MEMORANDUM

To: Mayor and Council Members

From: Greg Meszaros, Director, Austin Water

Date: July 3, 2014

Subject: Austin Water Resource Planning Task Force Recommendations

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I am forwarding the Austin Water Resource Planning Task Force report on behalf of Sharlene Leurig who serves as the Chair. The Council appointed the Water Resource Planning Task Force in April 2014 (Resolution 20140410-033).

Based on the Task Force's recommendation, the next key step will be for the City of Austin and Austin Water to develop an Integrated Water Resource Plan.

cc: Marc A. Ott, City Manager
Robert Goode, P.E., Assistant City Manager

Austin Water Resource Planning Task Force

Report to City Council

July 2014

(Council Resolution No. 20140410-033)

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EXECUTIVE SUMMARY

This report by the Austin Water Resource Planning Task Force recommends immediate actions that should be taken by the City of Austin to mitigate the impact of our ongoing drought and to catalyze investment in a water-resilient and water-efficient economy.

The Task Force recommends that the City of Austin first invest in protecting and optimizing water from the Colorado River under its existing contract with the Lower Colorado River Authority. Specific recommendations on priority efforts to increase water conservation and to optimize our existing contract water are offered in Section 3.0.

The Task Force recommends that the City Council and Austin Water Utility focus on local opportunities to enhance Austin's water supplies. These include options that previously have not been considered at scale, such as commercial/industrial water reuse and rainwater capture and infiltration. Implementation of these water management strategies may be achieved through revisions to existing codes and ordinances, such as the Watershed Protection Ordinance. It also means renewing our commitment to water reuse for our distributed water system.

As a fast-growing city dependent on water supplies that are susceptible to drought, it is prudent for Austin Water to consider options for improving the reliability of our water supplies. The evaluation of options should be undertaken as part of an Integrated Water Resource Plan that considers the rate impacts of Austin Water customers and the political risk of projects that could affect Austin's relationship with its neighbors. Projects beyond our existing LCRA contract should be considered as part of a transparent and competitive process with public input.

Investments in the Integrated Water Resource Plan and recommendations in Subsections 3.1 and 3.2 should be accounted for in the FY15 budget. These steps cannot be delayed.

I. INTRODUCTION

Austin's ongoing drought is a reminder of the susceptibility of our sole water source, the Colorado River's Highland Lakes, to prolonged drought. We know our region is likely to endure more droughts in the future, and to become drier over time, bringing less inflow to the Highland Lakes from local precipitation and tributary rivers from West Texas. We also know that higher temperatures are likely to cause greater evaporation from our lakes, making them a less dependable tool for water storage.

Austin is growing rapidly, and our region is expected to double in population in the next 25 years.

Recognizing the above, the Highland Lakes will remain the City of Austin's primary water supply. The City must continue to protect and steward both our senior water rights in the Colorado and our contracted firm yield with the Lower Colorado River Authority.

An important element of maintaining a reliable Highland Lakes water supply is reducing demands during all lake stages, not just during drought. We need to seize upon this opportunity to hasten the ongoing cultural shift in how we use and provide water. This is necessary so that Austin can retain its economic competitiveness and quality of life and achieve its water affordability and sustainability goals. Recent water use data shows that both residents and businesses are willing and able to embrace a more water-efficient way of life.

This report is the Task Force's recommendation on immediate actions that should be taken by Austin Water Utility and the City Council to mitigate the water supply impact from the ongoing drought and to catalyze investment in a water-resilient and water-efficient economy. The Task Force emphasizes that the Key Recommendations offered in Chapter IV of this report should be incorporated into the FY15 budget.

The recommended near-term strategies in this report are an effective and appropriate response to the existing drought conditions. The present drought is hydrologically unprecedented, however, and we understand that the City must plan for and anticipate a future in which drought persists and even intensifies. Should this occur, the City of Austin may need to invest in additional water supplies or storage beyond the range of either the current or recommended strategies for demand reduction and supply augmentation.

During times of crisis Austin may be forced to execute water demand reduction and alternative supply options that might not otherwise be consistent with community values. For these reasons, we have offered a decision matrix for use by Austin's leadership to evaluate new supply and storage options. We also offer to City Council our view on principles that should guide our community's decisions in how we manage and secure water for the future.

II. Guiding Principles for Austin's Water Choices

Based on public testimony presented at our meetings and our own collective decades of experience in water resources management and planning, the Austin Water Resource Planning Task Force recommends the following principles to guide our community's water management decisions:

- Water to meet basic human needs must be affordable for every Austin resident.

- Water to meet the needs of homes, businesses, and industry must be reliably sourced.

- Water supplies should be locally sourced, and water use should reflect the locally available supply. Localized water supply projects to supplement Austin's Highland Lakes, such as Aquifer Storage and Recovery and brackish water desalination, should be evaluated and prioritized, before water from other areas is imported.

- Saving water, or reducing demand, is widely recognized as the most reliable, affordable, and sustainable way to meet water demands. Building a water-efficient economy should take priority over developing supplies that can be expensive, capital and energy-intensive, and environmentally harmful. Conservation and re-use should be a higher priority to meet Austin's water demands than investing in new water supplies from areas outside of Austin.

- Water management strategies should further Austin's goal of developing a new culture of water stewardship, reducing per capita potable water use, and encouraging reuse and efficiency.

- In developing this new culture of water stewardship, broad participation and social equity are essential.

- Water management strategies must be environmentally sustainable and cost-effective.

- Several water demand management strategies must be implemented to achieve the most effective results, including aggressive water conservation and proactive implementation of Austin's Drought Contingency Plan before emergency conditions develop.

- The City must invest in demand-management strategies, in addition to supply augmentation strategies, to effectively achieve a significant reduction in water demand.

- City efforts to diversify water supply sources should not come at the expense of affordability, sustainability, and City environmental protection goals.

- Water management strategies must be consistent with the Imagine Austin Comprehensive Plan, particularly the goal of sustainably managing our water resources, directing development away from the Barton Springs Edwards Aquifer watershed, and building an economy that is water and energy efficient and reduces greenhouse gas emissions.

- The City must act in coordination with and take into account the concerns of neighboring communities when considering water management strategies that may impact their water resources.

- The City must act in concert with LCRA and other stakeholders to assure an LCRA water management plan that accurately reflects best estimates of future hydrology in watersheds contributing to Colorado River flows and the firm yield of the Highland Lakes water supply.

- Austin must consider the linked implications of increased water demands and energy-intensive supply options along with electrical production management, particularly during drought conditions.

- Our water supply options must consider impacts to the natural environment, Austin's urban forest canopy, spring, creek, and river flows, and the myriad human and nonhuman lives that depend upon them.

- Austin values its residential and urban gardens and farms, and the food security and independence that they represent. For the widest possible range of drought conditions, water to irrigate locally-produced food should continue to be made available.

- Austin Water Utility's historical business and financing model based on revenue from water commodity sales biases decisions in favor of supply options to the detriment of demand management. The vision, inspiration, and management of Austin's water demand strategy must come from outside these historical commodity-based business and financial frames.

III. Austin's Water Needs

Austin Water Utility demand forecasting has historically been linked to the utility business model. Utility forecasts have focused on indoor and outdoor water use by customer class as a basis for predicting revenue and for sizing infrastructure to accommodate demand peaks.

The utility's water conservation goals have been lumped into a single value of 140 gallons per person per day. This one conservation goal encompasses water demand consequences from decisions as wide-ranging as cooling tower infrastructure, the efficiencies of computer chip manufacturing, and whether there is mulch on our gardens, backyards are contoured to catch rain runoff, and we fix leaky toilet flapper valves. It fails to distinguish between aspirational goals and actual water needs.

As Austin manages both the current drought and an uncertain water future, we need a more specific and use-disaggregated model for defining and predicting community water needs. Like a speedometer in a car, we need a water dashboard that provides information specific to our varied water use decisions—one that gives us information from which strategic choices can be made to target demand management, measures the consequences of demand management and supply decisions, and evaluates our performance against community sustainability standards.

The Water Resource Planning Task Force, comprised of community volunteers, had neither the time nor resources to develop the water demand model that we believe Austin deserves. We did, however, segment water use data provided by Austin Water Utility and where possible compare the segmented data to efficiency standards. Our evaluation of water needs demonstrates an untapped potential to set specific and meaningful community goals for water demand management.

Data provided by Austin Water Utility for our analysis is presented in Appendix H. A description of our evaluation, its results, and its limitations is presented in Appendix I. A few of the key conclusions of our analysis are these:

- Residential indoor water use is the single highest water use category. Average Single-Family and Multifamily Residential customer use in Fiscal Year 2013 ranged from 58 to 54 gallons per person per day. This amount is high compared to 45.2 gallons per person per day for efficient homes.[1] The potential water savings, if every customer household in Austin achieved this water efficiency standard, would be 11,300 acre-feet per year.

- Single family residential outdoor water use was the second highest water use category in Fiscal Year 2011, and the fourth highest in Fiscal Year 2013. Year 2013 was rainier than 2011. The average amount of outdoor water for single-family residential use was 50 gallons per person per day for Fiscal Year 2011 and 25 gallons per person per day in Fiscal Year 2013. Multi-family outdoor water use was 47 and 28 gallons per person per day for the same periods. Single family and multi-family residential outdoor water use appears to be responsive to rainfall amounts.

- There was no data available to the task force from which to calculate estimated needs for indoor commercial use or use by Austin Water Utility's six large customers.[2] The

[1] American Water Works Association, http://www.drinktap.org/home/water-information/conservation/water-use-statistics.aspx, accessed June 14, 2014.
[2] Samsung, Freescale, University of Texas, Spansion, Hospira, and Novati.

proposed Integrated Water Plan would fill this gap in Austin's ability to establish a water need budget.

- Not all of the City of Austin water demands are reflected in Austin Water Utility data. Additional significant water demands not reflected in the utility data include water for electrical generation by Austin Energy and parkland irrigation using direct lake withdrawals. A complete water demand picture and future water road map for the City must include all water uses.

No one person or entity will or can control every Austin water demand decision. A secure and sustainable water future for Austin depends on building a community vision of what is possible in the realm of demand reductions and what it would take to achieve that. A disaggregated water demand model provides important information on where the biggest potentials for water conservation lie, allows us to set more meaningful demand management goals, and provides a better benchmark against which to compare our water use. We recommend that the Austin Water Utility create a comprehensive projected water demand model based on disaggregated uses and regularly updated to reflect advances in water efficiency and conservation technology and to capture other factors that we know affect water usage, including land use (i.e., density), water pricing, and climate trends.

IV. Key Recommendations

The Task Force strongly recommends that Austin explore a different approach beyond the current utility model.

- We encourage the City Council, AWU, and the community to embrace new decentralized[3] models in addition to traditional centralized models.

- We encourage the City Council, AWU, and business and residents to explore options that may not have been attractive 25 years ago based on cost, water availability, and other issues.

- The utility needs to look inward and critically assess internal processes and its ability to respond to changing water supply conditions and to implement water supply strategies.

- Implement a risk-based renewal planning approach to future utility needs. High risk assets should be addressed first.

- Austin Water Utility needs to place a priority on developing partnerships with the community, with other city departments, and with other entities in our region that share our goals.

[3] Refer to page 10 of this Report for a description of "decentralization."

- Diversifying sources and investing in deep water conservation will require that Austin Water Utility continue to examine its rate structure and balance revenue reliability with volumetric rates that strongly discourage water waste.

1.0 Integrated Water Resource Plan and Independent Conservation Assessment

The City of Austin and Austin Water Utility must develop a realistic Integrated Water Resource Plan similar to LCRA Water Management Plan and Austin Energy Integrated Resource Plan. This plan should be budgeted for the FY15 cycle.

1.1 Basic Goals

- An Integrated Water Resource Plan will assist in identifying and facilitating opportunities for regional partnerships, technology cost sharing, balanced regional water reliability, and improved drought preparedness.

- Austin is now the 11th largest city in the United States. For a city of this size not to have an Integrated Water Resource Plan is an unacceptable source of risk to our long-term economic security and our quality of life.

- In developing this plan, Austin should evaluate the impact of various water supply and climate scenarios to ensure sustainability of water supply and to assess the range of outcomes that we should be prepared to address.

- Multi-departmental and community input in developing an Integrated Water Resource Plan is essential.

    - Austin Energy should participate in developing and implementing the plan, opening up much-needed collaboration on the energy demands of our water system and the water demands of our electric grid.
    - Watershed Protection should be involved in developing and implementing the plan. Their expertise in the importance of maintaining minimum flows, achieving the highest quality of natural waters in the urban environment, protecting natural habitats, and the potential for rainwater and storm runoff to supplement potable water supplies are key to a secure water future.
    - The Office of Sustainability should also be involved in this plan and help to champion interdepartmental solutions.

- Demand-side options (i.e., water conservation) must be included in the Integrated Water Resource Plan and be placed on par with supply augmentation options. As such:

    - The Plan should include a demand forecast that goes beyond extrapolating historic water use or a simple assumption of 140 gpcd to actually reflect the possible effects of population growth, climate change, land use changes and water pricing on demand forecasts. This is critical to ensure that Austin Water does not overbuild assets to satisfy water demand that is not supported with evidence. This Task Force recommends using the "Urban Water Demand in California to 2100: Incorporating Climate Change" open source tool made by the Pacific Institute as a model for demand forecasting.[4]

- The Integrated Water Resource Plan should include an Austin water needs budget disaggregated by customer classes and indoor and outdoor use. A disaggregated water demand model provides important information on where the biggest potentials for water conservation lie, allows the City Council, AWU, and the community to set more meaningful demand management goals, and provides a better benchmark against which to compare our water use.

- The Integrated Water Resource Plan should include an independent analysis of the potential water supply benefits of implemented and non-implemented conservation programs. This Conservation Potential Assessment should include a cost-benefit analysis of individual conservation programs and would ideally present a cost curve of water conservation program options to guide decision-making on program investment. The Conservation Potential Assessment should assess where untapped opportunities to achieve water savings still exist to help prioritize conservation spending by Austin Water Utility. The Conservation Potential Assessment created for Cascade Water Alliance may be a model for this analysis.

- Austin's water rates are likely to be affected by the steps we take to ensure water reliability, whether these actions are to conserve our water (reducing volumetric sales) or to increase supply (especially new capital assets). The Integrated Water Resource Plan should include a comparison of the rate impacts of selected strategies. San Antonio Water System's Integrated Water Resources Plan should serve as a model for this analysis.

- The plan should consider all water that the city is using and not just water that is "run" through the utility.

- Meaningful public participation in water supply strategies is paramount to creating a new water paradigm to meet future water supply challenges. This will enable Austin residents and AWU customers to become educated and engaged regarding our water supply challenges and to be partners in solutions.

- Work on this Plan should begin immediately, guided by this report to Austin City Council, and should be budgeted in the FY15 cycle.

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[4] Available at http://pacinst.org/publication/urban-water-demand-to-2100/.

1.2 Additional Focus

- Decentralization: The decentralized concept is the idea that storm water and wastewater are most effectively and efficiently managed by treating it—and reusing it—as close to where it is generated as practical. Infrastructure failure and vulnerabilities are minimized while water resource utilization is maximized on a local and highly integrated level. The overall system becomes more reliable and adaptable to a variety of future development scenarios. Decentralized storm water or wastewater treatment infrastructure can be part of Austin Water Utility's capital portfolio. It can also be developed economically by institutions and private developers at a competitive cost of service to what AWU offers, a model that frees up Austin Water's capital to meet other needs

- Water sharing with agriculture: Austin's wholesale water provider, the Lower Colorado River Authority, provides water to many different sectors, including municipal users like Austin and agricultural water users. In the early years of the ongoing drought, most of the water delivered from the Highland Lakes was delivered for agricultural water use. Although the present condition of the Highland Lakes has resulted in interruption of water deliveries for many agricultural users contracted with LCRA, there may be opportunities to gain municipal supply through voluntary cooperation with agricultural water users with firm contracts. The most senior right on the Colorado River is held by the Garwood Irrigation District, which uses the majority of its rights for agricultural purposes. The Integrated Water Resource Plan should examine the potential cost and water supply benefit of voluntary water sharing with Garwood and other agricultural users with firm rights. There is precedent for such arrangements in Southern California, where San Diego County Water Authority and its wholesale provider, Metropolitan Water District of Southern California, gained substantial long-term water deliveries by financing conservation efforts by agricultural users with senior water rights to the Colorado River.

- Codes and ordinances: Code and regulatory impediments like the prohibition on rainwater use for potable supply within 100 feet of centralized water service should be carefully examined in light of historical and scientifically-based risk data. Gray water and rain water use should be allowed, supported, and encouraged in all situations for which any health risks are no more than other widely-allowed activities. Regulatory decisions should be independent of any concern regarding the consequences of more widely-available water alternatives on the Utility's income.

- Diversification of supply sources: Reliability of water supply can be improved by diversifying supply sources, after we first assure that existing supplies are protected and used efficiently. New supplies that are local and, where appropriate, decentralized, are preferred over remote sources that require energy and cost-intensive pumping and large upfront capital costs.

- Develop and foster regional cooperation to build a reliable and water-efficient economy for our region, in partnership with entities who share our goals of sustainability.

- Focus on multiple cycle reuse of existing water supplies. The lowest cost water is that which is already under our control.

- Water demand should be addressed by realistically assessing water needs versus wants.

- Austin Water Utility should mitigate the ratepayer impacts of investing in new supply options by adopting a capital planning approach that attempts to discover revenue-positive or revenue-neutral opportunities throughout its asset portfolio. Designing wastewater treatment facilities to capture (and monetize, where possible) the wastewater energy and nutrient load is one way of discovering this ratepayer benefit. Progressive utilities around the country, including San Antonio Water System, Alexandria Renew Enterprises and East Bay Municipal Utility District already generate energy or sell natural gas from their wastewater facilities.

- Austin Water Utility can also mitigate ratepayer impacts by encouraging the use of private capital to finance decentralized infrastructure throughout the city. Given Austin's extraordinary growth and the scale of new development and redevelopment citywide, there is vast untapped potential to provide water solutions that do not implicate the balance sheet of Austin Water, which is already challenged by necessary efforts at water conservation and essential capital investments. In New York City and San Francisco, private land developers have demonstrated the economic opportunity of developing parcel-scale storm water and wastewater reuse projects. These projects provide wastewater treatment and non-potable water at a cost of $11 – $15 per 1,000 gallons, making it competitive with Austin's combined water and wastewater rates. Better still, these projects can be designed to be net energy neutral, using the heat from onsite wastewater treatment to provide hot and chilled water loops that can offset the energy needs of the building. The economic competitiveness of these projects scales with size, but with the smallest economic project pegged at 300,000 sq-ft, there are many opportunities within our growing city. One example of such a project is the New School in New York City.[5]

2.0 Water Conservation and Supply Project Evaluation Matrix

The Task Force developed a matrix that we recommend be used to evaluate different potential water supply projects. This matrix includes evaluation criteria that we believe reflects Austin's values and ranges from cost to social impacts. We encourage the city council to direct the utility to use this or a substantially similar approach to evaluate possible water supply projects. We have provided definitions of the water supply project evaluation criteria and scoring criteria in order to be clear about the aspects that we feel are important to consider when evaluating water supply.

[5] Cost statistics from Ed Clerico, Natural Systems Utilities, which designed the New School wastewater project.

Despite the importance this community places on sustainability and water efficiency, data provided by the Austin Water Utility on the demand management and supply water yield and costs favor supply side options over demand management. Potential demand management yields have been underestimated.

While the potential demand management option yields have been underestimated, costs for demand side management options were systematically overestimated. Although supply options were capitalized over 30 years, demand management costs were initially based on all costs occurring during the first implementation year. The utility made some adjustments, but there are still accounting discrepancies in the cost calculations that are unfavorable to demand-side options.

While it is important to evaluate water supply projects, the Task Force did not feel that it was appropriate to score the water supply projects that were presented to us for several reasons. We did not have sufficient time to go into the level of detail on strategy yield and cost that is necessary to accurately populate this matrix. The numbers that were provided to the Task Force were from different sources and in some cases varied dramatically. Different methodologies were used to arrive at cost and savings conclusions for different alternatives. This made scoring projects in a meaningful way difficult in this timeframe. By scoring the strategies, the Task Force would have given the illusion of precision when we don't have enough information to provide precise scoring on each of these strategies.

We recommend that when populating the matrices, AWU and the City should take care to develop costs for both supply and demand management projects using consistent methodology to allow for appropriate comparison. The full life cycle costs of each project must be considered over the lifetime of that project's estimated life, including construction/procurement costs, land acquisition costs, costs of required treatment, pumping and transmission. Supply projects should include the estimated cost burden on wastewater that would be produced by the additional water throughput. Only when all costs are accounted for can supply projects be accurately compared against demand management programs.

In addition, Austin Water should look to other water utilities that have capitalized water conservation programs, which has the benefit of smoothing the cost impact on ratepayers. Associated capital expenditures for all projects, regardless of demand or supply management, should be amortized over a set period and added to the related annual operations and maintenance (O&M) cost for a total annual cost of the project. Although it is not currently City financial policy to bond finance associated capital components of demand management strategies, this approach provides for relative comparison of strategies with supply-side options and recognizes the statutory and constitutional authority in the State of Texas to bond finance demand management expenditures. Progressive cities, such as Las Vegas, Seattle, and New York City, have used their enterprise revenue bonds to finance water conservation efforts on the private property of their customers on the basis that the efforts serve the public interest, have quantifiable water savings that extend for at least as long as the lifetime of the debt used to finance them, and are secured through some means, such as a conservation easement or contract with the property owner.

3.0 Water Conservation and Supply Recommendations

The Task Force believes that Austin faces immediate and long-term water supply challenges. We recommend that Austin take immediate action to use our current supplies more efficiently while moving to develop additional supplies. Our recommendations are as follows:

3.1 Short-Term Demand-Side Management Strategies

The drought response and water conservation discussed below should be implemented immediately. Conservation should, however, not be limited to just these programs.

3.1.1 Proactive Implementation on Drought Response Stages

We support the development and implementation of an Interim Stage 3 drought restriction as soon as feasibly possible to preserve water supplies. We recommend the implementation of Stage 3 Interim at no later than 500,000 acre-feet (combined storage for Highland Lakes) and Stage 4 at no later than 400,000 acre-feet (combined storage for Highland Lakes). Prior to implementing Stage 4, however, the Utility should remove all restrictions for gray water systems that comply with gray water requirements of the 2012 Uniform Plumbing Code. This gray water outdoor watering option would help to preserve landscapes and the urban tree canopy. (See Codes and Ordinances Chapter VI.)

3.1.2 Priority Water Conservation Measures

Cost effective strategies that reduce water use should be a priority. We recommend that the City place a strong focus on implementing demand side strategies (strategies that reduce per person water use) before implementing supply-side options. Using the supplies that we currently have as efficiently as possible is paramount to sustainably managing our water supplies whether in drought or out of drought. Austin Water Utility should develop benchmarks with the aid of independent consultants with a historical commitment to conservation, reuse, and decentralized options to use in evaluating potential water conservation programs. Benchmarks should include cost and other factors.

- Cost effective strategies that reduce water use should be a priority.
- Toilet replacement programs –replacing older, inefficient toilets should be a priority. There are a variety of programs contemplated by the utility that target toilet replacement.
- Capturing cooling tower condensate in new facilities should be required.
- Remove all restrictions for gray water systems that comply with gray water requirements of the 2012 Uniform Plumbing Code. This gray water outdoor watering option would

help to preserve landscapes and the urban tree canopy. Other codes and ordinances that stand in the way of increasing our water efficiency and expanding the use of local water resources should also be removed. (Specific recommendations on this are offered in Chapter VI: Codes and Ordinances.)

- Engage home and commercial builders to discourage in-ground irrigation systems and limit irrigated area in new development (similar to programs implemented by Georgetown, San Antonio, and the LCRA). Impact fees should be higher for new construction built with irrigation systems and other features that use more water and lower for water efficient or water neutral new construction.

- Invest in customer water report software or services that can realize greater customer water savings and more cost-effectively market Austin Water's existing incentive programs. One example is WaterSmart Software, which has achieved a 5% reduction in total water demand in 6 months at the East Bay Municipal Utility District. The software gives customers personalized reports on relative water usage compared to neighbors and identifies opportunities for rebates they haven't used. A third-party estimate pegged the cost of water saved through WaterSmart at a midpoint unit cost of $380/acre-foot for email reports and $400/acre-foot for written reports to customers.

- Developing the remainder of the core reclaimed water system has the largest potential water supply impact of any demand-side strategies to better utilize existing water supplies.

- Leak and Pipe Failure Detection and Remediation – Continue and enhance efforts to reduce leaks and system losses from AWU infrastructure, with greater transparency on current efforts and a cost-benefit analysis of options for reducing system water losses. Specifically, develop and share the relationship between loss reductions and costs.

3.1.3 Mid-Term Demand-Side Management Strategies

Water conservation programs should include a mix of regulatory and behavior-based options.

- Building and plumbing code modifications;
- Behavior Modification, including software tools to help Austin water customers identify water-saving opportunities;
- Education - Value of Water initiatives and building a conservation culture should be a priority;
- Rebates and incentives (e.g., irrigation system removal);
- Consumption comparisons on average household bill;
- The decentralized concept (discussed above);
- Reclaiming storm water for beneficial purposes.

3.2 Short- and Mid-Term Water Supply Strategies

In addition, we recommend that the city pursue several water supply strategies as soon as possible.

3.2.1 Short-Term Strategies

- Automation of Longhorn Dam Gates;
- Walter Long Lake Off-Channel Storage (existing capacity) ;
- Varying Lake Austin Operating Level – Implement at below 600,000 acre-feet of combined storage. This strategy should be coupled with a robust education campaign to inform the public why this is being done. Unlike the LCRA proposal, this proposal would be limited to non-peak recreational months.[6] For a representation of the approximate outlines of portions of Lake Austin with a 3-foot drawdown, see Appendix G.
- Capturing local inflows to Lady Bird Lake. Austin Water Utility should immediately calculate the estimated cost and yield of this option.

3.2.2 Mid-Term Strategies

We expect that the city will study these options in more detail to fully evaluate their suitability for water supply solutions.

- Tiered implementation approach. Diversification of water supply sources should be achieved through integration of regional strategies identified in City and Region K water planning processes. Begin with the end in mind.

- If there is potential to replace Decker Power Station at Lake Walter E. Long, and new electric supplies do not need this water supply, the use of Walter Long Lake enhanced off channel storage should be implemented.

- Indirect Potable Reuse – The use of Lady Bird Lake to convey treated wastewater effluent from the South Austin Regional plant to an intake for the Ullrich Water Treatment Plant represents a significant departure from historical practice. While wastewater effluent is routinely treated to a quality that meets drinking water standards, those standards are not protective of more sensitive ecosystems. We are aware of no implemented wastewater treatment technology on a municipal scale that reliably achieves the nutrient concentration levels currently measured in Lady Bird Lake.

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[6] Austin Water should clearly distinguish between the current Austin Water proposal and the LCRA plan considered last year. Austin's proposal is not for a year-round drawdown; it maintains normal lake levels during the months of June through September, the recreational high season.

Nevertheless, under severe drought conditions, this water supply represents a source that is in alignment with community values to exhaust every available local supply before importing water from other regions. Therefore, we recommend that the City of Austin consider exercising this option in the event of 400,000 acre-feet of combined storage or less. Discharge into the lake should occur for the shortest possible time. Council should recognize that permitting for the wastewater discharge permit into Lady Bird Lake could take a considerable amount of time.

4.0 Funding

- The City should investigate alternative financial delivery mechanisms for future water supply projects.

- City of Austin signed a contract with the Lower Colorado River Authority in 1999 to ensure that the agency would provide future water to the City during a repeat of the drought of record, prepaying $100 million to secure the supply. LCRA should participate in funding any future water supply projects that are necessary for a reliable future supply of comparable volume to the City of Austin.

V. Recommended Strategies for Study

During the course of evaluations by the Water Resource Planning Task Force, a number of strategies were considered that could potentially serve as sources of water within a long-term framework or could provide other benefits over both short and long periods. Some benefits from employing these strategies are diversification of Austin's water supply, minimal environmental impacts, and making use of groundwater and aquifers that are not being used to their fullest sustainable potential. The Task Force did not feel there was sufficient information to evaluate the costs and benefits of these approaches against each other, but did find there to be sufficient value in the diversification of Austin's water supply and storage to merit further consideration and study. These strategies and brief descriptions are presented below (for full descriptions, see Appendix C: Water Supply Project Descriptions):

- Reclaimed Water Infiltration - recharge (injection) of treated wastewater into alluvial sediments along the Colorado River and pumping from alluvial sediments down-gradient.

- Aquifer Storage and Recovery (ASR) - including in the Trinity Aquifer, brackish Edwards Aquifer, and Carrizo/Wilcox Aquifer. ASR been done successfully by San Antonio Water Systems (SAWS) and the cities of El Paso and Kerrville.

- Desalination - brackish Edwards and Carrizo/Wilcox Aquifers. SAWS is currently constructing a large-scale desalination system.

- Permanent intake to capture spring inflows from Lady Bird Lake.

Another strategy to be considered is flow augmentation at Barton Springs. This will not provide additional water, but will provide significant environmental benefits. The City of Austin is in a position to increase flow at Barton Springs during drought when low flow and decreased water quality threaten the endangered salamanders at the springs. This can be accomplished by providing water to Edwards Aquifer users during severe drought, providing water to recharge the aquifer, and purchasing groundwater production permits from Edwards Aquifer permittees. These actions would allow for more discharge of groundwater from Barton Springs, thereby improving the conditions for the salamanders and minimizing harm to the salamanders during severe drought.

The WRPTF recommends that the City give these strategies serious consideration and, where appropriate, conduct studies to evaluate their feasibility. In addition to a thorough engineering analysis, these strategies should be evaluated according to the Principles (Chapter II) and Decision Matrix (Appendix E) provided in this report.

VI. Codes and Ordinances

Water conservation and diversification of water supply sources are priorities for the City and are fundamental responsibilities shared by all of its departments, operations, and facilities. These objectives should be reflected in the City's codes and ordinances, policies, and other guidance documents. Revisions to existing ordinances and development of new ordinances may be warranted to achieve the City's goal of developing a culture of water stewardship and acknowledging the true value of water. Where feasible, such measures should be implemented as expeditiously as possible.

For example, the Watershed Protection Department recently concluded, and the City recently enacted, Phase 1 of a new Watershed Protection Ordinance, including over 220 improvements to the Land Development Code. The purpose of the WPO is, in part, to improve creek and floodplain protection and improve the overall health of the watershed.

The Watershed Protection Department has now commenced Phase 2 of the WPO revisions, which explores water quality control measures that incorporate beneficial use of storm water. This Phase 2 process provides the Watershed Protection Department with an opportunity to ensure that the principles of water conservation and enhancement of water supply sources are prioritized in their development of ordinance revisions. For instance, Watershed Protection should evaluate requiring rainwater harvesting, tied into a drip irrigation system, for commercial and multi-family projects. Further, storm water treatment systems should maximize infiltration.

Similarly, in 2010, the Landscaping Ordinance was revised, but further revisions are still warranted. As the City moves toward becoming a more effective water steward, it should evaluate and revise the Landscaping Ordinance to ensure that it is consistent with the City's water conservation objectives and maximizes water reuse options. Examples of options that should be considered include:

- incentivize sustainable landscapes;
- limit size of irrigated turf lawns in new developments;

- to the extent that current codes and ordinances require turf grass landscapes before certificates of occupancy be issued, these requirements should be removed;
- reduce allowable use of potable water for irrigation;
- maximize use of reclaimed and harvested water for irrigation;
- require commercial and industrial sites to use air conditioning condensate;
- revise existing auxiliary water ordinances and rules to eliminate requirements to replace existing pipe with purple pipe;
- require automated irrigation systems to use drip irrigation (as opposed to spray irrigation).

Innovative water conservation measures, such as residential gray water reuse, have been explored by the City, and pilot projects are underway. The City should continue in pursuing these new strategies, and should invest more resources to expeditiously evaluate and implement them. For instance, the City should remove all restrictions for gray water systems that are compliant with the 2012 Uniform Plumbing Code. The City should also evaluate "laundry-to-landscape gray water systems" for multi-family developments (new and retrofit).

Decentralized storm water and wastewater treatment and reuse can limit capital expenditures by city departments for centralized water infrastructure and can provide cost-effective services for large development. The City should adapt its permitting requirements to enable decentralized stormwater and wastewater treatment for non-potable uses and where economically justifiable, provide financial incentives for this alternative water service model to be implemented.

CodeNEXT provides an additional opportunity to prioritize water management strategies, such as water reuse, in the City's Land Development Code. The City should use this opportunity to develop a program that encourages zero-net-water homes and businesses.

In short, effective water management strategies may be achieved via regulatory measures, with relatively minimal capital investment. Accordingly, water management should be a guiding principle implemented by all City departments.

VII. Developing a Culture of Water Stewardship Innovation

1.0 Becoming the Most Water-Efficient Community in Texas

Austin rightly touts itself as a world-class city and center of technical innovation with a wealth of intellectual capital. Austin should capitalize on these assets and its reputation by creating a dramatic and achievable goal of becoming the "most water-efficient city in Texas." This will require clear, understandable metrics that go beyond the current 140 gallons per capita per day (gpcd) target, which is the result of the legislative process and does not represent the ultimate achievable goal for per capita water use. Achieving this goal will also require a consistent public message about the need, and urgency, for achieving it (for example, dramatic population growth during a time of unprecedented drought and climate change; recognition of water as a finite resource that is critical to the city's health, economy, culture, and identity). Unfailing public education efforts are required to instill a new water ethic, as well as an understanding of the real costs — and value — of water in the 21st century.

Austin will rightly face immediate comparisons with other Texas cities — most notably San Antonio and El Paso — that have reduced water consumption and developed a new water ethic among their residents. Those cities have already surpassed Austin's stated goal of 140 gpcd. Austin should copy, and improve upon, lessons from both of these success stories, but it should also look outside state boundaries for examples of innovative municipal water programs that might be applied in central Texas (e.g., Las Vegas, Nevada; cities in southern California; Tucson, Arizona; Santa Fe, New Mexico).

As part of the Integrated Water Resource Plan recommended by this Task Force, the City of Austin should adopt a stretch target for our water demand. This Task Force recommends consideration of ambitious targets such as California's 20 by 2020 plan, which requires cities to reduce total water use by 20% of 2008 levels by 2020. Another is the 90 gpcd by 2020 challenge for the Colorado River Basin in the Intermountain West.

2.0 Leading a New Era of Regional Cooperation

Along with our recommendation that Austin diversify its water portfolio rather than rely solely on LCRA surface water, we also think the City should lead a new era of regional water cooperation rather than cede that role solely to LCRA. Unlike LCRA, which is charged with a primary focus on raw surface water supplies from the lower Colorado River and Highland Lakes, the City has a strong "retail" focus on end users of treated water in a municipal setting. Austin may also be better situated than LCRA to work with its neighboring water users (cities, counties, water districts) who may not be in the LCRA service area or who may be interested in water from sources other than the Highland Lakes.

Rather than viewing water resources as a zero sum game, Austin should work with its neighbors as a regional leader. As part of this leadership, Austin should regularly convene a regional water summit where it should:

- share its staff resources, ideas, planning, and best practices with regional neighbors, and invite them to do the same;
- invite nearby cities, water districts, counties, and river authorities to participate; and
- state an overarching goal of achieving regional benefits that would otherwise be more difficult without cooperation (lowered costs, more efficient use of water

supplies, increased public influence), as well as reinforcing a new regional water ethic to achieve efficient use of local supplies.

Austin should continue to cooperate with LCRA in regional water issues while taking full advantage of the LCRA/COA Water Partnership (formed under the June 2007 settlement agreement) by staffing it at the highest level. The City should also continue to take an active leadership role, and encourage regional neighbors to do the same, in participating in revisions to the LCRA Water Management Plan in order to protect the City's long-term firm water supply.

3.0 Tapping into the Cityscape as a Water Supply Source

Until the turn of the 20th century, Austin's most reliable sources of water were the Barton Springs/ Edwards Aquifer and rainwater stored through lean times. With the advent of centralized water treatment technologies and construction of the Highland Lakes in the 1940s, Austin gradually shifted its reliance to water from the Colorado River. Today we are reminded of what Austin's earliest settlers knew: drought is a regular part of life in Central Texas, making the rainwater that falls outside the Highland Lakes catchment area all the more valuable.

Centralized water storage and treatment is likely always going to be part of Austin's water portfolio. However, a new generation of water treatment technologies makes point-of-use treatment economically feasible. Point-of-use capture and treatment may become economically competitive with centralized water services as the costs of point-of-use technologies improve and as the economics of centralized water services adjust to higher sourcing and treatment costs.

At the same time, Austin Watershed Protection Department is embracing the concept of augmenting its centralized stormwater infrastructure with cityscape water storage, recognizing the economic limitations of a purely centralized approach to capturing, retaining and treating stormwater. (It is worth noting that "stormwater" is a term that regards rainwater as a pollutant vector and flood source rather than a resource.)

Looked at in this way, our entire cityscape can be designed and retrofitted to function as a water supply source. The economic capacity of this cityscape approach to water supply is not fully understood. What we do know is we are barely scratching the surface of what our cityscape can provide through the thoughtful design of streets, buildings and parks to capture, store and treat water for beneficial use in the City of Austin.

This presents both risks and opportunities to Austin Water and its ratepayers. If we ignore the potential for distributed infrastructure across our cityscape, we risk overbuilding our centralized system and forcing water rates upward. As water rates rise, the economics of providing point-of-source systems become even more attractive, driving even more customers away from the centralized services, causing the utility to adjust rates upward to make up for lost sales, and on and on in a vicious cycle of rate increases. We are better off recognizing the potential for this disruptive technology and designing our policies to encourage its development to best augment our central system.

We can encourage investment in this distributed water infrastructure through code and ordinance revisions, credits to tap fees and rate structure revision to reflect the economic benefit of the water services provided by private property owners. For example, Austin Water Utility could adjust its connection fees to reflect the true cost of service for large commercial customers who provide their own water supply through onsite capture and/or treatment.

Appendix A

Water Supply Project Evaluation Criteria - Demand

Recommended COA Drought Response Decision Matrix
DEMAND MANAGEMENT

	COA Water Management Strategy Description	STRATEGY YIELD (AC-FT/YEAR)	Cumulative Yield (Ac-Ft)	WATER SUPPLY PROJECT EVALUATION CRITERIA																												
				Water Supply Benefit 25%						Economic Impacts 20%				Environmental Impacts 20%					Social Impacts 10%			Implementability 15%							Risk of Alternative Supplies 10%		Final 100%	Comments
				Supply Volume	Drought Resilience	Improved Reliability and Utilization of Existing Supplies	Quality Compatibility with Existing Distribution Systems	Local Control (resilience)	Diversification	Unit Cost* ($/Ac-Ft)	Treatment Need/Cost	Energy Intensity	Energy Generation	Impacts on Other Water Supplies	Instream Flow	Endangered/Threatened Species Impact	Wetlands	Water Quality	Imagine Austin Plan	Balances Economic and Environmental Impacts with Community Interests	Recreation	Required External Adoption	Land Acquisition	Timing of Implementation	Regulatory Approval	Political Opposition	Public Acceptance	Legal Uncertainties	Dependence on Climatic Conditions (Variability of Yield)	Hydrologic Storage- Potential Environmental Release		
Optimize Existing Supplies via Efficiency & Conservation	**Conservation - *(Drought Response)***																															
	Stage 3																															Strategy is already in place by AWU.
	Stage 3 Interim (Hand Watering Only)																															Strategies already in place by AWU. Task Force supports Stage 3 interim phase. Combined storage triggers need to be determined for each drought response.
	Stage 4																															
	Conservation - *(Demand Management)*																															
	Mandatory Toilet Retrofit on Residential Resale																															
	(Mandatory Toilet Changeout for Commercial & Multifamily Buildings – Point in Time)																															
	Limit irrigated area in new residential development																															
	Require new facilities to capture A/C condensate for reuse																															
	Require retrofit of existing cooling towers to meet efficiency standards																															
	Require home audits at time of sale																															
	Mandatory irrigation audits for high users																															
	Implement smart meters for residential customers																															
	Additional staff for marketing reclaimed water program																															
	Water budget rates (applied to irrigation-only meters)																															
	Hot water on demand incentives																															
	Provide rebates for 0.8 gpf toilets																															
	Other - *(Demand Management)*																															
	Leak Detection																															
	Decentralization (WW/Reuse/Reclaimed/Net Zero Systems)																															
	Direct Reuse; Completion of Core Reuse System																															
Regulatory	Building code modifications																															
	Plumbing code modifications																															
	Stormwater management programs/incentives																															
	Land use management programs/incentives																															
	Gray water use programs/incentives																															
	Developers/industry bring their own water																															
	Participate in LCRA Management Plan process																															
	Water pricing structures																															
	Enter into drought stages earlier																															
Behavioral	Incentives for conservation programs																															
	Incentives for rainwater harvesting systems																															
	Water Education Initiatives																															
	Consumption comparison average on water bill																															

Appendix B

Water Supply Project Evaluation Criteria - Supply

WATER SUPPLY PROJECT EVALUATION CRITERIA

			Water Supply Benefit 25%						Economic Impacts 20%				Environmental Impacts 20%					Social Impacts 10%			Implementability 15%							Risk of Alternative Supplies 10%		Final 100%	Comments
	COA Water Management Strategy Description	**STRATEGY YIELD (AC-FT/YEAR)**	Supply Volume	Drought Resilience	Improved Reliability and Utilization of Existing Supplies	Quality Compatibility with Existing Distribution Systems	Local Control (resilience)	Diversification	Unit Cost ($/Acre-Ft)	Treatment Need/Cost	Energy Intensity	Energy Generation	Impacts on Other Water Supplies	Instream Flow	Endangered/Threatened Species Impact	Wetlands	Water Quality	Imagine Austin Plan	Balances Economic and Environmental Impacts with Community Interests	Recreation	Required External Adoption	Land Acquisition	Timing of Implementation	Regulatory Approval	Political Opposition	Public Acceptance	Legal Uncertainties	Dependence on Climatic Conditions (Variability of Yield)	Hydrologic Storage- Potential Environmental Release		
Optimize Existing Supplies/ Operational Augmentation via Efficiency	**Augmentation of Supplies - *(Supply Management)***																														
	***System Operational Improvements** (Existing Supplies)*																														
	Longhorn Dam Gate Operation																														
	Reduced Lake Evaporation																														
	Walter Long (Decker)Lake Off-Channel Storage																														
	SAR Discharge Relocation above Austin Gauge																														
	Lake Austin Varying Operating Level																														
	***Enhanced Operations** (Additional Capital Req'd)*																														
	Automate Longhorn Gates																														
Operational Augmentation w/Signif. Capital, Permitting, Community Impact	Walter Long (Decker) Lake Off-Channel Storage (enhanced storage)																														
	Capture Local Inflows to Lady Bird Lake																														
	Aquifer Storage & Recovery (Edwards Aquifer)																														
	Aquifer Storage & Recovery (Regional Non-Edwards Aquifer)																														
	Indirect Potable Reuse - SAR to Lady Bird Lake																														
	Barton Springs Capture & Augmentation																														
New Supplies	**New Groundwater Supplies**																														
	Blue Water Systems[A*] (Treat & Deliver)																														
	Forestar[A*]																														
	Northern Edwards Wellfield[A*]																														
	Vista Ridge[A*]																														
	Hays-Caldwell Public Utility Authority[A*]																														
	Trinity Aquifer supplies																														
	Other																														
	Brackish desalination[B*]																														
	Reclaimed water bank infiltration																														
	Colorado Bed and Banks[A*]																														
	Rainwater harvesting																														
	Commercial																														
	Residential																														
	ASR- Regional/Desalination																														

Notes:

A - These alternatives represent a treated water supply and would not incur the water treatment costs the other alternatives would require.*

B - The evaluation would be specific to the site/aquifer under consideration and is not universal*

Appendix C

Water Supply Project Descriptions

Water Supply Projects Descriptions

<u>DEMAND MANAGEMENT STRATEGIES</u>

<u>Optimize Existing Supplies via Efficiency & Conservation</u>

Conservation - (Drought Response)

Stage 3 Stage 3 Drought Response, as outlined in city code and the city's drought contingency plan, allows up to 6 hours of outdoor watering per week, limits operational hours for splash pads, and prohibits filling of spas/hot tubs.

Stage 3 Interim (Hand Watering Only) As an interim drought response measure, the utility has proposed an option that would allow outdoor irrigation only with a hand-held hose. All automatic and hose-end sprinklers would be prohibited, but, consistent with Stage 3, vehicle washing at certified facilities would continue to be allowed, as would maintenance of nursery stock and operation/installation of pools. This measure would be imposed within the Director's authority as authorized in city code.

Stage 4 Stage 4 Emergency Response, as outlined in city code and the city's drought contingency plan, prohibits all discretionary potable water uses including irrigation, repair of irrigation systems, vehicle washing, surface washing, and filling of pools, spas and fountains.

Conservation - (Demand Management)

Mandatory Toilet Retrofit on Residential Resale This strategy would require a homeowner, in order to finalize sale of a property, to provide certification by a licensed plumber that all toilets in the home have flush volumes at or below the specified flush volume (1.6gpf at time of recommendation, currently 1.28gpf).

Mandatory Toilet Changeout for Commercial & Multifamily Buildings – Point in Time This strategy would require all commercial and multifamily buildings to provide, by a specified date (2017), certification by a licensed plumber that all toilets on the property have flush volumes at or below the specified flush volume (1.6gpf at time of recommendation, currently 1.28gpf), or be subject to non-compliance fines.

Limit irrigated area in new residential development – This strategy would limit the area that can be served by an automatic irrigation system to no more than 2.5 times the building footprint. It would require some form of plan review, which is currently not required for residential properties, as well as final inspection.

Require new facilities to capture A/C condensate for reuse – Buildings permitted after the start date of the ordinance would be required to capture condensate from A/C systems for beneficial reuse indoors (toilet flushing) or outdoors (irrigation or required landscape area), theoretically limiting the potable water demand of new development.

Require retrofit of existing cooling towers to meet efficiency standards – This strategy would require properties with cooling towers to provide by a certain date certification by a licensed plumber that towers are operating at no fewer than the minimum cycles of concentration and with all conductivity controllers, blowdown meters and other conditions of the current plumbing code.

Require home audits at time of sale – This strategy would require that, as a condition of sale, homeowners would have to have a professional conduct an audit of interior and exterior water-using fixtures and provide a copy of the report, along with recommendations for conservation potential, to the buyer and the City. Savings are assumed to come from greater awareness by the buyers, but are based on audit programs in other states where audits are performed for existing homeowners. The City would also need to encourage and train water audit professionals to meet demand, and the program would likely require outdoor audits to be performed by licensed Landscape Irrigation Inspectors according to TCEQ rules.

Mandatory irrigation audits for high users – This strategy would require that customers who use more than 40,000 gallons per month in any two months of a 12-month period undergo an evaluation of their irrigation system. Savings would be contingent on the homeowners implementing recommendations of the auditor; audits could be provided by (additional) City staff, or from a third party at the homeowner's expense.

Implement smart meters for residential customers This strategy assumes that approximately 190,000 residential water meters are exchanged for "smart" meters that allow users to access real-time data on water use. Savings are from greater homeowner awareness of water use, and assumed to be approximately 10% based on results from other cities. The utility would also save money from reduced labor costs, reduced water theft, and less time spent by customer service agents on bill complaints.

Additional staff for marketing reclaimed water program – This strategy adds an additional staff member dedicated to recruiting new customers for the reclaimed water program along existing and planned lines to reduce potable water demand and create economies of scale in the reclaimed water system.

Water budget rates (applied to irrigation-only meters) – This strategy would apply a different rate structure to dedicated irrigation meters (typically at commercial and multifamily properties); possibly applying the residential tiered rate, or pricing all water above a certain amount at the highest residential rate. Savings are based on price elasticity estimates for reductions in water use. The strategy would require billing system changes, and could have equity or cost-of-service concerns, as not all commercial properties have dedicated irrigation meters.

Hot water on demand incentives – This strategy would provide a $100 rebate to customers installing qualifying hot water on demand systems, designed to minimize the waste of water while waiting for the desired temperature in bathrooms and kitchens.

Provide rebates for 0.8gpf toilets This strategy would provide a $50 rebate to customers installing 0.8 gallon per flush toilets to replace 1.6 gpf or higher toilets. Currently, there is only one known manufacturer of fixtures at this flush volume.

Other - (Demand Management)

Leak detection – Continue and improve leak detection program.

Decentralization (WW/Reuse/Reclaimed/Net Zero Systems) – The decentralized concept is the idea that wastewater is most effectively and efficiently managed by treating it—and reusing it—as close to where it is generated as practical. Infrastructure failure and vulnerabilities are minimized while water resources utilization is maximized on a local and highly integrated level. The overall system becomes more reliable and is adaptable to a variety of future development scenarios.

Direct Reuse - Completion of Core Reuse System (Demand Management) - This strategy involves a near-term construction program to complete the central part of Austin's direct reuse system and involves 19 miles of pipeline mains, a pump station and storage tank. Completing the core reuse system will enable a system capacity increase to 2.2 billion gallons per year for a projected 135 customers.

Regulatory

Building code modifications – Development in Austin should be directed at water conservation and intelligent water management. The building code shall include positive reinforcement of rainwater harvesting, reclaimed water use, plumbing for gray water/reuse opportunities, urban canopy, water conservation innovations, and other considerations to improve water efficiency and promote water conservation.

Plumbing code modifications – Plumbing code shall include modifications to improve efficiency standards, plumbing for gray water/reuse opportunities, and include other considerations to improve water efficiency and promote conservation.

Stormwater management programs/incentives – City of Austin should review existing policies and programs and evaluate additional opportunities for the capture of additional water supply from stormwater flows. These programs should include the evaluation of example utilities in that have successfully implemented these programs and the consideration of physical infrastructure to accomplish such goals.

Land use management programs/incentives – Develop and focus on low-impact development strategy targeted to retain and restore the hydrology to more native conditions.

Gray water use programs/incentives – City of Austin should review existing policies and programs and evaluate additional opportunities for expansion of the use of gray water within its jurisdiction. These programs should include the evaluation of example utilities in that have successfully implemented these programs and the consideration of physical infrastructure to accomplish such goals.

Developers/industry bring their own water – City of Austin should require any new development to provide a secure water supply to the development at the time of permit application. This can include City of Austin water supply but should include firm delivery amounts and agreements prior to building approval.

Participate in LCRA Management Plan process – City of Austin signed a contract with the Lower Colorado River Authority in 1999 to ensure that the agency would guarantee future water to the city, prepaying $100 million to secure the supply. LCRA should participate in funding any future water supply projects that are necessary for a reliable future supply of comparable volume to the City of Austin. The City should continue its participation in the LCRA management plan process with a focus on earlier implementation of water conservation and drought trigger responses. In addition, this participation should promote the storage in the Highland Lakes and water conservation program consistency among water users of the LCRA system.

Water pricing structures – Develop more aggressive water pricing structures for drought and water supply restrictions.

Enter into drought stages earlier – Enter into water supply restrictions and drought declarations earlier based on improved triggers and recent data.

Behavioral

Incentives for conservation programs – Water conservation should be promoted and incentivized where opportunities exist. The most affordable water is water that is already under the City's control. City codes, policies, and procedures should all be geared to improve water efficiency and promote conservation.

Incentives for rainwater harvesting systems – City of Austin should incentivize opportunities for additional expansion of rainwater harvesting programs within jurisdiction. City should consider options such as adding rainwater harvesting to provide decentralized opportunities within current distribution system and expanding the existing rebate programs. Review of existing regulations and policies should be conducted to find opportunities for water efficiency through rainwater capture. These policies should be reviewed in conjunction with stormwater management policies to identify opportunities to work together.

Water Education Initiatives – City of Austin should develop an education program to instill a new water ethic, as well as an understanding of the cost/value of water within the community. This education would involve a consistent public message about the need and urgency to meet the City's water needs for our rapidly growing population while sustaining a finite resource that is critical to health, economy, culture, and identity.

Consumption comparison average on water bill – AWU customer would receive a monthly water use comparison with neighborhood/zip code water consumption comparison on their COA utility bill. The intent of the program is to bring awareness to their water use and provide a basis for comparison to average use in their area or seasonal use.

SUPPLY MANAGEMENT STRATEGIES

Augmentation of Supplies

System Operational Improvements of Existing Supplies

Longhorn Dam Gate Operation – Primary releases from Longhorn Dam are from bascule gates. Pulse flows result in excess releases. LCRA designed and funded installation of knife gates for improved performance but still cannot control flows to match downstream flow needs. Project is being coordinated by LCRA and AE, which involves shifting operations to use existing lift gates to release water through Longhorn Dam. Provides more flexibility and better debris control. Note that this operation approach was used historically prior to the installation of the knife gates (sometimes referred to as keyholes).

Reduced Lake Evaporation-include Fayette – NSF-approved product applied to lakes to form a monolayer that reduces evaporation. Product is made from insoluble fatty acids from coconuts and palm and comes in a powder form which biodegrades within 72 hours. Literature on the product and process indicates that evaporation could be reduced by 20 to 30%. The product would need to be regularly applied to the lake surfaces using a spreading process such as application from the stern of a motor boat. For the purposes of comparative analysis, estimates of water savings from reduced evaporation from this project from Lady Bird Lake and Lake Long were developed. There may be other products or methods in the arena of evaporation that could be explored.

Walter Long (Decker)Lake Off-Channel Storage – Lake Long is used for cooling water for Decker Power Station. Water from the Colorado River is diverted to provide makeup water for evaporation to maintain this lake for steam-electric cooling purposes. The power plant can operate with a 3-ft. variation in lake level (which represents a volume of approximately 3,750 AF). The approach would be to save more water in lakes Travis and Buchanan through strategic lake refill operations coordination with LCRA in wetter local conditions and, potentially, through timely releases from the Lake Long's dam to possibly satisfy downstream requirements, including meeting environmental flow requirements.

SAR Discharge Relocation above Austin Gauge – Project to relocate a portion of the SAR WWTP treated effluent discharge to upstream of the river flow gage known as the "Austin gage", which is located near US 183 bridge over the Colorado River not far downstream of Longhorn Dam. The approach would be to use discharge flow to meet environmental flow requirements at the Austin gage. LCRA's Water Management Plan (WMP) requires LCRA to maintain a 46 cubic feet per second (cfs) minimum flow at that gage. This project would only be beneficial when environmental flow maintenance at this gage is the controlling factor in LCRA releases from upstream reservoirs. The Krieg Field reclaimed water line could be used to discharge flow below Longhorn Dam. This project would require a wastewater discharge permit.

Lake Austin Varying Operating Level – Project to vary Lake Austin lake levels seasonally to allow local flows to be captured rather than "spilled" downstream. Drought response emergency operational approach would be to let local usage draw the lake level down a few feet to be able to catch runoff from local storm events should they occur. This approach would allow for controlled use of that runoff as opposed to that water spilling over the dam to flow downstream even if is not needed downstream at that time. Recent rain events in 2012 and 2013 in Austin are examples of event that could have resulted in combined storage benefits to this operational approach. These events did not provide significant inflows to lakes Travis and Buchanan but did provide large amounts of runoff into Lake Austin and other areas of Austin to the east.

Enhanced Operations Involving Additional Capital, Permitting or Community Impact

Automate Longhorn Gates – Project to automate Longhorn Dam knife gates to provide improved operational control on flow releases. This project would also provide trash racks to prevent clogging. The project would minimize staff time required to conduct gate operations to fine tune flow control.

Walter Long (Decker) Lake Off-Channel Storage (enhanced storage) – Enhance operations of Long Lake to allow more fluctuation in lake level up to approximately 25 feet. Project would result in operating Long Lake essentially as an off-channel storage reservoir to benefit storage levels in lakes Travis and Buchanan. Lake Long holds approximately 30,000 AF when full. The concept would allow water from Long Lake to be released to meet downstream needs, including environmental flows and other uses, which would otherwise need to be released from lakes Travis and Buchanan. Project would require making improvements to increase ability to refill lake by increasing pumping capacity at Colorado River pump station and by building a reclaimed water main from Walnut Creek WWTP to Lake Long. A reclaimed water main along this general route is included in the Reclaimed Master Plan and would be beneficial for other purposes. Project would necessitate taking Decker Power Station Plant off-line. Austin Energy (AE) is in the process of conducting their 2014 Generation Plan Update. AE is evaluating future options at this site. It is anticipated that significant changes may be forthcoming, which may create improved opportunities for use of Lake Long in this manner. AWU will continue to coordinate with AE on timing aspects, as necessary.

Capture Local Inflows to Lady Bird Lake – Project would install a floating pump intake below Tom Miller Dam and a transmission main to pump water from Lady Bird Lake (LBL) into the Ullrich Water Treatment Plant intake line for treatment and delivery into Austin's water distribution system. This project would allow for the capture of spring flows, including flows from Barton Springs that flow into LBL, and other storm flows when they are not needed downstream for environmental flow maintenance or for downstream senior water rights.

Aquifer Storage & Recovery – Project would store water underground for later use. Keys to this project include source water and locating a suitable aquifer. Colorado River sourced water would not address the current drought. Conceptually water is stored in times when excess water is available for storage so that it can be taken out for use when needed. Use of reclaimed water for the purposes of storing water for the ASR project can increase near-term supply but may not provide benefits to combined storage of lakes Travis and Buchanan if water would need to be released from the lakes to makeup the water being stored in the ASR project. Project considered Northern Edwards Aquifer with Walnut Creek WWTP as a source of reclaimed water. Project requires construction of conveyance pipeline and ASR wells.

Indirect Potable Reuse - SAR to Lady Bird Lake – Project would move a portion of the South Austin Regional (SAR) Wastewater Treatment Plant (WWTP) discharge to Lady Bird Lake (LBL). Requires acceleration of reclaimed water mains identified in the Reclaimed Master Plan. Water would be withdrawn from a new intake pump station on LBL below Tom Miller Dam. Project would require construction of pumping facilities and pipeline to move the water from LBL into the Ullrich WTP intake line. System would only operate when downstream demands are being met. Based on preliminary assessment, the retention time in LBL for this water is approximately 6 months. Project would require nutrient removal at SAR WWTP for the treated WWTP effluent water to be discharged into LBL.

Barton Springs Capture & Augmentation – Groundwater pumping could be offset by connection to alternate water supply, including City of Austin, to allow for additional spring flow during critical flow needs. Environmental benefits are expected, however, no new water supply volume is generated from this strategy as additional surface water would meet most offset demand. Water right retirement or purchase is another component of this strategy that offers benefits without any infrastructure or supply impacts.

New Groundwater Supplies

Blue Water Systems (Treat & Deliver) – Existing project supplying Carrizo-Wilcox water to a location east of Austin near the City of Manor. Blue Water Systems holds permits for export of up to 75,000 AF/year from the Post Oak Savanna GCD. The project currently supplies ~1-2 MGD to other entities east of Austin in the vicinity of SH 130 and US 290. Existing system can be expanded to supply Austin with approximately 10 MGD. Blue Water would be responsible for expansion construction with cost recovered in rates. A take-or-pay contract would be required. A contract could be for between 5 and 30 years.

Forestar – Forestar has groundwater leases in Bastrop and Lee Counties. However, there is no existing infrastructure. Forestar has a contract with Hays County to reserve 45,000 AF/year for $1 million per year. The company has applied for 45,000 AF per year in permits from the Lost Pines GCD but received permits for only 12,000 AF/year. Forestar has filed suit for permits. Infrastructure development depends on long-term contract. Availability is unknown.

Northern Edwards Wellfield – Northern Edwards has been used by entities in the past (Lamplight Village), however, the well yields are typically low ~ 1 MGD. The water quality is good, however, compatibility would need to be determined and verified. Project would require land purchases.

Vista Ridge – Consortium including Blue Water Systems, which responded to SAWS's request for proposals for water supply. 50,000 AF of permitted Carrizo-Wilcox water. Project would include construction of a pipeline from Burleson Co. to San Antonio and other treatment and delivery facilities.

Hays-Caldwell Public Utility Authority – Brief Description: Public Utility Authority made up of San Marcos, Kyle, Buda, Crystal Clear, and Canyon Regional. There is no existing infrastructure. HCPUA has permits for 10,400 Ac-Ft/Yr from the Gonzales County GCD and a partnership with Texas Water Alliance for an additional 15,000 Ac-Ft/Yr.

Trinity Aquifer Supplies – Explore opportunities for limited water supply diversification in the western and southern portions of the City's service area that have access to these supplemental water supplies.

Other New Supplies

Brackish desalination – Develop wells in down dip brackish zone of the Edwards Aquifer, generally in the southeast area of Austin near US 183 and SH 130. Project would require desalination plant, drilling and completion of 20 production wells and 8 disposal wells, and extensive land purchases.

Reclaimed water bank infiltration – Spread effluent from the South Austin Regional (SAR) WWTP in an infiltration basin, which would recharge into the local Colorado Alluvium formation. Then recapture the water in alluvial wells along the river. Once the water is recaptured, it is pumped to the water treatment plan through a pipeline. This option requires significant land purchases.

Colorado Bed and Banks – Recapture discharged effluent downstream to be pumped back upstream for treatment. City of Austin and LCRA have applied jointly for the water rights permit, in accordance with the terms of the 2007 settlement agreement between Austin and LCRA.

Rainwater harvesting – Water supply augmentation for City of Austin water supplies should be considered under the general principle that diversification of water sources should be prioritized. Collecting and utilizing your rainwater is as old as Texas history and should be an important consideration in future options to include in the water supply portfolio.

> **Commercial –** The City of Austin should consider providing incentive programs and retrofit programs to capture large-scale institutional rainwater catchment systems. This approach can facilitate decentralization strategies and provide a balanced approach to managing the utilities infrastructure.
>
> **Residential –** The City of Austin should continue to fund and expand residential opportunities for rainwater harvesting to offset peak summer load demands. Incentive and rebate programs should be diversified to meet a wide range of user needs and promote conservation and water efficiency.

ASR- Regional/Desalination (Regional Non-Edwards Aquifer) – City of Austin should develop and participate in large-scale regional ASR system with partners such as LCRA, Cities including Pflugerville, Round Rock, Buda, Kyle, and others to develop a drought-proof regional water supply storage and withdrawal system to augment existing supplies using a combination of sources such as groundwater, desalinated supplies, and reuse sources.

Appendix D

Definitions - Water Supply Project Evaluation Criteria

Definitions - Water Supply Project Evaluation Criteria

Water Supply Benefit

1. Supply Volume - Does the proposed water supply strategy provide a significant volume? How high is our confidence in the reliability of the water supply (applies to strategies that are savings or supply based)?
2. Drought Resilience - Does the amount of water supply from water supply strategy change based on drought condition (is it "drought proof")?
3. Improved reliability and utilization of existing supplies - Does proposed water supply strategy extend existing supplies so that we can serve more people for longer with the same amount? Does the proposed water supply strategy maintain necessary downstream supplies such that Highland Lakes storage is extended?
4. Quality compatibility with existing distribution systems - Would existing infrastructure or treatment program need to be modified to address water quality concerns from a new source?
5. Local Control (resilience & risk) - Does the proposed water supply strategy secure supply from a local water source under the control of the Austin community? Is the proposed water supply strategy associated with potential risk for future accessibility if not under local control of the Austin community?
6. Diversification – Does the water supply strategy diversify Austin's current water supply portfolio?

Economic Impacts

1. Annual Cost - Annual cost to implement strategy (should include all construction, treatment, distribution and system upsizing costs on the water and wastewater side, unless otherwise noted). A higher annual cost is assumed to have a higher effect to ratepayers.
2. Treatment Need/Cost - Does cost of proposed water supply strategy include treatment? If not, what is treatment cost (if known)?
3. Energy Intensity - Does proposed water supply strategy have a larger energy associated with production, treatment and transport than current Austin Water supplies?
4. Energy Generation - Does proposed water supply strategy have an opportunity for energy generation/offset?

Environmental Impacts

1. Impacts on other Water Supplies - Does the proposed water supply strategy have potential for water quality or quantity impacts of another source/supply?
2. Instream Flow - Does the water supply strategy decrease instream flows in the Colorado River or other contributing streams?
3. Endangered/Threatened Species impact - Does water supply strategy negatively impact species habitat (terrestrial or aquatic) or environmental flows for an aquatic species?
4. Wetlands - Does water supply strategy impact size or productivity of existing wetlands?
5. Water Quality - Does proposed water supply strategy negatively impact water quality in any way? Does proposed water supply strategy enable development on the Barton Springs/Edwards Aquifer contributing or recharge zones?

Social Impacts

1. Imagine Austin Plan - Does proposed water supply strategy conform to Imagine Austin goals? In particular IA Plan Goal 2: Sustainably Manage our Water Resources. Pages 191 - 192. http://www.austintexas.gov/sites/default/files/files/Planning/ImagineAustin/webiacpreduced.pdf
2. Balance Economic and Environmental Impacts with Community Interests - Does proposed water supply strategy reflect Austin's community values and quality of life goals?
3. Recreation - Does proposed water supply strategy impact water-based recreation activities? (Ex. kayaking/SUP/fishing and other recreation activities on Lady Bird Lake, Colorado River Paddling Trail in Bastrop)

Implementability

1. Required External Adoption - Are necessary entities coordinating on proposed water supply strategy? Is there an MOU required/present? Does Austin currently posses the water rights or contract for proposed water supply strategy? If not Austin, does supplying entity/individual have clear access to water? Does Austin need to get any permits? TCEQ, COE, etc?
2. Land Acquisition - Does proposed water supply strategy require land acquisition?
3. Timing of Implementation- How fast can proposed water supply strategy be put online/implemented?
4. Regulatory Approval - Does proposed water supply strategy require any regulatory approval? Is it routine (i.e. quick) process or more involved?
5. Political Opposition - Is there political opposition to the proposed water supply strategy (local and/or in water source area)
6. Public Acceptance - Does public "embrace" proposed water supply strategy. Will there be an issue with public acceptance? If water supply strategy was implemented, would surrounding communities object?
7. Legal Uncertainties – Are there legal uncertainties associated with water supply strategy? Will these issues affect yield or accessibility to water?

Risk of Alternative Supplies

1. Dependence on Climatic Conditions - Is the predicted supply yield of the proposed water strategy affected by climate conditions? Is variability of yield expected with a change in climate conditions?

3. Hydrologic storage risk for potential environmental release - Is the supply yield of the proposed water supply strategy likely to result in overall no significant net gain in Highland Lake storage due to current LCRA WMP operations?

Appendix E

Recommended Scoring System – COA Drought Response Decision Matrix

Recommended Scoring System for COA Drought Response Decision Matrix - *Example, Requires Completion*

Category	Sub-Category	Scoring System				
		-2	-1	0	1	2
Criteria 1: Water Supply Benefit	Supply Volume			Minimal (<___ AF)	Moderate (___AF < x <___ AF)	Significant (> ___ AF)
	Drought Resilience	Greatly reduced reliability during drought	Notable reduced reliability during drought	Neutral	Slightly reduced reliability during drought	100% reliabiliity through drought
	Improved reliability and utilization of existing supplies	WSP does not improve reliability and utilization of existing supplies	WSP extends existing supplies to serve more people	WSP extends existing supplies to serve more people	WSP extends existing supplies to serve more people and protects Highland Lakes supply	WSP significantly extends existing supplies to serve more people and protects Highland Lakes supply
	Quality compatibility with existing distribution systems					
	Local Control (Resilience and Risk)					
	Diversification					
Criteria 2: Economic Impact	Annual Cost					
	Treatment Need/Cost					
	Energy Intensity					
	Energy Generation					
Criteria 3: Environmental Impacts	Impacts on other Water Supplies					
	Instream Flow					
	Endangered/Threatened Species Impact					
	Wetlands					
	Water Quality					
Criteria 4: Social Impacts	Imagine Austin Plan					
	Balances economic & environmental impacts w/community interests					
	Recreation					
Criteria 5: Implementability	Required External Adoption					
	Land Acquisition					
	Timing of Implementation					
	Regulatory Approval					
	Political Opposition					
	Legal Uncertainties					
	Public Acceptance					
Criteria 6: Risk of Alternative Supplies	Dependence on Climatic Conditions					
	Hydrologic storage risk for potential environmental release					

= To be Completed

Appendix F

Modeling Drought Response Strategies

Richard Hoffpauir, PhD., P.E. – June 25, 2014

Modeling Drought Response Strategies

Austin Water Resources Planning Task Force

June 25, 2014

Richard Hoffpauir, Ph.D., P.E.

Drought Response Strategies

- Drought response strategies were modeled for the purposes of exemplifying simulated net benefits on storage in lakes Buchanan and Travis under repeated drought conditions.
- Simulating several groupings or "tiers" can uncover strategy synergies or interferences.
- The tiered strategy models in this handout are based on task force request from the June 19, 2014 AWRPTF meeting. The tiered strategy groupings are not necessarily reflective of final task force recommendations.

Assumptions for Austin DCP Implementation

Projected Diversions in Thousand Acre-Feet (TAF) - Rounded to Nearest 0.5 TAF							
Stage	**Assumption: Modeled Highland Lakes Combined Storage Level Trigger (AF)**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Conservation Stage	Full to 1.4 MAF	155.0	158.0	159.5	161.0	162.5	164.0
Stage 1	1.4 MAF to 900,000	150.5	153.5	155.0	156.0	157.5	159.0
Stage 2	900,000 to 600,000	142.0	144.5	145.5	147.0	148.5	149.5
Stage 3	600,000 to 500,000	124.5	125.5	127.0	128.5	129.5	131.0
Interim*	500,000 to 400,000	109.0	110.0	111.0	112.0	113.0	114.5
Stage 4⁺	400,000 and below	99.5	100.5	101.0	102.5	103.5	104.5

***Includes conceptual "Interim" stage - potentially includes hand-watering only**

⁺Includes estimated reductions of indoor use correlating to community response to drought severity

Note: 1 acre-foot (AF) = 325,851 gallons

* As of 5/2014, estimates subject to change

Tier 1 Strategies

Strategy Description	Key Modeling Assumption	Model Implementation
Operating range of Lake Walter E. Long adjusted to allow for approx. 3' of drawdown before calling for LCRA stored water	Top 3,700 acre-feet of lake capacity is filled with local and run-of-river water only.	Start of simulation, June 2014
Longhorn Dam gate improvements to increase efficiency of downstream releases	6,000 acre-feet per year (afy) of improved release efficiency	June 2014
Increased Austin municipal conservation, beyond savings due to drought contingency stage implementation	Demands (previous page) are reduced by 5% in all stages	January 2015
Increase Austin municipal direct reuse, "Completing the Core"	1,800 afy in all DCP stages	January 2020

Incorporated into all three tier strategies is implementation of the DCP stages including the conceptual "interim" stage.

The key modeling assumption column for all three tier strategies is not necessarily reflective of the annual Highland Lakes storage savings. The Highland Lakes storage savings collectively from all strategies are shown graphically in the modeling results.

Tier 2 Strategies

Strategy Description	Key Modeling Assumption	Model Implementation
Capture local inflows in Lady Bird Lake, including from Barton Springs and Deep Eddy. "Excess flow" is diverted on Lady Bird Lake. Excess flow is simulated as water is not required for passage to downstream senior water rights and not needed to meet downstream LCRA environmental flow requirements.	Variable amount of excess flow is diverted per month, depending on hydrologic conditions	January 2016
Lake Austin Operations Operate Lake Austin within a 3' range to allow local flows to be captured rather than "spilled" downstream. Drought response emergency operational approach would be to let local usage draw the lake level down a few feet to be able to catch runoff from local storm events should they occur. Lake Austin operations are modeled only in the months of September through May when the combined storage of the Highland Lakes falls below 600,000 acre-feet.	Top 3' of Lake Austin is used for capturing local excess flow, approx. 4,500 acre-feet of lake capacity.	September through May only after Buchanan and Travis combined storage falls below 600,000 acre-feet

Incorporated into all three tier strategies is implementation of the DCP stages including the conceptual "interim" stage.

Tier 3 Strategies

Strategy Description	Key Modeling Assumption	Model Implementation
Walter Long Off-Channel Storage (Enhanced Capacity) Assumes Decker power plant is offline when this strategy is in effect. During the simulation period LCRA stored water is not called for maintaining storage contents in Lake Long while the power plant is offline. Decker Creek inflows, Colorado River "excess flows", and reclaimed water are stored in Lake Long. Releases of stored water are made to Decker Creek to meet down basin demands and to meet LCRA instream flow and bay & estuary inflow requirements.	Top 25' of Lake Long is used for releasing to Decker Creek, approx. 23,400 acre-feet of lake capacity.	Both Tier 3 strategies are simulated anytime after January 1, 2016 when Buchanan and Travis combined storage falls below 420,000 acre-feet. Tier 3 strategies cease if combined storage recovers to 650,000 acre-feet. With regard to the Decker strategy, no decisions have been made regarding actual future operations of Decker power plant.
Indirect Potable Reuse – SAR to Lady Bird Lake Indirect reuse through Lady Bird Lake for augmenting potable water supply. Indirect reuse simulated as a constant monthly amount. Releases of stored water from Lake Long are made to offset decreased return flow discharge above the Bastrop gage.	20 Mgd, approx. 22,400 afy	

Incorporated into all three tier strategies is implementation of the DCP stages including the conceptual "interim" stage.

Baseline Modeling Assumptions

- Combined Storage initialized to 787,000 acre-feet, as observed on June 1, 2014
- All simulations begin June 1, 2014 and end January 1, 2024
- Dry/reference year demands when not simulating curtailment due to lake combined storage below 600,000 acre-feet, i.e., pro-rata curtailment due to a declaration of a drought worse than the drought of record (DWDR) by LCRA
- Austin municipal demand growth
- Austin municipal demands reduced according to Austin's DCP stages
- Other firm customer demands reduced initially by 20% under DWDR. Reduction by 30% below 500,000 acre-feet of combined storage.
- Interruptible stored water cutoff under DWDR
- LCRA WMP Emergency Order for cutoff of interruptible stored water if DWDR not in effect
- LCRA temporary amendments for additional diversion points of LCRA run-of-river rights below the Highland Lakes
- LCRA Emergency Order to reduce the spring instream flow requirement between Bastrop and Columbus from 500 to 300 cfs for 6-consecutive weeks
- Corpus Christi run-of-river diversion of 35,000 afy begins, July 2015

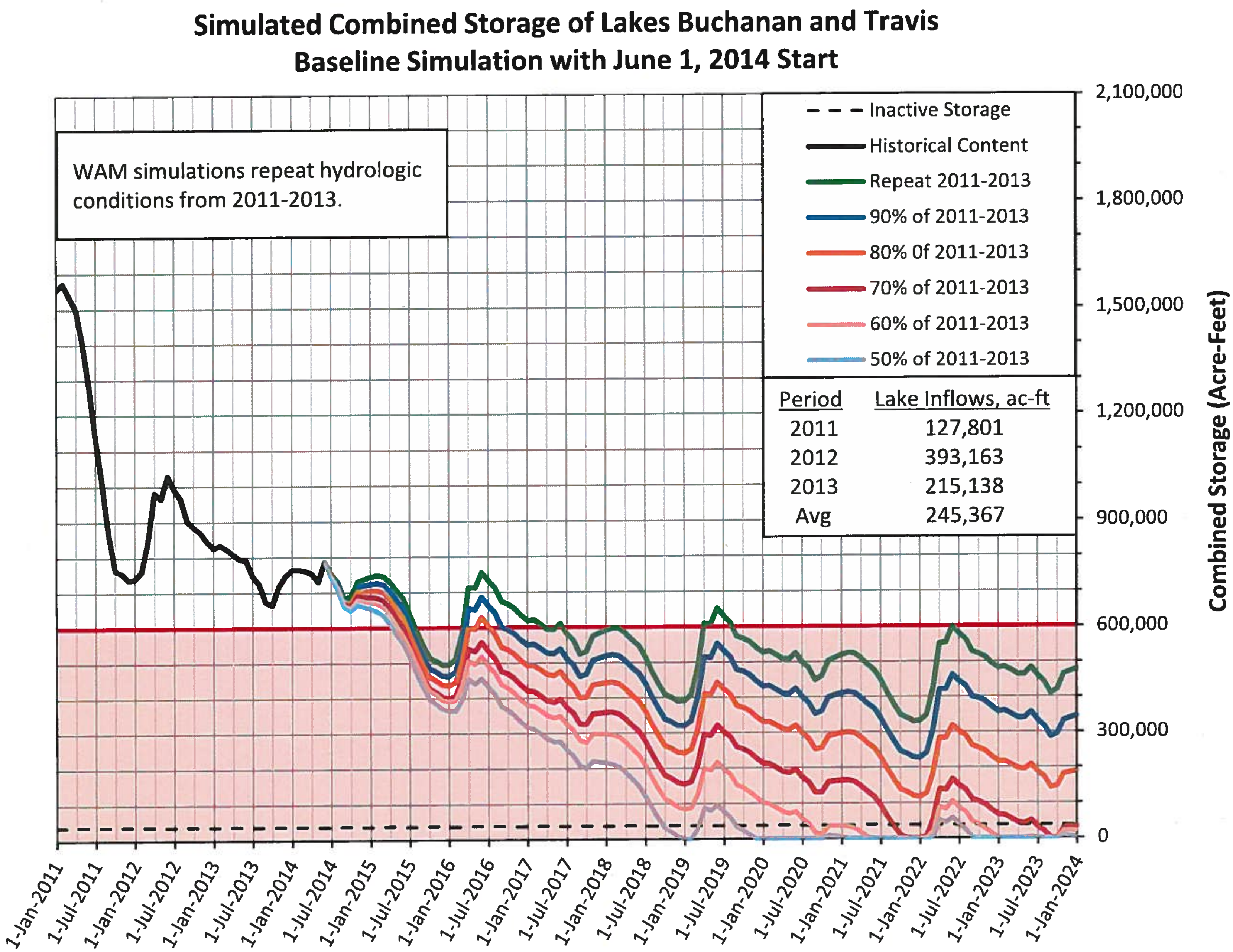
Baseline Modeling Assumptions
(continued)

- Latest Colorado River Basin hydrology dataset from TCEQ is used. The hydrology dataset includes all years of the current drought except for 2014.
- The percent reductions of the 2011-2013 hydrology repeats adjusts stream flows at all gages in the basin by the stated percentage.
- LCRA's groundwater supply in Bastrop county is simulated as a source for meeting power plant demands on Lake Bastrop. LCRA groundwater is simulated as 5,000 afy, and increased to 10,000 afy if drought conditions exist in Bastrop county on January 1 of each year.
- LCRA instream flow and bay & estuary freshwater inflow requirements are reduced in the simulation by 20% and 30% when combined storage falls below 600,000 and 500,000 acre-feet, respectively.
- The Baseline and Strategy Tier simulations do not contain the LCRA Lower Basin Reservoir Project (LBRP). The reservoir is expected to be operational in 2017 and will be located upstream of Bay City.

Simulation Hydrology

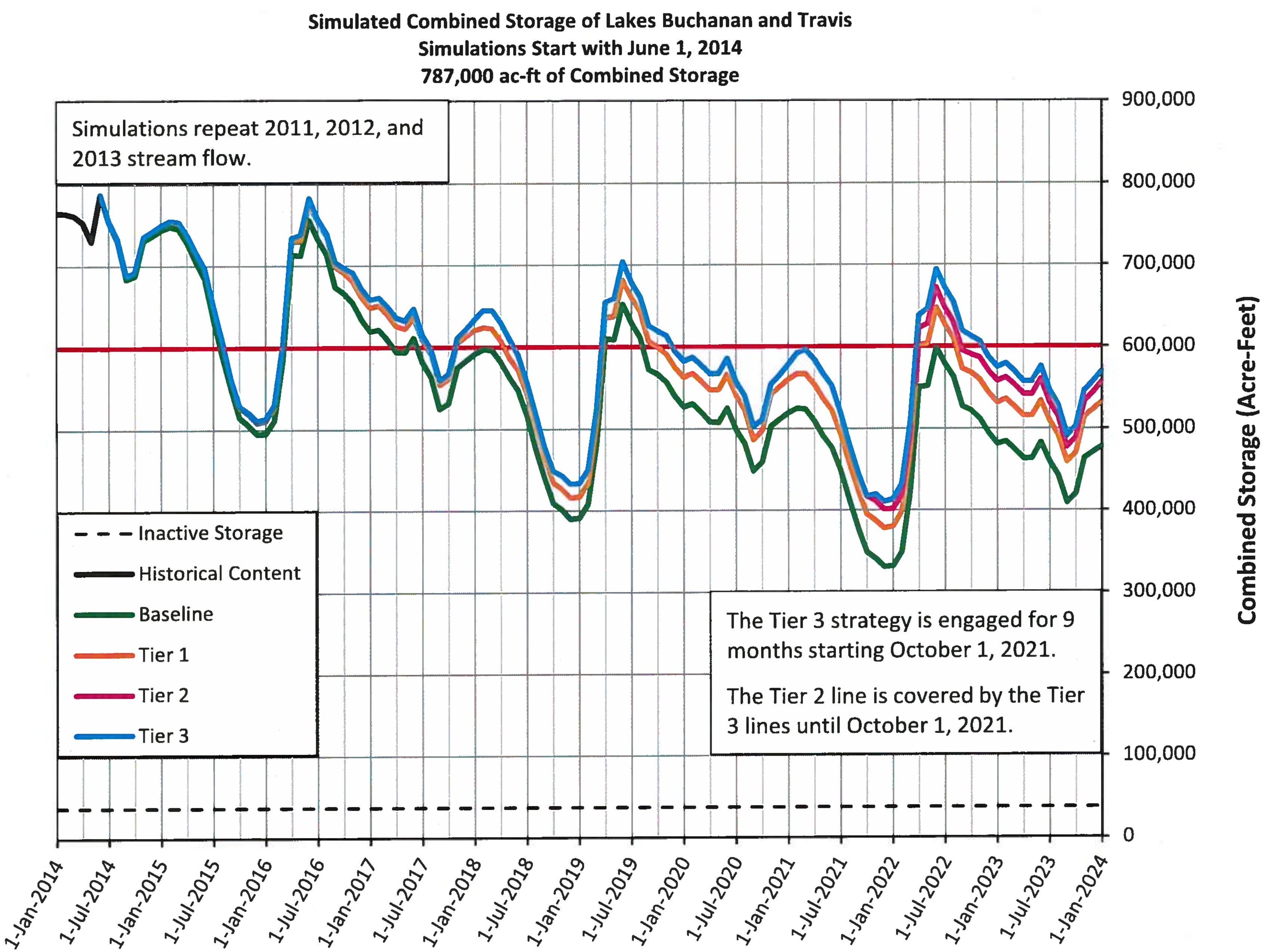
- The baseline and strategy tiers were simulated with two hydrologic conditions repeating for 9 full years.
  The following sequences begin with 2015:
  - 2011-2013 stream flow repeating
  - 70% of 2011-2013 stream flow repeating

- Hydrology for June-December 2014 is simulated by repeating the hydrology of June-December 2013. The 70% stream flow reduction is also applied.



Incorporated into the Baseline result shown here, and all three tier strategies, is implementation of the Austin DCP stages including the conceptual "interim" stage.

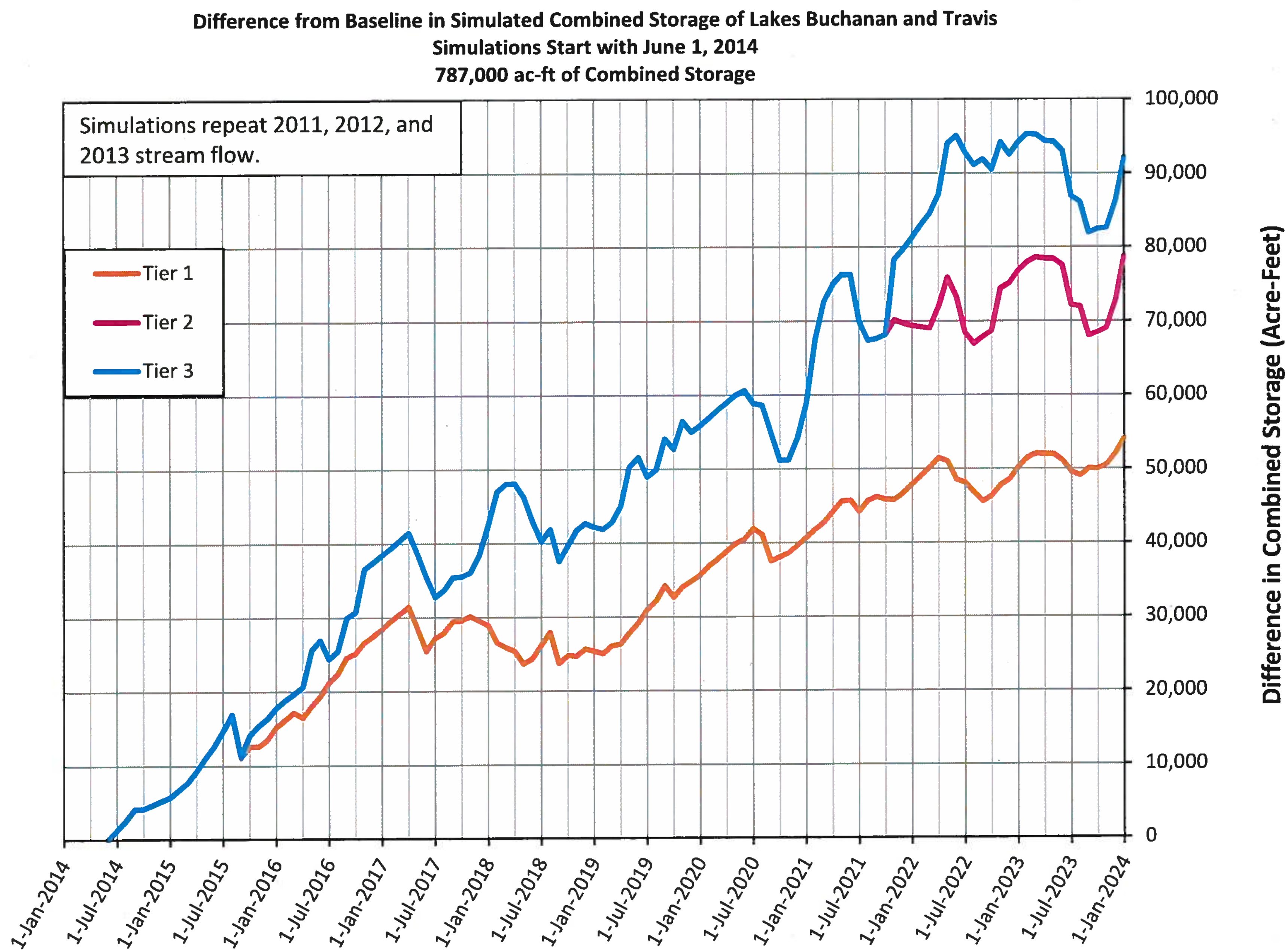
Results for Simulations with Repeat of 2011-2013 Stream Flow


Simulated Combined Storage of Lakes Buchanan and Travis
Simulations Start with June 1, 2014
787,000 ac-ft of Combined Storage
Simulations repeat 2011, 2012, and 2013 stream flow.
Inactive Storage
Historical Content
Baseline
Tier 1
Tier 2
Tier 3
The Tier 3 strategy is engaged for 9 months starting October 1, 2021.
The Tier 2 line is covered by the Tier 3 lines until October 1, 2021.
Combined Storage (Acre-Feet)
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1-Jan-2014
1-Jul-2014
1-Jan-2015
1-Jul-2015
1-Jan-2016
1-Jul-2016
1-Jan-2017
1-Jul-2017
1-Jan-2018
1-Jul-2018
1-Jan-2019
1-Jul-2019
1-Jan-2020
1-Jul-2020
1-Jan-2021
1-Jul-2021
1-Jan-2022
1-Jul-2022
1-Jan-2023
1-Jul-2023
1-Jan-2024

Time Spent at Various Combined Storage Levels

	Baseline	Tier 1	Tier 2	Tier 3
Storage	*Number of Months*			
At or Abv. 600k	32	49	52	55
500 - 599k	45	47	48	47
400 - 499k	31	15	16	14
Blw. 400k	8	5	0	0
	116	116	116	116

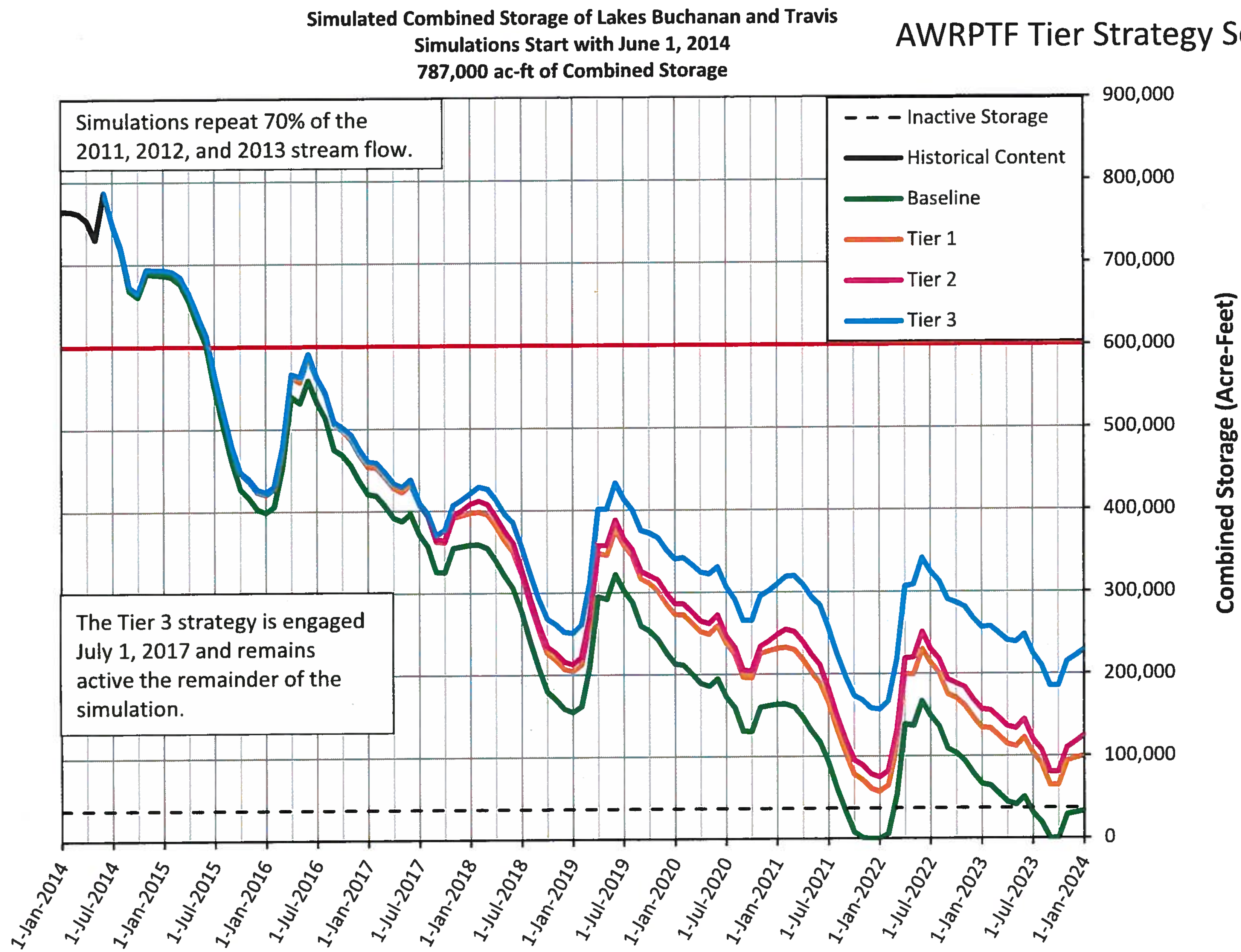
Storage	*Percent of Total Months*			
At or Abv. 600k	28%	42%	45%	47%
500 - 599k	39%	41%	41%	41%
400 - 499k	27%	13%	14%	12%
Blw. 400k	7%	4%	0%	0%
	100%	100%	100%	100%



Difference from Baseline in Simulated Combined Storage of Lakes Buchanan and Travis
Simulations Start with June 1, 2014
787,000 ac-ft of Combined Storage
Simulations repeat 2011, 2012, and 2013 stream flow.
Tier 1
Tier 2
Tier 3
Difference in Combined Storage (Acre-Feet)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1-Jan-2014
1-Jul-2014
1-Jan-2015
1-Jul-2015
1-Jan-2016
1-Jul-2016
1-Jan-2017
1-Jul-2017
1-Jan-2018
1-Jul-2018
1-Jan-2019
1-Jul-2019
1-Jan-2020
1-Jul-2020
1-Jan-2021
1-Jul-2021
1-Jan-2022
1-Jul-2022
1-Jan-2023
1-Jul-2023
1-Jan-2024

Results for Simulations with 70% Repeat of 2011-2013 Stream Flow

AWRPTF Tier Strategy Set



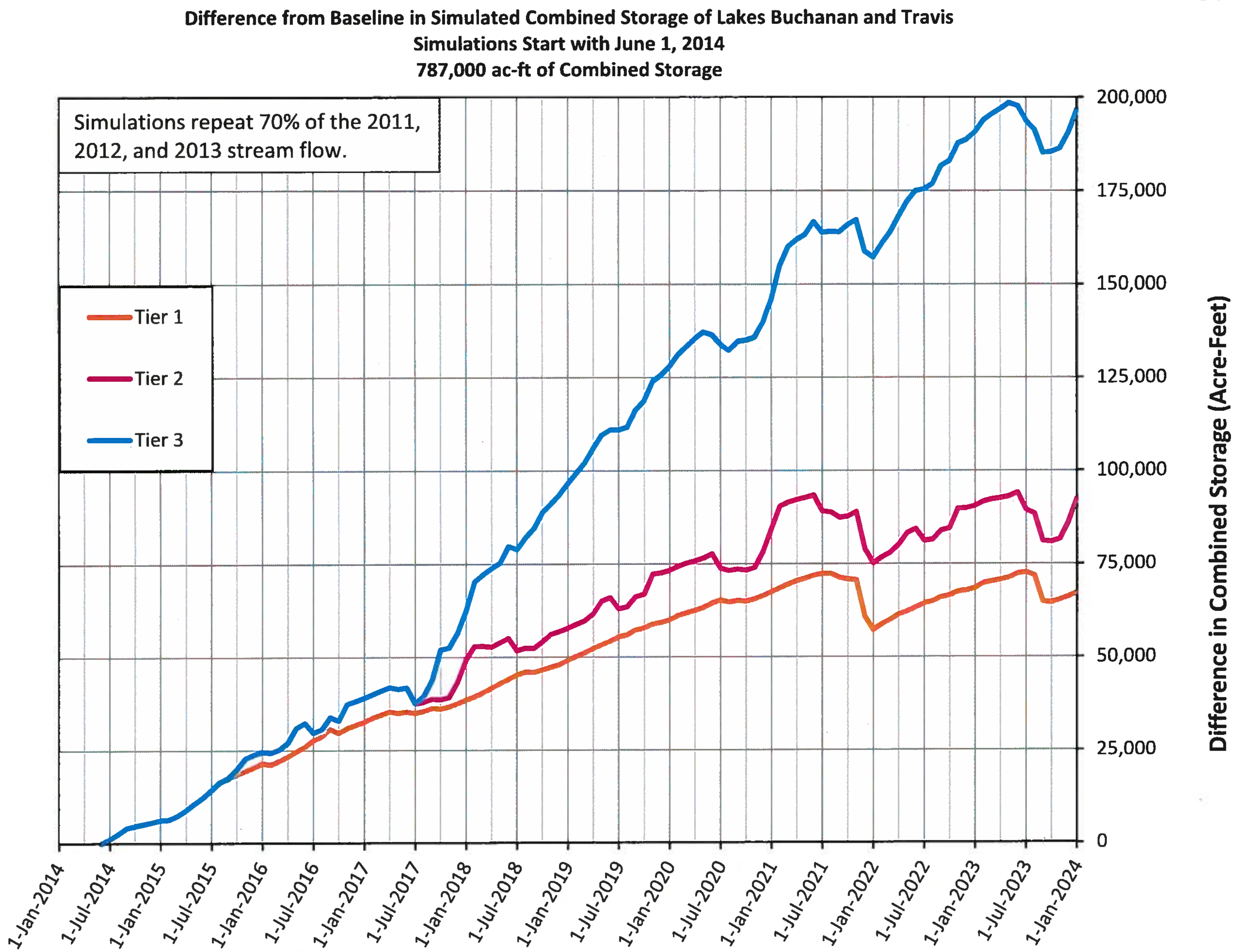
Time Spent at Various Combined Storage Levels

AWRPTF Tier Strategy Set

Storage	Baseline	Tier 1	Tier 2	Tier 3
	Number of Months			
At or Abv. 600k	13	13	13	13
500 - 599k	7	8	9	9
400 - 499k	13	17	20	27
Blw. 400k	83	78	74	67
	116	116	116	116

Storage	*Percent of Total Months*			
At or Abv. 600k	11%	11%	11%	11%
500 - 599k	6%	7%	8%	8%
400 - 499k	11%	15%	17%	23%
Blw. 400k	72%	67%	64%	58%
	100%	100%	100%	100%

AWRPTF Tier Strategy Set



Observations

- As strategies increase combined storage, firm demands and environmental flow requirements can increase. The benefit of the strategy can be measured in:
  - absolute gain in combined storage, and
  - the number of months spent at levels:
    - above the trigger for pro-rata reductions and implementing Austin's DCP stages, and
    - at higher levels of environmental flow maintenance
- The 70% stream flow scenario results in combined storage below 500,000 acre-feet for most of the simulation. Includes assumption pro-rata curtailment reduces instream flow and bay & estuary inflow requirements by 30% at these levels.

Observations (Continued)

- In the model, excess flow capture on Lake Austin, Lady Bird Lake, and at the river pump station for Lake Long increases as the combined storage in the Highland Lakes falls and firm customer demands and environmental flow requirements are curtailed.

- In the model, excess flow capture on Lake Austin, Lady Bird Lake, and indirect potable reuse through Lady Bird Lake work synergistically with operation of Lake Long as an excess flow storage and release facility. Releases from Lake Long increase the number of months when upstream flows can be counted as excess. Likewise, Lake Long releases offset the decrease in return flows below Longhorn Dam due to indirect potable reuse.

Other Considerations

- Certain assumptions were made in the modeling regarding water right permitting and priority order consideration of stream flows. Modifying operations of existing water rights may require application for a water right amendment at TCEQ.

Appendix G

Lake Austin Drawdown Summary

City of Austin – Watershed Protection Department

Lake Austin Drawdown Summary

Prepared by Chris Herrington, PE, City of Austin Watershed Protection Department
Chris.Herrington@AustinTexas.Gov, (512) 974-2840
06/16/2014, revised 06/20/2014

One potential alternative water supply augmentation evaluated by the Austin Water Utility (http://austintexas.gov/sites/default/files/files/Water/Final_Supply-Side_Presentation_AWRPTF_5-19-14.pdf) involves seasonally varying the operating levels of Lake Austin to allow capture of local flows rather than passing those inflows downstream in the Colorado River. Water surface elevation may be decreased up to 3 feet from the crest of the dam under this potential strategy. The normal water surface elevation of Lake Austin is 492.8 ft above mean sea level.

The Texas Water Development Board (TWDB) occasionally conducts bathymetric studies of Lake Austin. TWDB year 2009 lake depth information was used to visually approximate the difference in a 3 foot drawdown of water surface elevations at selected locations on Lake Austin for demonstration purposes. Please note that the lake bathymetry layer does not exactly align with the underlying aerial imagery shown, and the TWDB uses a 5 foot contour interval such that the differing elevations are only generalized approximations.

Figure 1. Downstream Lake Austin near Tom Miller Dam showing approximate location of normal water surface elevation (492.8 ft msl) (yellow) and a 3 foot drawdown (red) proposed for water supply augmentation.

Figure 2. Lake Austin mid-reach near Loop 360 bridge and Bull Creek Cove showing approximate location of normal water surface elevation (492.8 ft msl) (yellow) and a 3 foot drawdown (red) proposed for water supply augmentation.

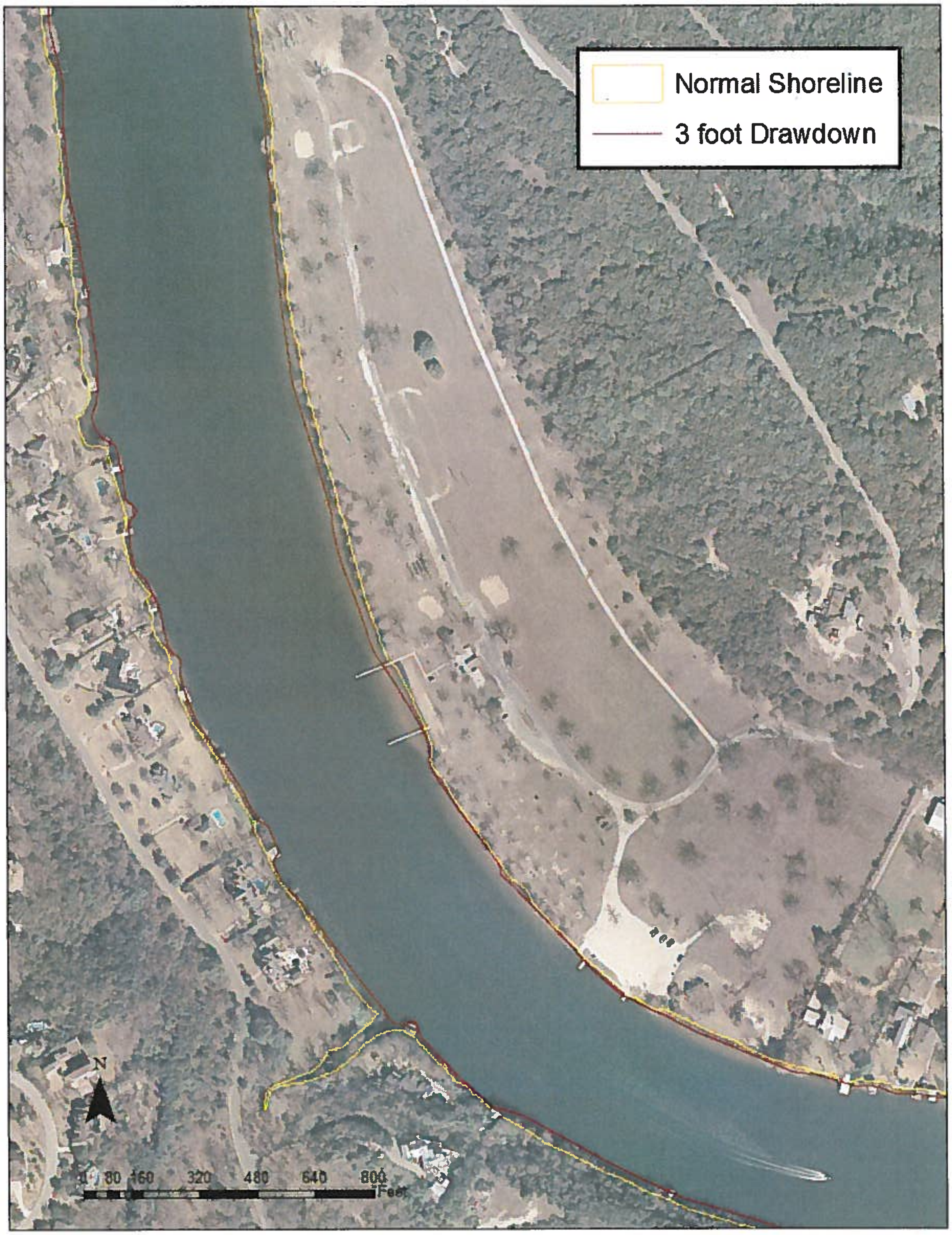


Figure 3. Lake Austin upper mid-reach near Emma Long Metropolitan Park showing approximate location of normal water surface elevation (492.8 ft msl) (yellow) and a 3 foot drawdown (red) proposed for water supply augmentation.

Appendix H

Water Use Modeling Request with Revised Population Estimates

City of Austin – Austin Water Utility

Water Use Modeling Request with Revised Population Estimates

Disaggregated Water Use Categories

Residential Indoor:
FY 11: 10,842,075,705 (54% of class)
FY 13: 11,279,989,930 (70% of class)
Residential Outdoor:
FY 11: 9,238,288,595 (46% of class)
FY 13: 4,776,815,370 (30% of class)

Multifamily Indoor:
FY 11: 7,582,167,600 (80% of class)
FY 13: 7,139,734,800 (79% of class)
Multifamily Outdoor:
FY 11: 1,895,844,800 (20% of class)
FY 13: 1,860,760,400 (21% of class)

Commercial Indoor:
FY 11: 6,691,880,400 (53% of class)
FY 13 7,153,964,400 (67% of class)
Commercial Outdoor:
FY 11: 5,830,801,400 (47% of class)
FY 13: 3,591,125,510 (33% of class)

Wholesale Indoor:
FY 11: 2,227,506,000 (63% of class)
FY 13: 2,197,483,200 (74% of class)
Wholesale Outdoor:
FY 11: 1,286,937,400 (37% of class)
FY 13: 756,792,728 (26% of class)

*Notes
The residential class includes duplexes, triplexes and fourplexes.
The Multifamily class includes fiveplexes and higher.
The indoor/outdoor splits are based on varied assumptions among different user classes.
All indoor/outdoor splits are based on billed consumption of the individual classes.

Large Volume Use:

FY 11:

Samsung - 1,212,413,000

Freescale – 651,613,700

University of Texas – 547,009,600

Spansion – 419,899,000

Hospira – 114,565,000

Novati – 69,790,000

Total – 3,015,290,300

(Total does not include an additional 599,992,400 gallons of University of Texas Commercial class consumption)

FY 13:

Samsung - 1,436,772,000

Freescale – 644,751,000

University of Texas – 464,694,200

Spansion – 389,113,000

Hospira – 83,756,000

Novati – 64,112,000

Total – 3,083,198,200

(Total does not include an additional 384,509,800 gallons of University of Texas Commercial class consumption)

System Use and Losses:

See attached Water Loss Summary

Use Factors

Number of connections

Residential – 193,278

Multi-family – 5,692

Commercial – 16,906

Industrial (Large Volume) – 28

Wholesale - 51

Total connections – 215,955

(Source: TWDB Annual Water Conservation Report for Water Suppliers for the City of Austin FY 13)

Persons per connection

FY13 Residential Service Area Population (projected) – 523,798

FY13 Multi-family Service Area Population (projected) – 350,608

FY13 Wholesale Service Area Population (projected) – 53,620

FY13 Total Service Area Population (Residential+Multifamily+Wholesale projected) – 928,026

(Source for Service Area Population: Utility Billing Dataset)

Average Household Size – 2.49

Average Family Size – 3.27

(Source for demographic data: American Community Survey Profile Report 2012 for Austin)

Per Capita Income

Per Capita Income - $31,130

Median Household Income - $52,453

Mean Household Income -$76,287

(Source for income data: American Community Survey Profile Report 2012 for Austin)

Rainwater Harvesting

Date Range	**System**	**Participants**	**Capacity**
2010 - 2014	Over 500 Gallons	303	799,909
2010 - 2014	Under 500 Gallons	929	140,976
2003 - 2010	Rain Barrel	3,170	401,490
Totals		**4,402**	**1,342,375**

(Source: WCTS query)

Graywater Reuse
2 gravity systems
(Source: Auxiliary Water Permit Search CY12-CY14)
4 systems of unknown type
(Source: Informal staff discussions)

Weather:
Maximum Temperature –
1994 – 104, 07-25
1995 – 103, 07-28
1996 – 102, 06-20
1997 – 100, 08-09
1998 – 108, 06-14
1999 – 106, 07-20
2000 – 112, 08-05
2001 – 105, 07-18
2002 – 102, 07-26
2003 – 110, 07-08
2004 – 101, 07-05
2005 – 107, 08-25
2006 – 104, 07-24
2007 – 100, 07-13
2008 – 105, 07-14
2009 – 106, 06-26
2010 – 107, 08-24
2011 – 112, 08-28
2012 – 109, 06-26
2013 – 108, 06-29

Mean Monthly Max Temp
1994 – 80.1
1995 – 78.8
1996 – 80.1
1997 – 76.4
1998 – 80.5
1999 – 82.1
2000 – 80.6
2001 – 78.8
2002 – 78.9
2003 – 79.9

2004 – 78.9
2005 – 80.8
2006 – 82.9
2007 – 78.8
2008 – 82.9
2009 – 81.8
2010 – 79.5
2011 – 84.0
2012 – 82.6
2013 – 81.3

Precipitation (Calendar year/inches) -
1994 – 41.16
1995 – 33.98
1996 – 29.56
1997 – 46.79
1998 – 39.12
1999 – 23.93
2000 – 37.27
2001 – 42.87
2002 – 36.00
2003 – 21.41
2004 – 52.27
2005 – 22.33
2006 – 34.7
2007 – 46.95
2008 – 16.07
2009 – 31.38
2010 – 37.76
2011 – 19.68
2012 – 32.98
2013 – 41.03
(Source for weather data: NOAA, Mabry Site)

AWU Water Loss Calculation		FY 11		FY 12		FY13				
WATER UTILITY GENERAL INFORMATION										
Water Utility Name:		Austin Water Utility		Austin Water Utility		Austin Water Utility				
Reporting Period:		October 1, 2010 to September 30, 2011		October 1, 2011 to September 30, 2012		October 1, 2012 to September 30, 2013				
Retail Population		855,699		855,869		874406				
SYSTEM INPUT VOLUME										
Water Volume from own Sources		52,834,738,000		47,137,782,000		45,927,345,000		gals	243,014,931,000	
Production Meter Accuracy (%)		98.00%		98.00%		98.00%		pct.		
Corrected System Input Volume		53,912,997,959		48,099,777,551		46,864,637,755		gals	247,974,419,388	
Wholesale Import Volumes		0		71,845,000		88,098,000			159,943,000	
Total System Input Volume		53,912,997,959		48,171,622,551		46,952,735,755			248,134,362,388	
AUTHORIZED CONSUMPTION										
Billed Metered	88 11%	48,165,313,300	89.34%	43,970,260,087	91.28%	41,793,546,138	89.01%	gals	221,481,472,325	
Billed Unmetered	0.70%	187,897,505	0.35%	3,310,877	0.01%	4,265,828	0.01%	gals	650704620.1	222,132,176,945
Unbilled Metered (amount used at AWU buildings/facilities)	0.20%	70,478,800	0.13%	55,684,700	0.12%	56,241,600	0.12%	gals	342911600	
Unbilled Unmetered (amount used by other city Departments	0.43%	94,727,346	0.18%	73,059,820	0.15%	69,148,969	0.12%	gals	563844394	906,755,994
Total Authorized Consumption	89.44%	48,518,416,951	89.99%	44,102,315,484	91.55%	41,923,202,535	89.26%	gals	223,038,932,939	223,038,932,939
Water Losses										
(System input volume minus authorized consumption)	10.56%	5,394,581,008	10.01%	4,069,307,067	8.45%	5,029,533,220	10.71%	gals		
Total Apparent Losses	2 26%	1,062,369,523	1.97%	1,063,431,734	2.21%	1,006,723,469	2.14%	gals	5,353,388,660	
Total Real Losses	8 31%	4,332,211,485	8.04%	3,005,875,333	6.24%	4,022,809,751	8.57%	gals	19,742,040,788	25,095,429,448
Unavoidable Real Losses, in MGD	3.24%	3,982,260	2.70%	4,007,127	3.04%	4,054,298	3.15%	MGD		
Infrastructure Leakage Index (Equals real loss volume (div by 365) divided by unavoidable real losses)		**2.980**		**2.057**		**2.718**				
Retail Price of Water		$4.12		$4.40		$4.53		Cost per 1,000 gal		
Cost of Apparent Losses		$4,376,962		$4,667,768		$4,560,457				
Variable Production Cost of Water*		$0.33		$0.39		$0.41		Cost per 1,000 gal		
Cost of Real Losses		$1,429,630		$1,173,296		$1,662,145				
Total Cost Impact of Apparent and Real Losses		$5,806,592		$5,841,063		$6,222,602				
SAVINGS FROM REDUCING ILI FROM FY08 LEVEL										
Real Water Loss at FY08 ILI		4,742,031,965		4,771,643,318		4,827,814,033			**Cumulative savings**	
Actual real water loss		4,332,211,485		3,005,875,333		4,022,809,751				
Savings in gal		**409,820,480**		**1,765,767,985**		**805,004,282**			**############** gal	
Savings in AF		**1,257.69**		**5418.942969**		**2,470**			**9,836** AF	
Savings in $		**$135,240.76**		**$688,649.51**		**$330,051.76**			**############**	
TWDB reliability assessment score		**69**		**69**		**67.5**				
									5 year average	
Water loss GPCD		17.27		13.03		15.76			16.17	
water loss percentage without wholesale									5 year average % loss	
									10.11%	

Appendix I

Austin Water Needs Estimates

Lauren Ross, PhD., P.E.

Appendix: Austin Water Needs Estimates

The Austin Water Resources Task Force undertook an effort to estimate Austin's water needs based on available historical water use, population, and land use data. Our volunteer efforts fall short of the detailed water needs model that would be part of the recommended Integrated Water Plan. Despite their lack of detail, however, our methods and results provide useful information regarding Austin's historical water use in disaggregated categories and where there are potential for demand reductions. They are also illustrative of the usefulness of such an analysis and for that reason we are including them in this appendix.

Information Sources

Water needs results presented in this appendix are based on information from the following three sources.

Austin Water Utility Data

The Austin Water Utility provided water use information in disaggregated categories for residential (single-family), multifamily, commercial, wholesale and Austin's six largest customers: Samsung, Freescale, University of Texas, Spansion, Hospira, and Novati. Data was provided for fiscal years 2011 and 2013. Each fiscal year begins on October 1 and extends through September 30. This data is included in the preceding appendix.

Water consumption data for residential, multifamily, commercial and wholesale uses were disaggregated into outdoor and indoor uses. This disaggregation is based on water use differences between low (winter) months and other months when landscape irrigation is more common. This disaggregation process produces inaccurate estimates. Utility customer irrigation meters show some irrigation occurs in every month. This information is, however, the currently best available and was used in this analysis.[1]

Austin Water Utility also provided information regarding the number of people served in three of its customer classes. This information is presented in Table 1.

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[1] Based on conversations with water utility staff.

Table 1 Austin Water Utility Customer Population

Customer Class	Fiscal Year 2011	Fiscal Year 2013
Single-Family	503,463	523,798
Multi-Family	336,996	350,608
Wholesale	51,538	53,620
Total	**891,997**	**928,026**

Austin Geographical Information System Data

The City of Austin makes GIS data available to the public. GIS data include information on the Water Utility service area, on land use, and on impervious area: buildings and transportation. These GIS data were used to calculate pervious and impervious areas by land use class within the utility service area. Table 1 summarizes these data.

Table 2. Land Use within Austin Water Utility Service Area

Land Use	Pervious (acres)	Building (acres)	Transportation (acres)	Total Area (acres)
Single-Family	49,741	9,689	690	60,119
Multi-Family	6,187	1,980	2,000	10,167
Commercial	5,289	1,374	3,245	9,908
Industrial	8,947	1,324	2,549	12,820
Civic	8,522	998	1,434	10,954
Other	227,088	1,809	19,334	248,232
Total area	305,773	17,174	29,253	352,200

Figure 1 shows the land use within the Austin Water Utility boundary. Figure 2 is a map showing impervious area surrounding the Waller Creek Center at 625 East 10th Street. The size of pervious areas for land uses associated with each customer class were used to calculate outdoor water demands.

Evapotranspiration Data

The Texas AgriLife Extension Service[2] maintains potential evapotranspiration data based on weather stations around the state. These data are used to estimate irrigation demands for a wide range of vegetation, including turf and landscape plants. The periods of record

[2] http://texaset.tamu.edu/.

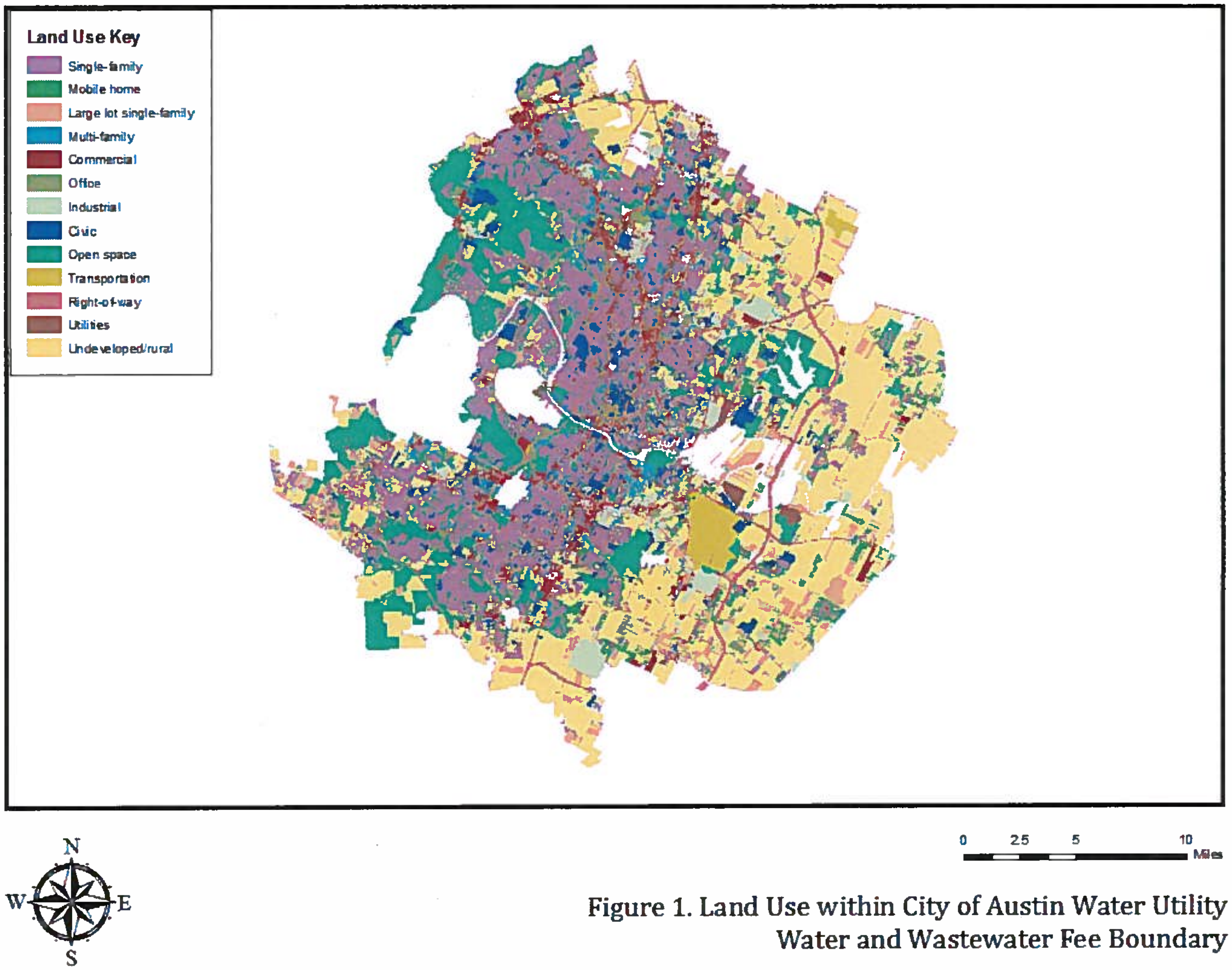


Figure 1. Land Use within City of Austin Water Utility Water and Wastewater Fee Boundary

June 14, 2014

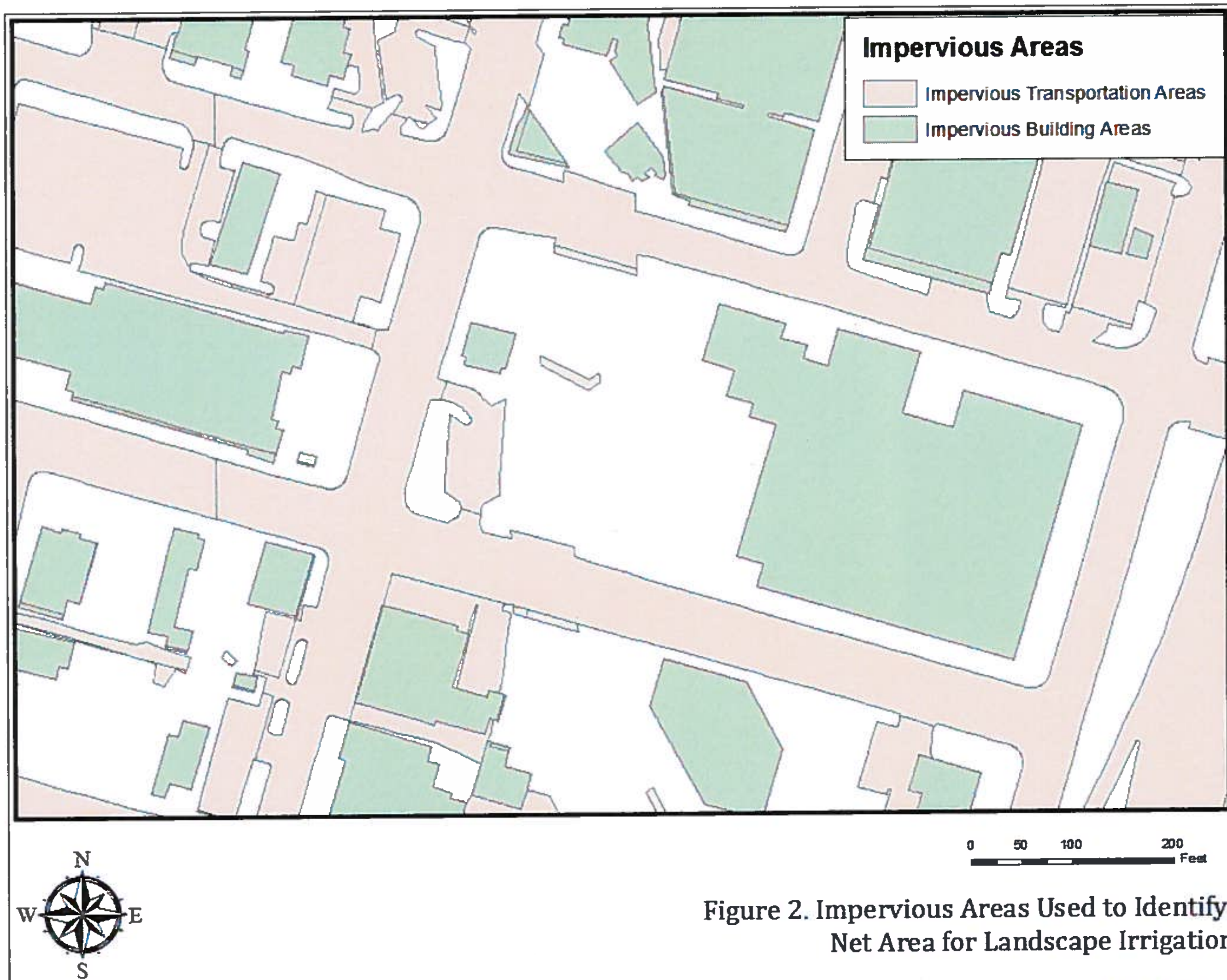
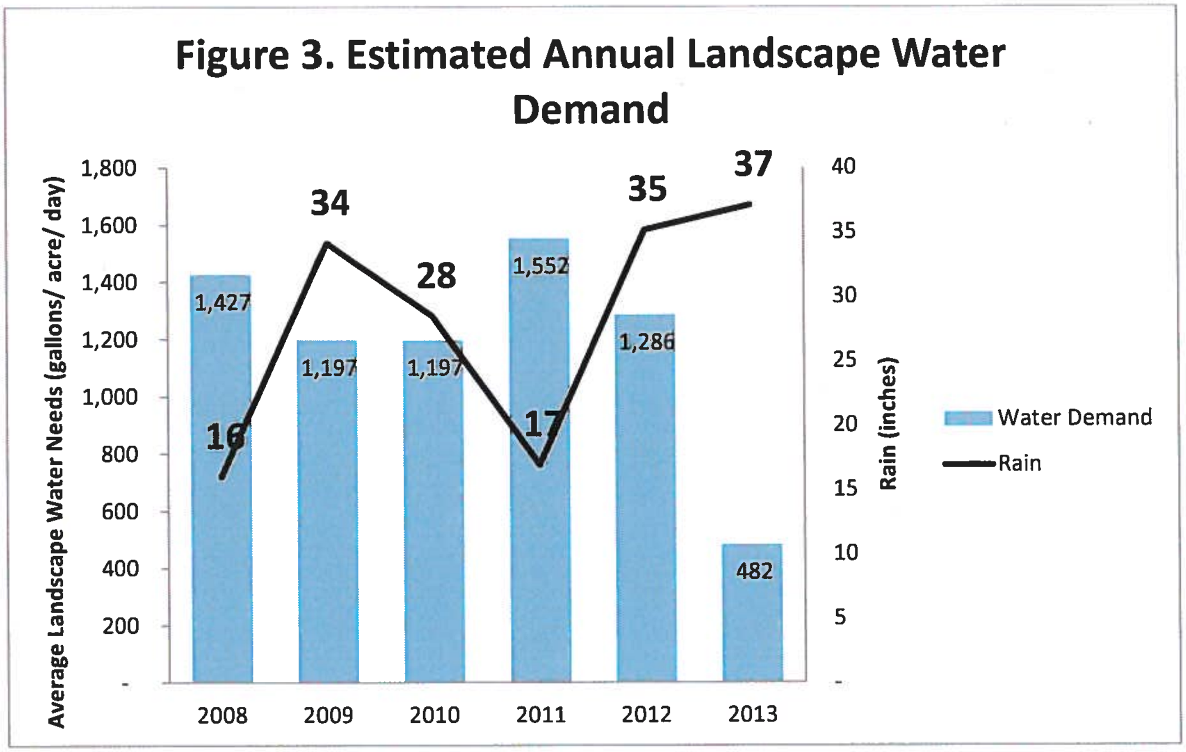


Figure 2. Impervious Areas Used to Identify Net Area for Landscape Irrigation

June 14, 2014

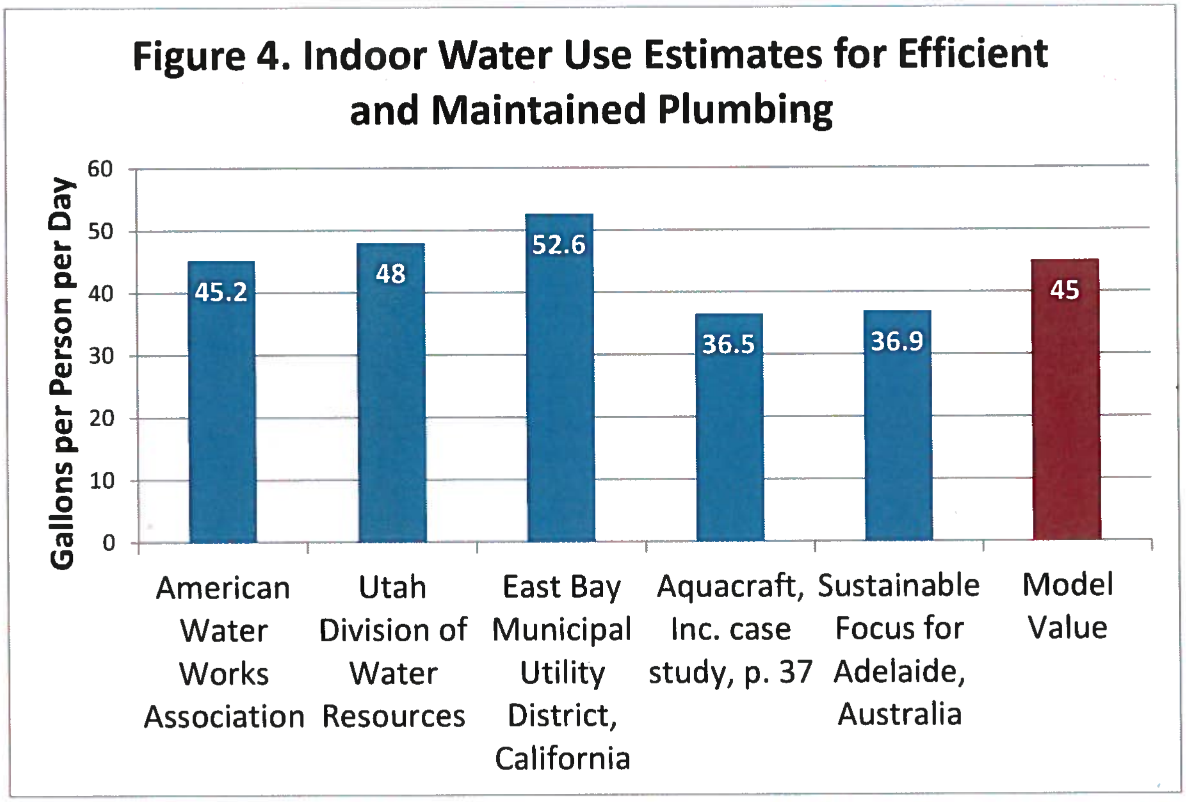
for potential evapotranspiration stations across Texas are varied. A time series of daily potential evapotranspiration was compiled from four Central Texas Stations: Georgetown; Austin; Austin Morrison; and San Antonio North. For days without data from any of these stations, potential evapotranspiration data was calculated using the Hargreaves equation. Irrigation demands were calculated using a warm season turf factor (0.6) and a high stress quality factor (0.4).

Figure 3 shows estimated annual landscape water demands for each year from 2008 through 2013, along with the total rainfall amounts in each year.



Indoor Water Use for Efficient and Maintained Residential Plumbing

Information was obtained from five different sources regarding the daily water use for households using efficient and well-maintained residential plumbing. Daily water use values ranged from 36.5 to 52.6 gallons per person per day. Data from these sources is charted in Figure 4.

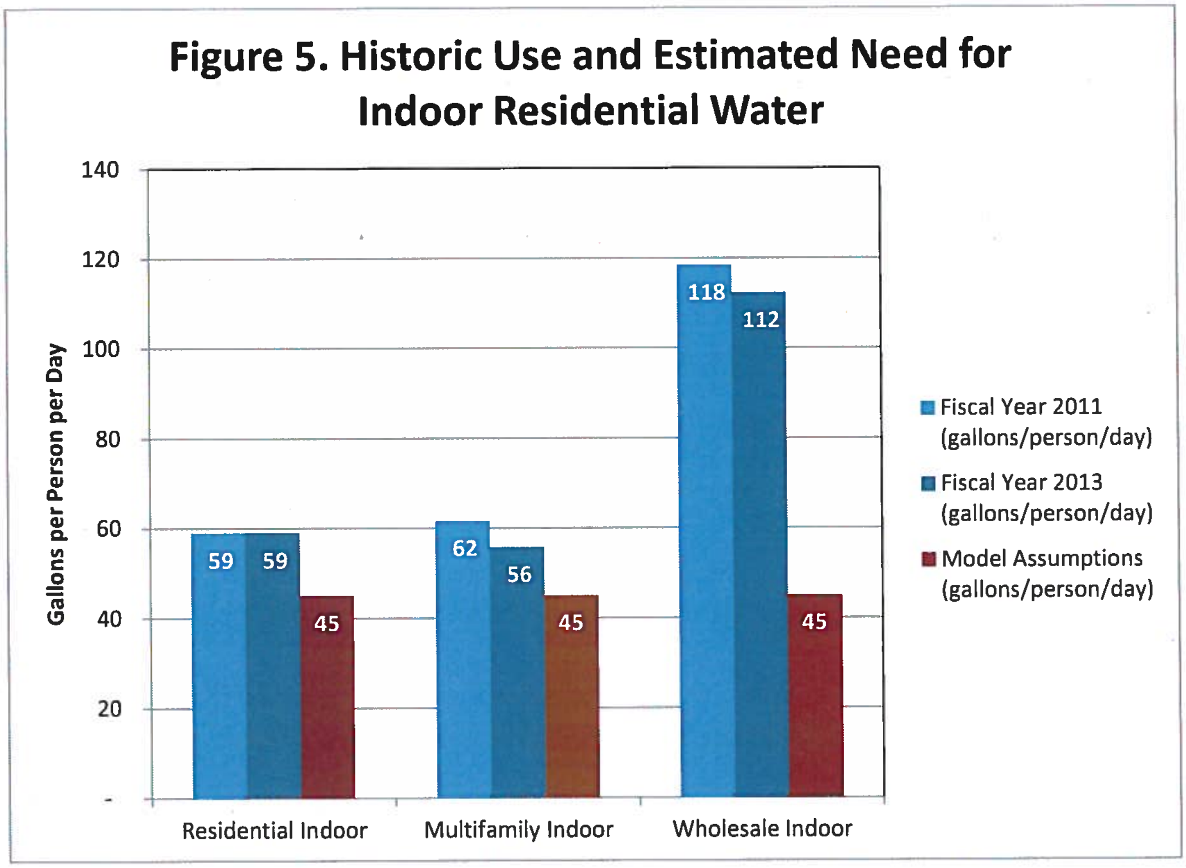


Analysis

The information described above was used to calculate indoor and outdoor water use per person per day for residential, multi-family, and wholesale customers. An estimated need was also calculated for indoor residential use based on 45 gallons per person per day. This value is lower than historical use, but well within the range of achievable indoor water efficiencies. Figure 5 compares historical daily use in fiscal years 2011 and 2013, in terms of gallons per person per day, to the estimated indoor need.

This chart shows that water use for all residential customer classes exceeds the standard for efficient indoor plumbing.

The estimated need for outdoor water use was based on 400 gallons per acre per day for pervious areas in each of the corresponding land use classes. This value is approximately one-third of average landscape irrigation demand values for years 2008 through 2012 shown on Figure 3. The year 2013 was wetter than usual and outdoor demands were corresponding lower.



Outdoor water demand for each customer class was calculated by multiplying 400 gallons per acre per day by the number of pervious acres in land use areas associated with that customer class in Table 2.

Water demand in fiscal years 2011 and 2013 are compared to the estimated water need in Table 3 and in Figure 6. The data show that water demands in fiscal year 2013 were 12,630 acre-feet higher than this calculation of the needed water amount, including some landscape irrigation. Most of this water savings would be achieved by reducing residential and multi-family indoor water use.

Table 3. A Comparison of Fiscal Years 2011 and 2013 Water Demand with an Estimated Water Need by Customer Class

Class	Fiscal Year 2011	Fiscal Year 2013	Estimated Need
Residential Indoor	33,275	34,619	26,405
Residential Outdoor	28,353	14,661	22,288
Multifamily Indoor	23,270	21,913	17,674
Multifamily Outdoor	5,819	5,711	2,772
Commercial Indoor	20,538	21,956	
Commercial Outdoor	17,895	11,022	6,379
Wholesale Indoor	6,836	6,744	2,703
Wholesale Outdoor	3,950	2,323	2,323
Six Large Customers	9,254	9,463	
Civic Outdoor		-	3,819
Total Customer Demand	149,191	128,411	115,781

Figure 6. Austin's Historical Water Use and Estimated Need by Customer Class