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A Review of Water Conservation Planning for the Atlanta, Georgia Region

Pacific Institute for Studies in Development, Environment, and Security

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Abbreviations and Acronyms

AADD: annual average daily demand
AF: acre-feet
ACF: Apalachicola-Chattahoochee-Flint
ARC: Atlanta Regional Commission
BACs: basic advisory councils
Board: governing board of the Metropolitan North Georgia Water Planning District
CB analysis: cost-benefit analysis
CE analysis: cost-effectiveness analysis
CUWCC: California Urban Water Conservation Council
District: Metropolitan North Georgia Water Planning District
DNR: Georgia Department of Natural Resources
DSS model: Demand Side Management Least-Cost Planning Decision Support System model
gpcd: gallons per capita per day
gped: gallons per employee per day
gpm: gallons per meter
MGD: million gallons per day
MNGWPD: Metropolitan North Georgia Water Planning District
NPDES: National Pollutant Discharge Elimination System
RDC: Regional Development Commission
TCC: technical coordinating committee
UFW: unaccounted-for-water
WS Plan: Water Supply and Water Conservation Management Plan
$/MG: dollars per million gallons

Introduction

The Pacific Institute[1] is one of the nation's leading centers for assessing water conservation and efficiency potential. In 2005, the Institute was requested to review the history of water conservation and efficiency programs and water demand forecasts in the region around Atlanta, Georgia as part of an effort to improve understanding of the potential for reducing water waste in the region and maintaining critical water flows for downstream ecosystems in Georgia and Florida. This report provides that review and concludes that significant untapped potential exists for reducing water use while providing for population growth and economic development, and that traditional water planning documents and efforts in the region underestimate this potential.

The Metropolitan North Georgia Water Planning District (MNGWPD), created in 2001, produces the principal water-planning document for the metropolitan Atlanta area. The first comprehensive water supply plan, the Water Supply and Water Conservation (WS) Plan, was released in 2003. The WS Plan projects substantial increases in 2030 water demand, rising from 650 million gallons per day (MGD) in 2001 to 1080 MGD in 2030. To meet future demand, the District largely relies upon new supply options, specifically five new reservoirs and reallocation of Lake Lanier and Lake Allatoona.

The WS Plan may significantly overestimate future regional demand for water and underestimate the potential for cost-effective demand management. Our analysis reveals the following:

- The District's population projection is too high, thereby overestimating future demand.
- The conservation analysis is incomplete. The list of efficiency measures evaluated does not include all cost-effective approaches. Even the more aggressive Program "C" in the WS Plan (which was not adopted) appears incomplete.

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[1] Pacific Institute, 654 13th Street, Oakland, California. www.pacinst.org. Dr. Peter Gleick, President

- The economic analysis used in the WS Plan gives an incomplete and misleading picture of the conservation potential in the District because of the type of analysis employed, the perspective taken, and the assumed implementation levels.
- Recycling and reuse can be expanded to meet future demand, reducing the need to develop new supply sources, such as the reallocation of Lake Lanier and Allatoona.

Recent water conservation assessments support our conclusion that the conservation potential identified in the WS Plan is low. For example, the District fails to meet the Georgia Department of Natural Resources' efficiency benchmarks. Moreover, implementation of actual conservation activities appears inadequate to effectively capture potential savings and some anticipated conservation programs have not been implemented.

Overview of Water Agencies

Regional description

With Senate Bill 130 in 2001, the Georgia legislature created the Metropolitan North Georgia Water Planning District (MNGWPD) (hereafter the District) to address water resource management planning in the metropolitan Atlanta area. As described on the District's website: "The general purposes of the District are to establish policy, create plans, and promote intergovernmental coordination for all water issues in the district; to facilitate multi-jurisdictional water related projects; and to enhance access to funding for water related projects among local governments in the District area."[2]

The District is located in northwest Georgia. Sixteen counties surrounding metropolitan Atlanta lie within the boundaries of the District, including Bartow, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Fulton, Forsyth, Gwinnett, Hall, Henry,

[2] http://www.northgeorgiawater.org/

Paulding, Rockdale and Walton Counties. The District is situated within the upstream headwaters of five river basins: Chattahoochee, Etowah, Flint, Oconee, and Ocmulgee.

The population of the sixteen counties within the District in 2000 was 4.0 million, roughly half of Georgia's total population. The District is composed of both rural and urban counties; for example, Fulton County, which includes Atlanta, has a population of over 800,000 and a density greater than 1,500 people per square mile, while Walton County has a population of only 60,000 and a density of less than 200 people per square mile. Between 1990 and 2000, the overall population of the counties within the District grew at an average rate of 3.3 percent per year, with significant differences among the counties.[3]

The counties within the District experienced large growth in employment between 1991 and 2000. Total employment in these counties was 2.1 million in 2000, up from a low of 1.4 million in 1991. Since 2000, however, employment has been stable.[4] The service industry is the largest and fastest growing sector. Employment in the service industry was 1.8 million, an increase of over 50 percent since 1990. Non-service industries (manufacturing, natural resources/mining, and construction) employed only 305,000 people in 2001. Manufacturing and natural resources/mining were among the slowest growing industries in the region between 1990 and 2001.[5]

Agriculture is practiced throughout the District, although it is not the dominant industry. Over 500,000 acres were in farms in 2002, and less than one percent of those farms were irrigated. Field crops are the dominant crop type.[6]

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[3] United States Census. 1990. 1990 Summary Tape File 1 (STF 1) - 100-Percent data. http://factfinder.census.gov/servlet/GCTSubjectShowTablesServlet?_lang=en&_ts=147270827615
United States Census. 2000. Population, Housing Units, Area, and Density: 2000. http://www.census.gov/census2000/states/ga.html

[4] The University of Georgia. 2004. Georgia Statistics System: Analysis of Employment Changes. http://www.georgiastats.uga.edu

[5] The University of Georgia. 2004. Georgia Statistics System: Analysis of Employment Changes. http://www.georgiastats.uga.edu

[6] United States Department of Agriculture. 2002. 2002 Census of Agriculture. http://www.nass.usda.gov/census/

Regional Water Agency Description

The organizational structure of the District includes a governing board (the Board), technical coordinating committee, and basin advisory councils. The 27-member Board has representatives from each county in the District as well as members appointed by the governor. The technical coordinating committee (TCC) is comprised of water and wastewater officials who provide technical expertise on water, wastewater, and stormwater management. The basic advisory councils (BACs) “provide support to the Board by supplying stakeholder and public input in the course of the water planning process” as well as “advise on the implementation of policy, the development of minimum standards, and the content of the plans.”[7]

The District is strictly a planning body without regulatory authority. With the assistance of the TCC and BACs, the District develops resource management plans and designs model ordinances. “Once the plans are developed, the Director of the Environmental Protection Division of the Department of Natural Resources will be responsible for ensuring that local governments implement the water plans.”[8] Governments who do not implement the plans may have their current permits for water withdrawal, wastewater capacity, or National Pollutant Discharge Elimination System (NPDES) stormwater permits frozen.[9] Governments that do not “substantially” adopt model ordinances may be ineligible for state grants and loans for stormwater-related projects.[10]

As required in Georgia Senate Bill 130, the District produced a Water Supply and Water Conservation Management (WS) Plan in 2003. Prior to the WS Plan, the Atlanta Regional Commission (ARC) prepared the Atlanta Regional Water Supply Plan, which assessed the current and future water use of 13 of the 16 counties in the District. The ARC has not updated this plan since 1997 and now cites future water use estimates based

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[7] Metropolitan North Georgia Water Planning District. 2001. Activities and Progress Report 2001. http://www.northgeorgiawater.org/pdfs/2001progressrpt.pdf
[8] http://www.northgeorgiawater.org/pdfs/Newsletters/waterresource_VOL1.pdf
[9] There are no reported cases of actions taken against local governments for failing to implement the District plans.
[10] Metropolitan North Georgia Water Planning District. Undated. About the District: Background. http://www.northgeorgiawater.org/

on the WS Plan. Thus the WS Plan has become the primary water-planning document in the region.

The WS Plan projects substantial increases in 2030 water demand, rising from 650 MGD in 2001 to 1,080 MGD in 2030. This projection is based on population projections, current water use, and modeled conservation potential. To meet the anticipated demand, the District concludes it will require additional supply:

> "All of the District's existing permitted surface and groundwater sources, plus currently planned reservoirs will supply up to 1,047 AADD-MGD. However, this yield is not secure. The reallocation of water storage at Lakes Lanier and Allatoona must be implemented to assure that dependable water supplies will be available to the District."[11]

Our analysis, however, reveals that the WS Plan may significantly overestimate future regional demand for water and underestimate the potential for cost-effective demand management. Overestimating demand is not unusual; in fact, it is very common. Planners tend to rely on simplistic assumptions about future demand based on fairly constant water-intensity projections and population growth. In addition, risk aversion drives planners to emphasize supply and adopt conservative estimates about the potential for demand management. While overestimating demand is perceived as a "safer" choice, it can lead to unnecessary infrastructure investments in infrastructure and harm to downstream users and the environment. The demand projections for the District are discussed in greater detail below.

[11] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Plan. Pp. 6-1.

Population Review

Population Projections

Future water demand and use depend on many factors. One of the most important and influential is the size of the population to be served. Because official Regional Development Commission (RDC)-derived population projections were not available to meet the WS Plan deadline, the District developed interim projections for two scenarios: a moderate- and a high-growth future.

The District developed population projections for the moderate-growth scenario based on national population projections, historical data, and land-use information. The District's future share of the US population was calculated according to a linear regression of the District's historical share of the US population between 1950-2000. The District's share of the population was then multiplied by the national population projection from Woods and Poole to obtain the District's future population. The District population was divided among the 16 counties based on historical growth rates. Land-use information from the ARC and comprehensive land-use plans placed an upper bound on the population for each county. Projected populations that exceeded the upper bound were shifted to less-developed counties. The ARC and other RDCs provided input on the final results.

Based on the method outlined above, the District's 2030 population is projected to reach 6.8 million in the moderate-growth scenario. Population in the high-growth scenario was simply defined as 15 percent greater than that in the moderate-growth scenario, or 7.8 million. This corresponds to average annual growth rates of 1.8 and 2.3 percent in the moderate- and high-growth scenarios, respectively. "To conservatively plan for District water supplies"[12] **the MNGWPD used the high-growth scenario for all water demand projections in the WS Plan.**

[12] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. p. 4-1.

Analysis and Review of Population Projections

Our analysis suggests that the population assumptions in the WS Plan are significantly higher than are likely to materialize and that this assumption alone has a large influence on future water demand projections. This suggests the need for a re-evaluation with another, more realistic population projection. In April 2005, the U.S. Census Bureau released population projections for the State of Georgia. According to the U.S. Census, Georgia's population was 8.2 million in 2000 and is projected to reach 12.0 million by 2030, an increase of 3.8 million. The WS plan, however, claims that population in the 16-county Atlanta region alone will increase by 3.8 million between 2000 and 2030. Thus the growth projected in the WS plan for this one region is the same as is projected by the U.S. Census Bureau for the entire state of Georgia. While Atlanta is one of the fastest growing metropolitan areas in the United States, counties outside of the Atlanta region are also experiencing growth;[13] counties outside of the District grew at an annual average rate of 1.5 percent between 1990 and 2000.[14] Thus, the U.S. Census Bureau estimate for the Atlanta region is likely to be significantly lower than 3.8 million in 2030.

As described above, the District developed interim projections for the WS Plan because official RDCs, such as the ARC, had not yet released their population projections. The ARC has since completed its projections.[15] The ARC projects that the population in the 13-county Atlanta Region will reach 6 million in 2030, a 62 percent increase over the 2000 population. There is a slight difference between the areas covered in the ARC and District projections; the ARC estimate covers 13 of the 16 counties in the District. In 2000, approximately 275,000 people lived in the three counties not included in the ARC projections. Assuming that these counties grow at the same rate as projected in the 13-county ARC region (~62 percent), then the population of these three counties in 2030 would be approximately 450,000. Thus according to the ARC, the population of the 16-

[13] University of Georgia. 2001. Georgia County Historical Population Profiles Website. http://www.cviog.uga.edu/Projects/gainfo/countypop/

[14] United States Census. 1990. 1990 Summary Tape File 1 (STF 1) - 100-Percent data. http://factfinder.census.gov/servlet/GCTSubjectShowTablesServlet?_lang=en&_ts=147270827615

United States Census. 2000. Population, Housing Units, Area, and Density: 2000. http://www.census.gov/census2000/states/ga.html

[15] Atlanta Regional Commission. 2004. Population and Employment Forecasts: 2000-2030. http://www.atlantaregional.com/regionaldata/forecastreport.pdf

county metropolitan Atlanta area would be 6.5 million in 2030. This projection is much lower than District's high projection of 8 million, and around 300,000 people lower than the moderate projection of 6.8 million (Figure 1). Because future water demand in the District is based on the high-growth population scenario, the results of the ARC study also suggest that the WS Plan overestimates 2030 water demand.

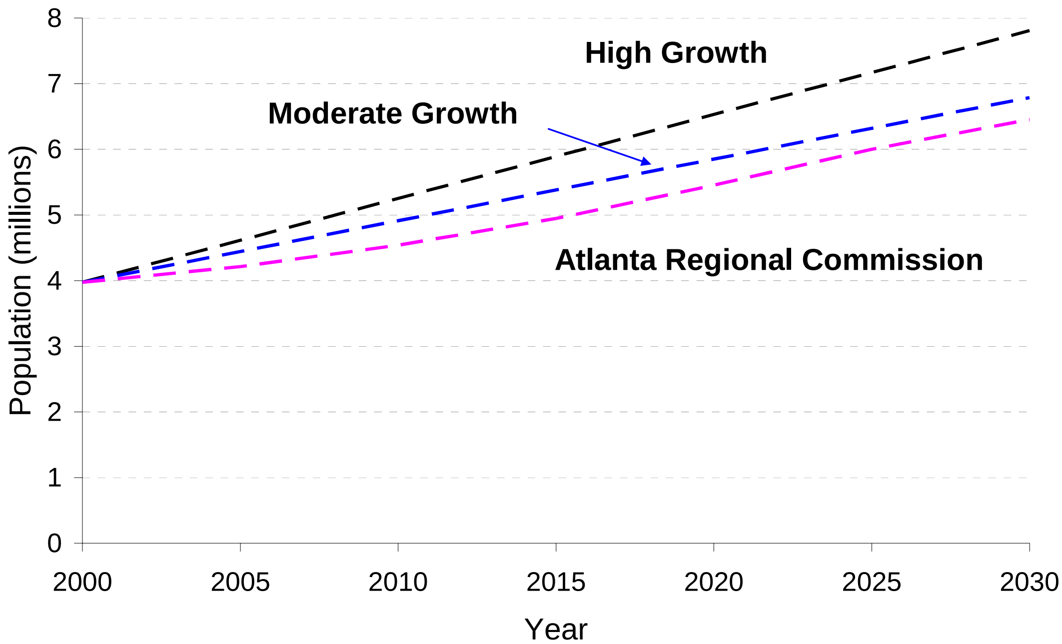

Figure 1. District population projections in the high- and moderate-growth scenarios. The Atlanta Regional Commission's population projection, expanded to include all 16 counties, is also shown.

Water Review

Water Resources

Although parts of Georgia receive up to 50 inches of precipitation per year, adequate water supply has been an issue of concern in the metropolitan Atlanta area, particularly during prolonged droughts. This is in part due to the physical location of the region. Because the District lies in a region characterized by "fractured rock geology, with relatively unreliable and unproductive groundwater aquifers," groundwater wells tend to be low yielding.[16] Further exploration, however, may identify high-yielding wells.[17] Currently groundwater supplies are relatively small, while surface water supplies over 99 percent of the District's water supply. The metropolitan Atlanta area, however, is located in the upper reaches of the river basin, where "there is less water available for withdrawal and use than in areas further downstream. The same vulnerability exists with respect to reservoir storage as well…it takes a longer time to collect and accumulate water for storage."[18]

The total developed water supply in the District is 933 million gallons per day (MGD), of which approximately 652 MGD is supplied to customers. The largest supply sources are Lake Allatoona and the Chattahoochee River system, which includes Lake Lanier.

Interbasin transfers are "a key element in supplying water throughout the District; there are water supply and wastewater transfers into and out of every basin in the District."[19] Interconnections provide a number of benefits, including improved reliability and protection in the event of an emergency. Interconnections also allow development in regions without an adequate local water supply. The Chattahoochee basin is the largest supplier, transferring nearly 157 MGD of water to other basins. While interbasin transfers are common throughout the District, there is some concern about these transfers; specifically that Atlanta will take water to benefit itself while harming other parts of the state. Because of this concern, the Georgia Board of Natural Resources (DNR) recommended passage of legislation prohibiting long-distance interbasin transfers (long-distance meaning crosses more than 2 counties) except in emergencies. Existing transfers would be grandfathered, as altering the current water and wastewater infrastructure would be expensive.[20]

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[16] Georgia Board of Natural Resources. 2001. Water Issues White Paper. p. 38
[17] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. Pp. 6-16.
[18] Georgia Board of Natural Resources. 2001. Water Issues White Paper. p. 38
[19] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. p. 3-5.
[20] Georgia Department of Natural Resources. 2001. Water Issues White Paper. p. 14.

Current (2001) Total Water Use

Current (2001) potable water use in the District is approximately 652 MGD on an average annual daily basis. Water use can be divided into the following four categories (with the percent of total use in parentheses): single-family (43 percent), multi-family (12 percent), commercial, industrial, and institutional (27 percent), and unaccounted-for-water (18 percent).[21] Unaccounted-for-water (UFW) includes water that does not go through a meter, i.e., water loss due to system leakage, hydrant flushing, and unmetered connections. These figures are consistent with ARCs water-supply study completed in 1997.[22] For residential water use, 79 percent is used indoor and 21 percent is used outdoor. For non-residential water use, 69 percent is used indoor and 31 percent is seasonal.[23]

The District practices both potable and non-potable reuse. Reclaimed water, however, is only a minor component of the District's water supply. In 2001, non-potable reuse accounted for only one percent of the wastewater treatment capacity.[24] This water meets golf course and limited urban irrigation needs as well as industrial process needs.

Potable reuse is both incidental and indirect. Incidental reuse occurs where wastewater effluent is discharged upstream of a water-intake system. This occurs widely throughout the United States. Indirect potable reuse occurs when treated wastewater is discharged into a lake or reservoir, such as Lakes Allatoona and Lanier, which provides water to be treated for future potable use. In some cases, land application of wastewater percolates through the soil and recharges the potable water supply. Currently five percent of the wastewater treatment capacity is subject to land application and some fraction of this is reused. Estimates of total indirect and incidental potable reuse were not provided in the District's Wastewater Management Plan.

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[21] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. p. 4-8.
[22] Atlanta Regional Commission. 1997. Regional Water Supply Plan. http://www.atlantaregional.com/water/supplyplan.html
[23] Calculated based on Metropolitan North Georgia Water Planning District. 2003. Task 6. Pp. 6.
[24] Metropolitan North Georgia Water Planning District. 2003. Long-Term Wastewater Management Plan. Pp. 3-3.

Box 1: Consumptive vs. Non-consumptive Water Use

The water literature is rife with confusing and often misleading terminology to describe water use, e.g. water withdrawal, consumptive use, non-consumptive use, etc. It is important, however, to clarify these terms, as different meanings can lead to different or conflicting conclusions about the water conservation potential. To be clear, water withdrawals refer to water taken from a source and used for human needs. These withdrawals can be divided into two water-use categories: consumptive and non-consumptive. Consumptive use is sometimes referred to as irretrievable or irrecoverable loss. According to Gleick (2003), "The term *consumptive use* or *consumption* typically refers to water withdrawn from a source and made unavailable for reuse in the same basin, such as through conversion to steam, losses to evaporation, seepage to a saline sink, or contamination." Additionally, water that is incorporated into products or plant and animal tissue is typically exported out of the basin of origin, and thus is also a consumptive use.

Throughout the world, agriculture is the largest consumer of water. In 1995, for example, agriculture in the United States consumed 60 percent of the water withdrawn for its use and accounted for nearly 85 percent of total consumptive water use. Irrigation water is consumed via a number of processes, including evaporation from the soil and plant surfaces, plant transpiration, animal consumption, the production of food and fiber (and subsequent export out of the basin), and deep percolation to groundwater. By contract, domestic-commercial and industrial-mining purposes consumed 19 percent and 15 percent, respectively, of the water withdrawn for its use (Solley et al. 1998).

Confusion about consumptive and non-consumptive water use has led many planners to underestimate the value of conserving non-consumptive water use and, consequently, the water-conservation potential. Many water planners believe that conservation measures that produce savings in non-consumptive water uses are less important than that from consumptive water uses. They argue that water that is used non-consumptively is available for reuse by downstream users and thus conserving this water does not produce any new water. These planners, however, fail to realize that *any* demand reductions reduce the amount of water taken from ecosystems and the need for new infrastructure investments to capture, treat, and distribute water. All reductions in water withdrawals maximize the amount of water left in the natural environment, providing benefits to downstream water quality, the environment, recreational uses, and even upstream use.

Sources:

Gleick, P.H. 2003. Water Use. Annu. Rev. Environ. Resour. Vol 28: 275-314.

Solley, W.B., R.R. Pierce, and H.A. Perlman. 1998. Estimated Use of Water in the United States in 1995. United States Geological Survey. USGS National Circular 1200.

Current (2001) Per-Capita Water Use

The total per-capita water use in the District, which includes publicly and self-supplied water and unaccounted-for-water, ranges from 95 gallons per capita per day (gpcd) in Paulding County to 254 gpcd in Bartow County and averaged 168 gpcd in 2001.[25] Single-family residential water use averaged 91 gpcd (70 and 21 gpcd for indoor and outdoor water use, respectively). Multi-family residential water use was 75 gpcd (65 and 11 gpcd for indoor and outdoor water use, respectively). Commercial, industrial, and institutional water use (typically measured and reported as gallons per employee per day) was 97 gped (70 gped for indoor use and 27 gped for seasonal use) (Figure 2).

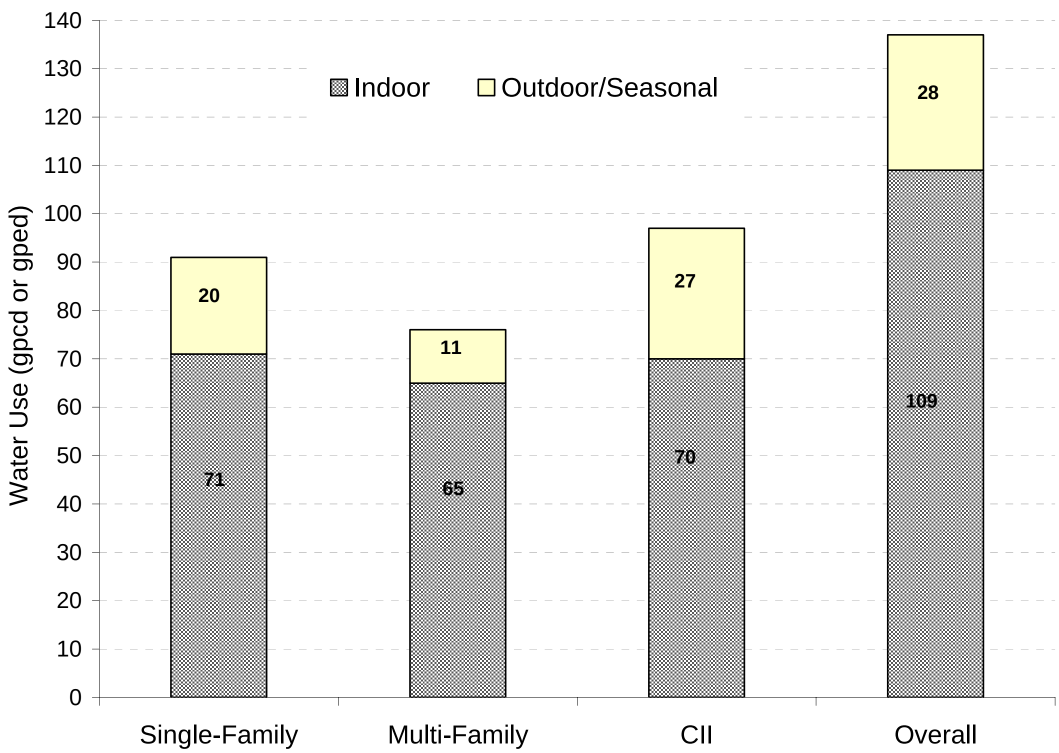

Figure 2: 2001 Per-capita (gpcd) and Per-Employee (gped) Water Use in the District. The water-use estimates for the single-family and multi-family residential and commercial, industrial, and institutional (CII) sectors are based on publicly supplied water. The overall estimate includes both publicly and self-supplied water, but does not include unaccounted-for-water.

[25] Metropolitan North Georgia Water Planning District. 2003. Pp. 4-12.

Current Conservation Programs and Policies

Water conservation and efficiency programs typically take two forms: programs to reduce water use without reducing services by improving efficiency and reducing waste (such as installing high-efficiency appliances); and short-term emergency measures that cut services (such as restrictions on lawn watering or car washing during droughts). The focus of this analysis is on the former – measures to improve water-efficiency and reduce waste.

Table 1 summarizes the District conservation programs and policies as of 2001. Conservation efforts range from fair to poor. Half of the local districts lack conservation programs altogether. Those districts with conservation programs emphasize school and public education, and only one district (City of Atlanta) distributes low-flow fixtures. Rate structures that encourage water use, such as uniform and declining block rate structures, are still used throughout the District. In addition, the reported rates of unaccounted for water (UFW) are high, ranging from one to 25 percent and averaging 18 percent. One district reports a UFW of over 80 percent due to frequent flushing of a new distribution system. The standard for UFW recommended by the American Water Works Association is typically 10 percent.[26] These data, and other data described below, suggest that significant untapped conservation potential exists in many different forms.

[26] American Water Works Association. 1996. "Committee Report: Water Accountability." Journal of the American Water Works Association, 88(7): 108-111.

Table 1. District Conservation Programs and Policies in 2001.

County	Entity	Year	Percent UFW	Water Rate Type (gpm)	Other Conservation Programs	Conservation Pricing Structure
Bartow	Bartow County	2001	22.7%	Uniform	Xeriscape, School Education, WTP Tours	NA
	City of Cartersville	2001	8.9%	Uniform	Xeriscape, WTP Tours	Rate Study Underway
Clayton	City of Riverdale	1995	3.0%	Uniform (≤3000), Inclining Block (>3000)	NA	NA
	Clayton County	2000	10.0%	Uniform, Base	WTP Tours, School Education, Public Education	NA
Cherokee	Cherokee County	1999	16.8%	Uniform (≤10,000), Inclining Block (>10,000)	School Education, Support WaterSmart, WTP Tours, Public Education	Summer surcharge
	City of Ball Ground	2001	25.0%	Uniform	NA	NA
	City of Canton	1995	12.0%	Declining Block	NA	Considering summer surcharge
	Lake Arrowhead	NA	NA	Uniform (≤5000), Inclining Block (>5000)	Education, Xeriscape	NA
	City of Waleska	1995	16.0%	Uniform (≤2000), Declining Block (>2000)	NA	NA
	City of Woodstock	NA	NA	Uniform (≤1000), Inclining Block (>1000)	NA	NA
	City of Holly Springs	1996	NA	Uniform (≤2000), Inclining Block (>2000)	NA	NA
Cobb	City of Austell	2000	11.1%	Uniform	NA	Summer surcharge
	City of Smyrna	NA	NA	Uniform	NA	Summer surcharge
	City of Powder Springs	NA	NA	Uniform	NA	NA
	City of Marietta	1995	13.0%	Uniform	NA	NA
	City of Kennesaw	NA	NA	Uniform	NA	Summer surcharge

County	Entity	Year	Percent UFW	Water Rate Type (gpm)	Other Conservation Programs	Conservation Pricing Structure
Cobb cont.	Cobb County-Marietta Water Authority	2000	3.0%	Uniform	WaterSmart Campaign, School Education	Summer surcharge
	Cobb County	1995	13.0%	Uniform	NA	Summer surcharge
Coweta	City of Newnan	1994	8.8%	Declining Block	School Education	NA
	City of Senoia	2001	3.0%	Base, Uniform	NA	NA
	Coweta County	2000	1.0%	Inclining Block	School Education	NA
DeKalb	DeKalb County	2000	14.8%	Uniform	Xeriscape, School Education	NA
Douglas	Douglasville-Douglas County	1999/2000	9.3%	Uniform	Xeriscape, Public Education, School Education	Surcharge rate above base rate
Fayette	Fayette County	2001	11.3%	Base (≤2000), Uniform (>2000)	Xeriscape, Public Education	NA
	City of Fayetteville	2001	9.0%	Base (≤2000), Uniform (>2000)	School Education, WTP Tours	NA
	City of Brooks	2001	NA	Inclining Block	NA	NA
Forsyth	City of Cumming	1997	18.1%	Uniform	Xeriscape, WTP Tours, Public, School Education	NA
	Forsyth County	2000	8.2%	Uniform	School Education, Public Education	NA
Fulton	City of Atlanta	2000	14.3%	Uniform	Xeriscape, Care and Conserve, Low Flow Fixtures Distribution, School Education, Public Education, Videos/PSA's, Leak Repair, Multi-family owner training	NA
	City of East Point	1996	NA	Inclining Block	Newsletter	NA
	Union City	1996	3.0%	Base Rate + Uniform	NA	NA

County	Entity	Year	Percent UFW	Water Rate Type (gpm)	Other Conservation Programs	Conservation Pricing Structure
Fulton cont.	City of Roswell	2000	12.0%	Base (≤4500), Uniform (>4500), Cons. Rate (>24,000)	Public Education, Xeriscape, Enforcement Team	NA
	City of Palmetto	2001	14.2%	Base (≤2000), Uniform (>2000)	NA	NA
	City of Mountain Park	2001	9.8%	Base, Uniform	Newsletter	NA
	City of Hapeville	NA	NA	Base (≤2000), Declining Block (>2000)	Newsletter	NA
	City of Fairburn	NA	NA	Declining Block	NA	NA
	City of College Park	1996	11.0%	Base (≤3000), Uniform (>3000)	NA	NA
	Fulton County	2001	10.0%	Uniform	Xeriscape, Public Education, Bill Inserts, Website, Publications	NA
	City of Alpharetta	NA	NA	NA	School Education	NA
Gwinnett	City of Buford	2000	13.5%	Base (≤4000), Uniform (>4000)	NA	NA
	Gwinnett County	1999	16.4%	Uniform	Xeriscape, School Education	Summer surcharge
	City of Suwanee	NA	NA	Base (≤3000), Inclining Block (>3000)	NA	NA
	City of Norcross	1995	6.0%	Uniform	NA	NA
	City of Lawrenceville	1996	16.0%	Uniform	NA	NA
Hall	City of Gainesville	1999	13.9%	Base, Uniform	WTP Tours, School Education, Public Education	NA
	Hall County	1999	80.8%	Base, Uniform	Tied to Gainesville programs	NA
Henry	Henry County	1998	23.8%	Declining Block	WTP Tours, School Education, Public Information, Recycle Water at Public Pools, Pamphlets	NA
	City of Stockbridge	NA	NA	Declining Block	NA	NA

County	Entity	Year	Percent UFW	Water Rate Type (gpm)	Other Conservation Programs	Conservation Pricing Structure
Henry cont.	City of Locust Grove	1995	NA	Base (≤2000), Inclining Block (>2000)	NA	NA
	City of Hampton	NA	NA	Base (≤3000), Uniform (>3000)	NA	NA
	City of McDonough	2001	14.3%	NA	NA	NA
Paulding	Paulding County	2001	14.0%	Base (≤2000), Uniform (>2000)	Xeriscape	NA
Rockdale	Rockdale County	1998	17.0%	Inclining Block	NA	NA
Walton	Walton County	NA	NA	NA	NA	NA
	City of Monroe	2000	16.2%	Declining Block	Public Education, Xeriscape, Bill Inserts	NA
	City of Social Circle	2001	13.0%	Base (≤2000), Uniform (>2000)	NA	NA

Note:

gpm: gallons per minute

NA: Data not available

UFW: Unaccounted-for-water

WTP: Water treatment plant

Source: Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. p. 5-1 to 5-4.

Water Use Projections

In the WS Plan, the conservation potential was evaluated using the Demand Side Management Least-Cost Planning Decision Support System (DSS) model (Maddaus Water Management 2003). The DSS model is an end-use model that employs a cost-benefit analysis to assess conservation measures from a utility perspective. An initial set of 100 conservation measures was screened based on qualitative criteria: technology/market maturity, service area match, customer acceptance/equity, and if better measures are available. Nearly half of the measures passed the initial screening process. Measures that could be managed as one program were combined to produce a final set of 25 measures. The DSS model was then used to individually evaluate these 25 measures, and the measures were ranked on the cost of the water saved. Conservation measures were combined to form three programs (A, B, and C) with increasing levels of water savings. The programs are briefly described below:

- **Program A** includes measures considered the most cost-effective and is a small increase from current efforts. It includes three measures, Public Education, Unaccounted for Water Reduction (where needed), and Residential Retrofit.
- **Program B** includes Program A measures plus a few additional measures. It was designed to be the midpoint, and generally consisted of 10 measures, all relatively cost effective, but less aggressive, yet still able to save significant amounts of water.
- **Program C** includes 20 measures [described by the Plan as a practical limit for conservation program managers to handle at one time], including all Program A measures and most Program B measures, plus additional measures. Measures that either saved a small amount of water or were not cost-effective (benefit-cost ratio less than 1.0 and a high cost of water saved) were eliminated. Aggressive regulatory measures are included.[27]

Table 2 shows the estimated savings for each of the option programs. The "no conservation" option, roughly based on multiplying current per-capita demand by the projected future

[27] Metropolitan North Georgia Water Management District. 2003. Water Supply and Water Conservation Management Plan.

population, results in a 2030 demand of 1299 MGD.[28] Continued implementation of existing state and federal plumbing codes would reduce 2030 water demand to 1,199 MGD and per-capita demand to 154 gpcd, an eight-percent reduction over projected demand without the "no conservation" option. Programs A and B would reduce demand an additional four and 10 percent, respectively, below the demand with the plumbing codes alone. The most comprehensive package evaluated, Program C, was estimated to reduce per-capita demand to 137 gpcd, 11 percent less than demand with the plumbing codes alone.

Additional cost-effective conservation savings have been identified in other water-conservation analyses.[29] These are discussed further below, following review of the conservation assessment used in the WS Plan.

Table 2. Estimated Water Savings for Each of the Option Programs in the WS Plan.

	2030 Water Savings (MGD)	2030 Water Use (MGD)	Per Capita Use (gpcd)	2030 Reduction Below Baseline	Cost of Water Saved ($/MG)	Water Utility Benefit-Cost Ratio
No Conservation		1,299	168			
Plumbing Codes (Baseline)		1,199	154		0	
Package A	52	1,147	147	4.3%	326	2.9
Package B	118	1,081	139	9.8%	199	4.8
Package C	132	1,067	137	11.0%	212	4.5

Source: Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. p. 5-15.

All three of the programs assessed in the WS Plan are highly cost-effective, and the cost of the water saved is relatively cheap. Program B is the most cost-effective, with a water utility cost-benefit ratio of 4.8. The cost of the water saved ranges from $199/MG ($65/AF) in Program B to

[28] We note that water withdrawals for the MNGWPD are from a number of basins, including the Apalachicola-Chattahoochee-Flint (ACF) basin. Additionally, there are withdrawals from the ACF basin that are from users outside of the MNGWPD.
[29] Gleick, P.H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California." Pacific Institute for Studies in Development, Environment, and Security. See also, Mayer, P.W. et al. 1999. Residential End Uses of Water. AWWA Research Foundation. Denver, Colorado.

$326/MG ($106/AF) in Program A.[30] This is supported by a conclusion in a recent Pacific Institute report that "it is much cheaper to conserve water and encourage efficiency … than to build new water supplies or even, in some cases, expand existing ones."[31]

Figure 3 shows the effect of each of the option programs on 2030 demand. With the projected population growth of 95 percent and implementation of the plumbing codes, 2030 water demand would be 1,199 MGD, or 84 percent higher than 2000 demand. With the implementation of Program C, however, 2030 water demand would be 1,067 MGD, or 64 percent higher than 2000 demand. Note that each subsequent program contains the conservation measures from the preceding program, i.e., Program B includes the plumbing codes plus the measures in Programs A and B. Likewise, Program C includes the plumbing codes plus the measures in Programs A, B, and C.

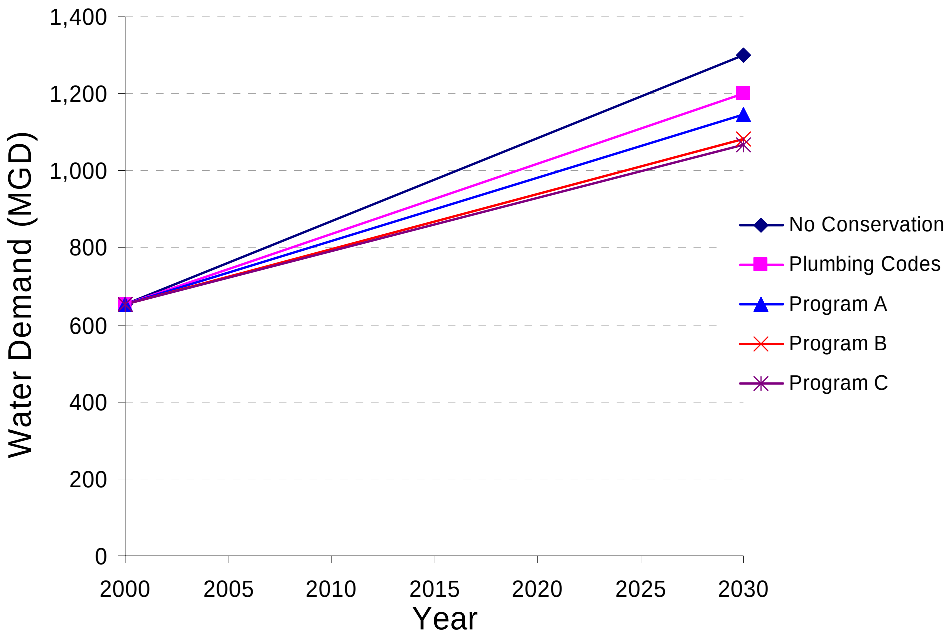

Figure 3: Projected Water Demand Under Each of the Conservation Option Programs in the WS Plan, assuming the High Growth Scenario.

[30] The cost of the water saved for Program B is less expensive than Program A, because two measures included in Program B, conservation pricing and retrofit-on-resale, save a significant amount of water at a low cost. These highly cost-effective measures are not included in Program A because this program is intended to represent minor increases over current efforts.

[31] Gleick, P.H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California." Pacific Institute for Studies in Development, Environment, and Security. Pp. 117.

The District adopted Program B as the recommended program, even though Program C is still cost-effective and includes a broader set of savings. Program B contains the following measures:

- Retrofit kits for older residences (both single-family and multi-family) that include low-flow showerheads, toilet leak detection dye tablets, displacement device or early closure device, faucet aerators, faucet washers, and pamphlets
- Increased public education
- System water audits/leak detection
- Conservation pricing
- Residential water audits to high-users
- 0.5 gal flush urinals in new commercial construction and remodels requiring a building permit
- Commercial water audits
- Rain-sensor/shut-offs on new developments with automatic irrigation systems and rebates for old systems
- Incentives for sub-metering on existing apartments and required sub-meters on new MF units
- Retrofit on resale for single-family and multi-family homes

Under Program B, projected 2030 water demand is 1,081 MGD, with a per-capita demand of 139 gpcd. This represents a 10 percent reduction over demand with plumbing codes alone. Three measures provide the majority of water savings (with the percent of total savings listed in parentheses): system leak reduction (35 percent), conservation pricing (24 percent), and retrofit on resale (20 percent).

Adoption of Program C would reduce 2030 demand to 1,067 MGD and per-capita demand to 137 gpcd, 11 percent below demand with plumbing codes alone. Program C contains all of the measures in Program B, plus nine additional measures. All nine measures, which include cooling tower meters and irrigation audits of large turf areas, are designed to reduce demand in the commercial, industrial, and institutional sector.

Analysis and Review of the District's Conservation Potential

Our society, economy, and environment use water for a variety of purposes. For the most part, however, we do not want water; we want the services that water provides, i.e., clean clothes and dishes and healthy lawns, etc. Many of these services, however, can be accomplished with substantially less water than is currently used, a concept that lies at the heart of water conservation and efficiency. The term *water conservation and efficiency* refers to actions and technologies that reduce water use without compromising services. Conservation and efficiency measures can be either short- or long-term. Most conservation programs established by water utilities, as well as the programs assessed in the WS Plan, however, are based on long-term measures that save water over the lifetime of the device or action. Additional short-term, temporary measures, such as outdoor watering moratoriums, can also be employed to reduce demand during severe droughts or water-supply interruptions. These additional, temporary measures are not reviewed here.

This section reviews and analyzes the long-term conservation potential in the District. Our analysis indicates that official projections of water savings are likely to significantly underestimate the District's actual conservation potential. Recent water conservation assessments indicate that the conservation potential identified in the WS Plan is low. For example, the District already fails to meet the Georgia Department of Natural Resources' efficiency benchmarks, described in more detail below. Moreover, implementation of actual conservation activities appears inadequate to effectively capture potential savings.

Efficiency Benchmarks

Benchmarks provide a standard by which water-management efforts can be compared or judged. In May of 2004, the Georgia Department of Natural Resources (DNR) issued efficiency benchmarks to serve as a guide for water utilities, which stated:

> "Benchmarks help water users measure their relative water use efficiency and to judge whether improvements could be made to save water. Water efficiency benchmarks are a

> direct, simple and practical measurement tool for the public, private sector, government, and the media to understand what is efficient water use and what is wasteful water use."[32]

According to these benchmarks, efficient indoor water use is between 50 and 70 gpcd for single-family users and 50 to 60 gpcd for multi-family users; efficient outdoor watering is 15 gpcd; and system UFW should not exceed 10 percent. Thus, a target of around 100 gallons per capita per day is considered minimally efficient use. This is comparable to the level determined to be moderately efficient for users in other parts of the United States as well, though these analyses also identified considerable improvement potential, as noted below.[33]

While detailed projected 2030 water use in the WS Plan is not reported by sector, a simple analysis enables us to assess whether future per-capita demands achieve the efficiency benchmarks. As described above, the average single-family and multi-family indoor efficiency benchmarks are 60 and 55 gpcd, respectively; the outdoor efficiency benchmark is 15 gpcd. In 2001, single-family water use accounted for 79 percent of residential water use; multi-family water use accounted for the remaining 21 percent of residential use. Thus the weighted average efficient residential water use should be 59 gpcd for indoor uses and 15 gpcd for outdoor uses, for a total residential water use of 74 gpcd (Table 3). Note that because we used the *average* efficiency benchmarks, this is a conservative estimate of efficiency. We also note that most of the savings appear to accrue in the residential sector, even though studies (see below) suggest the potential for substantial commercial and industrial efficiency improvements.

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[32] Georgia Department of Natural Resources. 2004. Water Conservation Program: Water Conservation Plan Guidelines. Pp. 4.
[33] Gleick, P.H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California." Pacific Institute for Studies in Development, Environment, and Security. Also, AWWA WaterWiser. 1997. Residential Water Use Summary – Typical Single Family Home.

Table 3: Indoor, Outdoor, and Total Efficiency Benchmarks for the Residential Sector.

	2001 Water Use (MGD)	Percent of Residential Use	Indoor Benchmark (gpcd)	Outdoor Benchmark (gpcd)	Residential Benchmark (gpcd)
Single-Family Residential	280.4	0.79	60	15	75
Multi-Family Residential	78.2	0.21	55	15	65
Weighted Average			**59**	**15**	**74**

Projected 2030 demand in the WS Plan with implementation of Programs B and C does not achieve the efficiency benchmarks established by the DNR. If we assume that the District reduces UFW to 15 percent, as outlined in Program B, then the proportion of water use in the other sectors will increase slightly. For example, residential water use will account for 57 percent of total District water use in 2030, compared to 55 percent in 2001 (Table 4). According to the WS Plan, total District water use in 2030 is projected to be 1081 MGD with Program B and 1067 MGD with Program C. The residential sector will account for 57 percent of total use, or 616 MGD and 608 MGD with implementation of Programs B and C, respectively. Using the District population projection of 7.8 million people in 2030, per-capita demand for the residential sector will be 79 gpcd and 78 gpcd with Programs B and C, respectively. As described in the paragraph above, average efficient residential water use should be 74 gpcd. Thus with implementation of Programs B and C, District residences will use seven percent and five percent more water than an average efficient home as established by DNR, respectively. As described below, other studies conclude that conservation can reduce residential water use to levels far below the efficiency benchmarks established by DNR. This suggests that additional conservation potential exists in the residential sector.

Table 4: Per-Capita Demand in 2030 by Sector with Implementation of Programs B and C of the WS Plan.

	Fraction of Water Use		2030 Demand (MGD)		Population	2030 Per Capita Use (gpcd)	
Sector	**2001**	**2030**	**Program B**	**Program C**	**2030**	**Program B**	**Program C**
Residential	0.55	0.57	616	608	7,805,000	79	78
CII	0.27	0.28	303	299	7,805,000	39	38
UFW	0.18	0.15	162	160	7,805,000	21	21
Total	**1**	**1**	**1,081**	**1,067**		**139**	**137**

In addition, the conservation program in the WS Plan fails to meet the efficiency benchmark for UFW. The WS Plan calls for reducing UFW to 15 percent of water system withdrawals. This is significantly less efficient than the DNR efficiency benchmark, which states that "System unaccounted-for water (water leaks and losses) shall not exceed the state's current maximum 10% standard."[34]

Comparison with Other Conservation Studies

Recent water conservation assessments indicate that the conservation potential identified in the WS Plan is low. For example, a 1997 study by the American Water Works Association found that conservation could reduce indoor water use from 65 gpcd to 45 gpcd for single-family homes, a savings of over 30 percent.[35] The largest reductions were realized by replacing inefficient toilets and clothes washers with more efficient models.

Similarly, a Seattle study found that conservation and efficiency could substantially reduce indoor water use. Installing new, water-efficient fixtures and appliances reduced single-family indoor water use from 64 gpcd to 40 gpcd, a savings of nearly 40 percent, and far below the Atlanta targets. The largest reductions were achieved by installing efficient toilets and clothes washers. Further, homeowners rated the performance, maintenance, and appearance of the efficient appliances higher than the older appliances.[36]

While these studies have quantified the indoor conservation potential, a recent study by the Pacific Institute quantified the conservation potential for *all* urban sectors. The Pacific Institute report, "Waste Not, Want Not: The Potential for Urban Water Conservation in California," quantified the potential for water conservation and efficiency improvements in California's urban water use. The report concludes that existing, cost-effective technologies could reduce California's current (2000) urban water use by 30 percent. The cost-effective savings vary by

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[34] Georgia Department of Natural Resources. 2004. Water Conservation Program: Water Conservation Plan Guidelines.
[35] AWWA WaterWiser. 1997. Residential Water Use Summary – Typical Single Family Home.
[36] Mayer, P.W., W.B. DeOreo, and D.M. Lewis. 2000. Seattle Home Water Conservation Study: The Impacts of High Efficiency Plumbing Fixture Retrofits in Single-Family Homes. Aquacraft, Inc. Water Engineering and Management.

sector: 39 percent savings for residential indoor water use, 33 percent savings for residential outdoor water use, and 26 percent for the CII sector.[37]

Caution must be exercised when applying the outdoor and CII conservation potential estimates to any one location. While indoor water use is fairly consistent across the United States, outdoor and CII water use are strongly influenced by local conditions.[38] Thus the conservation potential for these sectors also varies according to local conditions For example, golf courses and office buildings use (and can potentially save) substantially more water than dairy or meat processors. Thus the industries present in a given area strongly influence the conservation potential of the CII sector.

While a quantitative assessment of the conservation potential in the CII sector is beyond the scope of this report, we can unquestionably assert that the conservation potential identified in Atlanta's Plan is weak and misses important efficiency opportunities. Few of the WS Plan savings result from programs in the commercial and industrial sector: implementation of Program B will save only 4.4 MGD from the CII sector; 50 percent of the savings is due to water audits and the remaining 50 percent is due to installation of 0.5 gpf urinals in new buildings. Other conservation assessments, however, conclude that the actual conservation potential is substantially higher. The most promising measures are discussed in greater detail below.

Economic Analysis

The economic analysis used in the WS Plan gives an incomplete and misleading picture of the conservation potential in the District because of the type of analysis employed, the perspective taken, and the assumed implementation levels.

The model used to assess the conservation potential in the WS Plan employs a "cost-benefit" approach to evaluate the conservation potential in the District. A cost-benefit analysis can be

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[37] Gleick, P.H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California." Pacific Institute for Studies in Development, Environment, and Security.
[38] Mayer, P.W. et al. 1999. Residential End Uses of Water. AWWA Research Foundation. Denver, Colorado.

conducted from a number of perspectives, including the "utility," "customer," and "community" perspectives. The perspective determines what costs and benefits are included in the analysis. The utility perspective is based on costs and benefits to the water utility; whereas the community perspective is based on costs and benefits to the water utility *and* customer and can include energy savings, as well as savings from reduced landscape chemical and fertilizer application, less landscape maintenance, and reduced detergent application for dishwashers and washing machines.[39] Environmental benefits from greater instream flows are also likely, although these benefits are difficult to quantify and are rarely included in any economic analyses. When they are included, they typically have the effect of making efficiency and conservation estimates even more economically attractive.

The model used in the WS Plan assesses the economics of the conservation measures and programs based on the utility perspective. Community costs and benefits, which for this analysis includes the customer's cost for installing and maintaining the water-saving device and energy savings, are discussed secondarily, but are not used to evaluate the measures. The utility perspective is much narrower than either the customer or community perspectives and misses important water-use efficiency cost savings that make many water-efficiency measures substantially cost-effective. The classic example is the high-efficiency clothes washer, which may not save sufficient water at present to cover their higher initial capital costs (although this is increasingly less true, as their costs come down). Water utilities therefore often view them as inappropriate for water conservation programs. Yet they have substantial energy savings as well, which makes them tremendously cost-effective to the consumer.

In addition, the "cost-benefit" approach is not the only way (nor necessarily the best way) to evaluate the "cost-effectiveness" of a measure or program. A cost-benefit (CB) analysis is a technique used to compare the costs and benefits associated with an investment. A CB analysis requires that a monetary value be placed on all costs and benefits, including the outcome. Measures or programs are compared based on the net cost (costs minus benefits) and/or the benefit-cost ratio; measures in which the benefits outweigh the costs are deemed "cost-effective."

[39] Vickers, A. 2001. Handbook of Water Use and Conservation. Waterplow Press, Amherst, Massachusetts.

A cost-effectiveness (CE) analysis takes a different approach. A CE analysis is a technique used to compare alternatives and is particularly useful if there are multiple ways of achieving the same outcome or if it is difficult to put a monetary value on that outcome.[40] For each alternative, a ratio of net costs (costs minus benefits) to the outcome achieved in physical terms, e.g., the cost per unit water saved, is determined. The alternatives are then compared to a baseline. For new water-supply projects or demand-management programs, the baseline is typically the avoided cost of building new supply or expanding existing supply. Alternatives that are cheaper than the baseline are deemed “cost-effective.” Thus while a CB analysis seeks to maximize the benefits, a CE analysis identifies **all** measures that provide water supply benefits at a lesser cost than the avoided cost of building new supply or expanding existing supply.

Adopting a CE approach yields a very different answer about the conservation measures that should be included in an effective conservation program. Table 5 provides the cost of savings per unit volume of water saved according to the WS Plan. We can compare these values with the avoided treated surface water cost of $1,500/MG to determine those measures that are cost-effective.[41] This comparison suggests that 22 out of 27 measures are cost-effective. Program B, however, includes only 11 measures, excluding a significant number of cost-effective measures.

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[40] International Center for Early Childhood Services. 2001. Cost-Effectiveness Evaluation Methodological Report. http://www.healthychild.ucla.edu/ICECS/resource/materials/outcomes/costEffectivenessReport.pdf
[41] Metropolitan North Georgia Water Planning District. 2003. Task 7. Pp.15.

Table 5. Costs, Benefits, and Water Savings of the Conservation Measures Assessed in the WS Plan.

Conservation Measure	Present Value of Water Utility Benefits ($1000)	Present Value of Total Community Benefits ($1000)	Present Value of Water Utility Costs ($1000)	Present Value of Total Community Costs ($1000)	Water Utility Benefit-Cost Ratio	Total Community Benefit-Cost Ratio	Average Water Savings (MGD)	Cost of Savings per Unit Volume ($/MG)	Net Utility Benefit ($1000)
RSF ULFT Retrofit on Resale	142,000	142,000	3,200	4,900	44.9	29.2	12.0	23.26	138,800
RMF ULFT Retrofit on Resale	59,400	59,400	2,300	3,800	26.3	15.7	5.0	40.01	57,200
Residential SF Washer Rebate	8,100	27,200	14,900	25,000	0.5	1.1	0.6	2,165.77	-6,800
Residential Shower Retrofit	37,700	138,000	14,200	14,200	2.7	9.7	3.0	412.06	23,500
Residential Water Audits	25,700	44,700	45,700	55,800	0.6	0.8	2.2	1,804.18	-20,000
Public Information	70,300	135,900	51,800	51,800	1.4	2.6	6.0	765.92	18,500
Multifamily Submetering	40,800	89,600	3,000	40,800	13.6	2.2	3.4	78.07	37,800
Irrigation Controller Rebate	6,400	6,400	10,300	13,900	0.6	0.5	0.6	1,452.42	-4,000
Rain Sensor Regulations	8,000	8,000	3,200	10,000	2.5	0.8	0.8	336.02	4,800
Non RSF Landscape Requirements	15,500	15,500	2,700	27,300	5.7	0.6	1.6	146.14	12,800
Commercial Water Audits	25,200	25,200	11,600	18,300	2.2	1.4	2.2	470.68	13,600
Commercial ULFT Rebates	50,800	50,800	12,500	25,100	4.0	2.0	4.1	273.11	38,200
Commercial Urinal Rebate	27,200	27,200	6,700	13,400	4.1	2.0	2.3	261.07	20,500
Commercial Washer Rebate	7,600	25,000	800	1,200	9.0	21.4	0.6	120.52	6,800
Cooling Tower Meter Rebate	4,700	4,700	1,200	2,500	4.0	1.9	0.4	234.68	3,500
Commercial Kitchen Spray Wash	4,300	9,100	1,600	1,600	2.8	5.8	0.4	393.32	2,800
Hotel & Motel Water Audits	2,500	2,500	2,100	2,600	1.2	1.0	0.2	894.72	400
Capacity Buy-Back for ICI	1,500	1,500	15,500	18,500	0.1	0.1	0.1	10,550.51	-14,000
Rebates for X-Ray Recycling Units	5,900	5,900	1,000	22,500	6.2	0.3	0.5	176.06	4,900
Require Self-Closing Faucets for ICI	16,200	16,200	1,000	10,600	16.8	1.5	1.5	58.15	15,200
Efficient Process Equipment for New ICI	12,500	12,500	3,300	14,300	3.8	0.9	1.1	259.51	9,200
Require 0.5 gpf Urinals for ICI	24,700	24,700	1,000	1,000	25.6	25.6	2.2	38.54	23,700
Irrigation Audits for Large Turf Areas	10,400	10,400	22,800	29,300	0.5	0.4	1.0	1,996.24	-12,400
Xeriscape of Public Areas	300	300	300	900	0.9	0.4	0.0	1,013.53	0
UFW Reduction	296,000	296,000	74,300	74,300	4.0	4.0	29.1	225.76	221,700
Conservation Pricing	198,200	254,000	8,800	8,800	22.4	28.8	20.1	38.81	189,400
Modified Residential Water Audits	8,900	15,500	15,000	18,300	0.6	0.8	0.7	1,832.07	-6,100

In addition, implementation assumptions in the WS Plan appear conservative. Implementation, or market penetration, refers to the number of individuals or households that employ a specific conservation measure and provides an indication of the effectiveness of a conservation program. Table 6 compares the implementation levels assumed in the WS Plan with those adopted by agencies who signed the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding Regarding Urban Water Conservation in California. The values adopted in the WS Plan refer to implementation over a 30-year period, while those of the CUWCC are for a 10-year period. Note that implementation levels for audits (commercial, residential, hotel/motel, and large turf areas), clothes washer rebates, and sub-meters in multi-family units assumed in the WS Plan are significantly lower than the CUWCC levels.

Table 6. Comparison of the market penetration of conservation measures for the CUWCC 10-year program and the District 30-year program. Note that market penetration for the measures in the District's 30-year program are, in many cases, lower than those of the CUWCC's 10-year program.

Conservation Measure	**Market Penetration by End of Program**	**CUWCC Market Penetration by End of Program**
Clothes washer rebate	12%	20%
Distribute retrofit kits	75% of existing non-low flow	75% of houses constructed pre-1992
Residential water audits	10%	15%
Public education	100%	100%
Submetering multi-family	25% existing, 50% new	100%
Commercial water audits	30% of Top 40%	10%
Commercial toilet/urinal rebates	40%/50% (toilets/urinals)	3%
Hotel/motel water audits	25%	10%
Irrigation audits of large turf areas	Top 25%	audits for 20% of accounts w/mixed use meters; water budgets for 90% w/dedicated meters
System water audits	All for UFW > 10%	100%
Conservation Rates	100%	100%

Market penetration affects the outcome of the economic analysis as well as the projected water savings from each measure. The total cost for each measure is based on incentive or unit costs, annual administrative costs, and a one-time set-up cost. Many of the measures have large set-up cost, moderate administrative costs, and low unit costs. The set-up cost "is for measure design by staff or consultants, any required pilot testing, and preparation of materials that will be used in marketing the measure"[42] and ranges from $10,000 to $100,000 for this analysis. The administrative costs include staffing and marketing costs and range from $2,000 to $25,000. With low implementation levels, the set-up and administrative costs are divided among a smaller number of units, resulting in a higher unit cost. This effectively increases the cost per unit water saved and lowers the benefit-cost ratio. Low implementation also reduces the water savings for a particular measure or program.

Efficiency Measures

Table 7 provides a matrix of conservation measures and indicates the range of measures currently available to reduce water use. Highlighted are those measures that were included in Program B, the recommended package. Comparing the available measures with those adopted suggests that significant conservation potential exists beyond what is projected in Program B for both indoor and outdoor use. In addition, recycling and reuse can meet future demand. Below we look at several of the available water-efficiency measures for each sector in greater detail.

[42] Metropolitan North Georgia Water Planning District. 2003. Task 7. Pp.12.

Table 7: Conservation Measures Water Districts Commonly Use to Reduce Water Demand. Those Measures Included in Programs B and C of the WS Plan Are Identified.

Conservation Measure	Sector	Indoor/Outdoor	Included in Program B?	Included in Program C?
Toilet retrofit on resale	Residential	Indoor	X	X
Clothes washer rebate	Residential	Indoor		
Distribute retrofit kits	Residential	Indoor	X	X
Submetering multi-family	Residential	Indoor	X	X
Dishwasher rebate	Residential	Indoor		
Dual-flush toilets	Residential	Indoor		
Toilet rebate	Residential	Indoor		
New home efficiency labeling program	Residential	Indoor		
Retrofit-on-resale	Residential	Indoor		
Irrigation controller rebates	Residential	Outdoor		
Rain sensor regulations	Residential	Outdoor	X	X
Landscape requirements	Residential	Outdoor		X
Turf removal programs	Residential	Outdoor		
Landscape professional/contractor education programs	Residential	Outdoor		
Low water-use plants/xeriscape workshops/education	Residential	Outdoor		
Low water-use garden award	Residential	Outdoor		
Landscape contractor certification program	Residential	Outdoor		
Soil moisture sensor rebate	Residential	Outdoor		
Gray water system education	Residential	Outdoor		
Water waste prohibition	Residential	Outdoor		
Rain barrel catchment	Residential	Outdoor		
Swimming pool and spa covers	Residential/CII	Outdoor		
Water audits	Residential/CII	Indoor/Outdoor	X	X
Capacity buy-back for processing equipment	CII	Indoor		
X-ray water recycling unit rebate	CII	Indoor		
Self-closing faucets in new CII buildings	CII	Indoor		X
Efficient process equipment regulation	CII	Indoor		X
Require 0.5 gpf urinals in new CII	CII	Indoor	X	X
Commercial toilet/urinal rebates	CII	Indoor		X
Clothes washer rebate (coin-op)	CII	Indoor		X
Cooling tower meters	CII	Indoor		X
Restaurant low-flow spray nozzles	CII	Indoor		X
Retrofit of existing car washes	CII	Indoor		
Require new car washes to recycle water	CII	Indoor		
Irrigation audits of large turf areas	CII	Outdoor		X
Xeriscape city/county buildings	CII	Outdoor		
Irrigation controller rebates	CII	Outdoor		
Rain sensor regulations	CII	Outdoor	X	X
Landscape requirements	CII	Outdoor		
Dedicated meters w/ET_0 budget	CII	Outdoor		

Table 7 continued.

Conservation Measure	Sector	Indoor/Outdoor	Included in Program B?	Included in Program C?
Reclaimed water for large turf areas	CII	Outdoor		
Hotel/motel water audits	CII	Indoor/Outdoor		X
Public education	Total System		X	X
Conservation rates	Total System		X	X
System water audits	Total System		X	X
Leak detection	Total System		X	X
Distribution system pressure regulation	Total System			

Indoor Water Use

The proposed conservation programs miss a number of cost-effective measures for reducing indoor water use in existing homes. An estimated 70 percent of the homes in the District were built prior to 1993 and therefore likely do not meet current plumbing code requirements.[43] Thus rebates may encourage homeowners to replace inefficient appliances with newer, more efficient models, resulting in significant water savings. Utilities throughout the country commonly provide their customers with such rebates. Rebate programs can be expanded to include water-efficient appliances that are not currently required under plumbing codes but have been shown to save significant amounts of water and energy, such as high-efficiency dishwashers and clothes washers, making them cost-effective to consumers.

The programs proposed in the WS Plan also lack measures encouraging efficient water use in new developments. As described in the Water Use Projections section, conservation measures were initially screened based on qualitative criteria. The initial screening process excluded nearly 60 percent of the conservation measures for new residential and commercial developments, such as establishing a new home-efficiency rating system. In regions experiencing high growth rates, such as the District, measures aimed at new developments can play an important role in reducing future water demand.

Similarly, the proposed indoor conservation measures for the CII sector are weak. Program B consists of just two conservation measures for reducing CII indoor water use: audits and a 0.5

[43] Metropolitan North Georgia Water Planning District. 2004. Launching Plans Into Action: Activities and Progress Report.

gpf urinal requirements in new CII buildings. A recent report by the Pacific Institute finds that more comprehensive conservation and efficiency can reduce current annual water use in California's CII sector by 39 percent overall. Savings vary by industry, but are largest for schools, office buildings, golf courses, retail stores, and restaurants. Recirculating cooling towers, x-ray water recycling units, and restaurant pre-rinse spray valves are among a few of the most promising technologies.[44]

For example, the California Urban Water Conservation Council (CUWCC) recently demonstrated the cost-effectiveness of restaurant pre-rinse valves. The CUWCC and participating agencies installed nearly 17,000 restaurant pre-rinse spray valves between October 2002 and December 2003, saving over 2.3 million gallons per day (2,600 AF annually) at a water agency cost of $65 per AF of water saved – far below the cost of providing the water or finding new supply. Customers are expected to save $500-1,000 annually on their utility bills due to water, wastewater, and energy savings. This program has been a tremendous success and plans are underway to expand it in the future.[45]

Outdoor Water Use

Program B contains only two measures aimed at reducing outdoor water use: audits and automatic rain shut-off valves. Studies have also shown that a number of other outdoor conservation measures are cost-effective and yield substantial water savings. For example, the cities of Austin, Texas and Las Vegas, Nevada offer rebates or direct payments for removing water-intensive grasses and for maintaining water use below budgets that the city reviews.[46] A study conducted by the Irvine Ranch Water District in California showed that evapotranspiration controllers reduced outdoor water use for high residential users by 24 percent.[47] The City of Santa Monica offers funding for new or remodeled innovative garden designs that include one or more of the following: native plants, water-efficient plants, water-efficient irrigation systems,

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[44] Gleick, P.H., D. Haasz, C. Henges-jeck, V. Srinivasan, G. Wolff, K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California." Pacific Institute for Studies in Development, Environment, and Security.

[45] California Urban Water Conservation Council. 2005. Rinse & Save: Final Report Summary. http://www.cuwcc.org/Uploads/product/CPUC_Reports/CPUC_Phase_I_Final_Report.pdf

[46] City of Austin, Texas Water Conservation. 2006. http://www.ci.austin.tx.us/watercon/landscape.htm

[47] Hunt, T. et al. 2001. Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine "ET Controller" Study. Irvine Ranch Water District. http://www.irwd.com/Conservation/FinalETRpt%5B1%5D.pdf

stormwater catchment systems, graywater systems, and/or other innovative water-saving features. On their website they note: “Research shows that converting turf and other water-thirsty plants, and traditional, high-volume spray sprinkler irrigation systems to California friendly plants and water-efficient irrigation systems, can save up to 80% of water and 60% of maintenance costs.”[48] In contrast, the City of Atlanta’s Water Wise Xeriscape Program is limited to small-scale educational trainings by “student” consultants, literature distribution, and consultations for gardeners.[49] While results will vary regionally, the significant water use in landscaping, and the potential for savings both suggest that more aggressive landscape irrigation programs in the District are warranted.

Training programs for landscape professionals and application of efficiency technologies have also been demonstrated to provide significant savings. The Municipal Water District of Orange County initiated a Landscape Performance Certification Program targeting large landscape customers with dedicated irrigation meters in Orange County, California. The program provides technical training sessions to landscape contractors and property managers (includes homeowner associations) and prepares water budgets for all sites owned or managed by the company. Sites are then assessed for compliance with the water budget, and property managers or landscape contractors are awarded a bronze, silver, or gold certification award based on the level of compliance. Companies that achieve certification are promoted with the intention of increasing market opportunities. It is estimated that each customer saves approximately 765 gallons per day on average, a 20 percent reduction of their outdoor water use, at a cost of $165 per acre-foot – well below the cost of new supply.[50] Educating landscape professionals about native and low-water-use plants and rebates available may also help increase participation in outdoor conservation programs.

Programs focused on curbing outdoor watering in new developments have also been successfully implemented throughout the United States. The Southwest Florida Water Management District

[48] City of Santa Monica. Grants for Landscaping. 2006. http://santa-monica.org/epd/news/Landscaping_Grant.htm.
[49] City of Atlanta Bureau of Water. 2006. http://apps.atlantaga.gov/citydir/water/xeriscape.htm.
[50] A&N Technical Services, Inc. 2004. Evaluation of the Landscape Performance Certification Program. Prepared for the Municipal Water District of Orange County, the Metropolitan Water District of Southern California, and the U.S. Bureau of Reclamation, Southern California Area Office. http://www.mwdoc.com/documents/LPC-Evaluation_000.pdf

instituted a Water-Wise Landscape Recognition Program in 2001. The program is designed to "call attention to the efforts of good water stewards in the commercial, government and builders segments of the community" by "spotlight[ing] new and retrofitted water-conserving commercial landscapes, including model homes."[51] Qualifying landscapes are identified with a "Water-Wise" sign. In addition, one builder from each county is presented with an award based on inclusion of water conservation principles in their landscape design.

Recycling and Reuse

As described in the Current Water Use section, recycling and reuse provide only a minor component of the District's water supply. While the use of recycled and reused water is projected to increase over the District's planning horizon, its overall contribution to the water supply remains small. The WS Plan states that

> "Based on preliminary calculations, the amount of reclaimed water available for indirect potable reuse could range from 40 MGD to 125 MGD AADD, or 4 to 12 percent of the projected 2030 AAD demand for the District … Water reuse in the form of indirect potable reuse plays a significant role in meeting the projected 2030 water demands, as does the aggressive water conservation program."[52]

The WS Plan includes discharge of 117 MGD of treated wastewater to Lake Lanier by 2030. This amount was deemed the most cost-effective due to concern about phosphorous discharge into the Lake. Because 50 MGD of wastewater is currently discharged into Lake Lanier, reclamation will provide an additional 67 MGD of potable water in 2030. Thus planned reclamation in the District will meet only 11 percent of projected 2030 demand. While the District expects to increase indirect potable reuse beyond 2030, it "incorporates it in a modest way, so that experience can be developed before this type of reuse becomes essential."[53]

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[51] Southwest Florida Water Management District. 2005. Water-Wise Landscape Recognition Program. http://www.swfwmd.state.fl.us/conservation/waterwise/index.html
[52] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. Pp. 6-20.
[53] Metropolitan North Georgia Water Planning District. 2003. Long-Term Wastewater Management Plan. Pp. 5-7.

Indirect potable reuse is also feasible in Lake Allatoona, which is located in the Etowah River Basin. Because supply in this basin is projected to exceed demand, however, the District has decided not to pursue this option: “the need to discharge reclaimed water to increase supply in Lake Allatoona during the next 30 years is not as significant.”[54] While opting not to pursue reclamation in Lake Allatoona, the District promotes reallocation of Lake Allatoona to increase the available water supply. This inconsistent policy exemplifies the District’s emphasis on new supply sources rather than conservation, efficiency, and reuse.

Further the District’s reliance on indirect potable reuse misses additional non-potable reuse opportunities. The Wastewater Management Plan, also produced by the District, concludes that non-potable reuse could reduce 2030 potable demand by 71 MGD. Because of the high cost associated with installing a new distribution system and the desire to minimize consumptive water use, however, the District has decided to pursue indirect potable reuse. Water districts throughout the United States practice non-potable reuse, indicating that while it may be more expensive than indirect potable reuse, it is often cost-effective. Further, installing a separate distribution system for non-potable water is significantly less expensive in new developments than in previously developed areas. Because the District is projected to experience significant growth over the next 25 years, dismissing non-potable reuse misses an important potential opportunity.

Although recycling and reuse is projected to meet only 11 percent of the District’s 2030 water demand, it has become an increasingly important component of the water-supply portfolios for water district throughout the United States. For example, the Irvine Ranch Water District, in Southern California, currently meets nearly 20 percent of its total demand with recycled water.[55] In 2004, the South Florida Water Management District reused over 25 percent of the total wastewater treated.[56] This suggests that significant opportunities exist to increase recycling and

[54] Metropolitan North Georgia Water Planning District. 2003. Water Supply and Water Conservation Management Plan. Pp. 6-21.
[55] Irvine Ranch Water District. 2005. Urban Water Management Plan. http://www.irwd.com/BusinessCenter/UWMP-2005-F.pdf
[56] South Florida Water Management District. 2004. Annual Agency Reuse Report. http://www.sfwmd.gov/org/wsd/wsconservation/pdfs/reuse/final2004annualreusereport.pdf

reuse throughout the District, effectively lessening the strain on the District's current water resources and the need to identify and develop new water supplies.

Weak Implementation Levels

Both the District and the State have taken a number of actions to promote conservation since the WS Plan was completed in 2003. While the District has made some progress, conservation efforts are still weak, and we note that the above actions are mostly focused on new developments, leaving many inefficient water uses and technologies in place. These actions are described below:

- The EPD required all District utilities to implement, at a minimum, a uniform rate structure by January 1, 2004 and a multi-tiered rate structure by January 1, 2006.
- In 2004, legislation was passed requiring rain shut-off sensors on all new commercial and residential irrigation systems in the District.
- The District is preparing model ordinances to encourage local jurisdictions to require sub-meters on all new multi-family developments, including apartments, condominiums, and townhouses.
- The District provided system leak detection training for water utilities, and is developing brochures for homeowners to reduce water use and household leaks.
- Public education and outreach programs, including television and billboard ads and workshops, have been expanded.
- The EPD has adopted an every-other-day watering schedule without hourly limitations.

A progress report released by the District in December 2005 reveals that implementation by local governments is inadequate. Figure 5 shows the water suppliers' responses to a survey about implementation of the adopted conservation measures in graphical form. Note that only conservation education has been implemented by more than 50 percent of the water suppliers. Despite the requirement to adopt a multi-tiered rated structure by January 1, 2006, only 45 percent of the District's utilities have adopted conservation pricing. Sub-metering policies have been adopted by only 20 percent of the water utilities. And only 10 percent of the water utilities provide retrofit kits to their customers.[57]

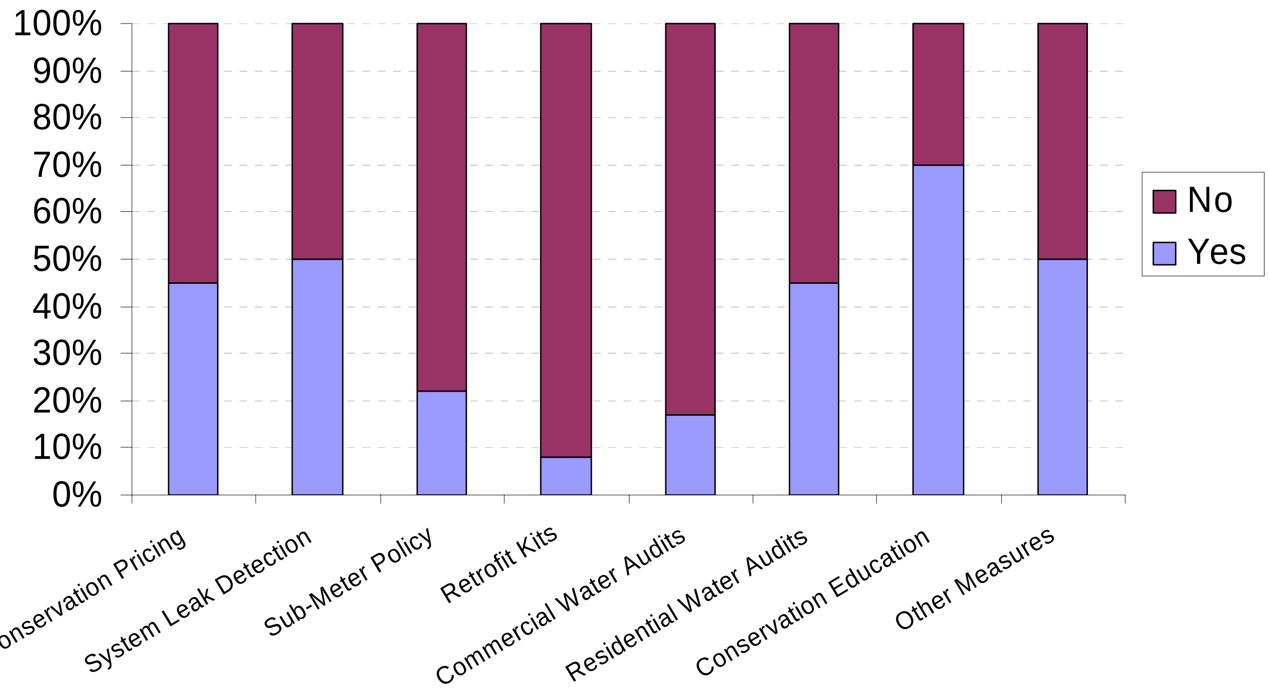

Figure 4. Implementation of Conservation Measures by Water Utilities in the District by December 2005. Many of the most basic water conservation measures remain unimplemented. Source: Metropolitan North Georgia Water Planning District. 2005. Protecting Water Resources: Elements of Success. Activities and Progress Report.

Some of the programs implemented may actually increase water use, such as a restriction on daily watering, requiring outdoor water use to be conducted every-other-day. This restriction allows homeowners with odd-number addresses to water on Tuesdays, Thursdays, and Sundays, and homeowners with even-numbered addresses to water on Mondays, Wednesdays, and Saturdays. Homeowners can water at any time of the day. In some cases, homeowners are watering more frequently than before the watering schedule was initiated: many homeowners believe that because they can water every day, they should water every day. This may actually

[57] Metropolitan North Georgia Water Planning District. 2005. Protecting Water Resources: Elements of Success. Activities and Progress Report.

encourage greater use.[58] A more effective approach might be to establish specific watering times (e.g., after 7 pm) and/or time limitations.

A recently proposed amendment to a key element of Program B in the WS Plan, the retrofit-on-resale measure, may also weaken conservation efforts. The retrofit-on-resale measure, which is estimated to account for 20 percent of Program B's water saving, requires a legislative bill for implementation. However, the bill, sponsored by assembly member Karla Drenner, did not even get a committee hearing.[59] Members of the real estate community strongly opposed the measure. The District organized a Retrofit Steering Committee, which concluded that "Mandatory, heavy-handed tactics are not the answer."[60] Rather, they opted to allow water suppliers to choose which programs they implement to replace older, inefficient fixtures, based on incentives.[61] They also recommended that implementation of the retrofit requirements be postponed from 2004 to 2010. The proposed amendment will reduce the water savings of this important measure and threaten the District's ability to meet its current conservation goals.

A second proposed amendment to the WS Plan would have a yet undetermined effect on conservation goals. The low-flow urinal measure for new commercial buildings was recently eliminated because it was deemed not cost-effective. Interestingly, the assessment in the WS Plan determined that this measure was highly cost-effective, with a benefit-cost ratio of 25.6. Water savings from this measure were relatively small, at an estimated 2.2 MGD (Table 6). In its place, the Board is considering adopting a measure to promote restaurant pre-rinse spray valves. Because the recently passed Energy Bill requires these valves in new construction, the "proposed retrofit education program would focus on education of existing food service establishments."[62] It is not clear, however, whether the District is proposing to provide valves to existing

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[58] Vickers, Amy. 2001. Handbook of Water Use and Conservation. Waterplow Press. Amherst, Massachusetts.
[59] Shelton, S. 2005. Water Mandate Runs Dry. The Atlanta Journal-Constitution. January 30, 2006.
[60] Metropolitan North Georgia Water Planning District. 2005. Technical Coordinating Committee Meeting Summary. June 23, 2005. http://www.northgeorgiawater.com/pdfs/TCCArchive/2005-6-23%20TCC%20MEETING%20SUMMARY.pdf
[61] Metropolitan North Georgia Water Planning District. 2005. Water Conservation Retrofit Steering Committee. August 31, 2005. http://www.northgeorgiawater.com/pdfs/TCCArchive/TCCWS092705/2005-08-31%20RETROFIT%20MTG%20NOTES.pdf
[62] Metropolitan North Georgia Water Planning District. 2005. Technical Coordinating Committee Meeting Summary. October 12, 2005

establishment, or if it is strictly an education program. Thus the potential effect of this measure on conservation goals remains unclear.

Alternative Supply and Demand Analysis

The WS Plan presents quantitative data about the projected population and total water demand in 2030. No information is provided about demand for each of the sectors. As a result, only a relatively simple alternative assessment of 2030 water demand is presented here, produced by examining different population projections and minor modifications to the conservation programs. The results of these changes are described below.

Figure 5 presents two different scenarios for 2030 demand. Scenario 1 shows demand under the high-growth scenario with implementation of conservation Program B. Recall that this is the scenario adopted by the District. An alternative scenario, Scenario 2, shows demand under the Atlanta Regional Commission's population projection with implementation of conservation program C. In addition, this scenario includes reducing the UFW to 10 percent, the efficiency benchmark established by DNR. Under Scenario 2, 2030 demand is 838 MGD compared to 1,081 MGD for Scenario 1. Not only is this a substantial improvement, but demand under this scenario never even exceeds current supplies, through 2030. Per-capita demand in 2030 is 130 gpcd in Scenario 2, a 23 percent reduction over the current (2001) per-capita demand of 168 gpcd. Additional conservation and efficiency measures can reduce 2030 demand further.

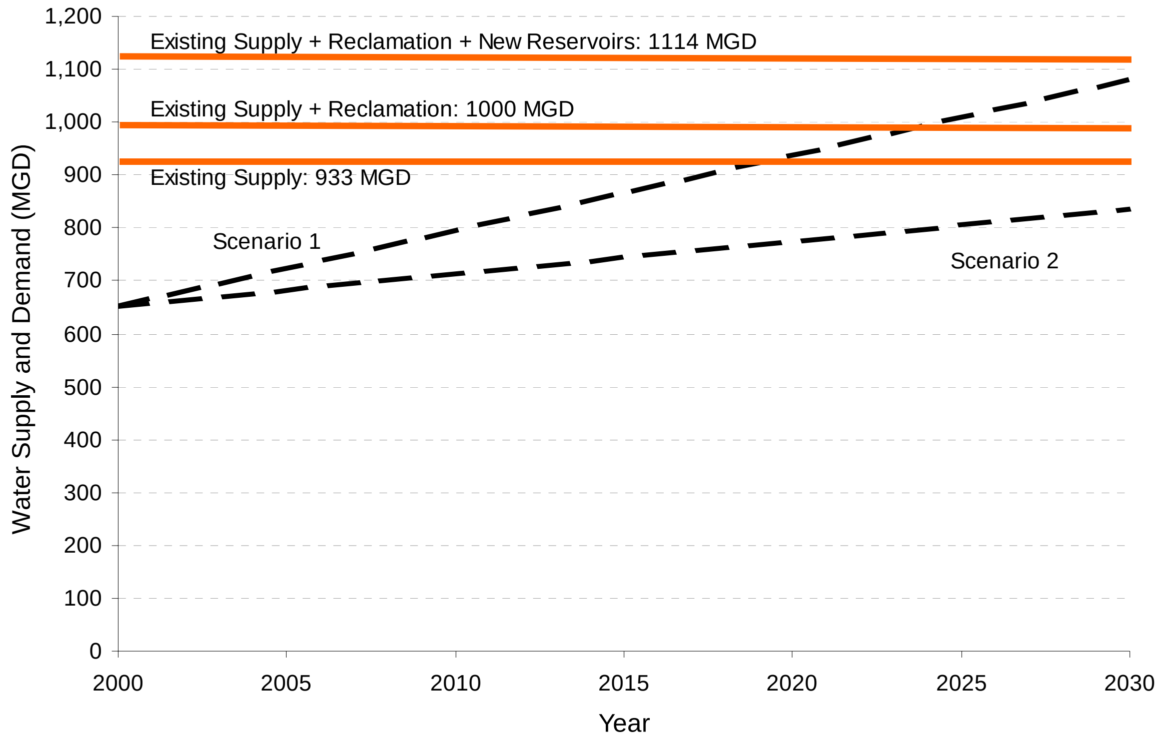

Figure 5: Water Demand and Supply Under Alternative Scenarios. The more efficient scenario (Scenario 2) can postpone, or even eliminate, the need for any new supply for decades to come.

Figure 5 compares the demand projections with various supply scenarios. The existing supply, 933 MGD, is sufficient to meet demand under Scenario 2 well past 2030. Reclamation can further boost the total District supply to 1,000 MGD, and building new reservoirs can increase supply to over 1,100 MGD. Further, reclamation can be expanded, providing significantly more water than is projected in the WS Plan. This additional supply can increase system reliability.

Conclusions

The Water Supply and Water Conservation (WS) Plan projects substantial increases in 2030 water demand, rising from 650 MGD in 2001 to 1,080 MGD in 2030. To meet future demand, the District largely relies upon new supply options, specifically five new reservoirs and reallocation of Lake Lanier and Lake Allatoona. **Our analysis, however, reveals that the WS Plan may significantly overestimate future regional demand for water and underestimate the potential for cost-effective demand management.** A straightforward re-examination of conservation scenarios, using more plausible population estimates and the cost-effective conservation efforts described by the WS Plan as Package C, produces a 2030 demand for water that remains below the level of existing supplies. Further, more efficiency improvements, recycling, and reuse can be expanded beyond projected levels.

Future water demand and use depend on many factors. One of the most important is the size of the population to be served. Because official projections were not available, the District produced two future population scenarios. The District projects that 2030 population will reach 6.8 million and 7.8 million in the moderate- and high-growth scenarios, respectively. The District used the high-growth scenario for all water-demand projections in the WS Plan.

Since completion of the WS Plan, the U.S. Census Bureau and the Atlanta Regional Commission have released additional population projections. These projections are substantially lower than the District's high-growth projection, but are comparable to the moderate-growth scenario. Because future water demand in the District is based on the high-growth scenario, the results of the ARC study suggest that the WS Plan overestimates 2030 water demand. Using the moderate-growth scenario reduces water demands, all other things being equal, by nearly 15 percent.

The District identified conservation as essential to meeting projected future demand. The WS Plan assessed implementation of three conservation programs (A, B, and C) with increasing levels of water savings. The District adopted Program B as the recommended program. Program B includes 11 conservation measures and reduces 2030 demand to 1081 MGD, 10 percent below demand with implementation of the plumbing codes alone.

Our analysis indicates that the projected water savings are likely to significantly underestimate the District's actual conservation potential. The list of efficiency measures evaluated does not include all cost-effective approaches. Even the more aggressive Program "C" (which was not adopted), appears incomplete. Under Programs B and C, the District does not achieve the efficiency benchmarks established by DNR. Other conservation assessments have also shown that the cost-effective conservation potential is likely to be significantly higher.

The economic analysis used in the WS Plan also gives an incomplete and misleading picture of the conservation potential in the District because of the type of analysis employed and the assumed implementation levels. The conservation potential is evaluated using a “cost-benefit” approach from the “utility” perspective. The “cost-benefit” approach, however, is not the only way (nor necessarily the best way) to evaluate the “cost-effectiveness” of a measure or program. In addition, the utility perspective is much narrower than either the customer or community perspectives and misses important water-use efficiency cost savings that make many water-efficiency measures substantially cost-effective.

Finally, the implementation levels of the conservation measures appear conservative and implementation efforts are falling below those necessary to capture even the modest savings projected by the WS Plan. With low implementation levels, the set-up and administrative costs are divided among a smaller number of units, resulting in a higher per unit cost. This effectively increases the cost per unit water saved and lowers the benefit-cost ratio. Low implementation also reduces the water savings for a particular measure or program.

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