Jordan Lake
Water Supply Storage
Allocation Request

CITY OF DURHAM

MAY 1, 2014 DRAFT

The City of Durham is requesting a 6.5 MGD Level I Jordan Lake water supply storage allocation to augment its existing 10 MGD allocation. This will enable the City to cost-effectively participate in the development of new intake, treatment, and transmission facilities located near the western side of Jordan Lake and shared with one or more other utilities. Durham will then rely on Jordan Lake, rather than its Lake Michie/Little River Reservoir system, to base-load its day to day water demands and to meet projected needs through 2045.

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INTRODUCTION

The City of Durham's 2014 Jordan Lake allocation application has been developed through its participation as a member and lead agency of the Jordan Lake Partnership (JLP), which is described below. All information provided and preferences expressed in this application package are consistent with information that Durham previously provided to the Partnership. Most importantly, Durham's Selected Alternative, which includes the request for an additional 6.5 MGD (6.5%) allocation of the Jordan Lake water supply pool, is consistent with the Recommended Regional Alternative developed and endorsed by the 13 members of the Jordan Lake Partnership.

The Jordan Lake Partnership – What It Is

The Jordan Lake Partnership (JLP) is a consortium of 13 local water supply utilities in the Triangle Region which has been working collaboratively since 2009 to develop a long-range plan for the Triangle's water supply. The Partnership has developed a Triangle Regional Water Supply Plan (TRWSP) that addresses the 50-year water supply needs of the 13 members that are listed below and whose service areas are shown in Figure 1:

- ***Town of Apex***
- ***Town of Cary***
- ***Chatham County (North water system)***
- ***City of Durham***
- ***Town of Hillsborough***
- ***Town of Holly Springs***
- ***Town of Morrisville***
- ***Orange Water and Sewer Authority (OWASA)***
- ***Orange County***
- ***Town of Pittsboro***
- ***City of Raleigh and Merger Partners***
- ***City of Sanford***
- ***Wake County (Research Triangle Park - South)***

The JLP has provided the Triangle Regional Water Supply Plan to the NC Division of Water Resources (DWR) in support of the Jordan Lake allocation requests submitted by individual JLP members. The TRWSP describes the planning process with which the regional water supply plan, including the Recommended Regional Alternative, was developed. The Recommended Regional Alternative includes the individual Jordan Lake allocation requests that Partners are expected to submit. This Introduction briefly presents the Recommended Regional Alternative and provides the larger context of Durham's request.

As part of the regional planning process, JLP members collaborated on the development and evaluation of water demand projections, water supply source options and alternatives, and a mutually

supported plan that can meet the future water supply needs of the Triangle Region through 2060. Other accomplishments of the JLP included (1) the compilation of a detailed inventory of finished water interconnections among the Region's distribution systems, (2) the development (currently underway) of a regional hydraulic model of those interconnections and potential improvements, (3) a feasibility study (also still underway) of new intake, water treatment plant, and major transmission facilities proposed for the western side of Jordan Lake. All of these efforts have been planned, directed, and funded by the Partnership.

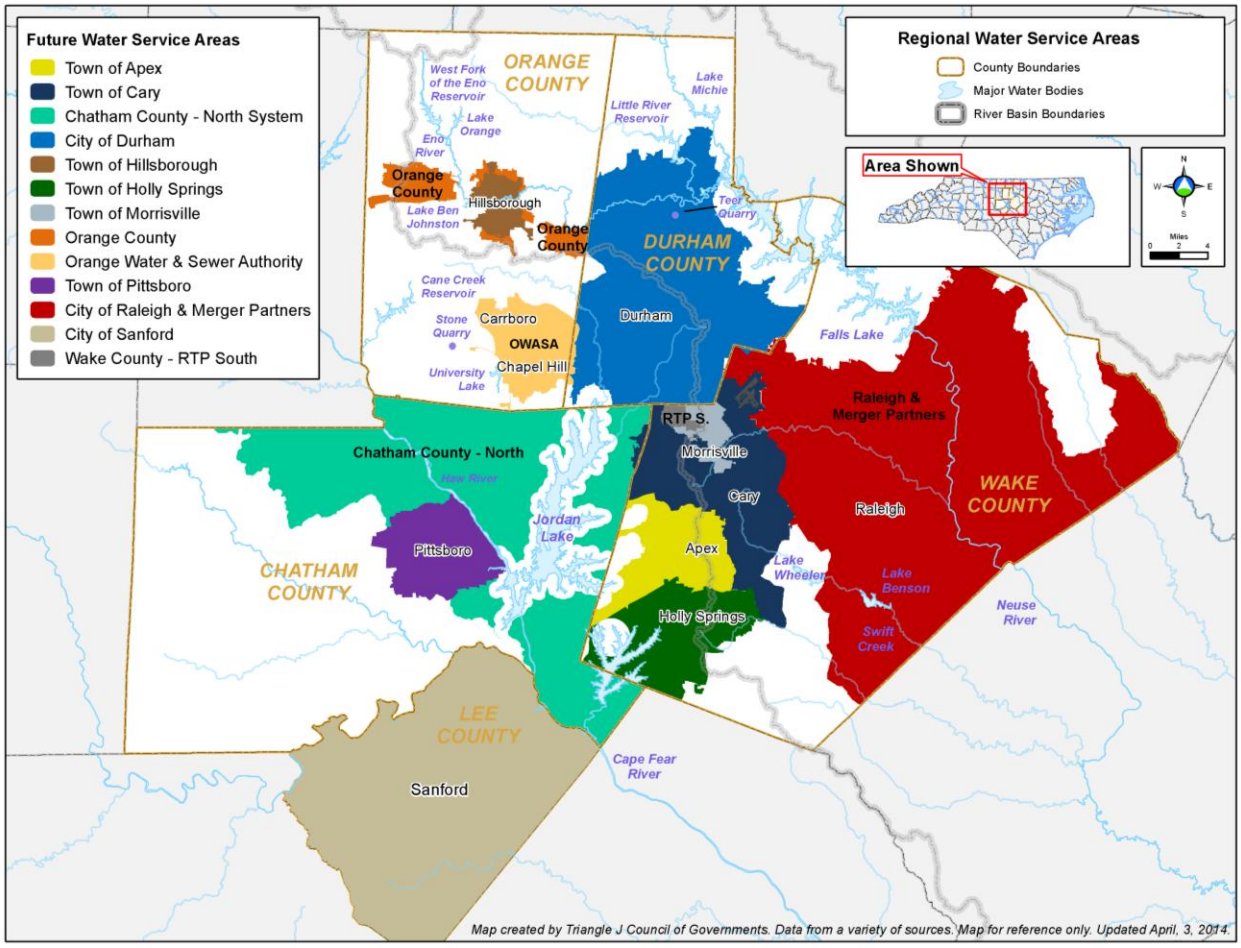


Figure 1 – Future (2060) water service areas of the Jordan Lake Partners.

Developing the Triangle Regional Water Supply Plan

The TRWSP has two basic components: (1) the identification of water needs through 2060, and (2) a plan for meeting those needs. The *Triangle Regional Water Supply Plan: Volume I – Water Needs Assessment* (May 2, 2012) presented the demand projections and initial estimates of water supply needs of all 13 JLP members. The *Triangle Regional Water Supply Plan: Volume II – Regional Water Supply Alternatives Analysis* (Draft, April 18, 2014) presents the methodology used to compile and evaluate water supply alternatives and provides details of the preferred alternative and regional water

supply plan. The following information summarizes those regional needs, the Recommended Regional Water Supply Alternative, and lists the proposed Jordan Lake allocation requests.

Triangle Region Water Demand Projections and Needs for Future Supply

Figure 2 illustrates the total regional water demand projections with reference to the total water supply of 199 MGD (horizontal line) currently available to the 13 JLP members. Each of the partners initially developed its own projections, which were then reviewed by the other partners and subsequently revised. The resulting revised, peer-reviewed projections were approximately 10-15% lower than the initial projections, as shown by the red shaded boxes in Figure 2, and represent a historic consensus among local water system professionals about the Region's water supply status and long-term needs.

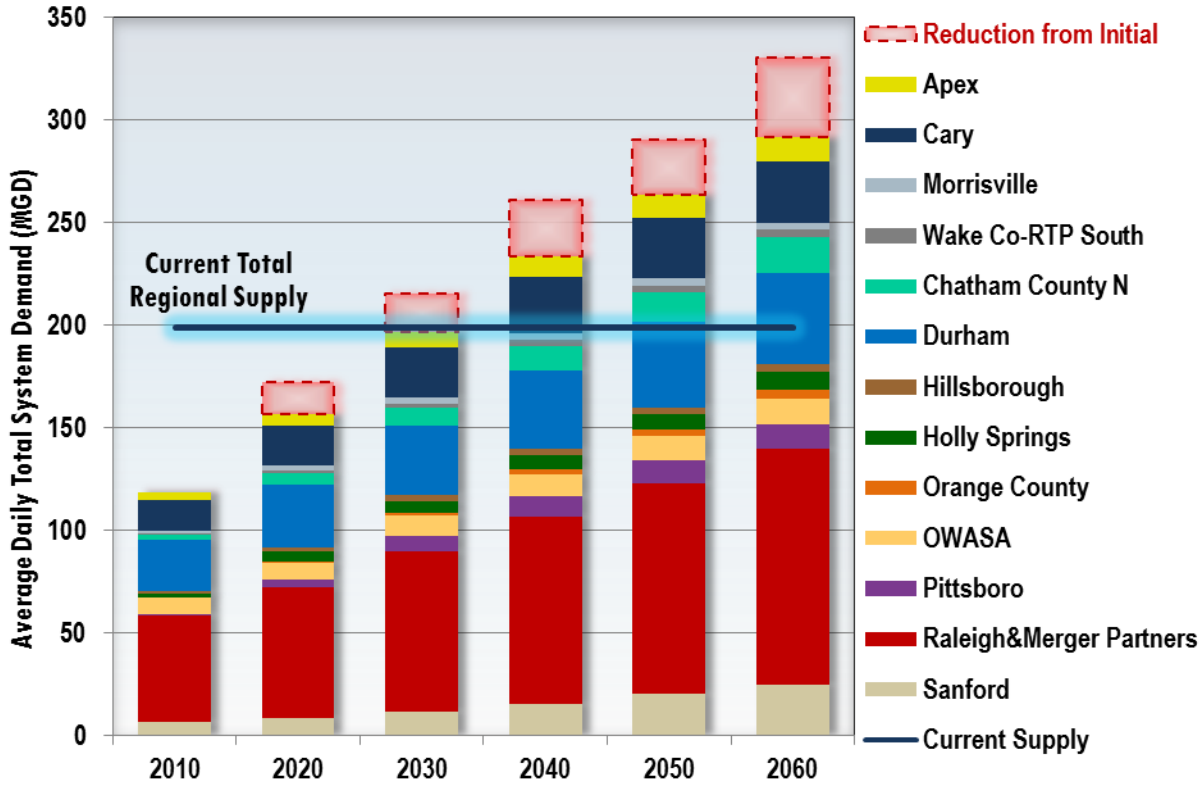


Figure 2 – Regional demand projections, current supply, and reductions resulting from peer review.

Table 1 presents each water system's need, which is defined here as each system's *average day demand minus the operational yield of its existing water supply sources, including existing Level I Jordan Lake allocations*. Based on demand projections and existing supply, the need for each partner was computed for the 2010 -2060 planning period at five year intervals as shown. The italicized columns for 2045 and 2060 highlight the key planning years for this current (Round 4) cycle of Jordan Lake allocations and the 50-year planning horizon of the TRWSP.

Table 1 – Projected Water Supply Needs (MGD) of the Jordan Lake Partners

Partner	2010	2015	2020	2025	2030	2035	2040	*2045*	2050	2055	*2060*
Apex *	0.0	0.0	0.0	0.0	0.0	0.3	1.4	*2.1*	2.5	2.8	*3.1*
Cary *	0.0	0.0	0.0	0.0	0.8	2.5	3.9	*5.1*	6.3	6.3	*6.3*
Morrisville *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	*0.1*
Wake Co. (RTP S.) *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chatham County N *	0.0	0.0	0.0	0.8	2.3	4.1	5.9	*7.0*	8.2	10.1	*12.1*
Durham *	0.0	0.0	0.0	0.0	0.0	0.0	0.2	*2.1*	4.0	5.2	*6.5*
Hillsborough	0.0	0.0	0.0	0.0	0.1	0.3	0.4	*0.6*	0.8	0.9	*1.1*
Holly Springs *	0.0	0.0	0.0	0.0	0.0	0.0	0.1	*0.6*	1.1	1.6	*2.1*
Orange County *	0.0	0.1	0.5	0.9	1.3	1.8	2.2	*2.6*	3.0	3.3	*3.7*
OWASA *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pittsboro	0.0	0.0	1.3	3.6	5.8	6.9	8.1	*8.4*	8.8	9.3	*9.8*
Raleigh & Merger	0.0	0.0	0.0	0.0	0.9	7.5	14.0	*19.7*	25.4	31.6	*37.7*
Sanford	0.0	0.0	0.0	0.0	0.0	1.3	3.2	*5.8*	8.4	10.6	*12.8*
Total	0.0	0.1	1.8	5.3	11.2	24.7	39.4	*54.0*	68.4	81.8	*95.2*

**** "Need" assumes that existing Level I Jordan Lake allocations are fully utilized***

The Recommended Regional Alternative

The JLP evaluated an array of water supply alternatives that could meet the Region's needs as presented in Table 1. The *Triangle Regional Water Supply Plan: Volume II – Regional Alternatives Analysis* presents the methodology and analyses used to compile and evaluate those alternatives. A preferred regional alternative for meeting the future needs of all partners through 2060 emerged from this effort and is referred to hereinafter as the "JLP Recommended Alternative."

Table 2 presents new water supply sources that would be brought online per the JLP Recommended Alternative. The Projected New Supply column lists the estimated yields of proposed new supply sources in addition to yields currently available. Those sources include new supplies as well as the expansion of existing sources.

The City of Raleigh's preferred source options remain uncertain with regard to timing and order of implementation, but Raleigh's options include four priority sources, any of which could provide an estimated additional yield of 13.7 MGD: (1) a new Little River Reservoir in eastern Wake County, (2) the reallocation of Falls Lake storage to increase the available Falls Lake water supply pool, (3) a direct withdrawal from the Neuse River upstream of Raleigh's Neuse River Wastewater Treatment Plant, and (4) a quarry reservoir adjacent to the Neuse River near Richland Creek. Under the JLP Recommended Alternative, Raleigh would meet its future demands from a combination of these Neuse Basin sources.

Table 2 –Supply sources to be developed per the JLP Recommended Alternative

Partner	Source Name	Basin	Type	Year Online	Projected New Supply [MGD]
Multiple	Jordan Lake – Round 4	Haw	Storage Allocation	2015	28.2
Multiple	Jordan Lake – Future Rounds	Haw	Storage Allocation	2025 – 2045	8.2
Sanford	Cape Fear River Withdrawal	Cape Fear	River Withdrawal	2025, 2045	12.8
Pittsboro	Haw River Withdrawal	Haw	River Withdrawal	2015, 2020	4.0
Hillsborough	W. Fork Eno Reservoir Expansion	Neuse	Reservoir Expansion	2015	1.2
OWASA	Stone Quarry Expansion	Haw	Quarry Reservoir	2035	2.1
Orange County	Town of Mebane Purchase	Haw	Purchase	2015-2020	2 (0.5 – 2.5)
Raleigh	Neuse Basin Option 1	Neuse	TBD	2025	13.7 (9-15)
Raleigh	Neuse Basin Option 2	Neuse	TBD	2035-2045	13.7 (9-15)
Raleigh	Neuse Basin Option 3	Neuse	TBD	2050-2055	13.7 (9-15)
TOTAL	All New Sources				96.2-100

In total, the JLP Recommended Alternative would provide approximately 100 MGD of water supply by 2060 (i.e., in addition to what exists today), which would meet the Region's projected cumulative need of 95.2 MGD. These alternative sources would reduce the risk of a supply deficit for any of the Partners – even during a recurrence of the most severe droughts recorded in the Triangle during the past 80 years.

Jordan Lake Allocations proposed in the JLP Recommended Alternative

The JLP Recommended Alternative includes new or expanded Jordan Lake allocations for several partners, both in this current Round 4 and in future allocation cycles. At the present time, 63% of the Jordan Lake water supply pool has been allocated. A 1% storage allocation is assumed to yield approximately 1 MGD of average day supply. All existing allocations are currently held by Jordan Lake Partnership members, and the JLP Recommended Alternative proposes that all existing allocations either be maintained or increased.

Table 3 presents current allocations, proposed Round 4 allocations, and future requests. Round 4 would meet water supply needs through 2045, with future allocations meeting needs through 2060. Table 3 indicates the total allocation amounts for each partner, who are expected to distinguish between Level I and Level II requests in their respective applications.

Table 3 includes all 13 JLP members, even though Raleigh (and its Merger Partners) and Sanford, are expected to meet their needs from other non-Jordan Lake sources. The Towns of Apex and Cary currently hold a combined Jordan Lake allocation for both communities. Cary has also finalized long-term agreements to serve the Town of Morrisville and the Wake County – RTP South service areas, and is expected to submit a joint allocation request on their behalf. Table 3 therefore includes the combined (total) proposed request, but also indicates the individual amounts of each.

Hydrologic effects of the JLP Recommended Alternative were modeled with the recently updated Cape Fear-Neuse Basin OASIS model and the last 80+ years of daily streamflow data. The model results

indicated that all of the partners and downstream water users would be able to meet their demands for all days, and that no water shortages would be experienced; i.e., the water supplies that comprise the JLP Recommended Alternative are able to meet the future water demands of the region under the full range of recorded hydrologic conditions, while at the same time allowing downstream water users to meet their future demands as well.

Table 3 – Jordan Lake allocations (MGD) proposed per the JLP Recommended Alternative

Partner	Current		Total Round 4 Requests		Future Rounds (2060 Need)	
Apex	8.5	32.0	10.6	46.2	11.6	48.5
Cary	23.5		28.6		29.8	
Morrisville	3.5		3.5		3.6	
Wake County (RTP South)	3.5		3.5		3.5	
Chatham County - N	6		13		18.2	
Durham	10		16.5		16.5	
OWASA	5		5		5	
Orange County	1		1.5		2	
Holly Springs	2		2		2.2	
Hillsborough	0		1		1	
Pittsboro	0		6		6	
Raleigh & Merger Partners	0		0		0	
Sanford	0		0		0	
TOTAL JLP	63		91.2		99.4	

Moving Toward Implementation

The JLP Recommended Alternative is the result of more than four years of collaborative planning by the Partnership. The water supply needs of the 13 Partners were vetted through successive rounds of peer review and represent the most complete long-term picture of the Region's water needs compiled to date. A comprehensive analysis of water supply options determined that the JLP Recommended Alternative would be most acceptable in terms of implementation, environmental and community impacts, customer costs, and overall acceptance by local governments and the general public.

The JLP efforts constitute the successful collaboration – including an unprecedented level of mutual trust and respect – among local entities planning, coordinating, and moving toward implementation of a water supply plan that will meet the long-term needs of the entire Triangle Region. Individual partners will continue to operate their own systems, but the success of the Regional Water Supply Plan will depend on each Partner's ability to implement its respective water supply supplement as recommended.

The remainder of this document presents the City of Durham's specific allocation request.

SECTION I. WATER DEMAND FORECAST

Durham's demand forecasts were derived from a CDM *Water Demand Projections for the City of Durham, Technical Memorandum, September 16, 2010*. The methodology and Durham staff's subsequent adjustments to those demands in October 2013 are described in the text and summarized in the tables and figures below.

Population Estimates

CDM's 2010 technical memorandum presented several alternate demand scenarios based on different assumptions of population growth and water use by individual customer sectors. Population projections were based on the Durham City/County Planning Department's analysis of 2005 TAZ (Traffic Analysis Zone) data. Population and demand projections provided to the Jordan Lake Partnership and incorporated into this application were based on modifications to CDM's "Scenario 3," which assumed that build-out of Durham's water service area would occur by 2060.

Water Demand Projections

Residential water demands were based on population and average water use through the analysis of customer billing records. Non-residential demand projections were based on individual interviews and billing records of the largest commercial, industrial, and institutional users. Projections for the smaller non-residential users were based on the TAZ-projected number of employees and a per-employee water use rate within each non-residential sector. Customer accounts with separate irrigation meters were included in both the residential and non-residential sectors. Except as described below, projected demands assume that incremental *per capita decreases* in usage will occur in all customer sectors due to increased water use efficiency and conservation efforts (see Section II – Conservation and Demand Management). A robust reclaimed water system has not yet been established, because a water reuse master planning effort is still in its initial stages. Reclaimed water use and associated potable demand offsets are therefore not estimated at this time.

Demand projections employed the water use rates listed below. These were applied to each customer sector for the first decade of the planning period, followed by an assumed demand *decrease* of 1 gallon per capita per day (gpcd) per decade through 2060.

- Residential: 54 gpcd (reduced from CDM's original assumption of 60 gpcd)
- Commercial: 41 gpd/employee
- Industrial: 41 gpd/employee
- Institutional: 41 gpd/employee

Large water users in the Durham County portion of Research Triangle Park (RTP) were projected separately from the rest of the commercial sector, with demands increasing to 1.80 MGD in 2020 and remaining constant through 2060. The potential effects on demand projections of a new master plan recently completed for the Research Triangle Park Owners & Tenants Association have not yet been fully determined and therefore are not included in this document.

The largest industrial water users were projected separately from the smaller users, with the largest projected to remain at a constant demand 0.34 MGD throughout the planning period.

Duke University and Medical Center and Durham County Hospital were projected separately from smaller institutional users, with Duke University and Medical Center projected at 1.45 MGD in 2020, and increasing by 0.1 MGD in each planning year to 1.85 MGD in 2060. Duke Regional Hospital (formerly Durham County Regional Hospital) usage was projected to remain at a constant rate of 0.09 MGD.

Durham's "non-revenue water" projections are based on the following:

- Water treatment plant process water: 3.4% of total demand for 2020 and beyond
- Other non-revenue water (unbilled water, line flushing, hydrant testing, construction, waterline breaks, street cleaning, Fire Department use): 11.5% of total demand for 2015 through 2025, 9.5% of total demand for 2030 through 2050, and 7.5% of total demand for 2055 and beyond

Table I.1. City of Durham Water Use Sectors

Use Sector	Sub-sector/Description	
Residential	Includes all single family, multi-family, and (residential) irrigation use	
Commercial	Large Commercial Users (Non-Industrial) All Other Commercial Users (Non-RTP)	
Industrial	Top 20 Industrial Users (including RTP) Other Industrial Users	
Institutional	Duke University & Hospitals All Other Institutional Employers (schools, churches, etc.)	
Non-Revenue	Distribution System Process Water	(Included with Other Non-Revenue Water)
	Water Treatment Process Water	Calculated as 3.4% of total water demand for 2020 and beyond
	Other Non-Revenue Water	Includes unbilled water, line flushing, hydrant testing, construction, waterline breaks, street cleaning, and Fire Department use. Calculated as 11.5% of total water demand for 2015 through 2025; 9.5% of total demand for 2030 through 2050; and 7.5% of total demand for 2055 through 2060.

Table I.2 – Projected Population and Water Demand (MGD) for the Durham Service Area

Sector	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Population	246,200	266,300	286,400	307,900	329,400	350,900	372,400	393,900	415,900	436,900	458,400
Residential	13.24	14.36	15.47	16.47	17.46	18.42	19.37	20.28	21.19	22.06	22.92
Commercial	6.62	6.91	7.19	7.80	8.40	8.95	9.50	10.02	10.53	11.01	11.49
Industrial	1.31	1.28	1.24	1.36	1.47	1.58	1.68	1.79	1.89	1.98	2.07
Institutional	2.73	2.46	2.19	2.30	2.41	2.52	2.63	2.74	2.84	2.95	3.05
Dist. System Process	(Included in Other Non-Revenue Water)										
WTP Process	0.86	0.95	1.04	1.10	1.16	1.23	1.30	1.36	1.42	1.47	1.51
Other Non-Revenue	0.51	2.02	3.53	3.39	3.24	3.43	3.62	3.80	3.98	3.66	3.33
TOTAL	25.3	28.0	30.7	32.4	34.1	36.1	38.1	40.0	41.9	43.1	44.4

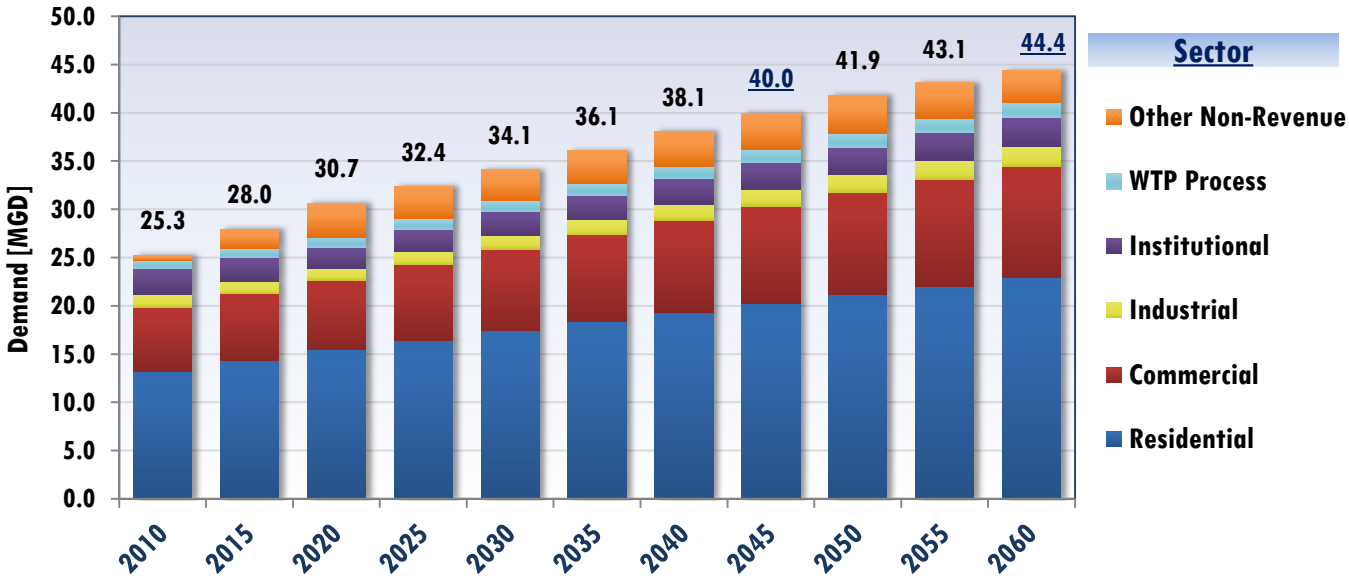


Figure I.1 – City of Durham Demand Projections by Customer Sector

Bulk Water Sales

Durham has emergency sales/purchase agreements in place with nearby communities, but does not provide or obtain water on a regular basis with any of these entities. Durham's 20-year agreement with Chatham County includes a staged increase in guaranteed water sales, with a maximum of up to 4.0 MGD by 2028. The agreement requires Chatham County to notify Durham on or before April 1st of each year of the County's anticipated need for that year; however, since the agreement was executed in 2008, Chatham County has purchased water only for short-term use during scheduled maintenance or other temporary outages, rather than for meeting regular day-to-day needs. All of Durham's other sales agreements are for mutual aid (emergency use) only.

Table I.3 – Sales to other systems

Purchaser	PWSID	Agreement Amount (MGD)	Begin Year	End Year	Regular or Emergency	Pipe Size (in.)
Cary	03-92-020	N/A	N/A	2028	Emergency	16
Chatham Co	03-19-126	N/A	N/A	2028	Emergency	16
Hillsborough	03-68-015	N/A	N/A	2008	Emergency	16
Orange-Alamance	03-68-020	N/A	N/A	2008	Emergency	N/A*
OWASA	03-68-010	N/A	N/A	2029	Emergency	12

**Via interconnection with Town of Hillsborough*

References

CDM, *Water Demand Projections for the City of Durham, Technical Memorandum, September 16, 2010* (Scenario 3 projections subsequently modified by Durham staff, October 31, 2013).

SECTION II. CONSERVATION AND DEMAND MANAGEMENT

Durham residents, businesses, and institutions used 12% less water in 2012 than in 1999, despite a 20% increase in total customer accounts. This significant increase in water use efficiency is consistent with trends observed nationwide and reflects the conservation ethic that was fostered among customers in Durham and other Triangle area communities – many of whom implemented permanent changes to reduce water use – during the record droughts of 2001-02 and 2007-08.

The City of Durham has reinforced this trend through a combination of educational outreach, regulatory initiatives, and customer incentives summarized below (parentheses indicate initial implementation dates):

Water Use Assessments (March 1995)

This ongoing service provided by Durham's Water Conservation/Efficiency staff continues to be one of the most valuable tools available to customers. Water Use Assessments (WUAs) were initially available only to residential customers; however, in recent years this service has been expanded to small commercial customers as well. WUAs result in substantial customer benefits by identifying the sources of leaks and providing individualized advice about the array of opportunities available for further water use reduction. A small one-time charge is applied to the water bills of customers requesting WUAs. The value of WUAs has been significantly increased with the implementation of electronic datalogging meters.

Reclaimed Water (June 2007)

Highly treated wastewater is available for non-potable use only to bulk customers at the North Durham Water Reclamation Facility (WRF). The bulk reuse program will be expanded to the South Durham WRF in the future. A Reclaimed Water Master Planning effort will begin in 2015 to expand the bulk reuse system and to explore the development of a robust reclaimed water distribution system.

Multimedia Education, Marketing, and Advertising (June 2008)

Immediately after the drought of 2007-08, Durham developed an aggressive conservation communications campaign that integrated traditional media (TV, radio, print, and online), direct marketing, public relations, cross promotions, and social networking. A central element of the campaign was the creation of the *DurhamSavesWater.org* website to provide ready access to water conservation information and tips, links to additional information, current and recent Durham demand trends, tiered rates, and other water-related information. *DurhamSavesWater.org* remains the central point of reference for water supply and conservation/efficiency information. Social media are now being incorporated into all messaging for these programs.

Tiered Water Rates (July 2008)

Higher volume single family residential (SFR) customers pay higher rates per cubic foot of consumption than lower volume users through a five-tiered rate system. For FY 2014, the first tier – up to 200 cubic

feet per month (approximately 1,500 gallons) – is charged at a rate of $1.75 per 100 cubic feet, or about $2.34 per thousand gallons. The fifth and highest tier is $5.63 per 100 cubic feet, or about $7.54 per thousand gallons, for all use above 1,500 cubic feet, or 11,200 gallons per month. All commercial/ institutional/industrial customers are billed at Tier 3 rates, while irrigation only customers are billed at Tier 5. Since tiered rates were first implemented in 2008, average monthly use for all SFR customers decreased nearly 18%. In 2008, 62% of all SFR consumption occurred in the two lowest tiers – a proportion that increased to 77% in 2013. During the same period, SFR consumption in the highest tier decreased from 16% to 2%.

Toilet Rebate/Credit Program (September 2008)

Durham offers a $100 rebate/credit for the replacement of conventional toilets with EPA WaterSense approved high efficiency toilets (HETs). Residential customers receive rebates, which are credited to subsequent water/sewer bills, for replacing up to three toilets per household. The rebate program was expanded to non-residential customers in 2011. As of January 2014, nearly 5,100 conventional toilets had been replaced with high efficiency models, resulting in a reduction of approximately 22 million gallons per year. Interest and participation in the program is expected to continue to grow. Durham's elected officials have supported the program through consistent funding in the City's annual budget. Through the efforts of the Conservation/Water Efficiency Program, the City actively participates as a utility partner in EPA's WaterSense program, which provides staff with access to the latest information about conservation and customer incentive programs.

Year-Round Irrigation Limits (June 2009)

Per Durham's Water Efficiency Ordinance adopted in 2009, spray irrigation is now limited to three days per week under normal weather and rainfall conditions; one day per week during Stage 1 Water Shortage conditions; and prohibited during Stage 2 or more severe Water Shortages. The alternate day irrigation schedule has significantly reduced daily demand spikes during peak seasonal periods. Staff is deployed daily during the peak lawn watering season to ensure compliance.

Rain/Moisture Sensors (June 2009)

Also per ordinance, sensors are now required on all new irrigation systems to prevent automatic activation when irrigation is unnecessary.

Automated Meter Reading (final phase to be completed in June 2014)

Durham embarked on a multi-phased meter replacement program in early 2010. In addition to using automated meter reading (AMR) technology to provide more efficient and accurate billing and leak detection, residential/small commercial customers were converted from bi-monthly to monthly billing. As an efficiency measure, electronic meters capture detailed usage information and provide indicators of leaks as well as backflow problems. By downloading this information via data loggers, permanent usage records are maintained and attached to customer accounts. Detecting and tracking leaks and anomalies earlier in the billing cycle (now monthly, rather than bi-monthly) provides opportunities for customers to voluntarily modify water usage, prevent waste, and decrease their bills.

Water and Sewer Rates and Charges (ongoing)

Consistent increases in customer rates and charges that reflect "the true cost of water" (e.g., all costs: supply, treatment, and delivery; wastewater collection and treatment; water and sewer line repair and replacement; maintenance and construction of major facilities, etc.) and provide an additional economic incentive to reduce water waste and increase efficiency. Since adopting tiered rates in 2008, Durham's elected officials have consistently supported modest incremental increases each year for volumetric rates and service/availability charges.

SECTION III. CURRENT WATER SUPPLY

Available Supply

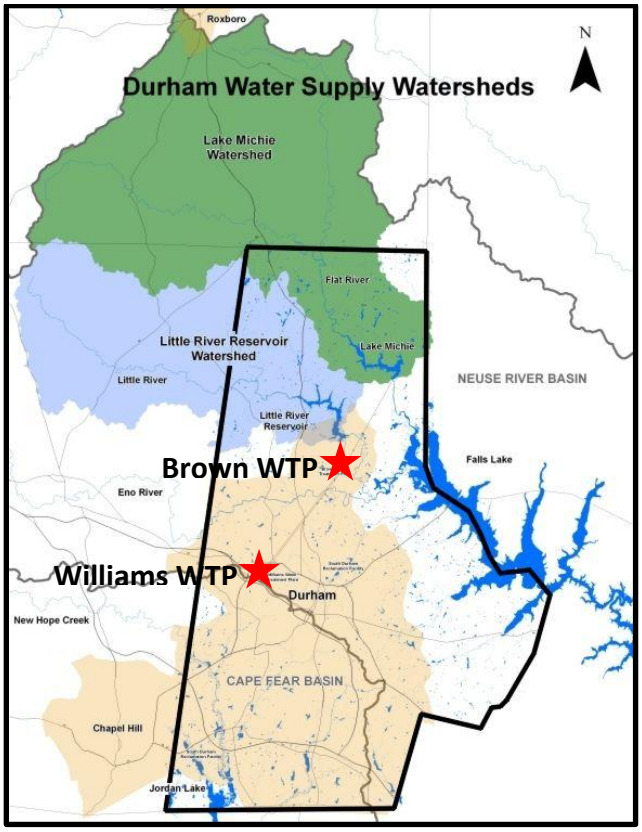


Figure III.1 – Map of Durham Water Supply Sources and Water Treatment Plants

Table III.1 – Existing Source Summary, Available Supply

Source	PWSID	SW or GW	Basin	WQ Classification	Available Supply (MGD)
Lake Michie	03-32-010	SW	Neuse (10-1)	WS-III, NSW, CA	27.9 [A]
Little River Reservoir	03-32-010	SW	Neuse (10-1)	WS-IV, B, NSW, CA	
Existing Jordan Lake Allocation	03-32-010	SW	Haw (2-1)	WS-IV, B, NSW, CA	10
Teer Quarry (Emergency Only)	03-32-010	SW	Neuse (10-1)	WS-IV NSW	(Natural Recharge Only)

[A] Period-of-record yield for the Lake Michie/Little River Reservoir system, as determined in *Hazen Sawyer Technical Memo– Use of the Teer Quarry Supplemental Raw Water Storage Project, November 2012.*

Purchased Water

As noted in the Bulk Water Sales discussion in Section I – Water Demand Forecast, Durham is a party to emergency sales/purchase arrangements with several nearby utilities; but, except for the commitment to sell specified volumes to Chatham County, these are mutual aid agreements that do not designate fixed or guaranteed amounts of water to any of the parties on a regular basis. Under their general terms, these agreements provide for the sale of water *subject to its availability from the seller*. Existing finished water infrastructure can supply Durham with up to 11 MGD through interconnections with the Town of Cary, 5 MGD from Raleigh, and 5 MGD from OWASA, but Durham has obtained water under these agreements only for limited amounts of time during severe drought conditions or periods of special operational need, such as planned/unplanned infrastructure maintenance or other outages. *Water available under these existing agreements represents only a short-term or temporary, rather than permanent, supply source for Durham.*

References

Hazen and Sawyer Technical Memorandum, *Use of the Teer Quarry Supplemental Raw Water Storage Project, November 2012.*

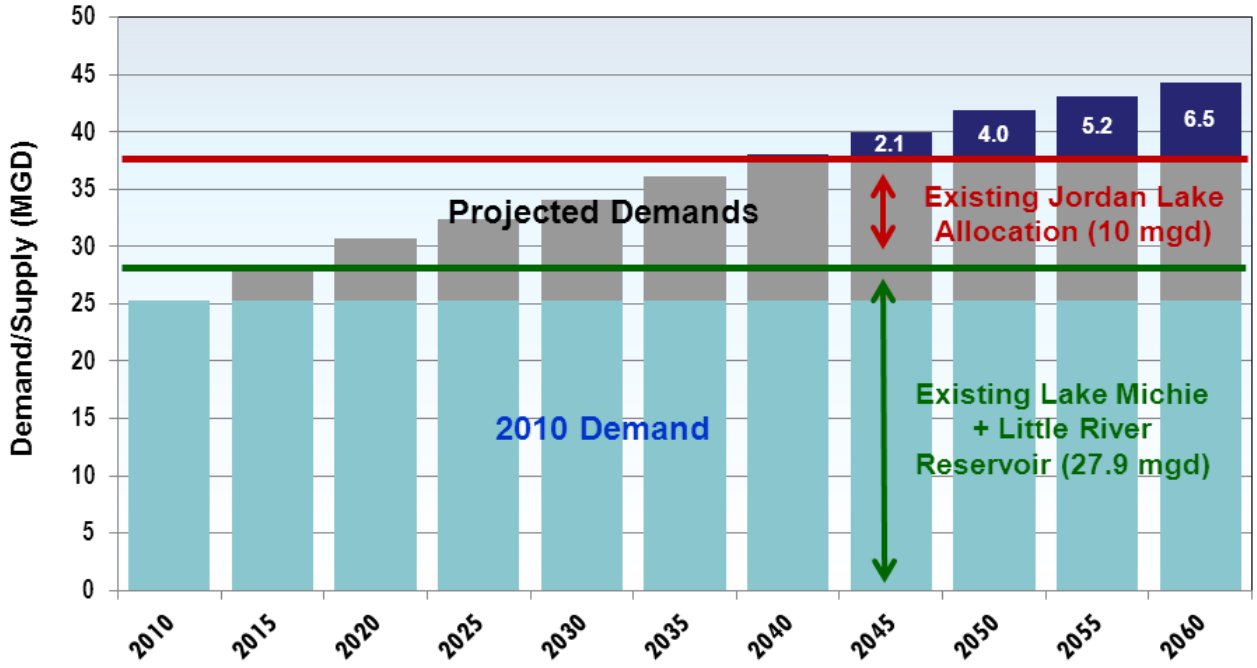
SECTION IV. Future Water Supply Needs

Table IV.1 - City of Durham, Existing Water Supply and Projected Water Needs *

	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Demand	25.3	28.0	30.7	32.4	34.1	36.1	38.1	40.0	41.9	43.1	44.4
Supply	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9
Demand % of Supply	*67%*	*74%*	*81%*	*85%*	*90%*	*95%*	***101%***	***105%***	***110%***	***114%***	***117%***
Need	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**2.1**	**4.0**	**5.2**	**6.5**

**** NB:*** *"Need" assumes that Durham's existing 10 MGD Jordan Lake allocation is being fully utilized.*

Figure IV.1 Existing Water Supply and Projected Demands



References

CDM, *Water Demand Projections for the City of Durham, Technical Memorandum, September 16, 2010* (Scenario 3 projections subsequently modified by Durham staff, October 31, 2013).

SECTION V. Alternative Water Supply Options

Source Options

Table V.1 – City of Durham, Additional Source Water Options

Source	Type	SW or GW	Basin	WQ Classification	Development Time (yrs)	Earliest Year Online	Additional Supply (MGD)
Jordan Lake Allocation	New Facilities at Jordan Lake	SW	Haw (2-1)	WS-IV, B, NSW, CA	5	2020	6.5
Teer Quarry	Offline Quarry Storage	SW	Neuse (10-1)	WS-IV, NSW, CA	5	2020	5.2
Raise Lake Michie to 365 MSL	Modify Existing Reservoir	SW	Neuse (10-1)	WS-III, NSW, CA	15	2030	12.0
Raise Lake Michie to 380 MSL	Modify Existing Reservoir	SW	Neuse (10-1)	WS-III, NSW, CA	15	2030	26.0
Reclaimed Water (RCW) Initial Implementation	Non-Potable Reuse of WWTP Effluent	N/A	Neuse (10-1)	N/A	5	2020	3.1
Reclaimed Water (RCW) Initial + Assertive Implementation	Non-Potable Reuse of WWTP Effluent	N/A	Neuse (10-1)	N/A	15	2030	10.5

Summary of Supply Alternatives

Table V.2 – Descriptions of Alternatives

Alternative	Description
Alternative 1	Additional 6.5 MGD Jordan Lake allocation in conjunction with new regional intake, treatment, and transmission facilities constructed near the western side of Jordan Lake
Alternative 2	Teer Quarry + Initial implementation of Reclaimed Water (RCW) system (non-potable reuse of highly treated wastewater)
Alternative 3	Raise the level of Lake Michie from its present elevation of 341 MSL to 365 MSL by constructing a new dam, intake, and raw water transmission facilities
Alternative 4	Raise the level of Lake Michie from its present elevation of 341 MSL to 380 MSL by constructing a new dam, intake, and raw water transmission facilities
Alternative 5	Initial + Aggressive Reclaimed Water (RCW) system

Table V.3 – Source Composition of Water Supply Alternatives (MGD)

Need and Source Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total Projected Need (2045)*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
Total Projected Need (2060)*	*6.5*	*6.5*	*6.5*	*6.5*	*6.5*
Sources:					
Jordan Lake Allocation - Rd 4	6.5	0.0	0.0	0.0	0.0
Teer Quarry	0.0	5.2	0.0	0.0	0.0
Raise Lake Michie to 365 MSL	0.0	0.0	12.0	0.0	0.0
Raise Lake Michie to 380 MSL	0.0	0.0	0.0	26.0	0.0
Reclaimed Water (RCW) Initial Implementation	0.0	3.1	0.0	0.0	0.0
Reclaimed Water (RCW) Initial + Assertive Implementation	0.0	0.0	0.0	0.0	10.5
Total New Supply (MGD)	**6.5**	**8.3**	**12**	**26**	**10.5**

**** NB:*** *"Need" assumes that Durham's existing 10 MGD Jordan Lake allocation is being fully utilized.*

Alternatives Analysis

Table V.4 – Summary and Ratings of Water Supply Alternatives

	Alternative 1 Jordan Lake	Alternative 2 Teer Quarry + RCW Initial	Alternative 3 Raise Lake Michie to 365'	Alternative 4 Raise Lake Michie to 380'	Alternative 5 RCW Aggressive
Allocation Request (% of storage)	6.5	0	0	0	0
Total Incremental Supply (MGD)	6.5	8.3	12	26	10.5
Environmental Impacts		More Than	More Than	More Than	More Than
Water Quality Classification	WS-IV, B, NSW, CA	WS-IV, NSW	WS-III, NSW, CA	WS-III, NSW, CA	N/A
Timeliness	Yes	Yes	Yes	Yes	Yes
Interbasin Transfer (MGD) [A]	None	1.9 (2020) 3.5 (2045)	4.2 (2030) 8.1 (2045)	4.2 (2030) 8.1 (2045)	4.2 (2030) 7.0 (2045)
Regional Partnerships	Yes, JLP	None	Potential (w/Raleigh)	Potential (w/Raleigh)	None
Technical Complexity	Complex	Complex	Complex	Complex	Very Complex
Institutional Complexity	Complex	Complex	Very Complex	Very Complex	Complex
Political Complexity	Complex	Complex	Very Complex	Very Complex	Very Complex
Public Benefits	Few	None	Few	Few	Few
Consistency with local plans	Yes	Yes	Yes	Yes	Yes
Total Capital Cost ($ millions)	$111.10[B]	$46.5[C]	$158.3[D]	$203.3[D]	$104.4[C]
Unit Capital Cost ($M/MGD)	$6.94[B]	$5.60[C]	$13.19[D]	$7.82[D]	$9.93[C]
Selected Alternative	✓				

Notes: *[A] Durham's existing maximum month transfer out of the Neuse River Basin is ~18.6 MGD*
[B] Includes costs of new WTP (Durham's 16.5 MGD share) and finished water transmission facilities
[C] Includes costs of WRF upgrades to meet RCW treatment requirements, but does not include costs of WTP expansion for additional treatment capacity
[D] Does not include costs of WTP expansion for additional treatment capacity

Alternative 1 (Preferred) – Jordan Lake Allocation in Conjunction with New Regional Intake, Treatment, and Transmission Facilities Constructed Near the Western Side of Jordan Lake and Shared with Other Utility Providers

Description

Four members of the 13-member Jordan Lake Partnership (Chatham County, the City of Durham, OWASA, and the Town of Pittsboro) are jointly evaluating options for a new regional intake and treatment plant located on the western side of Jordan Lake to supplement their existing supply sources and to provide more regional reliability and redundancy. The initial concept, for which the technical, economic, institutional, and environmental feasibility were recently estimated, includes a new intake structure, pumping facilities, and water treatment plant located south of U.S. Highway 64 near the western shore of Jordan Lake, as well as major finished water transmission lines to serve the four participating entities. Raw water intake and pumping facilities would be constructed within the lake and/or on land leased from the Army Corps of Engineers. The treatment plant would be constructed on property currently owned by OWASA adjacent to Corps land. Additional concept-level configurations are being developed and will be evaluated, but the participating Partners have agreed that the scenario outlined in this narrative provides a consistent technical and economic basis for developing their respective Jordan Lake allocation requests. Additional scenarios remain under investigation. A concept-level map of the potential regional facilities is presented in Figure V.1.

Facilities would be initially sized to meet maximum day demands of 44 MGD anticipated through 2040, and then expanded to meet ultimate (2060) maximum day demands of 60 MGD. Capital costs for this scenario include a new raw water intake, raw water transmission facilities, a water treatment plant (WTP), plus shared as well as separate finished water pumping facilities and transmission lines. Where applicable, costs include the purchase of land/easements, environmental mitigation, and Jordan Lake water supply storage allocations. For the concept-level planning purposes of this analysis, capital funding for the initial facilities is assumed to occur in 2015, with construction completed in 2020. The new intake facilities and all pipelines would be sized to meet ultimate (2060) maximum day demands. Each Partner's share of the capital costs of those facilities was calculated as the ratio of that Partner's ultimate demand to the total ultimate facility capacity. The WTP and shared pumping facilities are assumed to be constructed in two phases, with initial sizing to meet interim (2040) demands of 44 MGD. Each Partner's share of the capital costs for those initial facilities was calculated as a direct ratio of that Partner's interim demand to the total interim capacity of the WTP and shared pumping facilities. Facility expansion is based on ultimate capacity of 60 MGD in 2060, with financing for the expansion assumed to occur in 2035 and construction completed in 2040. Each Partner's share of the capital cost for the expansion was calculated as a direct ratio of that Partner's incremental increase in demand (from 2040 to 2060) to the total increase in facility capacity. As noted, initial and ultimate facility capacities of 44 and 60 MGD are based on projected maximum day demands in 2040 and 2060, respectively.

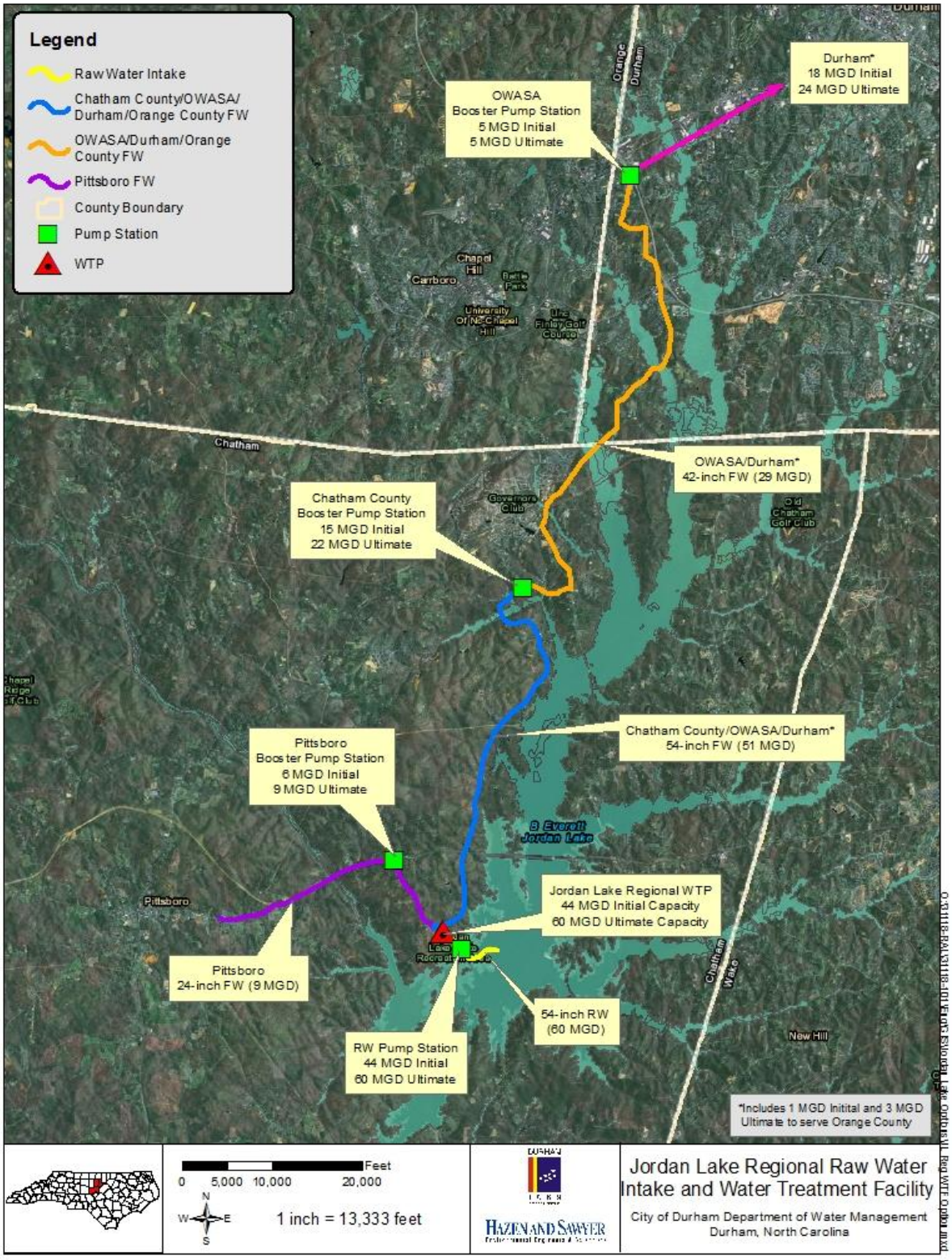


Figure V.1 Concept-level map of proposed regional facilities at Jordan Lake.

A summary of ultimate estimated capital costs (in 2010 dollars) is presented below (It is assumed that Orange County's share of the costs would ultimately be reflected in an agreement with the City of Durham, which would provide Orange County's Jordan Lake water through Durham's finished water interconnection with the Town of Hillsborough):

Summary of Conceptual-Level Capital Cost Estimates of Proposed Jordan Lake Regional Facilities			
Partner	**Total Allocation Request (MGD)**	**Cost Share ($M 2010)**	**Cost Per MGD of Allocation ($M 2010)**
Chatham County	**18**	**$102.1**	**$5.67**
Durham	**16.5**	**$115.0**	**$6.97**
OWASA	**5**	**$30.5**	**$6.10**
Orange County *	**2**	**$18.1**	**$9.05**
Pittsboro	**6**	**$46.5**	**$7.75**
Total	**47.5**	**$312.2**	**$6.57**

**** Orange County to be served via Durham-Hillsborough finished water interconnection; costs to be recovered through interlocal agreement.***

Unlike the other water supply alternatives considered in Durham's application package, *this Jordan Lake scenario and associated capital costs comprise new finished water (treatment and transmission) as well as raw water facilities*. Unit cost comparisons to the other supply alternatives, which *do not* include finished water treatment and transmission facilities, may therefore be misleading; that is, the unit costs for Jordan Lake may appear to be disproportionately high, as they do not represent a levelized or "apples to apples" cost comparison to the other alternatives. However, to disaggregate treatment and finished water transmission costs from the raw water components of this Jordan Lake scenario would not be meaningful, due to the locations and distances from Chatham County's and Pittsboro's existing treatment plants and service areas. Raw-water-only scenarios are not feasible for Chatham County, Orange County, or Pittsboro, but might be viable for OWASA and/or Durham. Such raw-water-only scenarios are still being evaluated.

The estimated total capital cost of $312 million represents an average unit cost of $6.57 million per MGD of Jordan Lake water supply allocation; however, as noted above, this includes finished water treatment and transmission facility as well as "water-supply-only" costs.

No specific agreements are in place among the Partners regarding possible financing, ownership, governance, or operation of a regional venture, but potential institutional arrangements could include single-entity ownership and operation (e.g., Durham, OWASA, Chatham County, or Pittsboro); shared or joint ownership, such as the present Cary-Apex water treatment or Western Wake (Cary-Apex-Morrisville) wastewater partnerships; interlocal agreements among individual utilities; or the creation

of a new entity, such as a Jordan Lake water supply authority. The actual institutional setting for any new regional enterprise would be established by the appropriate local policy-making bodies.

Jordan Lake Allocation Request

The City of Durham currently holds a 10 MGD Level I allocation and is requesting an **additional 6.5 MGD Level I allocation** – for a total of 16.5 MGD – to meet its projected needs as presented in Table IV.1 and Figure IV.1.

Available Supply

The requested **6.5 MGD** of additional Jordan Lake allocation would increase Durham's total available supply from its present capacity of **37.9 MGD** to **44.5 MGD**, which will be needed to meet projected demands of 40.0 MGD in 2045 and 44.4 MGD in 2060.

Environmental Impacts

Because this alternative does not require the development of a new water supply source, it represents none of the major environmental and social costs of a new reservoir, such as private land (and home) acquisition, road relocation, significant habitat destruction, and so forth. The direct environmental impacts of the proposed Jordan Lake regional facilities will be largely limited to the temporary and localized construction activities required for new raw water intake, pumping, treatment, and finished water transmission facilities. Virtually all of these will occur on property already owned by public entities or located within public rights of way. It is clear that this option represents the least environmental impacts of any of Durham's water supply alternatives.

Water Quality Classification

The water quality classification of Jordan Lake in the vicinity of the proposed intake is **WS-IV, NSW** and would remain unchanged with this alternative.

Timeliness

The timeliness of this alternative is **Acceptable**. Although the 2020 startup date for the proposed regional facilities may not be achievable, Durham's needs will be adequately addressed if the new facilities are in service by the late 2020s.

Interbasin Transfer

Neither Chatham County, Durham, Orange County, OWASA, nor Pittsboro currently transfer water out of the Haw River Basin (2-1). Implementation of the proposed Jordan Lake regional alternative would eventually involve an interbasin transfer (IBT) of up to 1.5 MGD from the Haw to the Neuse River Basin (10-2) by Orange County, but no transfers would occur by the other four entities. Orange County would access its Jordan Lake allocation via a finished water interconnection between the Durham and Hillsborough systems, but would not require IBT certification because its transfer would not exceed the 2 MGD statutory threshold.

Water obtained and treated from Durham's Jordan Lake allocation would be used only within the Cape Fear (Haw) portion of Durham's service area and therefore would not require IBT certification. Most notably, Jordan Lake would support a significant reduction in Durham's current and future transfers out of the Neuse Basin by decreasing its reliance on Lake Michie and the Little River Reservoir to meet all of the City's water supply needs. Because Durham anticipates using its full 16.5 MGD Jordan Lake allocation (10 MGD existing + 6.5 MGD requested) immediately upon completion of the new regional facilities, Durham's projected transfer of 20.4 MGD from the Neuse River Basin in 2020 would be reduced to 8.5 MGD. Similarly, the Jordan Lake option would enable Durham to reduce its projected 26.6 MGD transfer out of the Neuse Basin in 2045 to only 15.6 MGD. (Durham has a grandfathered capacity to transfer up to 45.4 MGD from the Neuse to the Haw River Basin.)

Regional Partnerships

This alternative was developed in coordination with the Jordan Lake Partnership and is fully consistent with the Triangle Regional Water Supply Plan as adopted by the Partnership.

Technical Complexity

This alternative is considered to be **Technically Complex,** but is well within the practical range of existing utility engineering practices and procedures.

Institutional Complexity

This alternative would be **Institutionally Complex** due (1) to the number of regulatory permits required and (2) the involvement of multiple units of local government who must collaborate and reach agreement on issues of financing, governance, operation, maintenance, etc. of the new facilities. A list of permits that would likely be required includes:

- Environmental Assessment per the North Carolina State Environmental Policy Act (SEPA)
- U.S. Army Corps of Engineers Section 404/North Carolina Section 401 Water Quality Certification for stream or wetland pipeline crossings (individual permit required if permanent wetland impacts exceed 0.5 acre)
- U.S. Army Corps of Engineers Land Use Request
- Duke-Progress Energy Encroachment Agreement
- Gas Pipeline Encroachment Agreement (depending on final water pipeline routes)
- NCDOT Encroachment Agreement
- NCDOT Driveway Permit
- Sedimentation and Erosion Control Permit
- NPDES Permit for waste process water
- DWR Site Evaluation Approval
- Water System Management Plan Certification/DWR Authorization to Construct
- Chatham County Site Plan/Construction Plan Approval
- Chatham County Building Permit
- Blasting Permit

- DWR Operating Permit

The existing Cary-Apex agreement regarding the construction, ownership, and operation of the Cary-Apex Water Treatment Facility; the Cary-Apex-Morrisville partnership in developing the new Western Wake Wastewater Facility; and the utility merger agreements among Raleigh and other Wake County municipalities have all demonstrated the economic and operational benefits of shared facilities. It is also believed that the successful and ongoing staff level collaboration demonstrated by the Jordan Lake Partnership and the recent focus of the Western Intake Partners represent a solid foundation on which the respective local policy boards can develop formal institutional agreements.

Political Complexity

This alternative would be **Politically Complex** due to the interlocal institutional factors described above.

Public Benefits

This alternative will provide **Substantial Public Benefits** through the economies and efficiencies of scale available through shared facilities. Such a regional approach also simplifies or streamlines regulatory oversight and is better able to respond to the evolving regulatory environment. Similarly, such an approach is better able to incorporate new and emerging technologies than may be feasible or cost-effective with more traditional individual local projects. Most importantly, additional intake and treatment facilities on the western side of Jordan Lake would provide much-needed regional reliability and redundancy in the event of unplanned/emergency conditions or other operational contingencies at the existing Cary-Apex facilities or elsewhere in the Triangle. Also, as noted above, this alternative does not require the development of new water supply sources, but ensures a reliable and sustainable water supply for the participating entities and reduces the volume of Durham's existing and future interbasin transfers out of the Neuse River Basin.

Consistency with local plans

This alternative is **Consistent** with local growth management and development plans. The proposed capacities of new intake, treatment, and transmission facilities have all been scaled to meet the future water demand projections of each participating entity.

Total Cost

Per the revised February 2014 guidance from DWR, estimates have been developed in 2010 dollars for the *total capital costs* and *unit capital cost per MGD of additional supply (yield)* for this alternative. As noted above, Durham's share of the total capital cost is estimated as **$115.0 million**, which represents a unit capital cost of **$6.97 million per MGD** of additional supply. It is important to emphasize that these costs include Durham's portion of new water treatment plant and finished water transmission facilities in addition to the "water-supply-only" elements of the other alternatives evaluated in this application.

References

Hazen and Sawyer, *Jordan Lake Joint Development – Western Intake, WTP, and Related Facilities, April 24, 2014 (analysis in progress as of May 1, 2014)*

Alternative 2 – Teer Quarry + Initial implementation of Reclaimed Water (RCW) system

Description

This alternative includes the development of two separate source options: (a) upgrading Durham's Teer Quarry to provide a 5.2 MGD offline supplement to the existing Lake Michie/Little River Reservoir system, and (b) offsetting 3.1 MGD of potable water demand with reclaimed wastewater effluent (RCW) for non-potable commercial, industrial, and irrigation uses. This alternative would therefore provide a total "addition" of 8.3 MGD to Durham's existing supply.

The use of the 1.3 billion gallon quarry to permanently supplement the existing reservoir system will require the construction of new intake, pumping, and transmission facilities that would enable the quarry to be refilled with excess water from the Eno River during periods of higher flow. An additional 3.1 MGD of projected demand would be met (offset) by the non-potable use of RCW, which would require improvements at both of Durham's water reclamation facilities and the construction of approximately 40 miles of new RCW distribution lines in highly urbanized portions of Durham's service area.

Jordan Lake Allocation Request

Durham currently holds a 10 MGD Level I Jordan Lake allocation, which would be retained under this alternative. **No additional Jordan Lake allocation would be requested.**

Total Supply

This alternative would increase Durham's 37.9 MGD available supply (27.9 MGD Lake Michie/Little River Reservoir plus existing 10 MGD Jordan Lake allocation) by **8.3 MGD** for a total of **46.2 MGD**, which could meet projected demands of 44.4 MGD in 2060.

Environmental Impacts

A Finding of No Significant Impact (FONSI) previously issued by the NC Department of Natural and Environmental Resources (DENR) allows the City to construct a raw water pumping station and to refill Teer Quarry from the Eno River. The direct impact of intake and pumping facility construction would be temporary and limited in extent. Long-term hydrologic impacts on Eno River stream flow would be minimized through compliance with the Eno River Water Management Operations Plan, to which Durham is a party, and which permits the City to withdraw up to 15 MGD from the Eno River during periods of higher flows. This option would increase the total volume of water transferred out of the Neuse River Basin; however, that increased transfer would not occur if future water supply needs are met through an increased Jordan Lake allocation.

The chief impacts of the RCW component of this alternative would result from the construction and installation of approximately 40 miles of new distribution pipeline within a highly developed urban environment. It is not known at this time how much, if any, disturbance would occur within environmentally sensitive areas.

Water Quality Classification

The water quality classification of the Eno River, from which the Teer Quarry would be periodically refilled, is WS-IV, NSW.

Timeliness

By itself, the Teer Quarry component of this alternative could be developed in a timely manner and would meet Durham's projected demands through 2045, but not through 2060. Those additional demands would be met through the gradual development and expansion of the RCW system.

Interbasin Transfers

Durham has a grandfathered IBT capacity to transfer up to 45.4 MGD from the Neuse River Basin (10-1) to the Haw River Basin (2-1). Maximum month transfers at the present time are about 18.6 MGD. This alternative would increase projected transfers by approximately 1.9 MGD if implemented in 2020 and by 3.5 MGD in 2045 for a total of 20.5 MGD in 2020 and 22.1 MGD in 2045 during months of maximum transfer. Because these total volumes are substantially less than the City's grandfathered capacity, no further IBT certification would be required.

Regional Partnerships

This alternative would be a Durham project only, and offers **no opportunities for regional or interlocal partnerships**.

Technical Complexity

The Teer Quarry component of this alternative is well within the practical range of existing utility engineering practices and procedures and is considered to be **Not Complex**. The RCW component is also well within the range of standard practices, but its challenges are considered to be **Very Complex** due to the geographic scope and duration of community disturbance associated with the installation of 40 miles of RCW distribution lines in a highly developed urban environment.

Institutional Complexity

This alternative is considered to be **Institutionally Complex** due to Federal and State permitting requirements. The **Teer Quarry** portion of this alternative would likely require the following permits:

- Letter of Map Revision (LOMR) or No-Impact (No-Rise) Certification from the Federal Emergency Management Agency (FEMA)
- Army Corps of Engineers Nationwide (or Individual) Section 404 Permit
- North Carolina Section 401 Water Quality Certification
- Water System Management Plan Certification/DWR Authorization to Construct
- Re-classification of the Teer Quarry to WS-IV/CA/NSW

The **RCW** component of this alternative would likely require the following permits:

- NCDENR non-discharge permit
- NCDENR reclaimed water permit for improvements to the South Durham Water Reclamation Facility (WRF)
- Modifications to existing permit at the North Durham WRF
- U.S. Army Corps of Engineers Nationwide (or Individual) Section 404 Permit
- North Carolina Section 401 Water Quality Certification for stream or wetland pipeline crossings
- NCDOT permits or encroachment agreements for pipelines installed in DOT rights-of-way
- NC Railroad Corporation permit for one or more pipeline crossings of the railroad right-of-way

Political Complexity

The **Teer Quarry** portion of this alternative is **Not Politically Complex** from Durham's perspective, as Durham's elected leaders are familiar with the quarry's value during the 2007-2008 drought. Plans for used of the Quarry would be consistent with the Eno River Water Management Operations. However, permanent use of the Teer Quarry could face opposition by downstream communities (Raleigh and Raleigh's Merger Partners) with concerns about potential hydrologic impairment of the Falls Lake water supply moving this in to the **Politically Complex** area.

The **RCW** component of this alternative is also considered to be **Politically Complex.** In addition to concerns about potential hydrologic impacts, the RCW program anticipated to generate citizen complaints and opposition due to traffic disruption and local inconvenience caused by the construction of approximately 40 miles of pipeline over an extended period of time in a highly developed urban environment.

Public Benefits

This alternative would provide **No Further Public Benefits** other than its value as a water supply source.

Consistency with Local Plans

This alternative is **Consistent** with Durham's growth and development plans.

Total Cost

Per the revised February 2014 guidance from DWR, estimates have been developed in 2010 dollars for the total capital costs and unit capital cost per MGD of additional supply (yield) for this alternative. The capital costs for the 5.2 MGD Teer Quarry and 3.1 MGD RCW portions of this alternative are estimated at $22.6 million and $23.9 million, respectively, for a total of **$46.5 million** or a unit capital cost of **$5.64 million per MGD** of additional supply. These estimates include the cost of water reclamation facility upgrades required to meet RCW treatment requirements, but do not include costs of additional finished water treatment capacity for supplemental water from the Teer Quarry.

References

Linwood Peele, Supervisor, Water Supply Planning Branch, North Carolina Division of Water Resources, Department of Environment and Natural Resources, *Interbasin Transfer Grandfathered Capacity Determination, February 6, 2014* letter to Mr. Don Greeley, Director, Department of Water Management, City of Durham.

Kimley-Horn and Associates, Inc., *Draft Teer Quarry Raw Water Storage and Pumping Facility, Supplemental Preliminary Engineering Report, July 27, 2012.*

McKim & Creed, *City of Durham Water Reuse Feasibility Study, Final Draft Report, October 2011.*

Secure Resources, PLLC, *City of Durham Jordan Lake Water Supply Allocation, Water Reuse Alternatives, Technical Memorandum (draft), January 15, 2014.*

Alternative 3 – Raise the Level of Lake Michie to 365 MSL

Description

Lake Michie's storage capacity would be increased from its present active volume of 2,800 MG to 5,300 MG by raising its present water surface elevation (341 feet MSL) by 24 feet (to 365 feet MSL) with the construction of a new dam, plus the construction of new intake and pumping facilities located downstream of the existing dam. This would augment Durham's existing supply system with an additional yield of 12 MGD, as estimated from recent hydrologic modeling conducted by Hazen and Sawyer Engineers, and would meet Durham's projected demands through 2060.

Jordan Lake Allocation Request

Durham currently holds a 10 MGD Level I Jordan Lake allocation, which would be retained under this alternative. **No additional allocation would be requested.**

Total Supply

Raising Lake Michie's water surface elevation to 365 MSL would increase Durham's total available supply from its present capacity of **37.9 MGD to 49.9 MGD**, which would meet the City's projected demands of 40.0 MGD in 2045 and 44.4 MGD in 2060.

Environmental Impacts

The expanded reservoir would inundate approximately 450 additional acres of bottomland. A total of 1,025 acres, including all or portions of 129 separate parcels, would be acquired to provide a 300-foot water quality buffer around the lake's new shoreline and approximately 0.7 acres of wetland mitigation and 53,000 feet of stream mitigation. The project would require the relocation of 4,400 feet of existing roadway, all existing Lake Michie recreational facilities, and modification to an existing Duke Energy electrical transmission line. The downstream hydrologic effects on the Falls Lake water supply pool of a larger upstream impoundment have not been modeled, but are potentially significant. The overall environmental impacts of this project would be substantially greater than the impacts of meeting Durham's future water supply needs through Durham's preferred alternative, which would rely on Jordan Lake, rather than the Lake Michie/Little River Reservoir system to base-load day to day needs.

Water Quality Classification

The **WS III, NSW, CA** water quality classification of Lake Michie would remain unchanged.

Timeliness

It is likely that the implementation of this alternative would require an extensive, lengthy permitting process complicated by potential legal challenges. If and when this additional supply were developed, it could meet Durham's projected demands through 2060.

Interbasin Transfer

Durham has a grandfathered IBT capacity to transfer up to 45.4 MGD from the Neuse River Basin (10-1) to the Haw River Basin (2-1). Maximum month transfers at the present time are about 18.6 MGD. This alternative would **increase these projected transfers** by approximately 4.2 MGD if implemented in 2030 and by 8.1 MGD in 2045 for a total IBT of 26.7 MGD during months of maximum transfer in 2045. Because these volumes are substantially less than the City's 45.4 MGD of grandfathered capacity, **no further IBT certification would be required**.

Regional Partnerships

This alternative is considered to be a Durham-only project, but may represent downstream water supply benefits to the City of Raleigh due to increased storage volume in the Upper Neuse Basin. The hydrologic impacts of this alternative have not been modeled; but, if favorable, this project **could present a partnership opportunity for the City of Raleigh and its Merger Partners**.

Technical Complexity

This project is well within the range of standard engineering practices, but its overall size and scope render it technically challenging, as it comprises virtually all the elements of a major new dam and reservoir: land acquisition, design and construction of new intake, pumping and transmission facilities, and the dam itself.

Institutional Complexity

This alternative is considered to be **Very Complex i**nstitutionally due to potentially time-consuming legal challenges and Federal and State permitting requirements, which would likely include:

- Comprehensive Environmental Impact Statement as required by the National Environmental Protection Act
- U.S. Army Corps of Engineers Section 404 Permit
- North Carolina Section 401 Water Quality Certification
- Water System Management Plan Certification

Political Complexity

This project would be **Very Complex** politically, due to expected opposition by environmental protection advocates and by downstream communities (Raleigh and its Merger Partners) with concerns about hydrologic effects on the Falls Lake water supply.

Public Benefits

This project would provide **Few**, if any, additional public benefits other than its value as a water supply source.

Consistency with Local Plans

This alternative is **Consistent** with Durham's growth and development plans.

Total Cost

Per the revised February 2014 guidance from DWR, estimates have been developed in 2010 dollars for the total capital costs and unit capita cost per MGD of additional supply (yield) for this alternative. The capital costs for this alternative are estimated at **$158.3 million**, or **$13.19 million per MGD** of additional supply. Unlike the estimates for Durham's preferred Jordan Lake alternative, these costs do not include the construction of additional water treatment plant capacity.

References

Hazen and Sawyer, Consulting Engineers, *Evaluation of Alternative Reservoirs on the Flat and Little River, October 1988.*

Hazen and Sawyer, Consulting Engineers, *Lake Michie Expansion Alternatives, Cost Update: Conceptual-Level Estimates of Water Facilities Project Capital and Life-Cycle Costs,* Worksheet Outputs, March 11, 2014.

Alternative 4 – Raise the Level of Lake Michie to 380 MSL

Description

Lake Michie's storage capacity would be increased from its present active volume of 2,800 MG to 10,500 MG by raising its present water surface elevation (341 feet MSL) 39 feet (to 380 feet MSL) with the construction of a new dam plus the construction of new intake and pumping facilities located downstream of the existing dam. This would augment Durham's existing supply system with an additional yield of 26 MGD, as estimated from recent hydrologic modeling conducted by Hazen and Sawyer Engineers, and would meet Durham's projected demands through 2060.

Jordan Lake Allocation Request

Durham currently holds a 10 MGD Level I Jordan Lake allocation, which would be retained under this alternative. **No additional allocation would be requested.**

Total Supply

Raising Lake Michie's water surface elevation to 365 MSL would increase Durham's total available supply from its present capacity of **37.9 MGD to 63.9 MGD**, which would meet the City's projected demands of 40.0 MGD in 2045 and 44.4 MGD in 2060.

Environmental Impacts

The expanded reservoir would inundate approximately 825 additional acres of land. A total of 1,025 acres, including all or portions of 129 separate parcels, would be acquired to provide a 300-foot water quality buffer around the lake's new shoreline and approximately 1 acre of wetland and 90,000 feet of stream mitigation. The project would require the relocation of 6,000 feet of existing roadway, all existing Lake Michie recreational facilities, and modification to an existing Duke Energy electrical transmission line. The downstream hydrologic effects on the Falls Lake water supply pool of a larger upstream impoundment have not yet been modeled, but are potentially significant. The overall environmental impacts of this project would be substantially greater than the impacts of meeting Durham's future water supply needs through Durham's preferred alternative, which would rely on Jordan Lake, rather than the Lake Michie/Little River Reservoir system to base-load day to day needs.

Water Quality Classification

The **WS III, NSW, CA** water quality classification of Lake Michie would remain unchanged.

Timeliness

It is likely that the implementation of this alternative would require an extensive, lengthy permitting process complicated by potential legal challenges. If and when it is developed, the additional water supply could meet Durham's projected demands through 2060.

Interbasin Transfer

Durham has a grandfathered IBT capacity to transfer up to 45.4 MGD from the Neuse River Basin (10-1) to the Haw River Basin (2-1). Maximum month transfers at the present time are about 18.6 MGD. This alternative would **increase these projected transfers** by approximately 4.2 MGD if implemented in 2030 and by 8.1 MGD in 2045 for a total IBT of 26.7 MGD during months of maximum transfer in 2045. Because these total volumes are substantially less than the City's 45.4 MGD of grandfathered capacity, **no further IBT certification would be required**.

Regional Partnerships

This alternative is considered to be a Durham-only project, but may represent downstream water supply benefits to the City of Raleigh due to the increased storage volume that it would provide in the Upper Neuse Basin. The hydrologic impacts of this alternative have not been modeled; but, if favorable, this project **could present a partnership opportunity for the City of Raleigh and its Merger Partners.**

Technical Complexity

This project is well within the range of standard engineering practices, but its overall size and scope render it technically challenging, as it comprises virtually all the elements of a major new dam and reservoir: land acquisition, design and construction of new intake, pumping, and transmission facilities, and the dam itself.

Institutional Complexity

This alternative is considered to be **Very Complex i**nstitutionally due to potentially time-consuming legal challenges and Federal and State permitting requirements, which would likely include:

- Comprehensive Environmental Impact Statement as required by the National Environmental Protection Act
- U.S. Army Corps of Engineers Section 404 Permit
- North Carolina Section 401 Water Quality Certification
- Water System Management Plan Certification

Political Complexity

This project would be **Very Complex** politically, due to the likely degree of opposition by environmental protection advocates and by downstream communities (Raleigh and its Merger Partners) with concerns about hydrologic effects on the Falls Lake water supply.

Public Benefits

This project would provide **Few**, if any, additional public benefits other than its value as a water supply source.

Consistency with Local Plans

This alternative is **Consistent** with Durham's growth and development plans.

Total Cost

Per the revised February 2014 guidance from DWR, estimates have been developed in 2010 dollars for the total capital costs and unit capita cost per MGD of additional supply (yield) for this alternative. The capital costs for this alternative are estimated at **$203.3 million**, or **$7.82 million per MGD** of additional supply. Unlike the estimates for Durham's preferred Jordan Lake alternative, these costs do not include the construction of additional water treatment plant capacity.

References

Hazen and Sawyer, Consulting Engineers, *Evaluation of Alternative Reservoirs on the Flat and Little River, October 1988.*

Hazen and Sawyer, Consulting Engineers, *Lake Michie Expansion Alternatives, Cost Update: Conceptual-Level Estimates of Water Facilities Project Capital and Life-Cycle Costs,* Worksheet Outputs, March 11, 2014.

Alternative 5 – Initial + Aggressive Reclaimed Water (RCW) System

Description

Wastewater treated to non-potable reuse standards would be provided to four reclaimed water pressure zones to support an average day (future) non-potable demand of 9.6 MGD (equivalent to 10.5 MGD of raw water demand) for commercial, industrial, and irrigation uses that would otherwise be met with potable drinking water. The project would require improvements at both of Durham's water reclamation facilities, construction of five elevated storage tanks, and a total of approximately 80 miles of new distribution lines.

Jordan Lake Allocation Request

Durham currently holds a 10 MGD Level I Jordan Lake allocation, which would be retained under this alternative. **No additional allocation would be requested.**

Total Supply

This alternative would increase Durham's 37.9 MGD available supply (27.9 MGD Lake Michie/Little River Reservoir plus existing 10 MGD Jordan Lake allocation) by **10.5 MGD** for a total of **48.4 MGD**, which could meet projected demands of 44.4 MGD in 2060.

Environmental Impacts

The chief impacts of this project would be from the construction and installation of approximately 80 miles of new distribution pipeline within a highly developed urban environment. It is not known at this time how much, if any, disturbance would occur within environmentally sensitive areas.

Water Quality Classification

(No water quality classification applies to treated wastewater, which would constitute the source water of this alternative.)

Timeliness

The estimated completion date of 2030 is considered to be **Acceptable** in meeting projected demands through 2060.

Interbasin Transfer

Durham has a grandfathered IBT capacity to transfer up to 45.4 MGD from the Neuse River Basin (10-1) to the Haw River Basin (2-1). Maximum month transfers at the present time are about 18.6 MGD. Implementing the Initial + Assertive Reclaimed Water alternative would continue Durham's existing IBT configuration and **increase existing transfers by approximately 4.2 MGD** if completed **in 2030** and by **7.0 MGD in 2045, for a total IBT of 25.6 MGD in 2045** during months of maximum transfer. Because these volumes are substantially less than Durham's 45.4 MGD grandfathered capacity, **this alternative would require no further IBT certification**.

Regional Partnerships

This alternative would be a Durham project only, and offers **no opportunities for regional or interlocal partnerships**.

Technical Complexity

This project would be **Very Complex**, but is well within the range of standard engineering practices. Its technical complexity is compounded by the geographic scope of expected community disturbance.

Institutional Complexity

This alternative is considered to be **Institutionally Complex** due to regulatory permitting requirements, which would include:

- NCDENR non-discharge permit
- NCDENR reclaimed water permit for improvements to the South Durham Water Reclamation Facility (WRF)
- Modifications to existing permit at the North Durham WRF
- U.S. Army Corps of Engineers Nationwide (or Individual) Section 404 Permit
- North Carolina Section 401 Water Quality Certification for stream or wetland pipeline crossings
- NCDOT permits or encroachment agreements for pipelines installed in DOT rights-of-way
- NC Railroad Corporation permit for one or more pipeline crossings of the railroad right-of-way
- FAA permit for one or more elevated storage tanks in southeast Durham in the vicinity of RDU International Airport

Political Complexity

This alternative is considered to be **Very Complex** politically. It is anticipated that this alternative would generate widespread citizen complaints and opposition due to the extensive traffic disruption and local inconvenience caused by the construction of approximately 80 miles of pipeline over a 15-year period in a highly developed urban environment. Additionally, there would likely be considerable concerns raised by downstream users (Raleigh and its Merger Partners) due to its potential reduction of return flows to the Neuse River Basin.

Public Benefits

This project would provide **Few**, if any, additional public benefits other than an alternative water supply source.

Consistency with Local Plans

This alternative is **Consistent** with Durham's growth and development plans.

Total Cost

Per the revised February 2014 guidance from DWR, estimates have been developed in 2010 dollars for the total capital costs and unit capita cost per MGD of additional supply (yield) for this alternative. The capital costs for this alternative are estimated at **$104.4 million**, or **$9.93 million per MGD** of additional supply.

References

McKim & Creed, *City of Durham Water Reuse Feasibility Study, Final Draft Report, October 2011.*

Secure Resources, PLLC, *City of Durham Jordan Lake Water Supply Allocation, Water Reuse Alternatives, Technical Memorandum (draft), January 15, 2014.*

Selected Alternative

The City of Durham's selected alternative is to receive an **additional 6.5 MGD Level I Jordan Lake allocation, which will enable it to participate in the development of new intake, treatment, and transmission facilities to be constructed near the western side of Jordan Lake and shared with one or more other utilities.** This alternative would represent a total Durham allocation of 16.5 MGD and enable the City to cost-effectively rely on Jordan Lake, rather than its Lake Michie/Little River Reservoir system, to base-load its day to day water supply needs and to meet projected demands through 2045. This approach offers the following additional benefits:

- The Jordan Lake water supply already exists, and therefore represents none of the major environmental and social impacts of developing a new source. The direct environmental effects of this alternative will be limited largely to the temporary and localized construction of new raw water intake, pumping, treatment, and finished water transmission facilities. Virtually all of these will occur on property already owned by public entities or located within public rights of way.

- The Jordan Lake alternative will decrease Durham's reliance on its Lake Michie/Little River Reservoir sources and substantially reduce existing and future transfers of water out of the Neuse River Basin.

- The Selected Alternative provides sufficient economies and efficiencies of scale to support Durham's participation in the development of major new intake, treatment, and transmission facilities on the western side of Jordan Lake. In addition to supplementing existing supply systems, these new facilities will provide much-needed regional reliability and redundancy in the event of unplanned/emergency conditions or other operational contingencies at the existing Cary-Apex Jordan Lake facilities or elsewhere in the Triangle.

- The capital costs per MGD of this alternative are less than three of the other four alternatives evaluated by Durham.

- The Selected Alternative is consistent with and supports the water supply plans of other local entities of the 13-Member Jordan Lake Partnership and is fully consistent with the Triangle Regional Water Supply Plan as developed and adopted by the Partnership.

SECTION VI. PLANS TO USE JORDAN LAKE

Durham's only access to its existing 10 MGD Level I Jordan Lake allocation is through its finished water interconnection and mutual aid agreement with the Town of Cary (see discussion of Purchased Water in Section III – Current Water Supply of this application). Because water available under this agreement represents only a short-term or temporary supply source that will not meet Durham's needs on a regular daily basis, permanent and reliable access to the City's existing and requested Jordan Lake allocation would be provided via new intake, treatment, and transmission facilities to be constructed near the western shore of the lake. Details of a proposed implementation plan, including a tentative schedule, are presented in the Description portion of Alternative 1 in Section V – Alternative Supply Options, of this application. It should be noted that this Alternative is only one of several regional scenarios still being evaluated jointly by Durham, OWASA, Pittsboro, and Chatham County. All options under review would employ the same new intake and raw water pumping facilities to be shared by the participating entities, but each scenario includes a different configuration of water treatment options. It is Durham's intent to implement one of the scenarios still under evaluation.

Raw and Finished Water Quality Monitoring Plan

It is anticipated that specifications of locational and parametric coverage, sampling frequency, etc. for raw water will be coordinated with existing Jordan Lake monitoring programs, such as NCDWR's ambient water quality monitoring network and the Triangle Area Water Supply Monitoring Project managed by the Triangle J Council of Governments in cooperation with USGS. A detailed in-plant monitoring program will be developed as specific processes and their operational monitoring requirements are defined for the new Jordan Lake regional water treatment facility. Finished water quality will generally be monitored per Durham's existing Water System Management Plan on file with NC DENR's Public Water Supply Section.

Estimate of Costs

(Please see the Costs section under Alternative 1 in Section V of this application for information regarding the estimated capital costs of Durham's Jordan Lake alternative.)