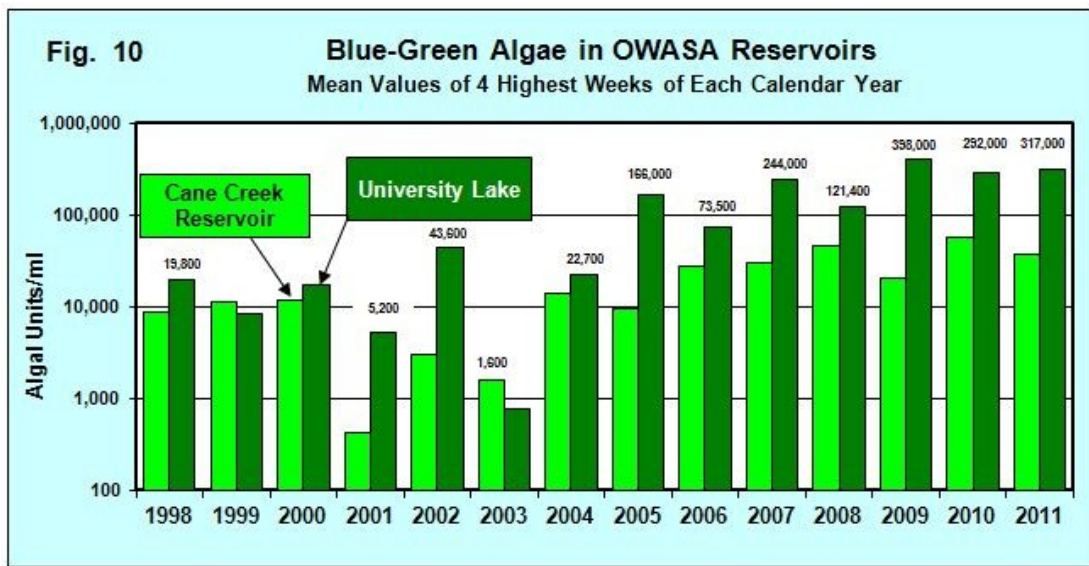
The Cane Creek watershed recommendations adopted by the OWASA Board of Directors in 1997 included a goal of acquiring ownership or conservation easements on 1,265 acres of additional land. Since that time, OWASA and Orange County have protected 960 and 363 acres, respectively, of Cane Creek watershed land through direct acquisition and protective conservation easements for a total of 1,323 permanently protected acres – thus exceeding the original goal.

A 2003 study of potential water quality benefits of land/easement acquisition in the University Lake watershed determined that a similar program would not likely improve University Lake water quality. However, it did recommend that OWASA consider the strategic acquisition of critical riparian buffer lands in the University Lake watershed on a case-by-case basis. Accordingly, OWASA purchased a 74-acre tract (the Ray Heirs property) immediately adjacent to Morgan Creek and University Lake when it became available in 2006 and applied a conservation easement that protects this riparian buffer in perpetuity, regardless of future ownership. OWASA resold this property during the past year with the perpetual easement intact.

No further funding for additional watershed land or easement acquisition is included in OWASA’s 15-year Capital Improvements Program.

As noted above, the principal water quality issues for Cane Creek and University Lake have been associated with nitrogen and phosphorus, which are nutrients that stimulate excessive algal growth. Certain types of algae, especially cyanobacteria (formerly known as “blue-green algae”), can cause water treatment problems – taste and odor, filter clogging, coagulation, and so forth – when they occur in high concentrations or blooms. Many of the same species also produce toxic organic compounds that are harmful to animals and humans under extreme conditions. Figure 10 presents blue-green algae concentrations in OWASA’s reservoirs from 1998-2011.

No State or Federal regulatory limits exist for algae, but water quality experts generally consider concentrations of more than 100,000 units per milliliter to indicate hypereutrophic conditions, or extreme nutrient enrichment. As shown in Figure 10, blue-green densities in University Lake have exceeded this threshold in six of the past seven years. Although these conditions have resulted in no reports of taste or odor problems in treated drinking water or affected the lake’s recreational benefits, we are continuing to monitor the trend closely and may engage further technical expertise to better understand University Lake’s nutrient/algae issues.



Each bar represents the arithmetic mean of the four highest concentrations of total cyanobacteria measured in weekly samples collected during each calendar year.

The State of North Carolina enforces a water quality standard for chlorophyll *a*, which is an indicator of algal concentrations. Although the appropriateness of this standard remains subject to technical debate, it was the basis of Jordan Lake’s designation as *water quality impaired*, and elevated chlorophyll *a* was the reason that University Lake and the Cane Creek Reservoir were placed on North Carolina’s “impaired waters” list in 2010. It is notable, however, that none of either lake’s intended uses for public water supply or recreation have actually been impaired or otherwise compromised. The Jones

Ferry Road Water Treatment Plant (WTP) has experienced virtually no treatment, taste, or odor issues in recent years, and there have been no incidents in either lake of fish kills or other environmental impairment – despite consistently high concentrations of algae and chlorophyll *a*. Treated water quality has improved in recent years due, in part, to OWASA’s participation in the Partnership for Safe Water described below in the Water Treatment section of this report. As a precautionary measure, University Lake and Cane Creek water samples have been analyzed during the past several summers for naturally occurring toxic substances that are sometimes produced by blue-green algae. All analytical results for the toxins microcystin, saxitoxin, cylindrospermopsin, and anatoxin-*a* were either less than their laboratory detection limits or well below water quality guidelines of the World Health Organization (no State or Federal standards in the U.S. have been established for algal toxins).

***Despite elevated algae and chlorophyll a concentrations, University Lake and Cane Creek Reservoir continue to meet all water quality standards related to drinking water and public health.***

Although the *impaired use* designation has no direct regulatory implications for OWASA, the US Environmental Protection Agency (EPA) requires states to develop individual TMDLs for water bodies that exceed water quality standards. (“TMDL” stands for Total Maximum Daily Load, or the total amount of a pollutant that a given water body can receive without exceeding a regulatory limit.) The State of North Carolina developed a TMDL for Jordan Lake several years ago when it was found to be impaired by chlorophyll *a* exceedances. The Jordan Lake TMDL specifies the amount by which total nitrogen and total phosphorus inputs must be reduced to bring the lake into compliance with the chlorophyll *a* standard. The Jordan Lake Rules enacted in 2009 specify the management details of how those reductions will occur.

The State’s *Addendum to the Jordan Lake TMDL* notes that because the University Lake and Cane Creek watersheds are both part of the larger Jordan Lake watershed, they are already subject to the Jordan Lake nutrient reduction targets and therefore OWASA’s reservoirs do not require individual TMDLs.

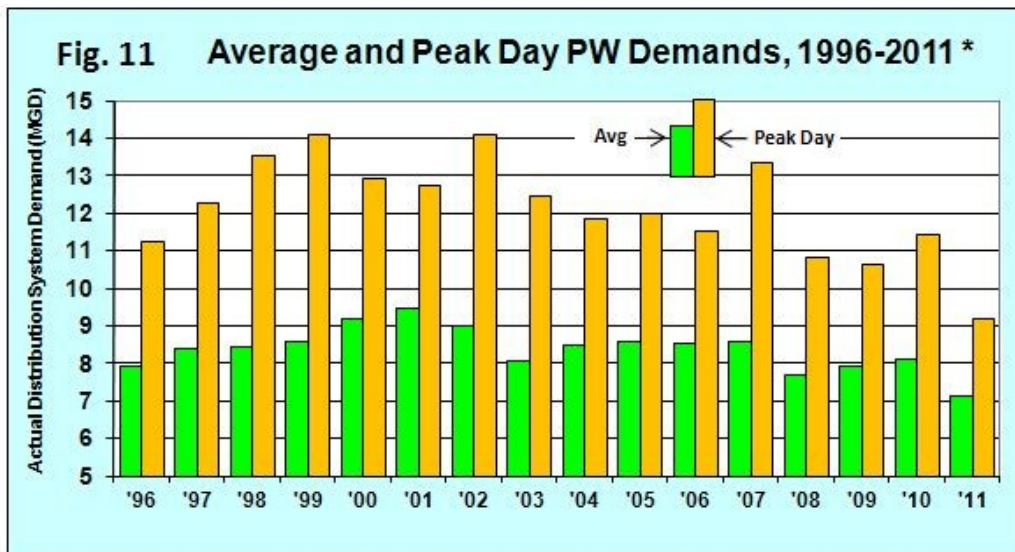
## **Water Treatment**

### **Does OWASA have enough water treatment capacity?**

Yes. Treatment capacity has been increased from 15 to 20 mgd since the original *2001 Master Plan* was completed. This was accomplished through the addition of two new filters, a finished water pump, and improvements to the existing clearwell in order to provide the extended disinfectant contact time required for a flow rate of 20 mgd. Additional upgrades and improvements are planned in the coming years, but no further capacity expansions are expected to be needed during the 15-year capital improvement planning period, due primarily to conservation efforts by OWASA and our customers.

**Why does treatment plant capacity (20 mgd) have to be so high if customers use less than 10 million gallons of water each day?**

The water plant is designed to accommodate peak demands during short periods of high use. The *2001 Master Plan* recommendations for water plant expansion were based on peak (maximum) day demand projections that were substantially higher than those which have occurred in recent years (Figure 11) and higher than those now expected for the future.



\* Data are reported for Jan-Dec calendar years, except 2011, where data are only available through September.

**How much drinking water treatment capacity will ultimately be needed?**

The original *2001 Master Plan* projected the need for 30 mgd of water treatment capacity to support anticipated peak day demands when the OWASA service area is fully built out, but the current demand projections of the *2010 Long-Range Water Supply Plan* indicate that ultimate needs will not exceed 18.5 or 22.5 mgd under Expected or High Demand scenarios, respectively. This significant change from the original *Master Plan* projections reflects major reductions in drinking water demand described earlier.

**Will the treatment plant be able to meet stricter drinking water quality standards if necessary?**

OWASA meets all current federal and state drinking water standards for public health protection and aesthetic quality, and we expect to meet stricter standards in the future as described below.

**Federal Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) –**

The LT2ESWTR requires systems to monitor their source water; calculate an average *Cryptosporidium* concentration; and use those results to determine if their source water is vulnerable to contamination that may require additional treatment. OWASA tested untreated water every month for two years from April 2007 through March 2009. *Cryptosporidium* was detected 4 times at an average of 0.016 oocysts/L. These results

place OWASA in the US EPA's "Bin 1" classification, which means that our water requires no additional treatment for *Cryptosporidium* removal. Starting in 2015, OWASA will be required to begin conducting a second round of source water monitoring in order to re-determine our bin classification.

**Federal Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) –**

The Stage 2 DBPR, which goes into effect in 2012, is intended to further reduce human exposure to chemicals produced when drinking water is disinfected with chlorine. The principal classes of disinfection byproducts regulated under this rule are total trihalomethanes (THMs) and five types of haloacetic acids (HAAs). The maximum allowable level will be calculated as an average at each compliance monitoring location (instead of as a system-wide average as previous required). The regulatory limit will be 80 parts per billion (ppb) for THMs and 60 ppb for HAAs.

Disinfection byproduct concentrations in OWASA drinking water have decreased since we began using chloramines for disinfection in January 2002 (chloramines are a class of compounds produced by the addition of ammonia and chlorine to the treated water). Chloramines provide effective disinfection while producing fewer THMs and HAAs than the chlorine-only system used before 2002.

Stage 2 DBPR monitoring will begin in November 2012 and will include eight monitoring sites rather than the four Stage 1 sites currently monitored for THMs and HAAs. Locational running annual averages will be regulated, rather than the simple average of all locations. Additionally, sampling will be required at regular 90-day intervals, rather than simply "once per quarter." The current locational running annual averages for the Stage 1 locations have not exceeded the new regulatory limits. While only two of the eight sampling locations will be the same as the current Stage 1 locations, we expect to continue to meet the new regulations. Samples have been collected from the Stage 2 locations quarterly since February 2010 with encouraging results. Locational running annual averages for THMs ranged from 30.9 ppb to 57.8 ppb (compared to the 2012 limit of 80 ppb); and 23.6 ppb to 52.4 ppb for HAAs (compared to the 2012 limit of 60 ppb).

**Lead and Copper** – Per Federal and State standards, OWASA tests for lead and copper in tap water every three years at 30 homes built between 1983 and 1985. The latest study was performed in 2011. All lead results were below the detectable level of 3 ppb. Additionally, all copper results were below the detectable level of 50 ppb.

**Contaminant Candidate List 3 (CCL 3)** – The federal Safe Drinking Water Act (SDWA) requires EPA to publish a list every five years of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulations. Contaminants on the list are known or anticipated to occur in public water systems and may require future regulation. The Contaminant Candidate List 3 (CCL 3) includes 12 microbiological and 104 chemical contaminants including pesticides, disinfection by-products, waterborne pathogens, pharmaceutical and personal care products (PPCPs), endocrine disrupting compounds (EDCs), and cyanotoxins (produced by some blue-green algae).

EPA conducts research on the occurrence, health effects, analytical methods, treatment technologies, and treatment costs for contaminants on the CCL. EPA also develops drinking water guidance, health advisories, and issues regulatory determinations for priority contaminants on the list. If the EPA adopts additional regulations to address other drinking water contaminants of emerging concern, OWASA may be required to make additional improvements to the water plant. Staff will stay informed of regulatory proposals, health effects and risk assessment studies, and advancements in water treatment technologies in order to anticipate any additional future treatment requirements.

**Unregulated Contaminants (UCMR3)** – The proposed Unregulated Contaminant Monitoring Regulation 3 was published in the Federal Register on March 3, 2011. The final rule is anticipated to be published in early 2012. As proposed, sampling for the third UCMR3 will occur from 2013-2015. The proposed monitoring includes two viruses and 28 unregulated chemical contaminants; including: 7 hormones, 9 volatile organic compounds, 1 synthetic organic compound, 4 metals, 1 Oxyhalide Anion, and 6 Perfluorinated Compounds.

**Revised Total Coliform Rule (RTCR)** - On July 14, 2010, EPA published the RTCR proposed revisions. The final rule is anticipated to be published in the summer of 2012, and then compliance would begin in 2015. Major changes to the rule include replacement of the total coliform maximum contaminant level (MCL) with an *E. coli* MCL; and when total coliform or *E. coli* are detected, systems will be required to conduct a special assessment to determine if any sanitary defects exist and, if found, correct them.

**Perchlorate** - On February 11, 2011, EPA published its decision to regulate perchlorate. This decision is the first time EPA has decided to regulate a substance from the Contaminant Candidate List. The EPA expects to publish the proposed regulation and analyses for public review and comment by February 2013, and then promulgate a final regulation within 18 months of the proposal.

Perchlorate is both a naturally occurring and a man-made chemical that is used to produce rocket fuel, fireworks, flares and explosives. Perchlorate can also be present in bleach and in some fertilizers. It is being regulated because it can disrupt the thyroid's ability to produce hormones needed for normal growth and development.

OWASA tested the finished water for perchlorate 8 times between 2001 and 2002 as part of the UCMR requirements. All results were below 4 ug/L. Additionally, we tested the finished water sample for Perchlorate on July 27, 2011. The result was 0.33 ug/L.

**Hexavalent Chromium (Chromium-6)** – No regulations are in place for allowable chromium-6 concentration in drinking water; however, the EPA currently regulates total chromium and has set the MCL at 100 micrograms/liter (ug/L). EPA is in the process of gathering information on the occurrence, treatment, and analytical methods for chromium-6 and is reviewing recently available health effects information. After this risk assessment has been completed, EPA will determine if new drinking water standards need to be established. In the meantime, EPA has issued a recommendation for enhanced monitoring of chromium-6.

Chromium-6 in drinking water may be naturally occurring; i.e., from geological formations, soils, etc. Other sources may include the manufacturing of textile dyes, wood preservation, leather tanning, and anti-corrosion coatings, where chromium-6 contaminated waste has migrated into the underlying groundwater.

OWASA tested our water for chromium-6 at various stages in the treatment process and in the distribution system several times during 2011. Results for the raw water samples ranged from <0.02 to 0.18 ug/L, with an average of 0.07 ug/L. There was little difference between the treated (finished) water and the distribution system samples, which ranged from 0.20 ug/L to 0.42 ug/L, with an average concentration of 0.29 ug/L. The highest concentration was found in the recycled process water, where concentrations ranged from 0.31 ug/L to 0.46 ug/L, with an average of 0.39 ug/L.

We are continuing to following the regulatory guidelines from EPA on chromium-6 and will conduct further sampling and testing to more fully understand the varying concentration levels within the water at different stages of the treatment process.

**Partnership for Safe Water** – OWASA received national recognition in 2011 for its work to ensure exceptional quality drinking water. We became only the ninth water utility in the United States and the first in North Carolina to receive the Excellence in Water Treatment award from the Partnership for Safe Water, which is a continuous improvement program for water treatment plants supported by the U.S Environmental Protection Agency, American Water Works Association (AWWA), and several other professional organizations. The Partnership's program challenges water treatment plants to focus not only on meeting regulatory standards, but to set higher treatment goals and to continuously seek ways for further improvement.

The Excellence in Water Treatment award is the highest level of performance that can be achieved in the partnership program.

## **Drinking Water Storage**

### **How much storage exists, and how much will be needed?**

OWASA's five elevated tanks and the underground clearwell at the water treatment plant provide 8.0 million gallons (MG) of finished water storage. The *2001 Master Plan* recommended that another 1.5 MG clearwell be added at the water plant in 2005 and that a new 1.5 MG elevated storage tank be constructed at OWASA's 17-acre property west of Old NC 86 and north of Carrboro in 2008 to meet growth projected for the 740-foot pressure zone in the northern part of OWASA's service area. As discussed earlier, the actual and expected reduction in average and peak day demands to levels substantially below the original *Master Plan* projections have allowed the future clearwell expansion to be deferred beyond the 15-year CIP planning period and future elevated storage tank capacity requirements to be reduced from 1.5 to 0.75 MG.

## **Drinking Water Distribution**

### **Does OWASA's distribution system suffer from the "aging infrastructure" problems of other urban areas?**

The recently completed *Water Distribution (Hydraulic) Model Update* study found that the water system has relatively few hydraulic deficiencies. Consequently, near term investment requirements are not significant. It also concluded that OWASA's present goal of replacing or rehabilitating three miles of water main per year is adequate, and that the Jones Ferry Water Treatment Plant will need no additional capacity improvements before 2030.

Also during the past year, OWASA's Drinking Water Distribution System Prioritization Model was updated. This diagnostic tool reviews pipeline age, material, repair history, criticality of customers being served, and other indicators that help prioritize water line replacement projects.

## **Wastewater Collection**

### **Can OWASA's sewer system handle all of the community's wastewater?**

Yes. The recently completed *Sewer Collection System Evaluation* study identified potential system deficiencies and specific areas in need of onsite physical inspection or other additional evaluation. Results confirmed the high priority and urgency of the Phase III Bolin Creek Interceptor project (which reached substantial completion on October 21, 2011) and also revealed that planned upgrades to the Morgan Creek, Meeting of the Waters, and other interceptor sewers can be postponed; but, upgrades to the Friday Center, Finley Golf Course, Dobbins Drive, and other less significant interceptors should be accelerated.

Several projects to expand the capacity of major portions of OWASA's largest interceptor sewer lines have been completed as recommended in the original *2001 Master Plan*. That document and the recent 2011 study identified specific portions of the sewer system that are subject to large volumes of stormwater infiltration and inflow (I/I). These areas remain a key focus of OWASA's sewer and manhole replacement/ rehabilitation program.

### **How much of a problem is represented by the inflow and infiltration (I/I) of stormwater into OWASA's sewer system?**

Decreases in peak sewer flows measured in recent years at the Mason Farm Wastewater Treatment Plant indicate that I/I reduction efforts begun in the early 1990s have been successful. Specially targeted sanitary sewer evaluation studies (SSEs) that were planned and funded through OWASA's capital improvements program after the original *2001 Master Plan* was completed have identified significant opportunities for further cost-effective I/I reduction in greater detail than before.

Unlike many older urban areas in other regions, OWASA's wastewater collection system is separate from the storm drainage system, which reduces the potential for I/I related

sewer overflows. Illicit connections of private storm drains and private sewers to the public sewer system are occasionally discovered and removed.

### **Wastewater Treatment**

#### **Have we evaluated the performance of the recently completed wastewater plant since it was expanded in 2007?**

Yes. The recently completed *Wastewater Treatment Plant Hydraulic and Treatment Capacity Study* evaluated the ability of the Mason Farm WWTP to accommodate and treat wastewater in accordance with OWASA State-mandated permit requirements. The study also made important recommendations for optimizing the plant's operations.

Overall findings were very positive and included the following highlights:

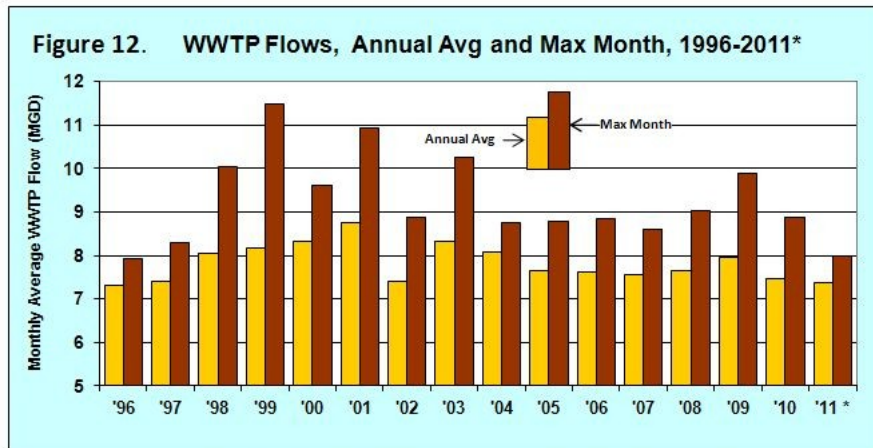
- The wastewater plant will be able to meet Jordan Lake nitrogen removal requirements without major near-term capital investment and with significantly less chemical use than previously thought. This can be accomplished by adjusting the treatment configuration of the plant's aeration basins.
- It is likely that more than \$60 million of previously programmed wastewater plant projects can be deferred beyond OWASA's 15-year CIP planning period, and no major plant expansion is expected to be required until sometime after 2030.
- Upgrading the aeration system for the biological treatment process (conversion from coarse to fine bubble diffusers) will significantly improve treatment efficiency and reduce energy consumption. This aeration system analysis also indicated the need for additional odor modeling, which subsequently determined that the treatment plant's "odor footprint" will change, and it will be necessary to cover and treat the air emanating from 10 of the 16 aeration basins, rather than covering only the 8 that had previously been specified. The aeration system and odor control improvements will be consolidated into a single project to be completed before the end of calendar year 2014 to meet OWASA's odor control commitments to the Town of Chapel Hill.
- Significant operating and maintenance cost savings of approximately \$300,000 per year can be achieved through reduced chemical and energy use by optimizing the plant's biological treatment process. These savings are now being realized, and the optimization work has also improved the quality of reclaimed water (reduced alkalinity) provided to the University.

#### **Can additional water conservation, demand management, and I/I improvements reduce or delay the need for future wastewater treatment plant expansions?**

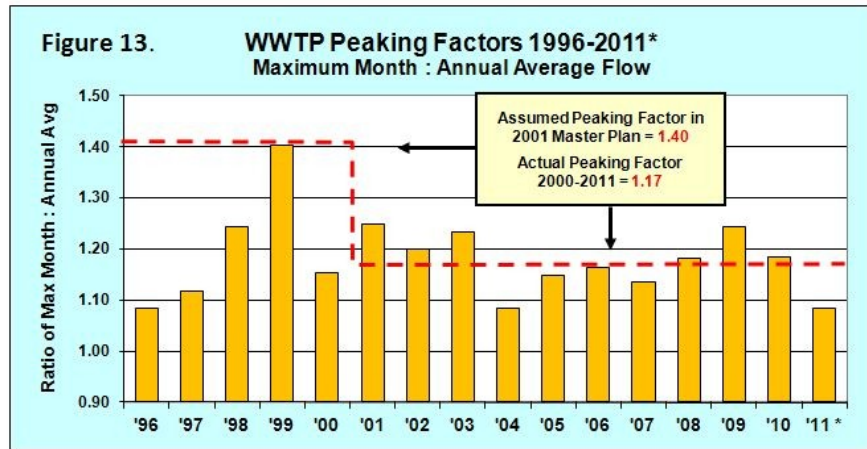
Yes. Efficiency measures that reduce indoor water use can have a corresponding reduction in wastewater discharges from our customers, thereby reducing or delaying the need for additional plant capacity.

Figures 12 and 13 show that wastewater treatment plant (WWTP) flows have followed the same generally decreasing pattern as drinking water patterns in recent years. As

noted before, water demand reductions by our customers are the result of their conservation efforts, many of which have reduced indoor water use and associated wastewater discharges. Maximum monthly flows typically occur during periods of higher rainfall and runoff and are affected more directly by weather than by customer use. The marked decrease in monthly peaking factors (Figure 13) likely corresponds to less stormwater inflow and infiltration (I/I) entering the sewer system and indicates that our ongoing program of repairing and rehabilitating aging sewer lines and manholes is achieving positive results.



\* Data are reported for Jan-Dec calendar years, except 2011, where data are only available through September.



\* Data are reported for Jan-Dec calendar years, except 2011, where data are only available through September.

**Will UNC’s use of reclaimed water reduce the need for future wastewater treatment plant capacity?**

No. RCW will reduce demands on OWASA’s water supply reservoirs and drinking water treatment plant, but not on the wastewater plant. The RCW system enables the

University to use highly treated effluent from the wastewater plant instead of drinking water in the cooling towers of its chilled water facilities and for other non-potable purposes, such as athletic field irrigation. The total amount of wastewater discharged to the sewer system will generally be the same as if treated drinking water had been used.

**Are there any discretionary treatment or reliability issues – not required by regulations – that OWASA should consider for the future?**

The *2001 Master Plan* identified several discretionary measures, including additional electrical generator standby capacity to ensure uninterrupted operation during power outages; filters to provide higher quality effluent (including advanced nutrient removal) and to help meet regulatory requirements for non-potable reuse; ultraviolet disinfection, which is more environmentally friendly than chlorine disinfection; improved capture and use of methane from biosolids treatment to heat boilers and power a blower; and improved odor control. *All of these improvements were included in the expansion and upgrade project completed in 2007.* Additional improvements to eliminate offsite odors per requirements of the Town of Chapel Hill's 2004 Special Use Permit will be completed by the end of 2014.

After the old methane gas-powered air blower was permanently removed from service in 2010, we completed a preliminary study of alternatives for using waste-generated methane for power production or other purposes. The study concluded that the capital cost of a new methane engine with a gas treatment system and construction of a fats, oil and grease (FOG) receiving facility (which would be needed to generate a sufficient volume of methane gas) would be in the general range of \$5 million to \$6.5 million. Payback would depend on several factors, but could be as early as 12.5 years with an adequate and reliable supply of FOG and if we collected a competitive tipping fee for accepting and treating FOG waste. Staff is conducting follow-up work to better understand the potential sources and volumes of FOG that might be available in Orange County. We are also evaluating opportunities for external funding assistance.

**How will we manage the increasing volumes of wastewater biosolids?**

OWASA produces about four dry tons per day of wastewater biosolids, which is the highly treated by-product of the wastewater treatment process. A portion of this is applied as liquid to agricultural land; the remainder is "dewatered" to the texture and consistency of moist soil and then transported to a private composting facility. Sufficient permitted farmland area is currently available – either in OWASA or private ownership – to accommodate the land application of all future biosolids production; but, this situation is especially sensitive to changes in private land ownership and to regulatory changes.

Although the land application of either liquid and/or dewatered biosolids will likely remain a vital component of our program for the foreseeable future, OWASA recognizes that some uncertainty still exists about the effects of certain biosolids constituents. We continue to support further studies to determine those impacts, and we are open to considering proven, reliable, and cost-effective alternatives for sustainable biosolids management. However, in the absence of such alternatives, we firmly believe that recycling biosolids through a properly managed program in strict compliance with State

and Federal regulatory requirements is a safe, cost effective, and environmentally responsible way of managing this inevitable by-product of our community.

A handwritten signature in black ink, appearing to read "Ed Holland". The signature is written in a cursive style with a horizontal line underneath it.

Edward A. Holland, AICP  
Planning Director