No. 142, Original

In The
Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

DIRECT TESTIMONY OF PETER MAYER, P.E.

October 26, 2016

TABLE OF CONTENTS

1. I, Peter Mayer, P.E., offer the following as my Direct Testimony.

2. I am an expert in civil engineering and municipal and industrial (M&I) water use, and urban water systems and demand management, including conservation planning and implementation, water loss control, municipal water rates and rate structures, demand forecasting, drought preparation and response, and utility metering.

3. The purpose of my testimony is to offer my opinions regarding Georgia's municipal and industrial water withdrawals and consumption in the Apalachicola-Chattahoochee-Flint River Basin (ACF Basin), the scope and effectiveness of Georgia's water conservation and efficiency policies, plans, and measures, and the overall reasonableness of municipal and industrial water use by Georgia in the ACF River Basin.

4. My testimony also explains why, based on my review of the best available data, I disagree with claims by Florida and assertions by its experts that Georgia's consumptive use of water for municipal and industrial purposes are "large," "ever increasing," and likely to "increase dramatically" over the coming decades.

I. SUMMARY OF OPINIONS

5. In forming my opinions, I performed an analysis of the total water withdrawn for municipal and industrial uses, the amount of water that is returned to the ACF system after it is used, and the total per capita and consumptive use of water for municipal and industrial purposes in the Georgia ACF Basin during the period 1994-2013. I also analyzed daily per capita water use in several water management districts in Florida to compare the reasonableness and efficiency of Georgia's municipal and industrial uses relative to that of the Florida districts. I also performed an analysis of the range of water conservation and efficiency measures implemented by water systems in the Metropolitan North Georgia Water Planning District (Metro Water District), which is a water planning district that includes most of metropolitan Atlanta and the majority of the population of the ACF Basin in Georgia. Finally, I have performed a review of the analysis and opinions offered by Drs. David Sunding and George Hornberger as they relate to Georgia's municipal and industrial water use in the ACF Basin.

6. After conducting those analyses, I have reached the following conclusions:

7. *First*, Florida's claim that "[l]arge, and ever-increasing, amounts of water" are "consumed upstream for municipal [and] industrial" purposes in Georgia is incorrect and unsupported by data. Georgia's total municipal and industrial water withdrawals and consumptive use in the ACF Basin did not increase between 1994 and 2013. Indeed, the overall trend in total municipal and industrial consumptive use in the Georgia portion of the ACF Basin over this 20-year period remained constant—and even declined slightly—despite a roughly 50% increase in population. And since the creation of the Metro Water District in 2001, Georgia's total consumptive use declined by more than 55% in the M&I sectors.

8. *Second*, per capita water use in the Metro Water District declined from 155 gallons per capita per day (gpcd) in 2000 to 98 gpcd in 2013. Per capita water use in the Metro Water District declined further and at a faster rate than in water management districts located in northern Florida, including the Northwest Florida Water Management District, which includes Florida's portion of the ACF Basin. These trends and comparisons demonstrate both the increasing efficiency of water use in Georgia and the effectiveness of Georgia's significant investments in water conservation and efficiency programs. Indeed, Florida's own municipal and industrial water use expert, Dr. Dracup, acknowledged that per capita water use at the level achieved in the Metro Water District demonstrates that "water conservation measures are being appropriately implemented."

9. *Third*, Georgia is a national leader in M&I water conservation and water loss control. Georgia has adopted some of the most comprehensive and forward-thinking water conservation and efficiency legislation anywhere in the United States. This legislation has been hailed as a "landmark" in efforts to improve water efficiency in the municipal and industrial sector. Among other efforts, Georgia has developed and implemented a nationally recognized water loss control program for public water systems across the state. In fact, Georgia is one of just five states or regulatory entities in the United States to require water loss control measures on this scale, and Georgia's programs far exceed any similar efforts in Florida.

10. *Fourth*, Georgia's municipal and industrial water consumption is remarkably small when compared to the amount of water delivered by the United States Army Corps of Engineers (Corps) to Florida, even under drought conditions. Yet this small amount of water

used by Georgia for M&I purposes supports the overwhelming majority of the population and economic activity in the ACF Basin.

11. *Fifth*, Dr. Sunding and Dr. Hornberger have made obvious errors in their analyses of Georgia's municipal and industrial water use that have caused them to overestimate municipal and industrial water use in Georgia. Likewise, Dr. Sunding has identified three specific measures that he suggests should be employed to reduce municipal and industrial water use, but his analysis of these measures substantially overestimates the potential water savings that could be achieved, while substantially understating the costs that would result. In fact, contrary to Dr. Sunding's testimony, the measures he has identified could cost billions of dollars to implement while yielding small reductions in consumptive water use of no real significance to Florida.

II. BACKGROUND AND PROFESSIONAL QUALIFICATIONS

12. I am a civil engineer and a registered and licensed Professional Engineer in the state of Colorado. I am the Principal of Water Demand Management, LLC (WaterDM) based in Boulder, Colorado. I provide expert analysis and consulting services to municipalities, public water systems, and organizations throughout the United States in the following areas:

- Municipal and industrial water use, research, and analysis;
- Water conservation and demand management planning and implementation;
- Water loss control;
- Analysis of municipal water rates and rate structures;
- Drought preparedness and response;
- Demand forecasting;
- Evaluation of changes in demand;
- Statistical analysis of water demand and modeling;
- Meter technology implementation; and
- Meter and service line sizing.

13. I have a Master of Science in Engineering (1995) from the University of Colorado, Boulder and a Bachelor of Arts (1986) from Oberlin College.

14. I have over 20 years of experience analyzing urban water systems and demand management throughout the United States, including conservation planning and implementation,

rate analysis, water demand research, demand forecasting, drought preparedness and response, utility metering, and water loss control. Since 1995, I have served as a consultant and researcher to urban water providers, the Water Research Foundation, the Alliance for Water Efficiency, state governments, and municipal and industrial water users in the United States and Canada. I have worked with and advised dozens of water providers and organizations such as the New York City Water Board; the Metropolitan Water District of Southern California; Austin Water, TX; the Colorado Water Conservation Board; Hilton Head, SC; Denver Water, CO; Tucson Water, AZ; the San Antonio Water System, TX; East Bay Municipal Utility District, CA; the U.S. Department of Justice; and many others.

15. I have served as the principal investigator and lead or co-author of numerous national and state-level water demand research studies including: Residential End Uses of Water (2016, 1999); Water Conservation: Customer Behavior and Effective Communications (2010); Colorado State Water Supply Initiative (2010); National Submetering and Allocation Billing Program Study (2004); Water Budgets and Rate Structures (2008); Commercial and Institutional End Uses of Water (2000); and many others. I am currently leading three national outdoor water use and savings research studies for the Alliance for Water Efficiency and I am the principal investigator of a national water meter and service line sizing research project for the Water Research Foundation.

16. I am co-author of the American Water Works Association (AWWA) G480 Water Conservation Standard and co-author of the Colorado Best Practices Guidebook for Municipal Water Conservation (2010). I served as Trustee of the AWWA Water Conservation Division from 2001-2007, during which I worked with the U.S. EPA to create the WaterSense™ program and helped to found the Alliance for Water Efficiency. I also served as Chair of the subcommittee and lead author of the AWWA M22 Sizing Water Service Lines and Meters 3rd. ed. (2014). In addition, I am currently the vice-chair of the AWWA Customer Metering and Practices Committee.

17. I have also been a Senior Technical Advisor to the Alliance for Water Efficiency since 2007 and editor of its Water Efficiency Watch, bi-monthly e-newsletter. I am a member of the American Water Works Association, the Alliance for Water Efficiency, the American Water

Resources Association, the American Society of Civil Engineers (ASCE), and the Colorado River Water Users Association.

18. I have authored over 50 articles and presentations for a variety of publications and conferences related to, among other topics, water use, demand trends, outdoor water use, water budgets and rate structures, water conservation and efficiency, demand management, metering, and loss control.

19. Additional details about my background and accomplishments are provided in my *curriculum vitae*. GX-1021.

III. Georgia's Water Use for Municipal and Industrial Purposes in the ACF Basin

A. Municipal and Industrial Water Use

20. The municipal and industrial water use sector includes a wide-range of residential, commercial, and industrial entities that use water for a variety of purposes. As its name suggests, and as defined by the United States Geological Survey (USGS), "Municipal and Industrial" water use consists of two components: municipal water use and industrial water use.

21. "Municipal water use" means "public supply," which is water withdrawn by public and private water suppliers that provide water to at least 25 people or have a minimum of 15 connections. Public water supply includes water delivered to users for residential, commercial, and industrial purposes and for a variety of public services, such as public pools, parks, and municipal buildings. "Industrial water use" is water used for fabrication, processing, washing, and cooling for industries such as chemical and allied products, food, mining, paper and allied products, petroleum refining, and steel.[1]

B. Sources of Municipal and Industrial Water Supply in Georgia

22. Water is used for municipal and industrial purposes throughout the ACF Basin in Georgia, predominantly in the Metro Water District. The Metro Water District includes 15

[1] My testimony focuses on municipal and industrial water use. This does not include water used for thermoelectric power generation, which has been specifically excluded from the USGS definition of municipal and industrial water use for many years. Only a small fraction of the water withdrawn for thermoelectric use is actually consumed. Thus, were I to include thermoelectric consumptive use in my calculations, it would not alter any of my conclusions or opinions.

counties and 93 cities including and surrounding the City of Atlanta. Approximately 5.1 million people in Georgia depend on the ACF Basin for their water supply. Almost 4.2 million of these people reside in metropolitan Atlanta and the Metro Water District. GX-863 (2016 Metro Water District Population Memo).

a) GX-863 is a true and accurate copy of an April 2016 Metro Water District memorandum and attachments describing the latest population and employment statistics for the Metro Water District. Experts in my field regularly rely on such data, and I reviewed this work in preparing my expert opinions.

23. Given the geology of the region, the metropolitan Atlanta area depends almost entirely on surface-water withdrawals. This is because the region is underlain by granite bedrock and crystalline rock aquifers, as shown in Figure 1. These aquifers are not porous like sand or gravel and they store very little water, meaning that groundwater wells are generally inadequate to meet anything but small and highly localized water needs.

Figure 1. Distribution of groundwater resources in Georgia[2]

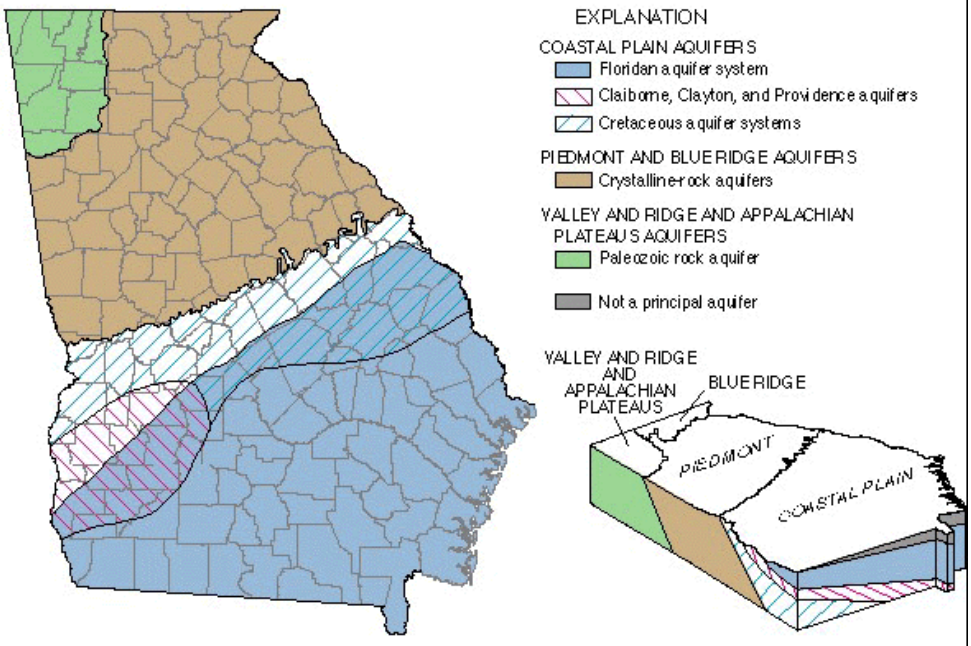


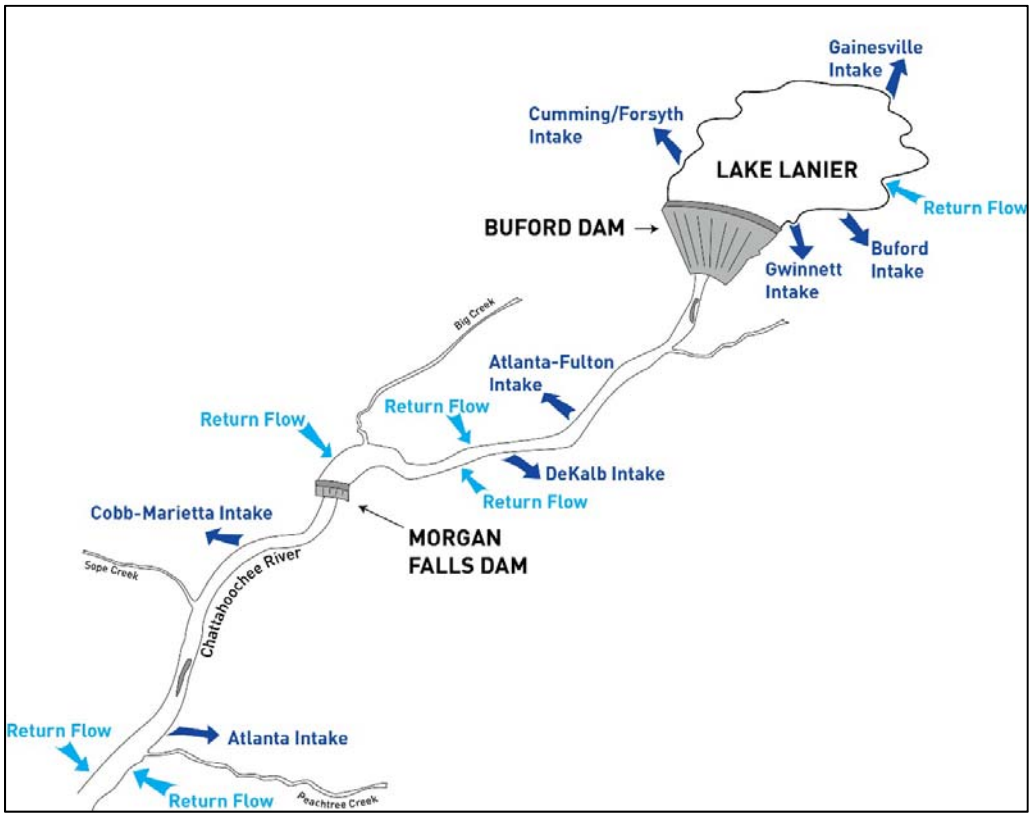
Figure 1. Area of use of principal aquifers and generalized diagram showing aquifers and physiographic provinces in Georgia.

[2] *See* https://pubs.usgs.gov/fs/FS-010-96/images/fig1.gif

24. Approximately 70% of the municipal and industrial supply for the fifteen counties of the Metro Water District comes from Lake Lanier and the Chattahoochee River Basin.[3] Although the area generally receives ample rainfall, river flows are not sufficient to meet the municipal and industrial water supply needs of the Metro Water District, particularly during the drier summer months and during droughts. Accordingly, the region depends on water stored in Lake Lanier to meet its water supply needs.

25. As shown in Figure 2 below, some water supply withdrawals in the Metro Water District are made directly from reservoir storage in Lake Lanier. Other withdrawals are made from the Chattahoochee River below Buford Dam, although these withdrawals also depend on water stored in Lake Lanier, as water is released from the reservoir by the Corps to ensure river flows sufficient to meet water supply and water quality requirements.

Figure 2. Water supply withdrawals & returns in the metro Atlanta area[4]



[3] *See* www.atlantaregional.com/environment/water

[4] http://atlantaregional.com/environment/tri-state-water-wars/background

26. As discussed in detail below, the majority of water withdrawn for municipal and industrial use is returned to the ACF Basin. For example, water used in homes that are connected to wastewater systems is collected and conveyed to a wastewater treatment plant, where it is treated to a high level and discharged back into the environment. Thus, only the quantity of water that is actually consumed and not returned—for instance, water that evaporates or transpires—constitutes consumptive use.

C. Population and Economic Activity Dependent on ACF-Basin Water

27. Georgia is home to the overwhelming majority of the population and economic activity dependent on the water supplies of the ACF Basin. In 2015, almost 5,100,000 people in Georgia relied on the ACF Basin daily for water supply, while just 90,000 people in Florida rely on the same waters. GX-863 at 6, Attachment A. Thus, approximately 92.2% of the ACF Basin's population resides in Georgia, while just 2.2% reside in Florida. GX-863 at Attachment A. To put this in perspective, the population of Fulton County that depends on the ACF Basin for water supply—which is just one county in the 15-county Metro Water District—is about 11.4 times larger than the population of the entire State of Florida within the ACF Basin. Moreover, although Georgia's total population grew by 50% from 1995 to 2015, as discussed below, its share of the population within the ACF Basin has increased by less than two percent relative to Florida and Alabama over that period, GX-863 at 9.

Table 1: Population Percentages Within the ACF Basin

YEAR	ALABAMA	FLORIDA	GEORGIA
1995	6.5%	2.5%	90.9%
2000	6.2%	2.4%	91.3%
2005	6.0%	2.4%	91.6%
2010	5.9%	2.3%	91.8%
2015	5.7%	2.2%	92.2%

28. Like population, economic activity in the ACF Basin is overwhelmingly concentrated in Georgia. In 2015, for example, Georgia accounted for 96% of the employment in the ACF Basin, while just 1.2% of the ACF Basin's employment exists in Florida. GX-863 at

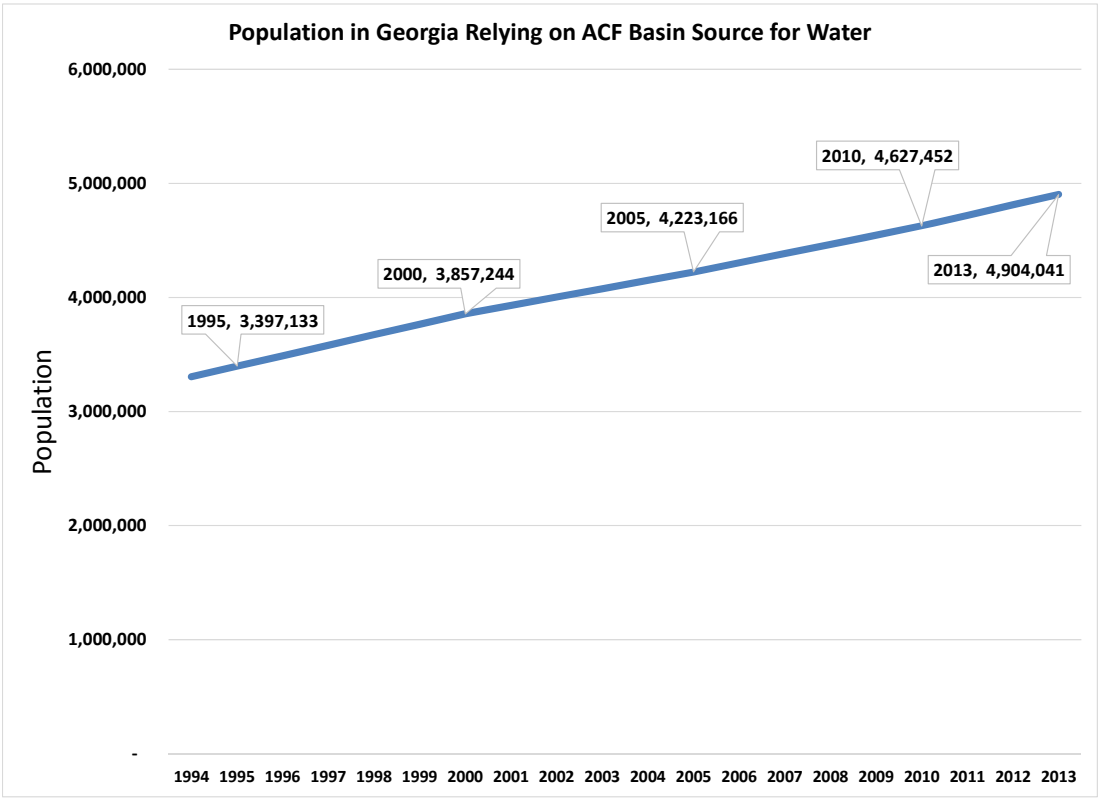
Attachment A. Additionally, the ACF Basin supplies water to more than 80 times the employees in Georgia than in Florida. GX-863 at Attachment A.

D. Total M&I Consumptive Use from the ACF Basin Has Declined in Georgia Over the Past 20 Years Despite Substantial Population Growth

29. I performed an analysis to determine the accuracy of the claim in Florida's complaint that "[l]arge, and ever-increasing, amounts of water" are "consumed upstream for municipal [and] industrial" purposes in Georgia. Florida Complaint ¶ 5. The results of that analysis show that this allegation is incorrect and unsupported by data. Georgia's overall municipal and industrial water consumption has remained essentially stable, and even declined slightly, since 1994, despite substantial growth in Georgia's population.

30. As shown in Figure 3, Georgia's population that relies on the ACF Basin for water supply grew by 50% between 1994 and 2013. Over that 20-year period, the number of people living in the Georgia portion of the ACF Basin that relied upon its water resources grew from approximately 3.3 million to more than 4.9 million, an increase of 1.6 million people.

Figure 3. Population in Georgia Relying on ACF Basin Waters (1994-2013)



31. As population grows in Georgia, as elsewhere, new residents and businesses require water to meet their everyday personal and business needs. An important way Georgia has addressed this additional water need is by adopting measures to reduce per capita water demand and by implementing policies to reduce consumptive uses of water and increase the amount of water that is returned to the system, as explained more fully below. These efforts have both expanded available supplies and mitigated any effects of population growth on downstream users.

32. I have analyzed the municipal and industrial withdrawals and returns in the Georgia ACF Basin contained in the Consumptive Use Database maintained by Georgia EPD, which tracks metered municipal and industrial water withdrawals and returns in the ACF Basin. JX-165 (Georgia Consumptive Use Database). This analysis shows that total municipal and industrial consumptive use remained constant, and even declined slightly, between 1994 and 2013.

b) JX-165 is a true and accurate copy of the Georgia EPD Consumptive Use Database, which I reviewed and relied upon in forming my opinions. It is a generally accepted practice by experts in my field to rely upon this type of data for calculating municipal and industrial water withdrawals, returns, and consumptive use.

33. As shown in Figure 4 below, municipal and industrial water withdrawals (represented by the blue bars) have varied over time, for example, reaching a high of about 686 mgd in 2006-2007 but falling to about 570 mgd in 2013. Over the same period, municipal and industrial water returns to the ACF Basin (represented by the green bars) have varied between about 428 mgd and 520 mgd. The difference between these values (represented by the purple line) represents consumptive use within the municipal and industrial sector.

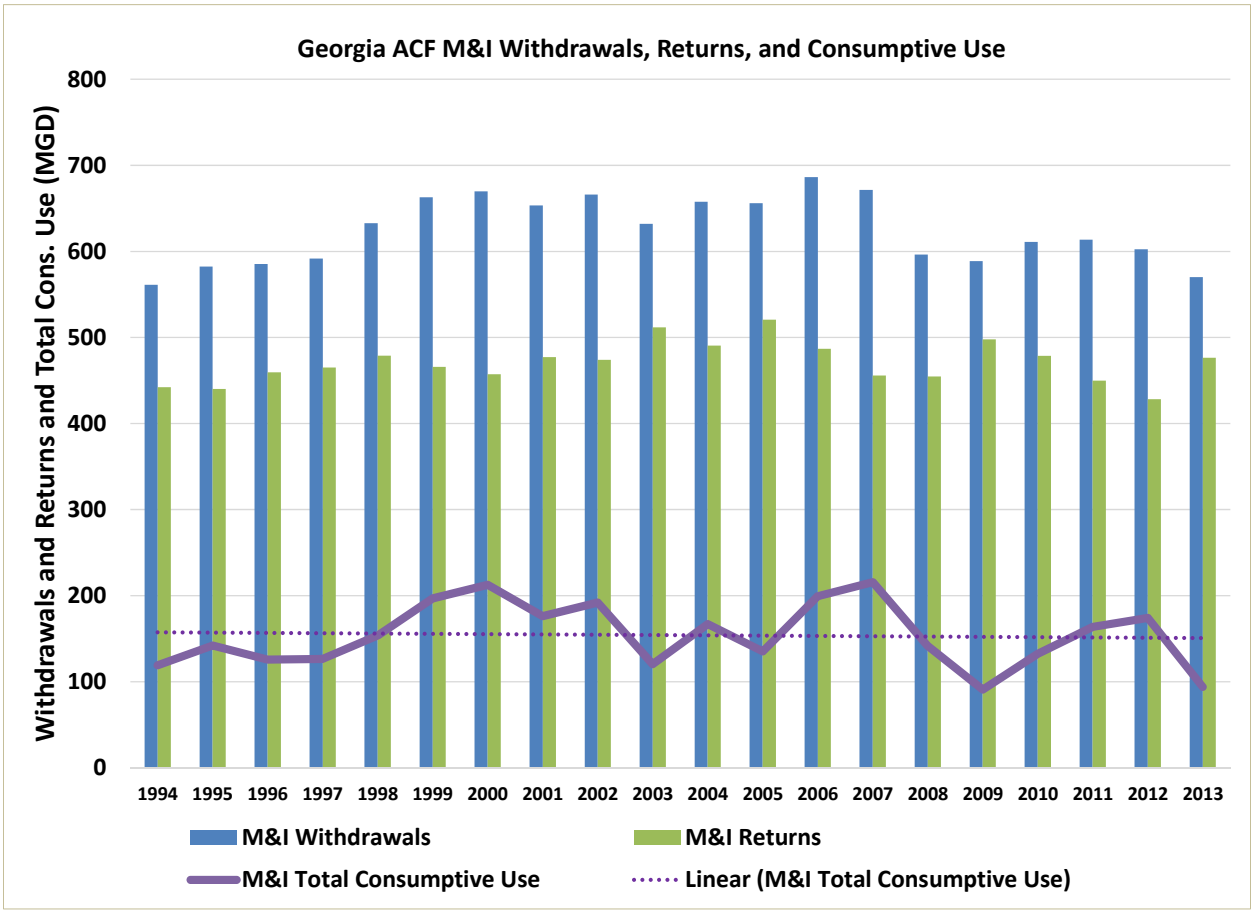
34. A significant point here is that Georgia returns to the ACF system a great majority of the water that it withdraws for M&I purposes. Within the Metro Water District, for example, more than 70% of the water withdrawn is returned to the ACF Basin. JX-165 (Georgia EPD Consumptive Use Database); GX-829 (Jan. 29, 2016 Comments of the State of Georgia: ACF Water Control Manual and Draft EIS with Exhibits A-K at GA02451997-GA02451998). That is true even in drought years. In 2011, for example, Georgia achieved a return rate of over 70%

during one of the worst droughts in State history. GX-829 at GA02451997-GA02451998. These return rates are projected to exceed 75% by 2050. GX-829 at GA02451998-GA02451999. Notably, these return estimates use conservative assumptions that exclude from consideration returns from unmetered treatment systems like septic tanks and M&I land application systems, which research in Georgia suggests may return upwards of 70% of the water they treat to streamflow. GX-107 at GA01441747.

c) GX-107 is a true and accurate copy of a publication entitled *Onsite Wastewater and Land Application Systems: Consumptive Use and Water Quality*, by University of Georgia Professors and Scientists D.E. Radcliffe, L.T. West, L.A. Morris, and T.C. Rasmussen. GX-829 is a true and correct copy of Georgia's 2016 Comments on the Draft EIS for the Corps' Water Control Manual to the Corps. Experts in my field regularly rely on such research publications and government documents, and I reviewed this work in preparing my expert opinions.

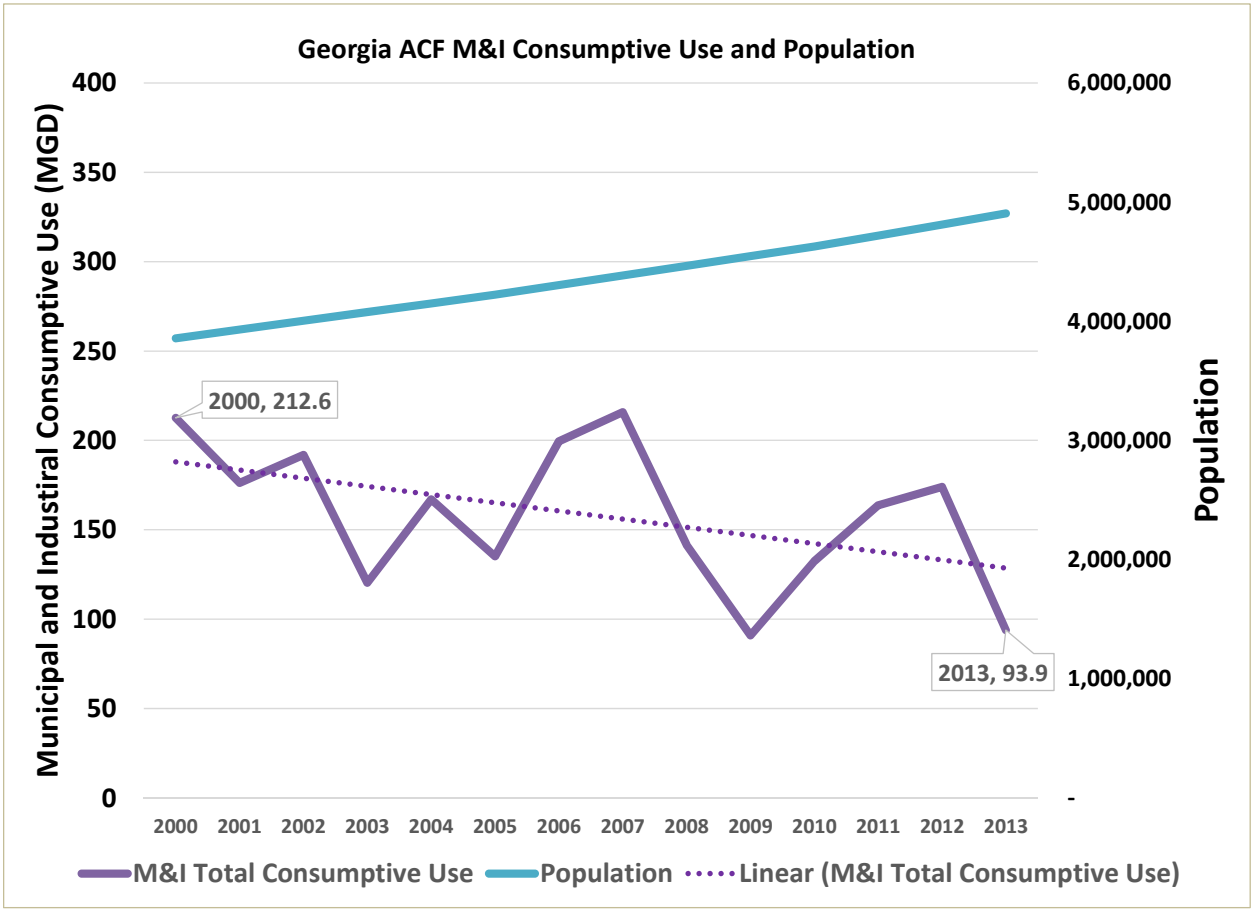
35. As Figure 4 shows, Georgia's M&I consumptive use in the ACF Basin has varied from year to year, as is typical in water systems, ranging from a high of about 215 mgd in 2007 down to less than 94 mgd in 2013. Municipal and industrial consumptive use in the Georgia ACF Basin was lower in 2013 than it was is 1994, and the overall trend in Georgia's municipal and industrial consumptive (reflected by a linear trend line) is slightly decreasing. This is a remarkable achievement given that ACF Georgia's population increased by 1.6 million users—or 48%—over the same period.

Figure 4. Georgia ACF Basin Total Annual M&I Withdrawals, Returns, and Consumptive Use



36. Moreover, this trend is even more pronounced during the period from 2000 to 2013, which includes the creation of the Metro Water District in 2001 and its development and implementation of water conservation and management plans in the metropolitan Atlanta area. As Figure 5 below shows, Georgia's municipal and industrial consumptive use in the ACF Basin declined from 212.6 mgd in 2000 down to 93.9 mgd in 2013. This represents a reduction of over 55% over the 14-year period, even as Georgia's population in the ACF Basin increased by approximately one million people.

Figure 5: Georgia ACF Basin Total M&I Consumptive Use vs. Population (2000-2013)



37. Despite this, Dr. Hornberger asserts that "municipal and industrial consumptive water use during the summer months of recent drought years has consistently been well over 600 cfs."[5] This provides an incomplete and incorrect picture, however. First, the values recited by Dr. Hornberger appear to include thermoelectric consumption, which, contrary to Dr. Hornberger's statement, is not considered "municipal and industrial" water use, as I explain above. Second, the values cited by Dr. Hornberger were taken from the year 2007, a drought that occurred nearly a decade ago and that predated—and thus does not reflect—the many water conservation and efficiency measures adopted by Georgia since that drought occurred. Indeed, the very same data compiled by Dr. Flewelling and cited by Dr. Hornberger make clear that monthly M&I

[5] Hornberger Testimony at p.40.

consumptive use during the 2011 drought, which is highlighted prominently in the testimony of Dr. Sunding, was more than 20% lower than the 2007 value Dr. Hornberger has chosen to report.

38. I have reviewed Florida's pre-trial brief, which claimed that municipal and industrial consumption levels were "369.5 million gallons per day (mgd) in 2011."[6] That is not accurate. Florida is confusing the total amount of water withdrawn with the amount of water that Georgia actually consumes, two critically different measures. In fact, Georgia's total municipal and industrial consumptive use in 2011 was less than 175 mgd, not 369.5 mgd as Florida claims. Moreover, in 2013, the last year for which we have data from the Consumptive Use Database, Georgia consumed only 93.9 mgd for municipal and industrial purposes.

39. In his written testimony, Dr. Sunding states that "consumption-related problems [in Georgia] have led to this case." I do not believe that statement is true, particularly when considering the M&I water use data. As shown above, total M&I consumptive use has declined steeply since 2000 and, as I discuss in greater detail below, M&I consumptive use represents only a very small fraction of the amount of water delivered to Florida.

40. I recognize that there are some groundwater uses in the ACF Basin that are not captured in the Georgia Consumptive Use Database, and thus are not reflected in the calculations of municipal and industrial water use above. For a number of reasons, however, these withdrawals do not materially alter my conclusions regarding municipal and industrial water use in Georgia. First, the overwhelming majority of M&I withdrawals in ACF Georgia are from surface water sources, which are included in the Consumptive Use Database and accounted for in the analysis above. For example, the metropolitan Atlanta area relies on surface water for 99% of its supply. Second, M&I withdrawals from groundwater likely have only a small effect on streamflows in the ACF Basin—on the order of 20 to 25 cfs. (Written Direct of Dr. Sorab Panday ¶¶ 72-81); Lawrence, S.J., Water Use in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010, and Water-Use Trends, 1985-2010. National Water Census Program. U.S. Geological Survey, 24 (2016). This is because not all groundwater withdrawals come from aquifers that are connected to surface water sources and, even those from connected sources do not have a 1-to-1 impact on surface water flows. (Written Direct of

[6] Florida Pretrial Brief at 17.

Dr. Sorab Panday ¶ 16). Finally, as noted above, my calculations and the Consumptive Use Database include conservative assumptions regarding returns to the ACF Basin. Thus, for all these reasons, consumptive use impacts from M&I groundwater withdrawals are small and would not change my analysis.

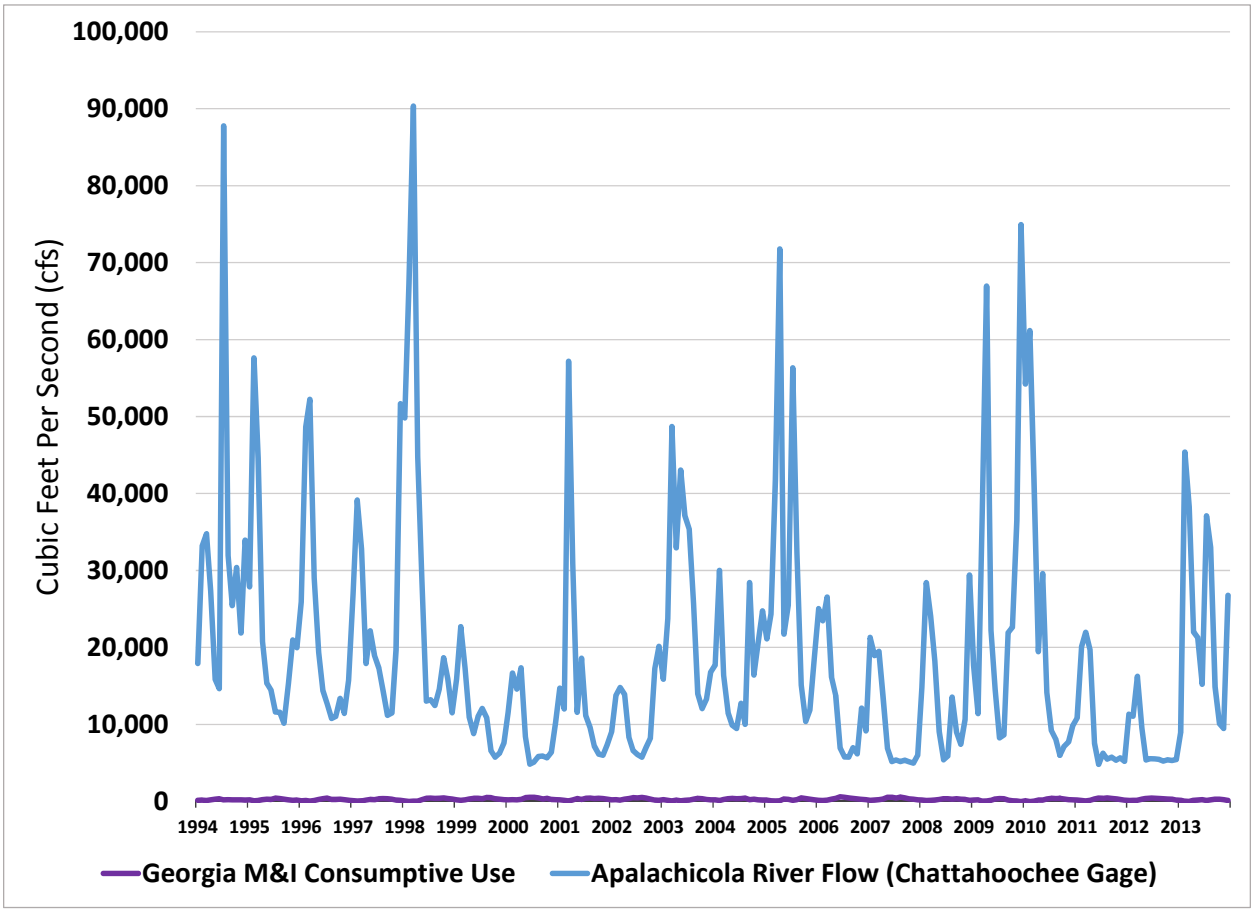
d) Lawrence, S.J., Water Use in the Apalachicola-Chattahoochee-Flint River Basin, Alabama, Florida, and Georgia, 2010, and Water-Use Trends, 1985-2010. National Water Census Program. U.S. Geological Survey (2016) is a research report published by the United States Geological Survey. Experts in my field regularly rely on such research publications, and I reviewed this work in preparing my expert opinions.

E. Despite the Enormous Benefits it Provides, Municipal and Industrial Consumptive Use Is Very Small Compared to the Amount of Water Florida Receives

41. As described above, municipal and industrial water use in Georgia provides significant benefits, supporting millions of people and economic output. Yet, when viewed in the context of the ACF Basin, municipal and industrial water consumption in Georgia constitutes only a tiny fraction of the water Florida receives.

42. Figure 6 below compares monthly municipal and industrial consumptive use (cfs) to the discharge of the Apalachicola River (cfs) as measured at the Chattahoochee Gage in Florida. As can be seen, municipal and industrial consumptive use in Georgia barely registers relative to the amount of water delivered to Florida, despite supporting millions of people and the overwhelming share of economic activity. Given this, it is difficult to understand how the measures Florida proposes to limit municipal and industrial consumptive use, discussed below, would have any material impact on the amount of water Florida receives or conditions downstream.

Figure 6. Georgia Municipal and Industrial Consumptive Use Compared to Apalachicola River Flow, 1994- 2013



F. Per Capita Water Use in Georgia Has Declined Substantially

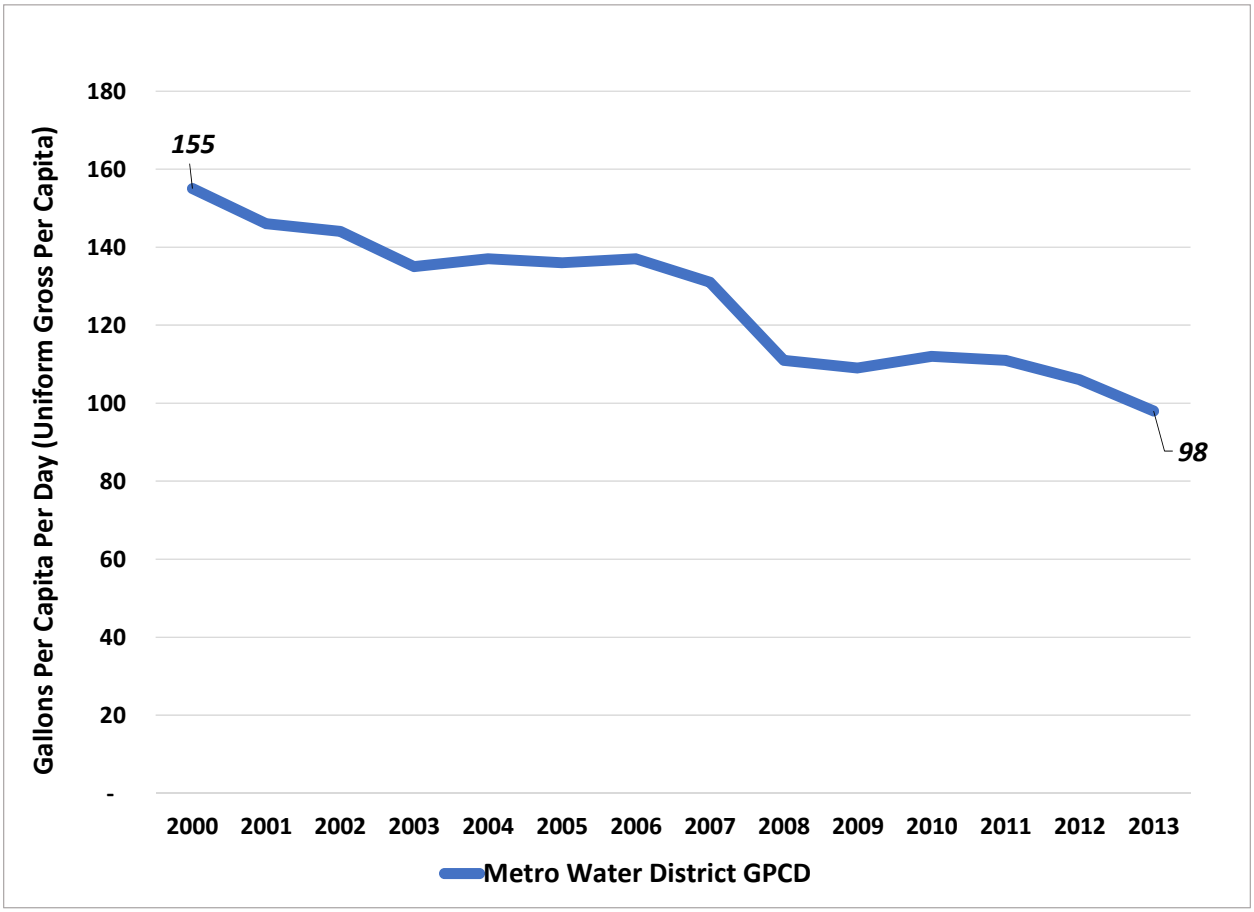
43. In addition to examining withdrawals, returns, and consumptive use in the ACF Basin, I also evaluated recent trends in the daily per capita water use in the Metro Water District, which includes the metropolitan Atlanta area. Water utilities and water planners use trends in per capita use to evaluate the overall effectiveness of water conservation and efficiency programs. In calculating per capita use, I applied the same method adopted by the State of Florida.[7]

44. As shown in Figure 7, per capita water use in the Metro Water District shows a sharp declining trend from 2000 – 2013, declining by 36.7% from 155 gpcd to 98 gpcd. In my

[7] The Florida Department of Environmental Protection and the Florida Water Management Districts use two standardized methods for calculating GPCD: Uniform Gross per Capita and Uniform Residential Per Capita. My analysis focused on the Uniform Gross Per Capita (UGPC) calculation due to the ease in comparing similar types of available data from both Georgia and Florida.

opinion, this reduction reflects the significant impact of water management, water conservation, and investments in water efficiency across the metro Atlanta region following the creation of the Metro Water District, which I discuss in greater detail below.

Figure 7. Metro Water District Per Capita Water Use, 2000 - 2013



G. Per Capita Water Use In Georgia Has Declined More Rapidly and Is Considerably Lower than in Northern Florida

45. The relative efficiency of Georgia's use is confirmed by comparisons to water management districts in Florida, which have higher per capita use than the Metro Water District and have not declined at the same rate as the Metro Water District.

46. Utilizing a standard method to calculate per capita use adopted by the State of Florida, I calculated and compared daily per capita water use in the Metro Water District to three water management districts in northern Florida:

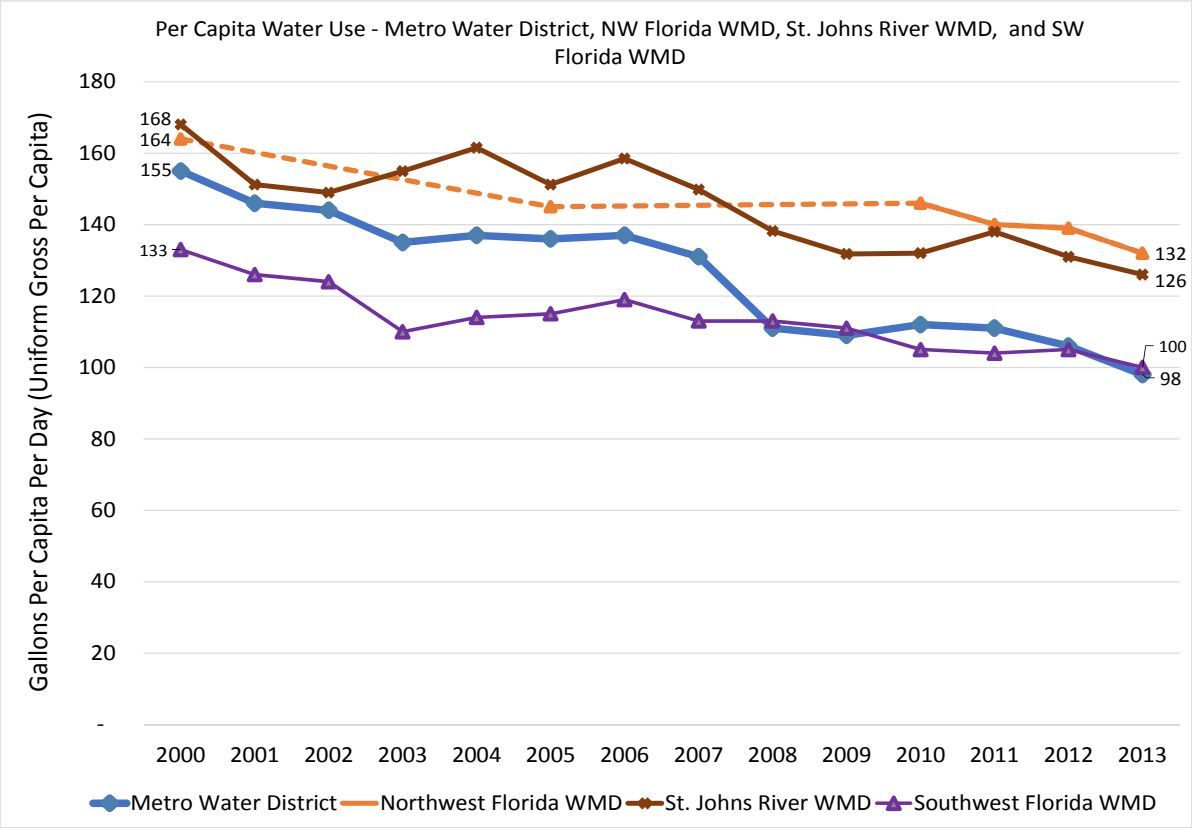
- the Northwest Florida Water Management District, which covers Tallahassee and includes Florida's portion of the ACF Basin;

- the St. Johns River Water Management District, which borders Georgia and includes the City of Jacksonville, Florida, the largest metropolitan area in North Florida; and

- the Southwest Florida Water Management District which includes the cities of Tampa and St. Petersburg, Florida.

47. As shown in Figure 8, Georgia's per capita use has been consistently lower than both of the two adjacent water management districts in Florida and dropped below the Southwest Florida Water Management District in 2013. Furthermore, Georgia's per capita use declined at a faster rate than in any of the three Florida water management districts over the most recent thirteen-year period.

Figure 8. Per Capita Water Use: Metro Water District (GA), and Northwest Florida, St. Johns River, and Southwest Florida Water Management Districts (FL)



48. In 2013, the difference between per capita water use in the Metro Water District and that of the St. Johns River Water Management District more than doubled from 13 gpcd to 28 gpcd. The disparity between the Metro Water District and the Northwest Florida Water Management District grew by an even greater amount from 9 gpcd to 34 gpcd; and in 2013 per capita use in the Metro Water District dropped below the Southwest Florida Water Management District.

49. Significantly, Figure 8 shows that gross per capita water use in the Metro Water District was only 98 gpcd in 2013, the final year of the analysis. Florida's own municipal and industrial water use expert, Dr. Dracup, acknowledged in his deposition that "something below a hundred gallons per capita per day" in Georgia would indicate that "water conservation measures are being appropriately implemented." (Dracup Dep. at 132:12-18.)

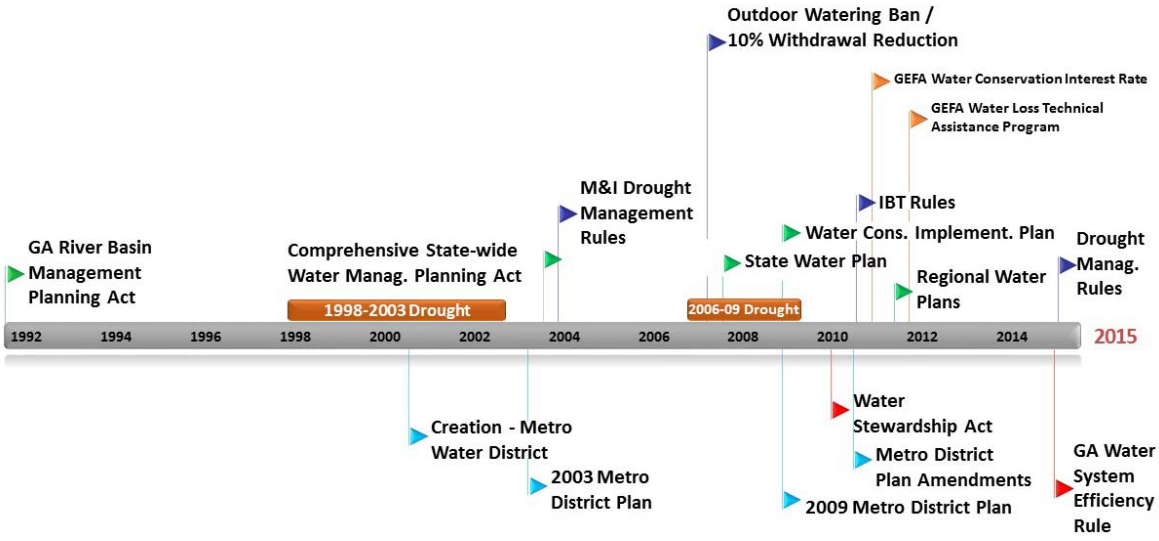
50. By comparison, per capita use the same year was 132 gpcd in the Northwest Florida Water Management District, 126 gpcd in the St. Johns River Water Management District, and 100 gpcd in the Southwest Florida Water Management District.

IV. Georgia Has Implemented Aggressive and Award-Winning Water Conservation And Efficiency Programs and Policies

51. As part of my analysis of municipal and industrial use in Georgia, I also examined Georgia's water conservation and efficiency efforts. As I describe below, Georgia has implemented far-reaching water conservation and water planning policies and programs that have limited municipal and industrial water supply demand in Georgia's portion of the ACF Basin. Further, the beneficial effects of these programs on municipal and industrial water demands will continue into the future. As a result of these efforts, the Metro Water District, the State of Georgia, and Georgia ACF water providers have repeatedly been recognized as a national leader in water stewardship and demand management.

52. Figure 9 below shows a timeline of significant municipal and industrial water management and policy measures adopted by Georgia between 1992 and 2015. The timeline shows that the pace of water management and policymaking has increased over time, particularly following the severe drought that struck Georgia and the ACF Bain from 2007 to 2009.

Figure 9: Georgia urban water management and drought timeline, 1992-2015



53. In the two sub-sections that follow, I explain in greater detail Georgia's significant water conservation and water planning actions to convey the scope and effectiveness of Georgia's efforts.

A. Metro Water District's Efficiency and Conservation Programs

54. In 2001, the Georgia General Assembly created the Metro Water District to serve as the water planning agency for the metropolitan Atlanta area. In this role, the Metro Water District was required to develop and maintain comprehensive long-term plans for water supply and water conservation, wastewater management, and watershed management for metropolitan Atlanta. These plans specifically include measures intended to reduce water demands and to increase water use efficiency.

55. Since its first water plans were developed in 2003, the Metro Water District has adopted a broad range of nineteen mandatory water conservation and efficiency measures that must be implemented by utilities within the District. Examples of these measures include, among others, (i) mandatory "conservation pricing" in which the cost of water increases with the amount each customer uses; (ii) water loss auditing and leak detection using the standardized, "best-in-class" American Water Works Association and International Water Association water audit approach; (iii) programs to replace inefficient plumbing fixtures with new, high-efficiency models; (iv) toilet rebate programs to encourage residents to replace old and inefficient toilets; (vi) requiring irrigation systems to utilize rain sensor shut-offs to reduce unnecessary irrigation;

(v) mandating that all new multifamily buildings install "sub-meters" for each individual unit, which encourage conservation by ensuring that residents pay the full cost of the water they use; and (vii) conducting education and public awareness programs to encourage water conservation and efficiency.

56. I am familiar with the types of measures that the Metro Water District has adopted, as I have recommended that other water utilities implement various combinations of similar measures. Measures such as the Metro Water District has required are highly effective at reducing water demand and increasing water efficiency, and they have undoubtedly produced results in the Metro Water District. For example, since 2008, more than 110,000 inefficient toilets have been replaced with higher efficiency models in the Metro Water District, resulting in a savings of almost 950 million gallons of water per year. GX-786 (2015 Metro Water District Activities & Progress Report at 5). They have repaired tens of thousands of leaks since 2009. And, today, 100% of users in the Metro Water District are subject to conservation pricing, an important conservation practice that is described further below.

e) GX-786 is a 2015 annual report of the Metro Water District describing conservation implementation progress on the part of water systems in the district. Experts in my field regularly rely on such government reports regarding water supply and conservation projects, and I considered it in forming my opinions in this case.

57. The policies and programs implemented by the State of Georgia, the Metro Water District, and local water providers in the ACF Basin from 2001 to 2013 have resulted in substantially lower per capita and total consumptive M&I water use. My conclusion is consistent with studies conducted by other M&I water experts, which have found that conservation measures adopted by the Metro Water District reduced water demands and per capita use by almost 20% independent of other factors that can affect water use, such as weather and economic activity. GX 785 at 4-1.

f) GX 785 is a 2015 Utility Climate Resiliency Study Report of the Metro Water District describing in part the impact of conservation measures on per capita use in the district. Experts in my field regularly rely on such reports regarding water conservation and per capita use.

B. Statewide Conservation & Planning Actions

58. In 2004, the Georgia legislature enacted the Comprehensive Statewide Water Management Planning Act, which mandated the development of a statewide water plan designed to protect public health and environmental quality and to meet future water needs while protecting aquifers and instream uses. (O.C.G.A. §§ 2-6-27, 12-5-520 to -525, 50-13-4 (amended).)

59. This Act required Georgia EPD to develop and submit to the legislature a comprehensive statewide water management plan that paved the way for a Water Conservation Implementation Plan, completed in March 2010. This plan provided explicit water conservation goals, benchmarks, best practices, and implementation actions designed to reduce water waste, water loss, and water use on a statewide basis across several major water use sectors, including (i) electric generation, (ii) industrial and commercial uses, (iii) domestic and non-industrial public uses, (iv) landscape irrigation, and (v) golf courses. JX-45 (2010 Georgia Water Conservation Implementation Plan at FL-ACF-02426558).

g) GX-64 is a true and accurate copy of the Georgia State Water Plan adopted in 2004. JX-45 is a true and correct copy of the Georgia Water Conservation Implementation Plan adopted in March 2010. Experts in my field regularly rely on such reports, and I reviewed them in preparing my expert opinions

1. The 2010 Water Stewardship Act and 2015 Efficiency Rules

60. In 2010, Georgia enacted the Water Stewardship Act, the stated purpose of which was "to create a culture of water conservation in the state of Georgia." JX-44 (S.B. 370, Georgia Water Stewardship Act). The Georgia Water Stewardship Act is perhaps the most comprehensive piece of state water conservation and management legislation enacted anywhere in the United States. After its passage, the Alliance for Water Efficiency immediately hailed the act as "landmark," noting that "only two other states, California and Texas, have adopted similar high efficiency plumbing standards" and pointing out that Georgia had become the first state

anywhere in the United States to require by state law the sub-metering of multi-unit residential, commercial and industrial buildings in addition to billing based on the actual water use.[8]

61. As part of the Water Stewardship Act, Georgia requires all public water systems serving more than 3,000 people to audit their water systems for water loss on an annual basis using the standardized methods and best practices developed by the American Water Works Association and International Water Association (AWWA/IWA); to validate the audit according to established procedures; and to submit the results of the completed validated audits to Georgia EPD within 60 days. Georgia is one of only five states or regulatory entities in the United States to require water loss audits in accordance with the AWWA/IWA water loss audit standards—and the only state to require that its water audits be validated by a third party. GX-792 (2015 Water Audits in the United States: A Review of Water Losses and Data Validity at 5). The Stewardship Act also requires by law that public water systems in Georgia develop and implement a water loss control program and show progress toward improving water supply efficiency over time.

h) GX-792 is a true and accurate copy of a publication from the Water Research Foundation and United States Environmental Protection Agency entitled *Water Audits in the United States: A Review of Water Losses and Data Validity*, (2015). Experts in my field regularly rely on such publications, and I reviewed this work in preparing my expert opinions.

62. In addition to requiring water systems across the State to conduct annual audits and develop a water loss control program, the Stewardship Act also imposed additional water conservation and efficiency requirements that include:

- Mandating that only high-efficiency plumbing fixtures can be sold in the State;
- Requiring local governments to adopt ordinances uniformly restricting outdoor landscape irrigation;
- Requiring local governments to adopt and enforce updated plumbing codes mandating (i) high-efficiency flow plumbing fixtures, including toilets, urinals and showerheads; (ii) the installation of sub-meters on all new multi-unit buildings,

[8] http://www.allianceforwaterefficiency.org/ga-legislation.aspx

including residential, commercial and light industrial facilities; and mandating the installation of high-efficiency cooling towers in all new construction;

- Mandating that state agencies (i) collaborate to enhance programs and incentives for water conservation; (ii) submit annual reports to the General Assembly summarizing programmatic changes implemented to encourage conservation and enhance water supplies; and (iii) review and revise state water-related policies, procedures, regulations and programs; and
- Establishing a "Joint Committee on Water Supply" to study and analyze the state's reservoir system and strategic needs for additional water supply.

63. Georgia has been lauded by the AWWA as a national leader in water loss. In its 2016 Water Audits and Loss Control Programs Manual, the water industry best practices manual for water loss control that water utilities are required to follow under the Stewardship Act, the AWWA specifically recognized "Georgia's Water Loss Control Program Successes," stating:

> The State of Georgia implemented a water loss control program that keys primarily on the collection and validation of utility water audit data. While requiring the use of the AWWA Water Audit Methodology, considerable resources are dedicated to the training and education of the water utilities in the data collection process. ...The State of Georgia has taken a very comprehensive approach in launching its water loss control program and benefits from its growing pool of well-validated data to more reliably identify the extent of losses in water utilities and the appropriate controls to cost effectively control these losses.[9]

64. Georgia's efforts to control water loss are particularly notable because they far outpace those of Florida, which does not employ uniform procedures for estimating non-revenue water and water loss. As Dr. James P. Heaney, Professor and Chair of the Department of Environmental Engineering Sciences at the University of Florida, explained: "Current

[9] 2016 Manual of Water Supply Practices–M36 Water Audits and Loss Control Programs, GX-847 at 22 (emphasis added).

procedures for estimating water losses in Florida are not uniform and the accuracy of the reported estimates of water loss is questionable."[10] Further, Dr. Heaney and co-author Kenneth Friedman recommend that Florida adopt the very same approach to water loss control and reporting that was adopted by Georgia under the 2010 Water Stewardship Act—namely, "Florida water utilities should adopt the water audit and loss control procedures that are described in the manual of water supply practices titled M36 Water Audits and Loss Control Programs (AWWA 2009)." I agree with these assessments. However, to my knowledge Florida has not taken action to implement these recommendations.

65. Water systems in Georgia have devoted significant resources to addressing water loss. For instance, the City of Atlanta, which Dr. Sunding criticizes for its "old pipelines," repaired more than 10,000 leaks from 2012 to 2015, while allocating more than $55 million for distribution system rehabilitation and repair projects that will improve system reliability and decrease water loss. In the broader Metro Water District, between 2009 and 2014, water systems identified and repaired more than 42,000 leaks. GX-350 at GA00566279 (2010 Activities & Progress Report); GX-697 at GA00566167 (2014 Activities & Progress Report). Likewise, the Clayton County Water Authority implemented a very early leak detection program, which has allowed the authority to save 6.5 billion gallons of treated potable water since the program commenced. GX-1103 (Did You Know? - Metropolitan North Georgia Water Planning District).

i) GX-350 and GX-697 are annual reports of the Metro Water District describing conservation implementation progress on the part of water systems in the district. Experts in my field regularly rely on such government reports regarding water supply and conservation projects, and I considered them in forming my opinions in this case.

66. Under the Stewardship Act, Georgia EPD was also required to adopt rules related to utility water loss control. In 2015, Georgia EPD adopted the water use and efficiency rules required by the Water Stewardship Act. Through the 2015 Water Efficiency Rules, water systems statewide are required to demonstrate progress in water loss control based on the annual

[10] August 2009 Friedman, K.R. and J.P. Heaney. Water Loss Management: Conservation Option in Florida's Urban Water Systems at pp. 24-32, Florida Water Resources Journal, *available at*: https://www.fwrj.com/techarticles/0809%20FWRJ%20tech1.pdf.

water audit results. Linking progress on water loss control with implementation funding, as Georgia has done, is a significant measure that a few other states, like California, have since emulated in their own recent water loss control legislation. In addition, if Georgia water systems fail to demonstrate progress in fixing leaks, those systems may be stopped from adding new service connections and their application to renew or modify an existing withdrawal permit may be denied. GX-1091 (2015 Georgia Water Efficiency Rules at 391-3-33-.05(3)(b)).

67. Together, the Stewardship Act and 2015 Efficiency Rules imposed a broad range of new water conservation and efficiency requirements on state agencies and local governments, residents, and businesses across Georgia. In my experience, the Stewardship Act and its implementing rules are some of the most significant and comprehensive water efficiency and conservation requirements in the United States.

2. Georgia's Regulation of M&I Water Use in Drought

68. Georgia has also implemented drought management rules designed to reduce outdoor water use in the M&I sector during periods of severe drought. Those rules, adopted in 2004, established pre-drought mitigation strategies for M&I water use intended to minimize the potential effect of drought and provided for graduated increases in restrictions based upon the level of severity of a drought. GX-1037 (May 26, 2004 Drought Management Rules at GA00081536).

69. Georgia applied these measures during the drought that struck the ACF Basin from 2007 to 2009, banning virtually all outdoor water use in 61 counties and, by mandate, requiring water suppliers in metropolitan Atlanta to reduce water withdrawals by 10%. JX-25 (Oct. 23, 2007 Georgia DNR Press Release at GA01210159).

70. Georgia strengthened these rules in 2015, adopting more stringent drought management rules and policies. GX-935 (2015 Drought Management Rules). The 2015 Drought Management Rules further improve Georgia's ability to respond to drought conditions. In fact, Georgia has already utilized the new 2015 rules in Georgia EPD's recent declaration of a Level 1 Drought Response, which requires public water systems in 53 counties to initiate a public information campaign to help citizens better understand drought, its impact on water supplies, and the need for water conservation. FX-765 (Sept. 9, 2016 EPD Press Release).

C. Other Significant Measures to Limit Consumptive Use, Increase Return Flows, and Extend Supply in the ACF Basin

1. Conservation Pricing

71. One way to limit municipal and industrial water use is through the use of increasing block rate "conservation pricing." Historically in the United States, water providers used either uniform rates, which remained stable regardless of the amount of water used, or "decreasing" rate structures that reduced the cost of water as customers increased their use. Water providers in Georgia have reversed this practice and adopted "conservation pricing" structures that increase the cost per unit of water with the volume of water consumed. This creates economic incentives for residents and customers to use less water.

72. Today, 100% of customers within the Metro Water District and over 90% of customers in the entire ACF Basin are served by utilities with increasing block rate conservation pricing, as can be seen in Table 2 below.

Table 2. Prevalence of conservation pricing in 2013 among water providers in the ACF Basin in Georgia, proportion of population by rate structure

Rate Structure	Metro District in ACF	ACF
Increasing Block	100%	90.5%
Uniform Rate	0%	5.0%
Decreasing Block	0%	4.4%
Increasing/Decreasing Block	0%	0%
Non-Volumetric Flat Charge	0%	0.1%

73. Further, under the 2015 Drought Management Rules I discussed earlier, those public water systems in Georgia with retail customers that do not already impose conservation pricing had to develop a drought surcharge program by August 4, 2016 as a temporary price incentive for customers to reduce water demand during a declared drought. Thus, nearly all of Georgia's population that relies upon the ACF Basin for water are already served by a system that uses conservation pricing, and those limited few that are not are covered during drought periods with the full implementation of the 2015 Drought Management Rule.

2. Indirect Potable Reuse

74. Indirect potable reuse is a technique whereby highly treated wastewater is used to replenish a water supply source, like a river, lake or aquifer, so that it can be withdrawn and used again in the future. In Georgia, indirect potable reuse helps to extend existing water supplies and maximize the benefits provided by existing water supply reservoirs and other infrastructure. It also reduces potential drought impacts by providing a dependable amount of water for use during dry periods. For these reasons, Georgia's use of indirect potable reuse as a water supply strategy creates strong incentives to return water to the ACF Basin.

75. Indirect potable reuse has been an important aspect of the Metro Water District's water supply and water conservation planning since the first plan was issued in 2003, and Georgia water supply providers have invested heavily in this water supply strategy. For example, Gwinnett County has spent more than $1 billion to construct and operate the F. Wayne Hill Water Resources Center, which is a state-of-the-art water reclamation facility that returns highly treated wastewater to Lake Lanier for indirect potable reuse. GX-286 (Nov. 12, 2009 Summary of Water Conservation, Mgmt., and Efficiency Projects at GWNT-DWR0012558). Gwinnett County also incurs substantial additional costs to operate this facility to pump treated wastewater uphill so that it can be treated and discharged to Lake Lanier for reuse. The facility is currently permitted by the State of Georgia to return 40 mgd to Lake Lanier, and this amount is projected to increase to 60 mgd by 2050.[11]

j) GX-286 is a true and accurate copy of a report entitled November 2009 Summary of Water Conservation, Management, and Efficiency Projects With a Special Focus on The Lake Lanier/Chattahoochee River Users. Experts in my field regularly rely on such documents, and I reviewed it in preparing my expert opinions.

76. There are several other indirect potable reuse examples across the Metro Water District. The City of Gainesville returns treated wastewater to Lake Lanier, which is the primary

[11] Jan. 30, 2016 Atlanta Regional Commission Comments on Draft Environmental Impact Statement: Update of the Water Control Manual for the Apalachicola-Chattahoochee-Flint River Basin in Alabama, Florida, and Georgia and a Water Supply Storage Assessment, *available at*: www.atlantaregional.com/File%20Library/Environment/Tri-State%20Water%20Wars/Water-Supply-Providers-Comments---Final.pdf

water supply source for the City and Hall County, Georgia. JX-37 (May 2009 Water Supply and Water Conservation Mgmt. Plan at p. 7-6); GX-829 (Jan. 29, 2016 Comments of the State of Georgia: ACF Water Control Manual and Draft EIS with Exhibits A-K at GA02451870). Likewise, Clayton County has developed an indirect potable reuse project that uses constructed wetlands to treat water before it is discharged above its water supply intake. GX-1007 (Clayton County Water Authority, Water Reuse Webpage).

k) JX-37 is a true and accurate copy of the Metro Water District's May 2009 Water Supply and Water Conservation Management Plan. Experts in my field regularly rely on such documents, and I reviewed it in preparing my expert opinions.

77. Large volumes of water are also returned to the Chattahoochee River within the Metro Water District, further enhancing the region's water supplies. Thus, returns to the Chattahoochee River below Buford dam and upstream of Atlanta are reused by water providers like the City of Atlanta and the Cobb County-Marietta Water Authority. These entities, in turn, return highly treated wastewater that is then withdrawn and reused by other water providers within the ACF Basin.

78. Indirect potable reuse is not only a vital water supply strategy today, but additional indirect potable reuse is projected to occur in the future. In fact, the most recent assessment by the Metro Water District projects that returns to Lake Lanier will grow to at least 99 mgd by 2050, with additional increases possible depending upon policies adopted by the Corps. GX-829 (Jan. 29, 2016 Comments of the State of Georgia: ACF Water Control Manual and Draft EIS with Exhibits A-K at GA02451870).

D. Funding for Water Conservation and Reuse Projects

79. In addition to the legislation I discussed earlier, the State of Georgia has also devoted significant financial resources to water supply, water efficiency, and water conservation programs. For example:

- Over the period from 2007 to 2013, the Georgia Environmental Finance Authority (GEFA) invested nearly $80 million in water conservation measures.[12] In March 2009 and April 2010, GEFA announced a total of $38.2 million of funding for green projects, including water conservation and leak abatement. Up to 60% of this funding was grant (or "principal forgiveness") funding.

- In May 2011, the GEFA Board of Directors approved a permanent 1% interest rate reduction for all eligible water conservation projects.

- In 2012, GEFA launched the Water Loss Technical Assistance Program which provided free water loss audit training to small water utilities across the state and subsequent funding for high-value water loss abatement activities identified in audits, including finished water meter flow verification, customer meter testing, and leak detection. In 2014, the American Council of Engineering Companies awarded GEFA a National Recognition Award for this program.

80. In addition to these select examples of how Georgia has devoted financial resources to reducing municipal and industrial consumption, GX-286 summarizes some of the additional substantial investments in the hundreds of millions of dollars that have been made at the utility and water district level over the past 15 years to fund water conservation and water reuse efforts across the Metro Water District.

81. In my opinion, Georgia has made real, substantive, and demonstrable investments in water conservation and reuse measures designed to return substantial additional quantities of water to the ACF Basin.

E. Awards in Water Conservation & Efficiency

82. As a result of Georgia's extensive efforts and investments to conserve water and improve efficiency in the M&I sectors, Georgia has emerged as a national leader in public water supply management.

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[12] GEFA 2013 Annual Report, *available at*: https://gefa.georgia.gov/sites/gefa.georgia.gov/files/related_files/document/GEFA-AR-2013.pdf

83. In a 2012 study, the Alliance for Water Efficiency and the Environmental Law Institute ranked Georgia among the very best states in the nation for water conservation and efficiency, tying for 4th nationally and receiving the highest score awarded to any state east of the Mississippi. Florida, on the other hand, tied for 20th in the nation and earned a grade of "C." GX-792. Georgia also leads the nation in progress on auditing of public water systems, GX-792, and has been recognized as a leader for its water conservation, education, and customer outreach programs.

l) GX-792 is a true and accurate copy of a publication from the Alliance for Water Efficiency and the Environmental Law Institute entitled *Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies*, (September 2012). Experts in my field regularly rely on such publications, and I reviewed this work in preparing my expert opinions.

84. In 2015, the Metro District was awarded the prestigious 2015 EPA WaterSense Excellence in Education and Outreach award, and the Cobb County Water System was awarded the 2015 WaterSense Promotional Partner of the Year award. GX-793 (2015 EPA WaterSense Awards).

85. On October 6, 2016, the EPA awarded two of only five 2016 WaterSense Promotional Partner of the Year awards to each of the Metro Water District and the Cobb County Water System. With the 2016 award, Cobb County Water System became a *five-time* Partner of the Year Award winner. That is a record of sustained excellence. In recognizing the Metro Water District for the *second year in a row*, the EPA specifically cited the District's "WaterSense at Work" best management practices to target the highest commercial water users in the area with water audits and the fact that the District had replaced more than 100,000 toilets in its region with more efficient models. The EPA also recognized the District's "Great Plumbing Fixture Giveaway" and annual "Water Drop Dash 5k and Water Festival for Fix a Leak Week" programs. GX-900 (2016 EPA Award Winners Save Water for Future Generations).

m) GX-793 and GX-900 are true and accurate copies of EPA press releases reporting its 2015 and 2016 WaterSense Awards. Experts in my field regularly rely on such

government published information, and I reviewed these reports in preparing my expert opinions.

86. Water systems, as well as cities and counties within the Metro District, have received dozens of other water conservation and efficiency awards in recent years. GX-286.

V. FLORIDA MISUNDERSTANDS AND MISSTATES GEORGIA'S CURRENT AND FUTURE MUNICIPAL AND INDUSTRIAL USE

87. Against Georgia's many water conservation successes, Dr. Sunding offers an extremely limited critique of Georgia's municipal and industrial water use—identifying just three measures to reduce municipal and industrial water use in Georgia: (1) "eliminate" interbasin transfers; (2) implement a "leak abatement" program; and (3) impose a mandatory 50% reduction in outdoor water use during times of drought. According to Dr. Sunding, two of these measures—eliminating interbasin transfers and leak abatement—would be deployed each and every year, and result in a savings of 66 cfs and 42 cfs, respectively. The third measure identified by Dr. Sunding—a 50% cut in outdoor water use—would be implemented only during drought years, which Dr. Sunding claims would result in an additional reduction in water use of about 207 cfs.

88. Dr. Sunding's analysis and his conclusions have numerous flaws. As I explain below, Dr. Sunding has again made errors in his analysis (as he did in his expert reports) that have caused him to overstate significantly the amount of water that could be saved through the measures he has identified. Furthermore, Dr. Sunding has either substantially understated, or failed to consider entirely, the costs that would result from his proposals.

A. Any Increase in Georgia's Future M&I Water Consumption Will Be Small

89. Before turning to the specific errors in Dr. Sunding's and Dr. Hornberger's analyses, it is important to clarify several points regarding Georgia's municipal and industrial water use. First, Dr. Sunding states that, unless new limits are imposed by the Court, Georgia's municipal and industrial water use will "grow dramatically" over the coming decades.[13] Dr. Sunding bases this opinion on outdated information, however, which fails to account for

[13] Sunding Testimony at p.19.

reductions in water demands that have resulted from the conservation and efficiency programs described above. For example, Georgia's projected water supply needs for municipal and industrial use from Lake Lanier and the Chattahoochee River for metro Atlanta in 2050 represent just a 47 mgd (73 cfs) increase in consumptive use from 2011 levels. GX-829 (Jan. 29, 2016 Comments of the State of Georgia at GA02451996 - GA02451999). This is a small growth in water demands that will be used to supply millions of additional people in the ACF Basin over the next three decades.

90. Second, Dr. Sunding incorrectly states that municipal withdrawals "reached their peak" in the summer of 2011 because Georgia did not declare a drought emergency and impose mandatory water use restrictions.[14] But in fact, summer time consumptive use in 2011 was substantially lower than it had been in previous years, reflecting various conservation and efficiency savings and other downward pressure on water use. Indeed, the data show that total municipal and industrial consumptive use in 2011 was lower than in five of the proceeding 10 years, including during prior droughts (e.g., 2006-2007) when outdoor water use was virtually banned in Georgia.

91. Third, Dr. Sunding appears to suggest that Georgia failed to implement recommendations from the Governor's 2009 Water Task Contingency Force (Task Force), an emergency task force established by former Governor Perdue in response to a water supply crisis that emerged in 2009 and threatened metro Atlanta's access to its public water supply from Lake Lanier. This critique is odd because the measures Dr. Sunding identified focused on building new reservoirs in the ACF Basin or expanding existing ones, and Florida has asserted that it has been injured by evaporation from the impoundments in the State of Georgia that exist today. It is difficult to understand, therefore, why Dr. Sunding would criticize Georgia for failing to construct additional reservoirs in the ACF Basin that would do nothing to reduce consumptive use.

92. Fourth, Dr. Sunding claims that his analysis shows "that Georgia can comply with the consumption caps in a way that minimizes their impact on Metro Atlanta so that the

[14] Sunding Testimony at p.6.

economic growth of that area is not restrained."[15] Remarkably, however, Dr. Sunding, a trained economist, provides no analysis of the long-term economic consequences of a permanent cap on water consumption in metropolitan Atlanta. Instead, Dr. Sunding's testimony regarding M&I water use focuses exclusively on measures that he claims—incorrectly—could reduce water use by 69 cfs in normal years and by an additional amount during drought years. This is very different from the perpetual restriction on water consumption that Dr. Sunding has advocated, and yet declined to evaluate from an economic perspective.

B. Dr. Hornberger Relies Upon Error-Prone Analysis

93. In his direct testimony, Dr. Hornberger, testified that he "relied upon the research and analysis performed by Dr. Flewelling" concerning future water use in Georgia, and that he agrees with Dr. Flewelling's estimates of Georgia's consumptive use "based on [his] own independent evaluation of [Dr. Flewelling's] methods, analysis, and conclusions." Drawing solely from Dr. Flewelling's conclusions, Dr. Hornberger testified in his direct that Georgia's consumptive use will increase "dramatically." However, Dr. Hornberger previously testified at his deposition that he had not independently re-calculated Dr. Flewelling's consumptive use estimates or his demand forecasts. (Hornberger Dep. Tr. 219:17-21.) Had he done so, Dr. Hornberger might have realized that Dr. Flewelling's estimates were methodologically flawed.

94. Dr. Flewelling's (and now Dr. Hornberger's) calculations assume that future consumptive use will increase by 57%. But this is based on changes in projected future *withdrawals* in Georgia's 2015 Modified Water Supply Request to the Corps, not the forecasted future *consumptive use*, which is projected to be lower than the values reported by Dr. Flewelling and Dr. Hornberger.

95. Furthermore, Dr. Flewelling's projections include two distinct errors related to interbasin transfers. First, Dr. Flewelling improperly double-counted interbasin transfers throughout his analysis, effectively doubling the volume of water projected to be removed from the ACF Basin. As Dr. Wei Zeng, the chief of Georgia EPD's Hydrology Unit, testified, the Georgia Consumptive Use Database already accounts for interbasin transfers. (Written Direct Testimony of Dr. Wei Zeng at 8.) I have independently confirmed and agree with Dr. Zeng's

[15] Sunding Testimony at p.3.

conclusion. Because the Georgia Consumptive Use Database includes records of both the water supply withdrawals and discharges from wastewater treatment plants in the ACF Basin, water discharged into another basin necessarily reduces the volume of water returned to the ACF Basin and thus appears as consumptive use in the Georgia Consumptive Use Database. Second, Dr. Flewelling compounded this mistake by incorrectly assuming that interbasin transfers would increase by 57% in the future. As I discuss below, interbasin transfers are not forecast to increase and have in fact been declining. Both of these errors in Dr. Flewelling's estimates cause Dr. Hornberger's estimates to be inflated as well.

96. Dr. Hornberger's decision to rely on the error-prone analysis prepared by Dr. Flewelling caused him to reach the erroneous conclusion that future municipal and industrial consumptive use in the ACF will "dramatically" increase. Municipal and industrial consumptive use in Georgia has actually declined over the past 20 years, as can be seen in Figure 4 above. And, as I previously noted, future municipal and industrial consumptive use is projected to increase by only a limited amount. This is inconsistent with the "dramatic" increase that Dr. Hornberger has suggested will occur.

C. Dr. Sunding Overstates the Impact of Leak Abatement Programs, Understates Their Costs, and Ignores the Fact that Georgia Already Implements "Leak Abatement" and is a National Leader on Water Loss Control.

97. Relying on the 2009 Task Force Report,[16] Dr. Sunding states that Georgia could, and should reduce "streamflow depletions" by 42 cfs (27 mgd) in the ACF Basin through "municipal leak abatement." Additionally, citing a projected cost of $17 million from the Task Force Report, Dr. Sunding suggests that this level of investment will be sufficient to achieve the savings proposed and consequently does not assign any incremental fiscal cost to his proposals for municipal leak abatement.[17] There are several problems with Dr. Sunding's analysis and conclusions.

98. As an initial matter, Dr. Sunding makes no effort in his testimony to independently calculate water loss in Georgia or to estimate the amount of water that might be

[16] Sunding Testimony, Table 4 and Table 5, p. 44 and Table 6, p. 45.

[17] Sunding Testimony at p.21.

saved. Although Dr. Sunding attempted to do so in his expert reports, his calculations of water loss were deeply flawed and they are not included in his testimony in this case. Instead, Dr. Sunding now relies exclusively on estimates of potential water savings included in the 2009 Task Force Report, but that report is out of date. Since that report was issued, Georgia enacted the 2010 Water Stewardship Act and the associated 2015 Water Efficiency Rules, which imposed new and more extensive requirements related to municipal and industrial leak abatement and water loss control in Georgia. Dr. Sunding's proposal for leak abatement does not take account of these new requirements, and does not represent any significant "new" water savings that Georgia is capable of achieving, because Georgia is already implementing best-practices to reduce real losses.

99. Moreover, Dr. Sunding misunderstands and misapplies the conclusions in the Task Force Report. As a result, Dr. Sunding has overstated the savings the Task Force projected and understated the costs of the measures identified. For instance, Dr. Sunding simply recites the Task Force Report for the conclusion that leak abatement would yield 27 mgd, or 42 cfs.[18] But this is incorrect for several reasons. First, the projected 27 mgd savings were not based on *current* levels of water use as Dr. Sunding suggests, but rather represented possible savings based on the Metro Water District's then-existing *projected future* water supply demands, which have now been superseded and far exceed existing use. JX-040 (Appendix III to Water Contingency Planning Task Force Report at 61-62); JX-126 (Dec. 4, 2015 Georgia Updated Water Supply Request at GA02337393). In fact, the Task Force Report specifically states that only 8 to 10 mgd of the projected 27 mgd in future savings would be available by 2012, three years after the report was issued. JX-040 at 61. Second, the Metro Water District's projected future demands have been reduced dramatically due to the water conservation and efficiency measures discussed above. Thus, there is nothing to suggest that these same savings would be available in the future under the Metro Water District's current water demand projections. Third, the 27 mgd savings projected by the Task Force were not confined to the ACF Basin; rather, this reflected the total water savings projected to occur across the entire Metro Water District,

[18] Sunding Testimony at pp. 44 – 45.

spanning six different river basins. JX-040 at 61-62. As such, it is not correct to assume, as Dr. Sunding does, that the entire reduction would occur in the ACF Basin.

n) JX-040 is true and accurate copy of Appendix III to the December 2009 Water Contingency Planning Task Force Report. Experts in my field regularly rely on such research publications, and I reviewed this work in preparing my expert opinions.

o) JX-126 is a true and accurate copy of the December 2015 State of Georgia's Water Supply Request. The request attaches a December 2, 2015 Metro Water District Memorandum regarding Projected Future Water Supply Demands for the Chattahoochee River and Lake Lanier System. Experts in my field regularly rely on such official government documents, and I reviewed this work in preparing my expert opinions.

100. Dr. Sunding also misunderstands, and thus greatly understates, the estimated costs of the Task Force's leak abatement program. The $17 million estimate he cites from the Task Force Report reflected only the capital costs associated with pressure management, which was itself just one piece of a much larger leak abatement program. The projected total cost of the full leak abatement program, which also included costs for leak detection, valve exercising and additional costs for pressure management, was ***$262 million***, or more than 15 times greater than the cost assumed by Dr. Sunding. JX-040 at 61, 65. Finally, while the projected water savings in the Task Force Report were expected to result from the leak abatement measures projected to cost $262 million, it is notable that this cost does not include the most expensive aspect of a comprehensive leak abatement program—the costs of line replacement—which the task force estimated would cost an additional ***$1.2 billion to $2.4 billion dollars***. JX-040 at 61. Dr. Sunding's assertion that 42 cfs could be saved today in the ACF Basin by implementing the Task Force leak abatement program is incorrect and he has minimized the significant costs of the program from the Task Force Report.

D. Dr. Sunding Ignores the Enormous Cost of Eliminating Interbasin Transfers

101. In his testimony, Dr. Sunding states that Georgia should eliminate existing interbasin transfers from the ACF Basin. Dr. Sunding states that "net transfers out of the ACF

Basin have exceeded 120 cfs,"[19] while Dr. Hornberger states that "inter-basin transfers show annual net exports approaching 100 cfs in recent years."[20] Based on this, Dr. Sunding asserts that elimination of existing interbasin transfers would reduce streamflow depletions by an additional 66 cfs, while assuming that there would be zero cost to do so. None of these conclusions are accurate.

102. Many communities across the United States rely on interbasin transfers of raw water to meet their water supply needs. Denver, Colorado, for example, depends on tunnels under the Rocky Mountains to move water from the wetter Colorado River Basin, west of the Continental Divide where snow accumulates, to the more arid eastern plains where the Denver metropolitan area is located. Similarly, Los Angeles and Southern California depend on massive raw-water interbasin transfers—on the scale of thousands of cfs—from northern California and from the Colorado River to provide water for millions of people and agriculture.

103. The interbasin transfers in the ACF Basin are very different. Unlike in California and Colorado, interbasin transfers in the Metro Water District are very small and do not come from tunnels or canals, but instead come from the normal operation of water and wastewater systems and the urban growth patterns of the area. Metro Atlanta sits atop a ridgeline and includes the headwaters of six different river basins. The ridgelines that separate these basins, which are not always steep or distinct, bisect individual counties and water service areas. Thus, in the Metro Water District, water is sometimes withdrawn from the ACF Basin but used by residents who happen to reside in another river basin. When this occurs, that water is returned to the wastewater system is conveyed by gravity to a water reclamation plant located outside the ACF Basin, where it is then discharged.

104. Eliminating these interbasin transfers, which are an inherent part of water and wastewater systems across the Metro Water District, would be a significant and incredibly expensive undertaking. This effort could require either (1) entirely reconstructing wastewater conveyance and treatment systems; or (2) constructing multiple pipelines to transport water back to its basin of origin after treatment. While I have not attempted to project the costs that would

[19] Sunding Testimony at pp. 21-22.

[20] Hornberger Testimony at p.40.

be associated with such a massive undertaking, they would certainly be substantial—in the hundreds of millions and more likely billions of dollars for the infrastructure alone. Further, eliminating interbasin transfers would require wastewater (or treated wastewater) to be pumped uphill and back over the ridgeline to the basin of origin, significantly increasing operations and energy costs. Yet, remarkably, Dr. Sunding assigns *zero* cost to his proposal to eliminate interbasin transfers from the ACF Basin. This is neither realistic nor reasonable, especially given that this entire investment would yield, by Dr. Sunding's own calculation, just 66 cfs.

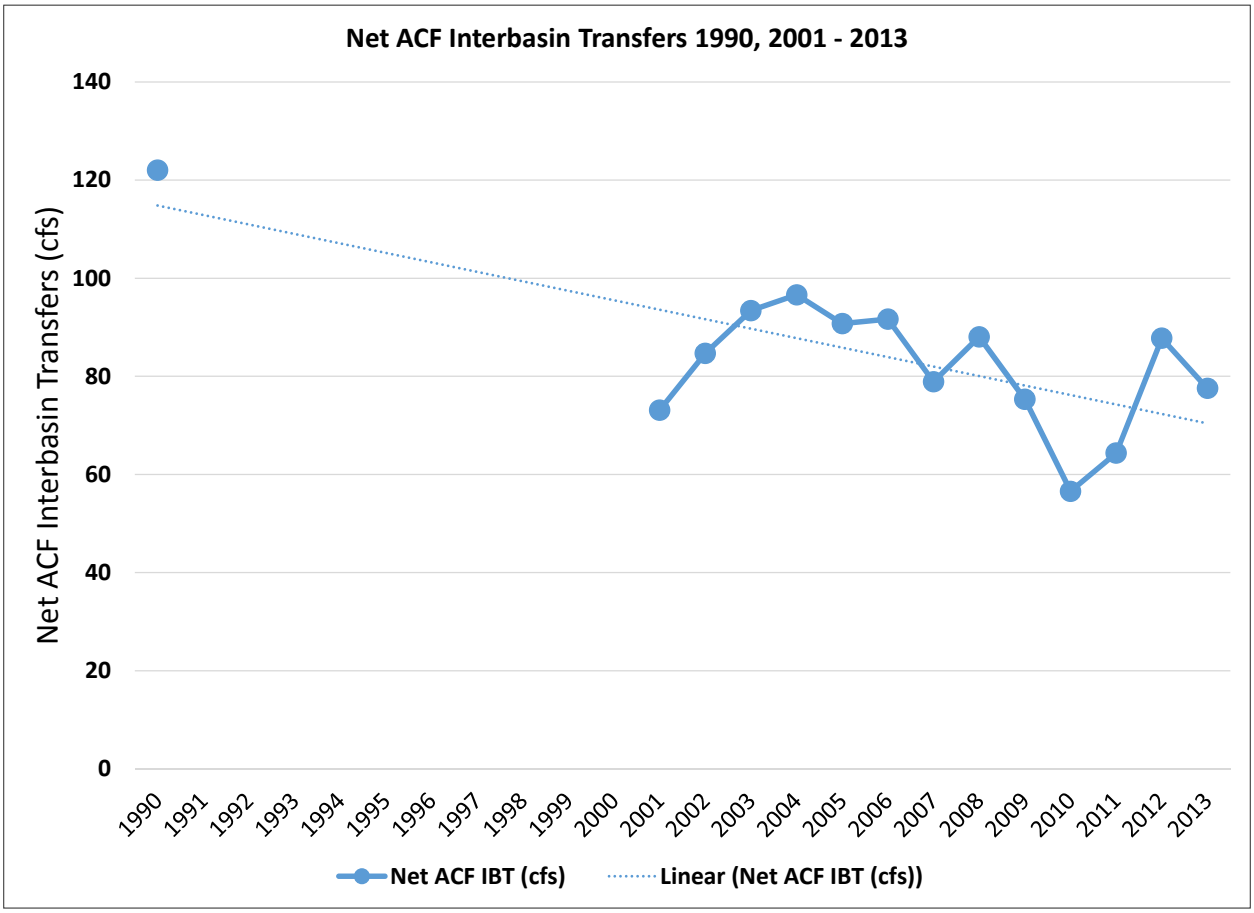
105. Contrary to Dr. Sunding's suggestion to eliminate all interbasin transfers regardless of cost, Georgia has taken a much more reasonable and pragmatic approach that closely scrutinizes new interbasin transfers and that minimizes interbasin transfers, to the extent practicable. For example, Georgia EPD rules identify a host of factors that must be considered before any new interbasin transfer can be approved and permitted, including quantity of the proposed interbasin transfer; the water needs of the donor basin; the reasonableness of the proposed water use; and the impact on interstate waters, to name a few. GX-1232 (2011 Interbasin Transfer Rules, at Rule 391-3-6-.07(14)(a)).

106. Further, Georgia EPD has issued guidance to the Metro Water District directing it to minimize interbasin transfers, to the extent practicable. For example, with respect to the District's 2009 plan, Georgia EPD directed the Metro Water District to "develop and analyze options to minimize future interbasin transfers." GX-18 (2001 EPD Water Planning Standards, at 4.) Likewise, on March 18, 2015, EPD also issued new guidance governing the Metro Water District's 2017 plan update that reiterates and strengthens that directive, stating that "[r]eturning highly treated wastewater to ... Lake Lanier and its watershed, and the upper Flint basin shall be encouraged, where feasible, to support the long-term sustainability of water use from these basins." GX-1089 (Mar. 18, 2015 EPD Guidance, at 2). More importantly, the guidance also mandates that the Metro Water District's 2017 "integrated plan ***shall*** include measures to minimize, where feasible, net losses from interbasin transfers from each of the six river basins that lie within the District area," including the Chattahoochee and Flint Basins. GX-1089 at 2.

107. Georgia's systematic approach has reduced interbasin transfers from the ACF Basin. I conducted an analysis of Georgia's net interbasin transfers from the ACF Basin using the Georgia Consumptive Use Database and Georgia EPD annual interbasin transfer reports. As

shown in Figure 10 below, the 120 cfs value recited by Dr. Sunding is an obvious outlier from more than 25 years ago. In the recent period since 2007, interbasin transfers never exceeded 89 cfs and have fallen as low as 58.3 cfs. Moreover, since 1990, these transfers have an obvious declining trend, an indication that Georgia's efforts to reduce interbasin transfers have been successful. This downward trend in interbasin transfers is expected to continue in light of the policies adopted the State of Georgia and the Metro Water District directing that interbasin transfers be minimized. For example, I have reviewed the Metro Water District's most recent projections of water supply withdrawals and returns from the ACF Basin, set forth in memoranda from the Metro Water District to Georgia EPD. Notably, there are no new interbasin transfers out of the ACF Basin projected in the current planning horizon through 2050. GX-829 (Jan. 29, 2016 Comments of the State of Georgia at GA02451865).

Figure 10: Net Interbasin Transfers for ACF Basin, 1990 and 2001-2013



110. Dr. Sunding also misstates the impact interbasin transfers from the upper Flint River have on Florida in his citation of the report entitled "Running Dry."[21] The Chattahoochee River and Flint River ultimately converge at Lake Seminole before forming the Apalachicola River, so exports from the Flint to the Chattahoochee (and vice versa) do not materially impact flows to Florida. Based on my analysis of the same Georgia EPD interbasin transfer records reported in "Running Dry," it turns out that 50% of the interbasin transfers in the upper Flint Basin in 2011 actually went to the Chattahoochee River, and therefore flowed downstream to Florida. Dr. Sunding's testimony that just 25% of public water supply in the upper Flint Basin is returned, thus overstates any potential impacts to Florida.

111. In my opinion, Georgia's approach to interbasin transfers in the ACF Basin is reasonable and efficient. There are enormous costs associated with eliminating interbasin transfers from the ACF Basin and the flow increases Dr. Sunding proposes are small. Furthermore, Georgia has worked to limit new interbasin transfers and to reduce existing interbasin transfers when feasible and appropriate through the normal replacement of existing infrastructure at the end of its useful life.

E. Dr. Sunding Overstates Potential Savings in Outdoor Water Use and Underestimates the Costs and Economic Impact of Drought Restrictions

112. In his written direct testimony, Dr. Sunding states that, during drought, Georgia should reduce municipal outdoor water use by 50% and thus "reduce streamflow depletions" by 207 cfs (or 134 mgd).[22] Dr. Sunding acknowledges that Georgia already has a drought year policy in place, but he criticizes Georgia for not implementing outdoor restrictions in 2011 and 2012. Dr. Sunding's analysis contains significant errors and omissions.

113. As an initial matter, Dr. Sunding has proposed a drought response measure, but he has excluded from consideration the most recent and best available information regarding drought management in Georgia. Dr. Sunding does not consider or discuss, for example, the effect of Georgia's 2015 Drought Management Rule, which I describe above. In fact, on September 9, 2016—five weeks before Dr. Sunding filed his written direct testimony—the 2015

[21] Sunding Testimony at p.4.

[22] Sunding Testimony at pp.35-38.

Drought Management Rule was used to declare a Level 1 Drought Response in the ACF Basin. FX-765. Dr. Sunding makes no mention of the rule or Georgia's current drought management process. Nor does Dr. Sunding address other measures adopted in Georgia to reduce outdoor water use even in non-drought years, such as the Georgia Water Stewardship Act's permanent measures, which include statewide restrictions on outdoor water use.

114. Furthermore, Dr. Sunding's analysis contains many errors that have caused him to overstate the level of outdoor water use in Georgia, and thus the potential savings that would result from a mandatory 50% reduction.

115. As set forth in my May 20 expert report and in subsequent analysis I have conducted, I identified a number of mistakes related to the estimation of outdoor water use in Dr. Sunding's expert reports filed on February 29 and May 20. The errors identified were in the application of the methodology Dr. Sunding employed for estimating outdoor use. These errors were brought to Dr. Sunding's attention in his deposition.[23]

116. In his written direct testimony, Dr. Sunding has acknowledged one of these errors overestimating outdoor use, explaining that he has conducted a new analysis to correct this mistake after his deposition.[24] Florida did not produce supporting data or information for Dr. Sunding's new analysis and opinions on M&I water use, however, so I have not been able to review the calculations and methods underlying Dr. Sunding's new estimates.[25] That said, based on Dr. Sunding's acknowledgement that he only corrected one specific error identified, it is reasonable to assume that Dr. Sunding has failed to correct the other errors in his analysis. If that is true, then his testimony continues to substantially overestimate outdoor water use in the ACF Basin.

1. Dr. Sunding Erred in Applying the "Minimum Month" Methodology

117. Dr. Sunding used what is known as the "minimum month" method to estimate outdoor water use in Georgia. This method is commonly applied by water professionals to

[23] Sunding Dep. Tr. at 390:10-392:1.

[24] Sunding Testimony at p.48.

[25] Given that I have not yet received this new material, I reserve my right to supplement or modify my testimony related to this topic should that information be produced.

estimate residential water use—indeed, I recently used this approach to estimate indoor and outdoor water use at selected single-family homes as part of a study conducted for the Water Research Foundation entitled Residential End Uses of Water, Version 2 (2016).[26]

118. Although the minimum month method is commonly used by water professionals, Dr. Sunding's application of it in this case has several problems. First, the minimum month method is typically and most appropriately applied to analyze the use of individual customers or groups of customers that have distinct indoor and outdoor water use patterns over the course of the year, such as occurs within the residential sector. Dr. Sunding's analysis deviates from this accepted practice by analyzing withdrawals at the utility level, including all customer categories.

119. When the "minimum month" method is applied at the utility level, as Dr. Sunding has here, it captures much more than just "outdoor" water uses like landscape irrigation that Dr. Sunding discusses; rather, it reflects what is more accurately described as "seasonal" and "non-seasonal" water use. Non-residential commercial and industrial water uses can and do vary seasonally for reasons that have nothing to do with outdoor irrigation or climate. Thus, seasonal water use thus differs from outdoor water use and includes many other uses of water such as industrial processes; evaporative cooling water used in cooling towers at industrial facilities, large commercial buildings, hospitals, and other facilities; changes in water use patterns resulting from seasonal travel and tourism; and other seasonal demands not related to and in addition to outdoor irrigation.

120. Because of this, Dr. Sunding's utility-level, minimum month approach has incorrectly classified potentially large volumes of water as "outdoor" use. In his deposition, Dr. Sunding acknowledged that his calculations could include commercial uses that vary seasonally, such as evaporative losses from commercial and industrial cooling towers. Sunding Dep. Tr. at 412:19-25. Yet it appears that Dr. Sunding has not corrected this error or reduced his estimates of outdoor water use in his testimony in this case.

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[26] DeOreo, W. B., P. Mayer, B. Dziegelewski, and J. Kiefer. 2016. Residential End Uses of Water, Version 2. Project #4309. Denver, Colo: Water Research Foundation. ©2016 Water Research Foundation.

121. For the same reasons, Dr. Sunding has also overstated the amount of water than can be saved through outdoor water use reductions, as seasonal water uses that are not related to outdoor irrigation cannot be curtailed in the manner Dr. Sunding suggests. This means that even greater reductions in outdoor water use would than what Dr. Sunding has projected.

2. Dr. Sunding Failed to Limit His Minimum Month Selections to the Winter

122. A fundamental assumption of the minimum month method is that little or no outdoor use water occurs during the winter months when plants are dormant. In Georgia, December, January, and February are usually the coldest months when little outdoor irrigation occurs and Dr. Sunding erred in failing to limit his minimum month analysis to these winter months. Although this error was brought to Dr. Sunding's attention at his deposition,[27] Dr. Sunding did not correct it in his written testimony and incorrectly included monthly minima that occurred during the Georgia irrigation season, violating one of the fundamental methodological assumptions of the minimum month approach. For example, in the analysis for his expert reports, Dr. Sunding chose water use from the month of July to represent typical indoor use for Mitchell County, Georgia. This is obviously incorrect, as July would fall at or near the very peak of the outdoor irrigation season.

3. Magnitude and Significance of Some of Dr. Sunding's Errors

123. As explain above, Dr. Sunding acknowledges in his written direct testimony that he "overestimated outdoor use in [his] expert reports" and states that he has recomputed his estimates of outdoor water use.[28] Yet, as I also explain above, this new analysis does not correct for other errors in Dr. Sunding's calculation.

124. I have quantified the magnitude of some of Dr. Sunding's errors by analyzing the same data set as Dr. Sunding but correcting his monthly minima error discussed above. Specifically, I selected only monthly minima occurring in the winter months (December through February). This, of course, does not address the fundamental methodological problem in Dr. Sunding's approach that what he calls "outdoor" water use is, in fact, "seasonal" water use that

[27] Sunding Dep. Tr. at 367:14-368:11; 374:5-376:1.

[28] Sunding Testimony at p. 48.

includes commercial and industrial uses unrelated to outdoor irrigation and other similar uses. Still, using the proper minimum month approach to recalculate outdoor use using the same underlying data as Dr. Sunding provides a conservative measure of the magnitude of some of his error.

125. Collectively, the errors in Dr. Sunding's calculation caused him to overestimate outdoor water use in his expert report by 45% to 120%. This overestimate corresponds to a volume of water ranging from 50,669 acre-feet to 69,845 acre-feet. Unfortunately, it is not possible to calculate precisely the error in Dr. Sunding's new calculations because he has not provided his new analysis or calculations for review. Additionally, Dr. Sunding has declined to provide in his written testimony any specific and verifiable estimates of outdoor water use, instead merely stating that he estimates that municipal outdoor water use was "over 130,000" acre-feet in 2011. Nevertheless, I can say, based on the little information Dr. Sunding has provided, that the errors above have caused him to overestimate outdoor water use in his written testimony by *at least* 16%, or 17,877 acre-feet, and likely much more when seasonal, non-irrigation water use is taken into account.

F. Dr. Sunding's Scenarios Are Not Reasonable or Achievable and Would Have Economic Impacts that Dr. Sunding has Ignored

126. Setting aside all of these errors, an objective evaluation of the municipal and industrial consumptive use caps Dr. Sunding has proposed shows them to be unreasonable and unachievable. The significant errors described throughout this section led Dr. Sunding to propose municipal and industrial conservation reductions that would require the elimination of most consumptive municipal and industrial water use in the ACF Basin. The level of consumptive use reductions Dr. Sunding has proposed far exceeds reductions achieved to date across California through drought response.

127. Through the three measures identified above, Dr. Sunding has suggested Georgia can achieve savings of 315 cfs across the municipal and industrial water use sector: 66 cfs through eliminating interbasin transfers, 42 cfs through leak abatement and an additional 207 cfs in outdoor water use reductions during droughts. Dr. Sunding selected 2011 as the year for which his scenarios are calculated, but it seems he never compared the proposed reductions against the actual 2011 water use. If he had, Dr. Sunding would have noted that he proposes a 72.5%

reduction in consumptive use during the peak month of 2011. A reduction of this magnitude would require the complete elimination of all seasonal water use including all outdoor water use, all evaporative cooling, and much more. In my more than 20 years of professional experience working with water utilities on conservation and drought response, I have never seen or prepared a plan to reduce consumptive use by 72.5% as Dr. Sunding has proposed. This is the clear result of the compounding of the numerous mathematical and methodological errors I have described.

128. Dr. Sunding's errors have led him to propose unrealistic consumptive use reductions. The costs of achieving and sustaining reductions at this level would be staggering. Yet, remarkably, Dr. Sunding has determined that Georgia would experience $0 incremental fiscal costs per year to achieve these reductions.

129. Dr. Sunding also misunderstands and understates the costs and economic impact of curtailing outdoor demand during a drought. Dr. Sunding suggests that his proposal to drastically reduce outdoor water use would not have any lasting impact on landscapes, asserting that "changes in the appearance of lawns will be temporary."[29] Dr. Sunding's exclusive focus on turf grass masks impacts to trees and other high-value landscaping that often cannot tolerate extended periods without irrigation. These impacts have costs that are not considered or addressed by Dr. Sunding.

130. Dr. Sunding assumptions that reducing outdoor use by 50% during a drought will have $0 incremental fiscal costs, and that urban irrigation is not directly associated with any economic output, are also incorrect. When irrigation bans are put in place during a drought, some lawns and landscapes will dry out and die. The loss of urban landscapes has real and substantive economic impact to homeowners as well as to those who make their living installing, maintaining, and caring for urban landscapes (the "green" industry) who lose considerable business during a drought. For example, researchers at the University of Georgia concluded that water use restrictions during Georgia's 2007 to 2009 drought impacted 7,000 small businesses that service urban agriculture across the state, resulting in the layoffs of 24,000 full-time and

[29] Sunding Testimony at 36.

15,600 part-time workers[30] and an economic impact estimated in the hundreds of millions of dollars.[31] Yet Dr. Sunding makes no effort to quantify or evaluate these impacts, instead claiming without any analysis that Georgia can simply impose restrictions on outdoor water use during a drought without any incremental cost.

131. Dr. Sunding's proposals would also have significant impacts on water and wastewater rates in Georgia. In order to cover the costs of implementing the measures he has identified, water and wastewater rates will necessarily have to increase. Yet utilities in the Atlanta area already have some of the highest water rates in the United States.[32] Further increases in water rates could have significant financial impact, particularly on economically disadvantaged Georgian's for whom even a small rate increase can represent a real burden. Again, however, Dr. Sunding makes no effort to quantify or evaluate these impacts to ratepayers.

G. Dr. Sunding's Scenarios Would Have No Meaningful Impact on Streamflow in the ACF Basin

132. Balanced against enormous costs, even the overstated and incorrect reductions in municipal and industrial consumptive use proposed by Dr. Sunding are unlikely to result in any meaningful changes in streamflow in the ACF Basin.

133. Figure 11 shows the relative impacts of Dr. Sunding's proposed reductions against the discharge of the Apalachicola River (cfs) as measured at the Chattahoochee Gage in Florida during 2011 and 2012, the two drought years Dr. Sunding identifies in his testimony. As can be seen, municipal and industrial consumptive use in Georgia barely registers relative to the amount of water delivered to Florida, despite supporting millions of people and the overwhelming share of economic activity. Given this, it is difficult to understand how the measures Dr. Sunding proposes, which include tremendous unacknowledged costs and

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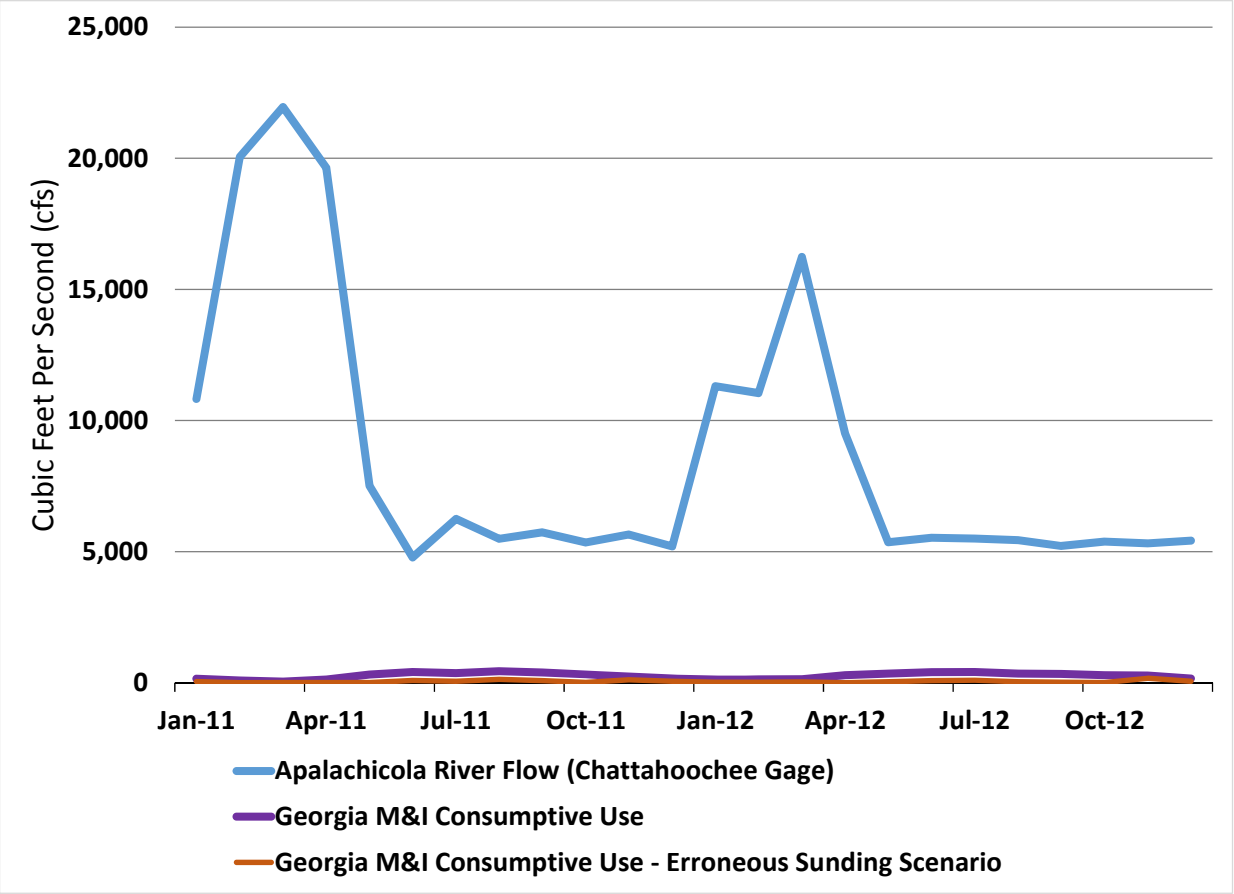
[30] Bauske, E., W.J. Florkowski and G. Landry. 2008. Economic Stress Continues for Georgia's Urban Agriculture. UGA Center for Urban Agriculture.

[31] Bauske, E., W.J. Florkowski and G. Landry. 2008. Layoffs Increase and Losses Accelerate in Response to the Drought. UGA Center for Urban Agriculture.

[32] 2015 Circle of Blue, Price of Water 2015: Up 6 Percent in 30 Major U.S. Cities; 41 Percent Rise Since 2010, *available at:* http://www.circleofblue.org/2015/world/price-of-water-2015-up-6-percent-in-30-major-u-s-cities-41-percent-rise-since-2010/.

disruption, would have any material impact on the amount of water Florida receives or on conditions downstream below Woodruff Dam.

Figure 11. Georgia Municipal and Industrial Consumptive Use and Erroneous Sunding Scenario, and Apalachicola River Flow, 1994- 2013



VI. CONCLUSIONS

134. In conclusion, Florida's claim that "[l]arge, and ever-increasing, amounts of water" are "consumed upstream for municipal [and] industrial" purposes in Georgia is incorrect and unsupported by the data. My analysis confirms that Georgia's total municipal and industrial water withdrawals and consumptive use in the ACF Basin has declined overall since 1993 despite a roughly 50% increase in population.

135. Georgia's M&I water use is reasonable and efficient and provides support for millions of people and an overwhelming share of economic benefits, while using just a tiny

fraction of the water from the ACF system. Because of Georgia's substantial efforts in M&I water conservation, per capita use has declined substantially since 2000.

136. Dr. Sunding and Dr. Hornberger have made significant errors in their analyses of Georgia's municipal and industrial water use. Likewise, Dr. Sunding's three M&I conservation proposals include substantially overstated water savings and substantially understated costs. In reality, the measures Dr. Sunding proposes could cost billions of dollars to implement while yielding reductions in consumptive water use that are a small fraction of the amount of water delivered by the Corps to Florida, even under drought conditions. Given these errors and Georgia's low M&I consumptive water use, any permanent cap on M&I consumptive use in Georgia would have impacts far in excess of those predicted by Dr. Sunding.

137. Finally, I strongly disagree with Florida's claims that Georgia's future M&I consumptive use will increase "dramatically" in the future, as these claims are based on a superficial evaluation of Georgia's outdated water supply withdrawals and not the amount of water that Georgia will actually consume. Rather, Georgia is poised to extend water efficiency gains in years to come and Florida's inflated projected increases have no bearing on the question of whether Georgia's future M&I water use will be reasonable. The analysis I have conducted shows that Georgia's current M&I water use is reasonable and will continue to be into the future.