MEMORANDUM

To: Mayor and Council Members

From: Greg Meszaros, Director, Austin Water

Date: June 6, 2014

Subject: Drought Response Strategies Including Alternative Water Source Options

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This memorandum and attached report is to follow-up on the Austin Water October 3, 2013 drought briefing and report back to Council on Resolution No. 20140327-039 approved on March 27, 2014. This resolution directed staff to provide a comparative analysis of a variety of alternative water source options, including short-, mid-, and long-range needs, and the costs, reservation options, funding options, and planning timelines associated with each.

Also approved by Council at its April 10, 2014 meeting is Resolution No. 20140410-033, which created the Austin Water Resource Planning Task Force (Task Force). This Task Force convened its first meeting on May 5, 2014 and is being supported by Austin Water and Watershed Protection. In accordance with its charge from Council, the Task Force will be working to evaluate the City's water needs, to examine and make recommendations regarding future water planning, and to evaluate potential water resource management scenarios for Council consideration.

The attached report includes the following sections:

- Drought Status Update
- Drought Response Framework
- Drought Response Strategies
    1: Austin Demand-Side Management
    2. Protect Colorado River System Firm Water Interests
    3. River and Reservoir System Operational Enhancements
    4. Water Supply Augmentation Options – Alternative Groundwater Supplies
- Other Mid to Long-Term Alternatives
- Drought Response Plan Development

Austin Water plans to continue working with the Austin Water Resource Planning Task Force over the coming weeks as the Task Force develops recommendations for Council consideration, based on the June 20th Task Force report deadline. Austin Water is currently focusing on short-term drought response strategies within a broad view of mid

to long-term options. Austin Water plans to continue evaluating options and shaping drought response plan options with input gained through the Task Force process.

Should you have any questions or comments, please do not hesitate to contact me.

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

Drought Response Strategies including Alternative Water Source Options

Report to City Council

June 2014

(Council Resolution No. 20140327-039)

Austin WATER

Drought Status Update:

The major drought the Colorado River basin is experiencing is continuing to deepen and may continue to do so for years into the future. Accordingly, Austin Water's current focus has turned to evaluating short-term drought response strategy options.

Extremely Low Inflows to Lakes Travis and Buchanan Continue:

The January-April 2014 period is the all-time driest January-April stretch since the lakes were built. The inflows of 35,529 acre-feet (AF) during this 4-month period is considerably lower than the 2011 total of 60,450 AF or the 2013 total of 45,777 AF for this same period of months. One acre-foot equals 325,851 gallons. The January-May 2014 period is the sixth driest January-May stretch since the lakes were built. The monthly inflows for January 2011 through May 2014 are shown in Attachment A.

Inflows to lakes Travis and Buchanan are a key measure of the drought's intensity. The top three all-time lowest inflow years in the period of record have occurred since the start of the drought in early 2008. These low inflows are considerably lower than the lowest annual inflow during the 1950's drought of record (501,926 AF in 1950). The extreme low inflows of 2011 were only 10% of the average annual inflow since lakes Travis and Buchanan were first filled in the early 1940's. The following is a table of the top 10 lowest inflow years. These inflows represent the volume of water flowing in to lakes Travis and Buchanan on an annual basis.

Rank	Year	Annual Total in Acre-Feet
1	2011	127,801
2	2013	215,138
3	2008	284,462
4	2006	285,229
5	1963	392,589
6	2012	393,163
7	1983	433,312
8	1999	448,162
9	2009	499,732
10	1950	501,926
Average Annual Total	1942 to 2013	1,230,284

The attached graph (Attachment B) shows the cumulative inflow into lakes Travis and Buchanan since March 2008 as compared to the cumulative inflow in the 1950's drought of record. The current cumulative volume of inflow is approximately 1.7 million AF below the cumulative inflow through the same number of months in the drought of the 1950's. These extreme low inflows represent uncharted territory for drought in this basin. The cumulative total of inflows to the lakes through the drought is a key hydrological measure of the drought's intensity and duration.

Combined Storage Volume and Forecast:

Another key measure of the drought's duration is the combined storage volume of lakes Travis and Buchanan. As of June 2, 2014, the current combined storage was approximately 789,000 AF (39% of full). Note that the combined storage volume was approximately 709,000 AF (35%) just prior to the Memorial Day weekend rain event. When full, the lake storage volume is 2 million AF. The reservoirs were last full near the start of 2008, which marks the start of the current drought.

Based on their May 2014 projection, if drought conditions persist, the Lower Colorado River Authority (LCRA) projects that the combined storage will drop below 600,000 AF this summer in the July/August time-frame (see Attachment C). With rains received in the past 2 weeks, it is likely that the June projection update will show a change to this timing. For reference, the lowest all-time combined storage volume was 621,221 on September 9, 1952. Last summer the combined storage reached as low as 637,046 AF on September 19, 2013. Attachment D shows a graph of combined storage volumes since January 2005. The following table shows the March 1st combined storage volume of lakes Travis and Buchanan over the past 5 years.

Year	March 1st Combined Storage in Acre-Feet
2010	1,652,638
2011	1,534,658
2012	846,820
2013	822,364
2014	761,448

Drought Conditions and Weather Outlook:

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service Climate Prediction Center - United States seasonal drought outlook projects drought to persist or intensify over a large portion of the mid to western parts of the state including in the Highland Lakes region through July 2014.

With continued drought conditions, the combined storage volume is on a path to cross 600,000 AF of combined storage in mid to late summer. This would trigger a declaration of a "Drought Worse than the Drought of Record" by LCRA's Board. This declaration would trigger LCRA pro-rata curtailment of firm water customers at an initial 20% reduction off of a baseline demand as recorded from September 2010 through August 2011. LCRA has indicated that 30% or more pro-rata curtailment requirements could be required at lower combined storage volumes. Specific LCRA combined storage volumes for deeper pro-rata curtailment levels have thus far not been established by LCRA's Board.

The National Weather Service projects that there is a greater than 50% chance that El Niño conditions could return in the Pacific Ocean and this could generate wetter weather probabilities for this fall and winter. However, the State Climatologist, Dr. John

Nielsen-Gammon has said that while there may be short periods of wetter conditions, the drought could last for years into the future.

Austin Water is also aware that the Texas drought could be part of a permanent shift in climate and many of the options laid out below, along with the Utility's conservation efforts, should also be considered efforts at adaptation to climate change.

Current Drought Response Efforts:
Austin has been in Stage 2 restrictions nearly continuously since September 2011 and has already been meeting its initial 20% water use reduction goals consistent with LCRA-approved pro-rata firm customer curtailment goals in both years 2012 and 2013. As part of its firm water customer pro-rata curtailment plan process, LCRA confirmed over 26,000 AF of documented annual water savings in the "reference year" (September 2010 through August 2011) from Austin's water conservation programs, including water reuse. Based on these documented annual water conservation savings plus Austin's estimates of additional water saved through Stage 2 implementation, Austin has saved more than an estimated 107,000 AF since September 2011 (over the last ~2.6 years). Austin's water savings contributed substantially to keeping the combined storage above the 600,000 AF emergency level in September 2013.

In accordance with Austin's Drought Contingency Plan (DCP), Austin is prepared to implement Stage 3 restrictions when the combined storage volume of lakes Travis and Buchanan falls below 600,000 AF. It is estimated that Austin's water diversions will decrease by an additional 19,000 AF per year (approximately), as compared to Stage 2 (based on FY 2015 estimates). Stage 3 allows 1-day per week watering but further restricts watering hours and includes other additional restrictions.

Drought Response Framework:

Goals:
To help frame drought response plans, Austin Water is the process of developing overarching goals, in addition to the drought response demand side stages already in place and being executed. These include:

- Water supply availability through duration of this unprecedented drought, which could last years into the future
- Work toward stabilizing Highland Lakes water supply in coordination with other basin users
- Consider options that create a multi-faceted response plan

As drought response plans are developed, it is critical that response strategies be viewed and understood in a basin-wide context. LCRA's Water Management Plan (WMP) is a key factor in understanding benefits and risks associated with implementation of essentially all potential drought response strategies. LCRA's WMP is the TCEQ-approved operational plan that LCRA follows in managing the stored water in lakes Travis and Buchanan.

LCRA's WMP includes interruptible supply curtailment levels and combined storage triggers that determine the amount of interruptible stored water to be provided to downstream interruptible agricultural water customers. While LCRA has been granted Emergency Orders (EO) to deviate from its current WMP such that in 2012, 2013, and 2014 the majority of downstream interruptible agricultural use has been cut off, the combined storage trigger levels and other provisions in the WMP or EO play a critical role in how LCRA manages the supply of water in the lakes.
In addition to lining out procedures related to interruptible stored water supply, LCRA's WMP includes provisions governing the manner in which LCRA provides water from lakes Travis and Buchanan to address environmental flow needs. LCRA has set aside a portion of its firm supply to be used to help maintain environmental flows, which include both instream flows and bay and estuary inflows.

As an example of the interconnectedness of the basin system and LCRA's current WMP, Austin could implement an additional drought response strategy that results in saving more water in the lakes which could, in turn, under some hydrologic conditions, result in the lakes reaching a high enough level to trigger a massive interruptible stored water release for downstream use, under the WMP or EO. Such a scenario has a risk of resulting in less stored water availability compared to not implementing the drought response strategy.

Similarly, the State's surface water rights system is based on priority order with time seniority determining a right's place in the priority system. This is sometimes referred to as a "first in time, first in right" system. Austin has some of the most senior water rights in the basin and has key agreements with LCRA whereby LCRA has agreed to subordinate a significant portion of LCRA's agricultural run-of-river rights to Austin. This means that even though the priority dates of some of those rights may be senior to Austin's, Austin still gets to take its water before these particular water rights. Still, there are significant downstream water rights that are senior to Austin's.

In order to evaluate drought response strategy options in this basin-wide context, Austin Water, through its consultant, uses a basin-wide Water Availability Model (WAM) for the lower Colorado River Basin. The WAM is a computer modeling platform and decision-support tool used state-wide in the state's various river basins to model surface water availability under varying hydrologic conditions.

Drought Response Strategies:

To help evaluate and develop drought response plans, Austin Water is in the process of exploring a wide-range of response strategies in a variety of categories including:

1. Demand-Side Management: staged drought restrictions
2. Protection of firm water interests: LCRA WMP revisions and Emergency Orders
3. River and reservoir system operational enhancements
4. Water Supply Augmentation and New supply options

Drought Response Strategy 1: Demand-Side Management

Demand-side management through implementation of Austin's Water Conservation Program and Drought Contingency Plans, as well as continued development of water reuse, are Austin's core water management strategies for the short, mid, and long-terms. As Austin Water continues to develop water management plan strategies and drought response plans, it is anticipated that these strategies will continue to be central to the mix of options and plans going forward.

City of Austin Water Conservation, Reuse, and Drought Contingency Plan:
Together, Austin's water conservation and water reuse programs are currently resulting in at least 26,000 AF of baseline annual water savings, including water loss reduction and water reuse, as documented in the LCRA's pro-rata curtailment plan development process. In addition, Austin has been in Stage 2 watering restrictions nearly continuously since early September 2011 (in Stage 2 for the last approximately 2.6 years), which alone has resulted in additional cumulative savings of an estimated 39,000 AF.

Austin's community response to water conservation and the drought continues to be significant. Last year, Austin's water use in terms of gallons per capita per day (GPCD) was 136 GPCD. This GPCD is reflective of a trend which is on path to meet Council's goal of reducing total water pumpage to 140 GPCD by 2020. As shown in the attached GPCD graph (Attachment E), Austin's total pumpage GPCD has decreased by 17% in 5-year rolling average since FY 2006.

In addition to what has already being accomplished through years of implementing its Water Conservation Program, the Utility is committed to increase water conservation into the future. Effective conservation programs have been and continue to be a major component of the City's commitment to water use efficiency and sustainability.

Austin Water is committed to continuing to explore various decentralized and auxiliary water options, including increased use of rainwater harvesting. The Utility plans to continue implementing programs to strengthen rapid leak response and leakage reduction, as well as evaluating new ways to further improve these programs.

As the Utility continues to expand water conservation options, efforts will be made to continue to encourage transformation to drought tolerant landscapes, including through rebates as part of the Grow Green program (managed by Watershed Protection). Conversion to drought tolerant landscapes is considered a short, mid, and long-term strategy with savings that will build over time. Austin Water is also working with builders to expand options for drought tolerant landscapes in new home construction.

While continuing to expand the reclaimed water system, discussed in more detail below, through the "Completing the Core" program, the Utility is also exploring expanding the use of reclaimed water, such as for toilet flushing and cooling on a wider-basis than currently.

DCP Implementation:

As the drought continues to deepen, Austin Water is prepared to implement further demand-side management levels through staged drought restrictions that are in Austin's DCP. The following table shows the estimated water demand for FY 2014 through 2019 under Stages 2 through 4 of the City's DCP:

Projected Demand in Thousand Acre-Feet

Stage	2014	2015	2016	2017	2018	2019
2	141.9	144.5	145.7	147.0	148.3	149.7
3	124.5	125.5	126.8	128.3	129.7	131.1
4	99.7	100.3	101.2	102.5	103.5	104.6

In accordance with Austin's DCP, Stage 3 is planned to be implemented when the combined storage volume of lakes Travis and Buchanan drops to 600,000 AF. As the table above indicates, it is estimated that in Stage 3, Austin's demand will drop to a level in the range of approximately 125,500 AF (based on estimates for 2015). Since the City has never implemented Stage 3, in which watering is allowed one day per week but with reduced hours compared to Stage 2, only after implementation will the actual level of demand reduction be observed. Accordingly, future adjustments to water savings estimates associated with Stage 3, and others, may need to be made.

While demand-side drought response management is critically important and planned, there are a considerable number of issues associated with prolonged deep levels of DCP implementation. Additionally, even with prolonged deep levels of DCP implementation, projections and estimates show that demand-side strategies cannot alone address the full range of issues and requirements this drought is placing on the systems, both on a river basin-scale and on an Austin distribution system-scale.

To help illustrate the scale of outdoor watering, the table below shows actual 2013 demand (rounded to the nearest 100 AF), which totaled approximately 142,000 AF, compared to the total if every month's consumption was like winter, during December 2013, for example, when outdoor uses are considerably reduced compared to other seasons of the year. The total of 12-months at winter use levels is 115,000 AF. The difference between these two conditions is in the range of about 30,000 AF less than current Stage 2 restriction levels. Therefore, we can estimate that outdoor watering is about 30,000 AF which is about 21% of our annual consumption (under Stage 2).

Austin's Monthly Municipal Demand (in AF)

Month	Stage 2 2013	Every Month Like Winter 2013
1	10,400	9,600
2	9,700	9,600
3	11,600	9,600
4	11,000	9,600
5	12,100	9,600
6	13,300	9,600
7	13,900	9,600
8	15,300	9,600
9	13,300	9,600
10	11,400	9,600
11	9,900	9,600
12	9,600	9,600
Total	142,000	115,000

Austin Water is considering proposing an interim level associated with Stage 3, to potentially be implemented prior to implementing Stage 4, which is a full cut off of outdoor uses. The concept for the interim level is to allow hand-watering only in order to help in our community's efforts to preserve the tree canopy and maintain other essential life-lines to outdoor uses.

In planning for on-going response to the drought, should it continue to deepen, concerns associated with prolonged Stage 4 DCP implementation are being discussed with the Task Force. Stage 4 includes a full cut off of outdoor watering. There are concerns about increased potential for water distribution and wastewater collection system operational impacts (these are briefly discussed below in the "Drought-related Operational Impacts" section), as well as community impacts such as protection of the tree canopy and landscape, dust suppression, and other potential impacts. There has been discussion of developing a drought response plan goal of planning steps to minimize the amount of time that Stage 4 may need to be implemented. Austin Water staff will continue to work with the community and the Austin Water Resource Planning Task Force to develop this goal concept as drought planning proceeds.

<u>Drought-related Operational Impacts:</u>
Austin Water is experiencing and managing a wide-range of drought-related operational impacts. A number of the key issues are discussed below.

The drought has led to changes in raw water quality. These changes have resulted in prolonged higher levels of algae that can lead to taste and odor issues, increased total trihalomethane formation, and increased hardness. With the on-going drought and increased chlorine usage, the Utility continuously monitors and makes adjustments to manage these issues, including trihalomethane formation. Trihalomethane is a byproduct of the disinfection process that has suspected carcinogenic effects and is regulated by the EPA and TCEQ. As a result, chemical demand has increased which has resulted in increased use of powdered activated carbon (PAC) and disinfection chemicals.

In the water distribution system, lower flows in prolonged Stage 2 watering restrictions have led to longer water age and residence time in the system. The system has more than 3,700 miles of water pipes and 39 storage tanks, which are designed to handle peak demands and fire flows. As flow decreases through the pipes due to deepening water restrictions, including possible cutoff of outdoor watering, conditions can occur with disinfection residuals dissipating and dropping below State minimum requirements, particularly in warmer weather.

Accordingly, it has been necessary to raise chlorine residuals. Prior to FY 2010, the target for chlorine residual leaving the plant was 2.2 mg/l. In December 2010, this target was increased to 2.5 mg/l and then again raised to 2.75 mg/l for 4 months in 2013. Additionally, if disinfection residuals drop too low in the distribution system, it may be necessary to flush to freshen the water in the system, take storage tanks off-line and drain them, or keep storage tanks off-line. On the wastewater-side, there are effects that include increased strength of influent stream to wastewater treatment plants. Austin Water continues to monitor the systems and will take necessary steps to manage accordingly. However, it is expected that Austin Water will experience challenges in the operational arena that have not been experienced since Austin has not previously implemented Stage 3 or even deeper levels of water use restrictions, Stage 4.

<u>Leak Response:</u>
Austin Water has implemented an active leak control program including leak detection services. In the last 2 years, 1,500 miles of water mains have been inspected using acoustic technology. Large diameter main leak detection started three years ago. In 2012, the Utility launched Renewing Austin, a 5-year water main rehabilitation and replacement program to upgrade aging water mains. The program represents approximately $125 Million in investment to rehabilitate or replace about 75 miles of water pipe. Additionally, the Utility has been aggressively pursuing improvements in leak response and repair. In FY 2009, Austin Water added a second shift to its leak response. Now most leaks are repaired in one day or less. Attachment F shows the leak repair

Austin's Infrastructure Leakage Index (ILI) is shown on Attachment G. According to TWDB guidance, the ILI is the ratio of real losses over the unavoidable annual real losses. The lower the amount of leakage and real losses that exist in the system, the lower the ILI will be. Austin's ILI has been in the range of 1 to 3 for the past 4 years. A target range

of 1 to 3 is one of the most efficient, according to the American Water Works Association guidelines.

Water Reclamation Program (Direct Reuse – Purple Pipe System):
The City of Austin's Water Reclamation Initiative (WRI) program provides highly treated wastewater effluent for non-potable uses such as irrigation, cooling, manufacturing, and toilet flushing. Austin's direct reuse system serves approximately 60 existing customers supplying approximately 1.5 billion gallons (4,650 AF per year), based on the most recent 5-year average.

The 2007 Water Conservation Task Force Projects have all been completed or will be completed by August 2014. The direct reuse system is continuing to be expanded with a near-term WRI program capital spending plan in the range of $5-8 million/year.

One of the key near-term WRI construction programs is referred to as "Completing the Core". The Completing the Core program includes construction of 19 miles of main, one tank, and one pump station in Austin's core including the downtown area. Through this program, the customer base is expected to increase to 135 customers with an increase in usage to 2.2 billion gallons (6,750 AF per year). The 25-year direct reuse system master plan includes a total of 130 miles of transmission mains to be constructed and an estimated annual use volume of 8.34 billion gallons (25,600 AF).

From a drought response strategy perspective, direct reuse projects that maximize system flexibility and supply multiple uses including both irrigation and non-irrigation uses are optimal. Additionally, under low flow conditions reuse water that is not returned to the river as treated wastewater effluent can result in increased releases from the Highland Lakes. LCRA accounts for Austin's return flows when determining how much water to release to satisfy downstream environmental flow needs and to provide run of river water to lower basin senior water right holders. Under certain circumstances, increased reuse can lead to higher releases from the Highland Lakes to satisfy these downstream needs.

LCRA Pro-Rata Curtailment of Firm Water Customers:
As Austin continues to implement water conservation and staged DCP restrictions, LCRA is planning to implement firm water customer pro-rata curtailment throughout the basin. LCRA's pro-rata curtailment is set to initially be 20% at the point in time when LCRA's Board declares a drought worse than the drought of record, which will be triggered by the lakes Travis and Buchanan combined storage level dropping to 600,000 AF. LCRA's pro-rata curtailment requirements will be placed on all LCRA firm water customers. Based on use levels in 2012 and 2013, Austin is currently meeting its pro-rata 20% reduction allotments.

It is anticipated that LCRA's Board will soon make a determination regarding the amount of curtailment and the combined storage trigger level for going to the next higher level of firm water customer pro-rata curtailment. It is anticipated that LCRA may require 30% curtailment off of the firm customer's reference year usage (based on diversion from September 2010 through August 2011) as the next increment of

curtailment. Further, it is anticipated that LCRA will require this higher level of curtailment at a combined storage trigger level in the range of approximately 500,000 AF (~25% full) or possibly 450,000 AF (~22% full). LCRA staff presented potential trigger levels in this general range in mid-2013 when combined storage levels dropped to near the 600,000 AF level. While LCRA has not yet conducted a process to formally determine Austin's 30% firm water customer pro-rata curtailment allotment, is anticipated that that amount would be in the range of approximately 137,000 acre-feet/year. (Austin diverted approximately 142,000 AF in 2013.)

Demand-side management will continue as a core water management strategy. However, due to the magnitudes and volumes of water demands, supplies, and the uncertain future of lake levels, the Utility is continuing to explore supply-side and alternative supply augmentation strategies to work together with demand-side strategies in an integrated and diversified plan approach.

Drought Response Strategy 2: Protect Colorado River System Firm Water Interests

With well more than a century of reliance and investment, Austin's core supply and infrastructure systems are centered around the Colorado River supply. Therefore, protection of Colorado River system firm water interests is critical. Austin has senior water rights and firm water supply agreements with LCRA that provide Austin with firm water supplies of up to 325,000 AF per year. This amount is roughly double Austin's current level of demand. Drought response strategies during times of low storage conditions are essential so that Austin can continue to realize the full benefit of its firm water supply agreements with LCRA. Additionally and as discussed below, working with LCRA and the TCEQ to ensure reservoir management is consistent with those firm water interests is critical.

LCRA Water Management Plan (WMP) Revisions:

LCRA's water rights permits require LCRA to operate lakes Travis and Buchanan in accordance with a TCEQ-approved LCRA WMP, to be updated periodically to account for changing conditions including firm demands. LCRA's current "2010 WMP" is being revised to take into account current drought conditions (including updated hydrology through 2013) through a process being led and administered by TCEQ.

In 2010, LCRA started the LCRA WMP revision process, which included an extensive 18-month stakeholder process with representatives throughout the basin. Proposed revisions were submitted to TCEQ in March 2012. After receiving extensive input from stakeholders, including Austin and other members of the public, concerning the need for the WMP to reflect the on-going extreme drought conditions, TCEQ worked to develop proposed revisions to the 2012 LCRA submittal to better address on-going drought conditions. This LCRA WMP revision process is critical to improving protection of firm water supplies. TCEQ has released its proposed WMP revisions (in a transmittal from TCEQ to LCRA dated May 16, 2014). After LCRA's review, it is anticipated that TCEQ will release the proposed revisions for public comment. Further, it is anticipated that the plan will go into a contested case hearing process that could take considerable time to reach a resolution.

In order to gain an understanding of TCEQ's proposed revisions, City staff is in the process of reviewing the proposed changes that reflect drought hydrologic conditions through 2013, and include modifications to better equip the plan to address drought conditions. It is anticipated that proposed revisions will be released by TCEQ for formal comment in the relatively near future. TCEQ's proposed LCRA WMP revision report is available to the public for review on TCEQ's web-site at www.tceq.state.tx.us.

LCRA WMP Emergency Orders:

Due to the unprecedented drought conditions, LCRA has sought and TCEQ has approved emergency orders (EOs) in 2012, 2013 and 2014, which have resulted in the cut off of most interruptible stored water for downstream interruptible uses, primarily rice farming in Colorado, Wharton, and Matagorda Counties. These TCEQ-approved EOs allow LCRA to deviate from its approved 2010 WMP in order to not be required to release large volumes of interruptible stored water from significantly depleted reservoirs.

In addition to receiving TCEQ EOs related to interruptible stored water releases, LCRA sought and received TCEQ approval in April for implementing an adjustment to the streamflow maintenance requirement from 500 cubic feet per second (cfs) to 300 cfs to support the State threatened Blue Sucker fish spawning habitat. This EO is expected to allow LCRA to keep more water in lakes Travis and Buchanan. The projected amount of water potentially saved in the lakes from the implementation of this EO is in the range of 17,000 AF for the 2014 Blue Sucker release period which is set to be concluded by the end of May. TCEQ EO's are temporary for a period of 120 days with one possible 60-day extension.

City staff will continue to focus on the protection of Colorado River System firm water interests as the drought, WMP revision process, and EOs progress. Staff will continue to stay actively engaged in working to assure that firm customers are properly protected..

Drought Response Strategy 3: River and Reservoir System Operational Enhancements

In this drought response strategy sector, projects to achieve water savings or extend supplies through river and reservoir system operational enhancements are summarized. These projects seek to make more efficient use of existing supplies with minimal capital investment required.

Also included in this section is a grouping referred to as enhanced operations, which also seek to make more efficient use of existing supplies, but would require capital investment.

The consulting team has conducted concept development, evaluation, and analysis of a wide-range of various drought response strategy options including those summarized below in this river and reservoir system operational enhancements section.

It should be noted that the project options listed in this section represent a list of "possible" projects leaving "no stone unturned". Being on the list does not represent a

recommendation but these are possible projects for consideration. Projects on this list may be mutually exclusive meaning that there may be a project on the list that, if it were to be implemented to gain some amount of water savings in the lakes, might reduce the amount of potential savings from other projects on the same list. Additional effort was made to identify projects or project elements that would help minimize "stranded capital". In this context, "stranded capital" is referring to investments that would be underutilized when the drought breaks. Projects that minimize stranded capital represent investments in infrastructure that continue to provide system benefits even in non-drought conditions. An example is exploring options that include potential early construction of portions of already planned reclaimed water system master plan components as part of a drought response strategy, as noted in some of the potential option descriptions in the sections below.

System Operational Improvement Options
(Minimal Capital Required)

System Operational Improvement Options (minimal capital required):

- Operate Longhorn Dam Lift Gate(s)
- Reduced Lake Evaporation
- Walter Long Lake Off-Channel Storage
- Move SAR Discharge Above Austin Gauge
- Lake Austin Operations

Preliminary comparative analysis:

Project: Operate Longhorn Dam Lift Gate(s)

Category: System Operational Improvements (minimal capital required)

Brief Description: 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).

Yields:	Cost:	Implementation:	Benefits:	Coordination/ Requirements/ Challenges:
2,000 to 4,000 AF/year	$8/AF or $0.03/1,000 gal	< 6 months	• No permits required • No capital costs	• Additional coordination between AE and LCRA

Project: Reduced Lake Evaporation

Category: System Operational Improvements (minimal capital required)

Brief Description: 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.

Yields:	Cost:	Implementation:	Benefits:	Coordination/ Requirements/ Challenges:
800 to 1,200 AF/year	$275/AF or $0.84/1,000 gal	< 6 months	• No capital costs	• Coordinate with AE and PARD, & with TCEQ and TPWD • Labor intensive • Limited real-world experience

Project: Walter E. Long Lake Storage				
Category: System Operational Improvements (minimal capital required)				
Brief Description: 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.				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
1,000 to 4,000 AF/year	$64/AF or $0.20/1,000 gal	< 6 months	• No capital costs	• Coordinate with AE, PARD, and LCRA • Water rights need to be addressed with TCEQ

Project: Relocate South Austin Regional (SAR) Wastewater Treatment Plant Discharge				
Category: System Operational Improvements (minimal capital required)				
Brief Description: 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. Preliminary capital cost estimate: ~$300,000				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
0 to 1,000 AF/year	$114/AF or $0.35/1,000 gal	1 year	• Potentially a small amount of benefit to combined storage in lakes Travis and Buchanan	• Requires wastewater discharge permit amendment from TCEQ

Project: Lake Austin Operations				
Category: System Operational Improvements (minimal capital required)				
Brief Description: 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.				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
0 to 5,000 AF/year Based on period of record, 30% of time it would be 0 and 50% of time would be at least 3,500 AF/yr	$10/AF or $0.03/1,000 gal	< 6 months	• Potential benefit to combined storage in lakes Travis and Buchanan • No capital cost • No permits required	• Public acceptance • In dry conditions may not yield combined storage savings

Enhanced Operations Options
(Capital Investment Required)

Enhanced Operations Options (capital investment required):

- Automate Longhorn Dam knife gates
- Increased use of Long Lake storage
- Capture local inflows to Lady Bird Lake
- Aquifer Storage and Recovery
- Indirect Potable Reuse through LBL

Preliminary comparative analysis:

Project: Automate Longhorn Dam Knife Gates				
Category: Enhanced Operations Options (capital investment required)				
Brief Description: 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. Preliminary capital cost estimate: ~$750,000				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
4,000 to 7,000 AF/year	$15/AF or $0.04/1,000 gal	1 – 2 years	• No permits required	• Coordinate with AE and LCRA

Project: Increased Use of Long Lake				
Category: Enhanced Operations Options (capital investment required)				
Brief Description: 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. Preliminary capital cost estimate: ~$22 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
8,000 to 20,000 AF/year	$183/AF or $0.56/1,000 gal	1 – 2 years	• Enhanced use of City-owned assets for water supply • Relatively low cost compared to other options of this relatively significant scale of potential yield • May fit in longer-term AE plans for Decker Power Station • Project would provide environmental flow benefits • Reclaimed water main construction consistent with Reclaimed Water Master Plan	• Coordinate with AE, PARD, and LCRA • Water rights need to be addressed with TCEQ • Requires wastewater discharge permit amendment from TCEQ • Would require ERCOT approval • AE customers would be exposed to the spot power market • Project would impact the lake's recreational uses

Project: Capture Lady Bird Lake Inflows				
Category: Enhanced Operations Options (capital investment required)				
Brief Description: 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. Preliminary capital cost estimate: ~$1.8 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
1,000 to 3,000 AF/year	$334/AF or $1.03/1,000 gal	1 – 2 years	• Enhanced use of City-owned assets for water supply • Potential benefit to combined storage volumes in lakes Travis and Buchanan • Provides supply link between Barton Springs discharge and City water treatment plant	• Requires coordination with LCRA • Water rights need to be addressed with TCEQ

Project: Aquifer Storage and Recovery				
Category: Enhanced Operations Options (capital investment required)				
Brief Description: 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. Preliminary capital cost estimate: ~$130 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
~4,000 AF/year	$1,000/AF or $3.07/1,000 gal	3 – 5+ years	• Enhanced use of City-owned assets for water supply • Potential benefit to combined storage volumes in lakes Travis and Buchanan • Provides supply link between Barton Springs discharge and City water treatment plant	• Requires significant permitting • Requires extensive aquifer study • Requires purchase of land for wells and other facilities • Requires additional treatment at WWTP

Project: Indirect Potable Reuse				
Category: Enhanced Operations Options (capital investment required)				
Brief Description: 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 a pumping facilities and pipeline to pump 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. Preliminary capital cost estimate: ~$30 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
Up to 20,000 AF/year	$190/AF or $0.58/1,000 gal	2 - 3 years	• Enhanced use of City-owned assets for water supply • Potential benefit to combined storage volumes in lakes Travis and Buchanan • Also provides supply link between Barton Springs discharge and City water treatment plant	• Requires nutrient removal at SAR for the water to be discharged into LBL • Requires pump intake & pipeline construction • Requires TCEQ wastewater discharge permit amendment • Water rights will need to be addressed at TCEQ • Public perception issue

Drought Response Strategy 4: Water Supply Augmentation – Alternative Groundwater Supplies

In this drought response strategy arena, alternative groundwater supply options to augment Austin's Colorado water supply are summarized. As with the options outlined in the previous section, the consulting team conducted the evaluation and preliminary comparative analysis work summarized below.

These projects range from various Carrizo-Wilcox Aquifer options to development of local groundwater supplies in the Northern Edwards Aquifer. Projects in this category represent the only options with a completely separate water source from the Colorado River system.

Austin Water does not currently rely on a groundwater source for its water supply. The arena of groundwater represents a significantly different regulatory, permitting, and source management landscape than surface water, like the Colorado River system. For example some level of treatment would be required in order to successfully mix groundwater and surface water. Groundwater would also require pumping, meaning additional electricity use. The Carrizo-Wilcox Aquifer extends across Texas including areas east of Austin that generally passes through Burleson, Lee, Bastrop, Caldwell, Gonzales and other counties to the east. The Northern Edwards Aquifer is located in the northern part of Austin and Travis County and extending into Williamson and southern Bell County.

There are two main groundwater administrative and/or regulatory entities in Texas, namely, Groundwater Conservation Districts (GCDs) and Groundwater Management Areas (GMAs). Additional analysis of detailed information from the various regulatory entities regarding applicable groundwater permitting and regulations would need to be conducted to further evaluate these alternatives.

Alternative Groundwater Supplies

Alternative Groundwater Supplies:

- Blue Water Systems
- Forestar
- Northern Edwards Wellfield
- Vista Ridge
- Hays-Caldwell Public Utility Authority

Preliminary comparative analysis:

Project: Blue Water Systems				
Category: Alternative Groundwater Supplies				
Brief Description: 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. Preliminary capital cost estimate: ~$26.5 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
Up to ~12,000 AF/year	$1,526/AF or $4.68/1,000 gal	1 - 2 years	• Separate alternative supply • No permits needed • Extends supply in lakes Travis and Buchanan	• Requires construction of facilities to connect to Blue Water System • Water would need to be treated for compatibility, requires treatment facility construction • Water compatibility concerns • Water quality variations a concern for some industrial customers • Requires water sale contract

Project: Forestar				
Category: Alternative Groundwater Supplies				
Brief Description: 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. Preliminary capital cost estimate: unknown				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
Unknown	Unknown	2 - 3 years	• Separate alternative supply • Extends supply in lakes Travis and Buchanan	• Requires construction of facilities to connect • Water would need to be treated for compatibility, requires treatment facility construction • Water compatibility concerns • Water quality variations a concern for some industrial customers • Requires water sale contract • Permits need to be resolved

Project: Northern Edwards Wells				
Category: Alternative Groundwater Supplies				
Brief Description: 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. Preliminary capital cost estimate: $7.6 million (to connect 4 wells)				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
1,000 to 1,500 AF/year	$431/AF or $1.32/1,000 gal	1 - 2 years	• Separate alternative supply • No permits required • Extends supply in lakes Travis and Buchanan • Project would be City-owned	• Would require land purchases • Water compatibility would need to be verified • Potential for low yields

Project: Vista Ridge				
Category: Alternative Groundwater Supplies				
Brief Description: 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. Preliminary capital cost estimate: unknown				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
Amount of available water and duration are unknown	Unknown	Potentially within 3 years	• Separate alternative supply • Extends supply in lakes Travis and Buchanan	• Requires construction of facilities to connect to proposed pipeline • Water would need to be treated for compatibility, requires treatment facility construction • Water compatibility concerns • Water quality variations a concern for some industrial customers • Requires water sale contract

Project: Hays Caldwell Public Utility Authority (PUA)				
Category: Alternative Groundwater Supplies				
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. Preliminary capital cost estimate: unknown				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
~25,000 AF/yr	Unknown – But could be around $650/AF or $2.00/1,000 gal	2 - 3 years	• Separate alternative supply • Extends supply in lakes Travis and Buchanan	• Requires construction of facilities to connect to proposed pipeline • Water would need to be treated for compatibility, requires treatment facility construction • Water compatibility concerns • Water quality variations a concern for some industrial customers • Requires water sale contract • Duration is not known

Other Mid to Long-Term Alternatives

Other Mid to Long-Term Alternatives:

In addition to the projects outlined above, as part of on-going water resources planning efforts the consulting team has identified the following as long-term alternatives for evaluation. Some components of these alternatives may also be viable mid-term options.

- Down-dip brackish Edwards Aquifer
- Reclaimed water bank infiltration to Colorado Alluvium
- Use of bed and banks of the Colorado River for indirect reuse of effluent

Project: Down-dip brackish Edwards Aquifer				
Category: Other Mid to Long-Term Alternatives				
Brief Description: 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. Preliminary capital cost estimate: $90 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
~5,000 - 10,000 AF/yr	$1,733/AF or $5.32/1,000 gal	5 - 10 years	• Separate alternative supply • Extends supply in lakes Travis and Buchanan	• Concentrate disposal would be a concern • Brine disposal permit required • Potential impact on overall Edwards level • Water quality could deteriorate over time • Requires construction of facilities to connect to wells • Water would need to be treated for compatibility, requires treatment facility construction • Water quality variations a concern for some industrial customers • Requires substantial land purchases • BSEACD permit consideration

Project: Reclaimed water bank infiltration to Colorado Alluvium				
Category: Other Mid to Long-Term Alternatives				
Brief Description: 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. Preliminary capital cost estimate: $110 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
~20,000 - 40,000 AF/yr Requires 20 production wells and 8 disposal wells	$667/AF or $2.05/1,000 gal	5 - 10 years	• Large-scale beneficial reuse project • Longer-term supply development • Enhanced use of City-owned assets for water supply	• Requires construction of facilities to pump the water from the alluvial wells to the water treatment plant • Requires substantial land purchases • Possible land application permit required • Meeting downstream needs may off-set some of the yield • Public perception

Project: Use of bed and banks of the Colorado River for indirect reuse of effluent				
Category: Other Mid to Long-Term Alternatives				
Brief Description: 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. Preliminary capital cost estimate: $310 million				
Yields:	**Cost:**	**Implementation:**	**Benefits:**	**Coordination/ Requirements/ Challenges:**
~40,000 - 70,000 AF/yr	$691/AF or $2.12/1,000 gal	5 - 10 years	• Utilizes bed and banks of the river to transport water downstream where it can be diverted for use • Could provide cost credits off of water diversions under the terms of the 2007 agreement	• Requires water rights permit • Requires land purchases • Meeting downstream needs may off-set some of the yield

Drought Response Plan Development

In support of the drought response plan development process, the consulting team, working in conjunction with Austin Water staff, has developed a wide-ranging list of "possible" projects. The approach in developing the list is to "leave no stone unturned" and to consider all options evenly. It should be made clear that being on the list is not a recommendation.

In exploring various drought response strategies, it has become clear that there is no "silver bullet". What has also become apparent is that all options have potential down-sides or limitations. Again, with the options exploration process, the approach was and will continue to explore all options. As the process for developing drought response plan strategy options for Council consideration proceeds, with input from the Austin Water Resource Planning Task Force (AWRPTF) and the public, it is anticipated that some of the options on this list may quickly fall off and some are anticipated to rise to the top, while others may be considered as emergency measures to be taken in the future only if the combined storage falls to a critical level. Additional new options may also be discovered and explored as the planning process proceeds.

Austin is currently discharging a significant amount of return flow water back to the river from its major water treatment plants (~100k AF on an annual basis). As has been discussed previously, once these return flows are discharged back to the river, the

return flows becomes waters of the State available for downstream permitted uses. Therefore, in evaluating drought response options that involve use of Austin's treated effluent, a net benefit analysis needs to be considered to determine if there is a net gain in the combined storage volume of lakes Travis and Buchanan. In many scenarios, especially during periods of low river flow during drought conditions, LCRA may need to release water from the Highland Lakes to offset the amount reused by Austin. The goal is to be able to show that a strategy demonstrates an overall benefit to the lakes.

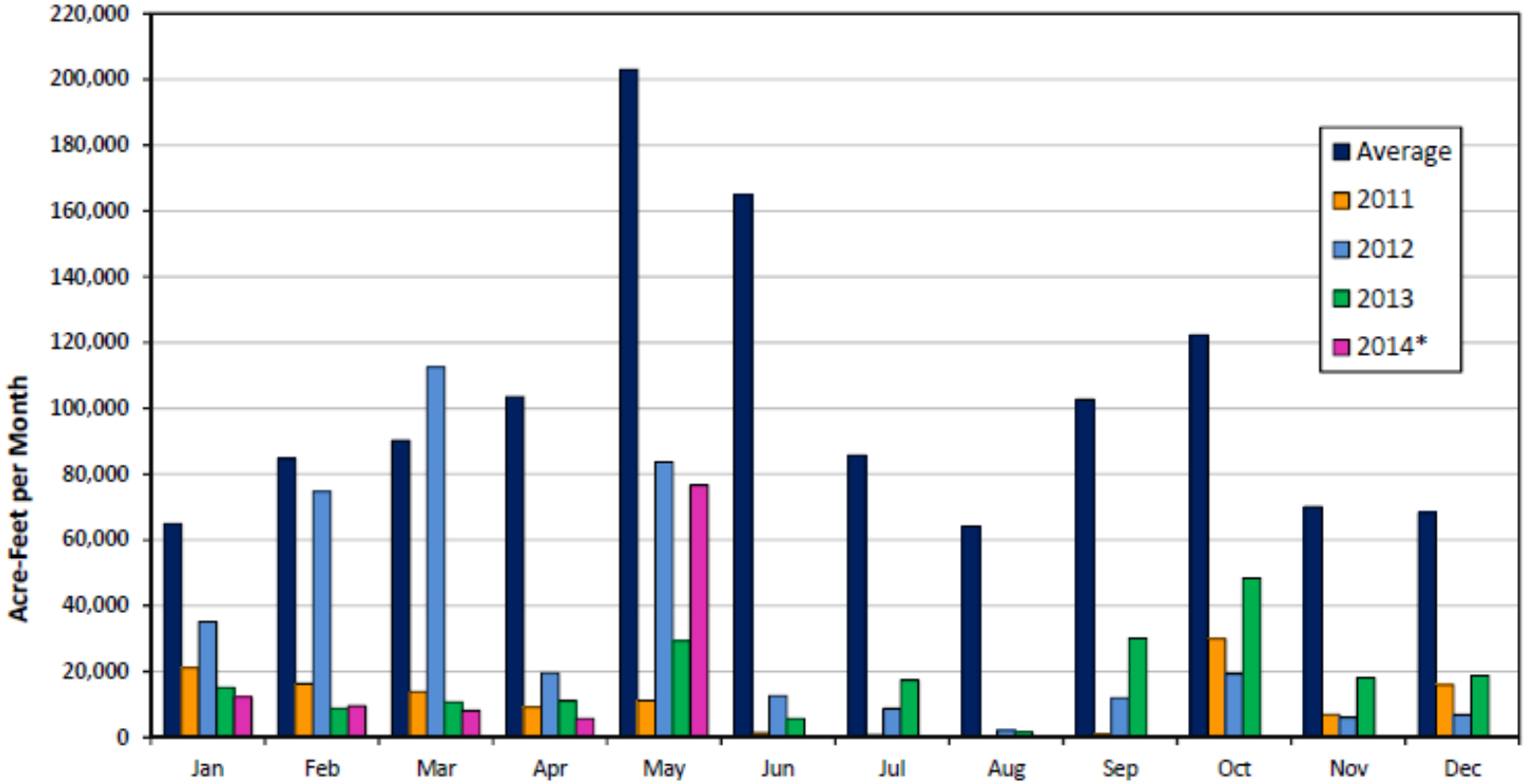
As has been previously outlined, Austin Water, through its consultant, has tools and expertise to use the basin system water availability model to model the effect of strategy projects. The results can show if a strategy or set of strategies demonstrate an overall benefit via modeling. Attachment H shows an example of WAM output that shows the baseline model plot of the WAM output for combined storage volumes in lakes Travis and Buchanan with inflows modeled under drought persistence hydrology scenarios.

Austin Water will continue to work on developing drought response plan options and to work in support of the AWRPTF as the Task Force works through their process of developing recommendations for Council consideration. The Utility has discussed with the Task Force the concept of developing a tiered implementation plan approach. As drought continues and deepens, Austin would add larger scale projects with more investment. The approach would include establishing triggers for projects based on storage in lakes Travis and Buchanan. These levels could trigger project planning/permitting, or trigger the start of construction, for example. As most of the options would require some time to implement, it is important that the Utility not wait too long to plan for some of these projects. It is also important to note that planning for a project does not mean that the project will be implemented, particularly if the drought eases. It only means that the Utility would be prepared to take action should it become necessary.

A concept presented to the Task Force is to define policy goals for the Drought Response Plan including identification of project selection criteria, minimum acceptable combined lake storage for lakes Travis and Buchanan, and the value of avoiding prolonged Stage 4 restrictions implementation.

In addition to the preliminary comparative analysis information included in this report, attached is a preliminary decision matrix (Attachment I), which summarizes key factors for each project. This preliminary decision matrix has been provided to the Austin Water Resource Planning Task Force. Austin Water is in the process of continuing to update and identify options to potentially add to the matrix.

Inflows to Lakes Buchanan and Travis



Calendar Year Totals, ac-ft	
Average:	1,230,284
2011:	127,802
2012:	393,163
2013:	215,138

Jan.-May Totals, ac-ft	
Average:	546,288
2011:	71,632
2012:	325,572
2013:	75,042
2014:	112,194

Monthly averages correspond to the historical period of record, 1942 through present.

*Inflow data for 2014 are preliminary and subject to revision.

Since the lakes were built:

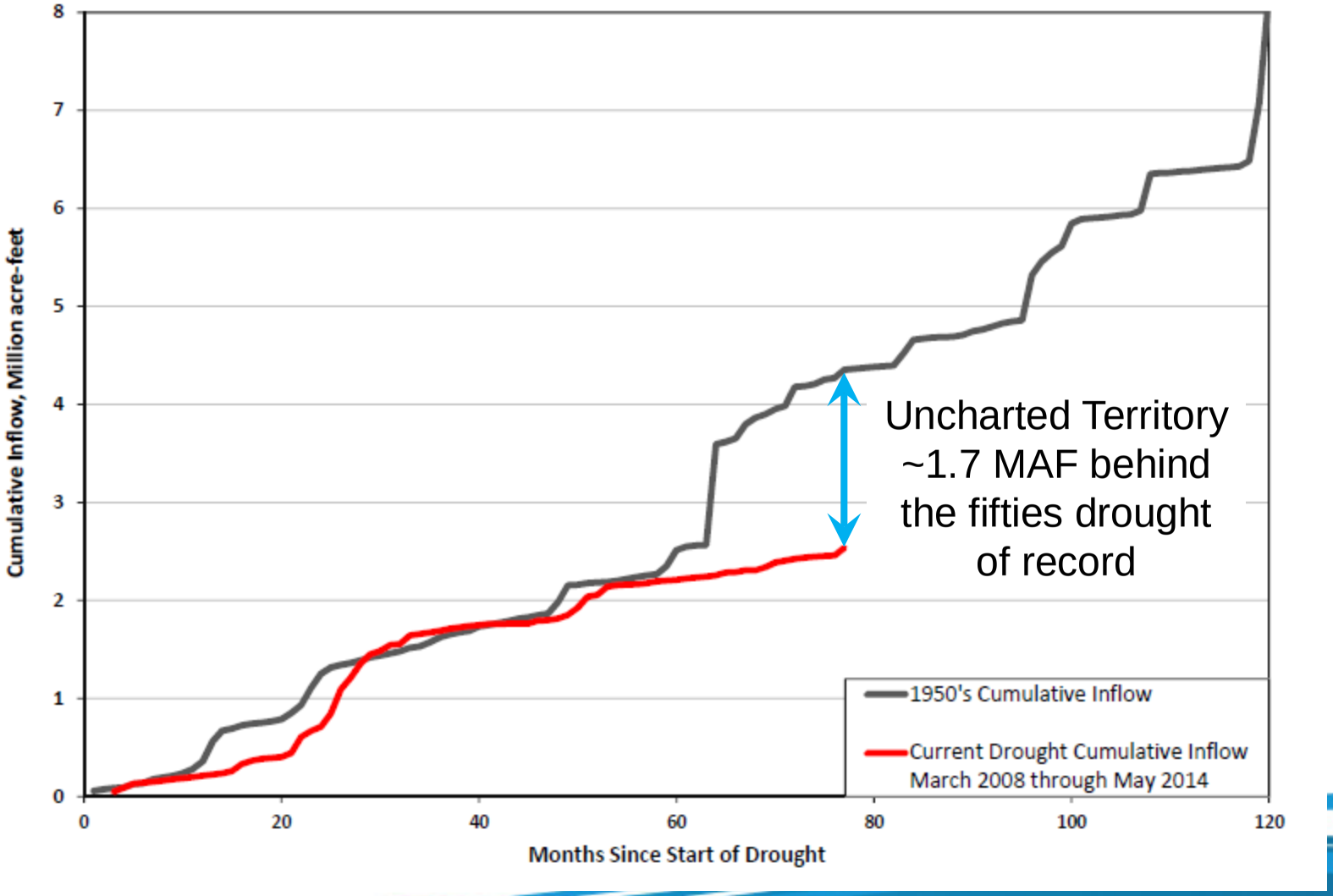
2014 January-April was the all time driest January-April stretch

2014 January-May was 6th driest January-May stretch

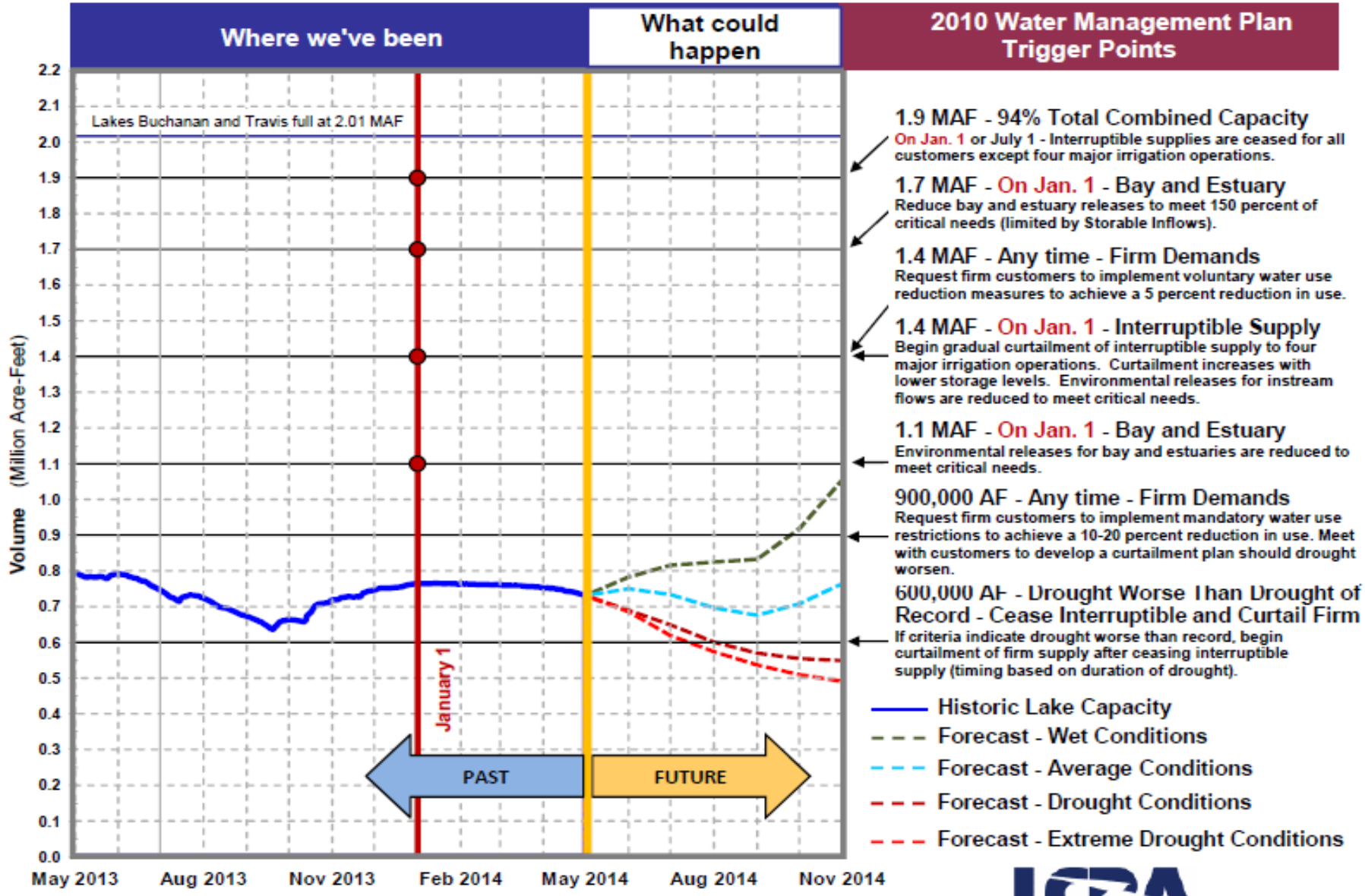
Attachment A

Austin WATER
Clearly Reliable

Cumulative Inflow to Lakes Buchanan and Travis



Highland Lakes Storage *



Note: MAF equals One Million Acre-Feet
One Acre-Foot (AF) equals 325,851 gallons.

Date: May 1, 2014

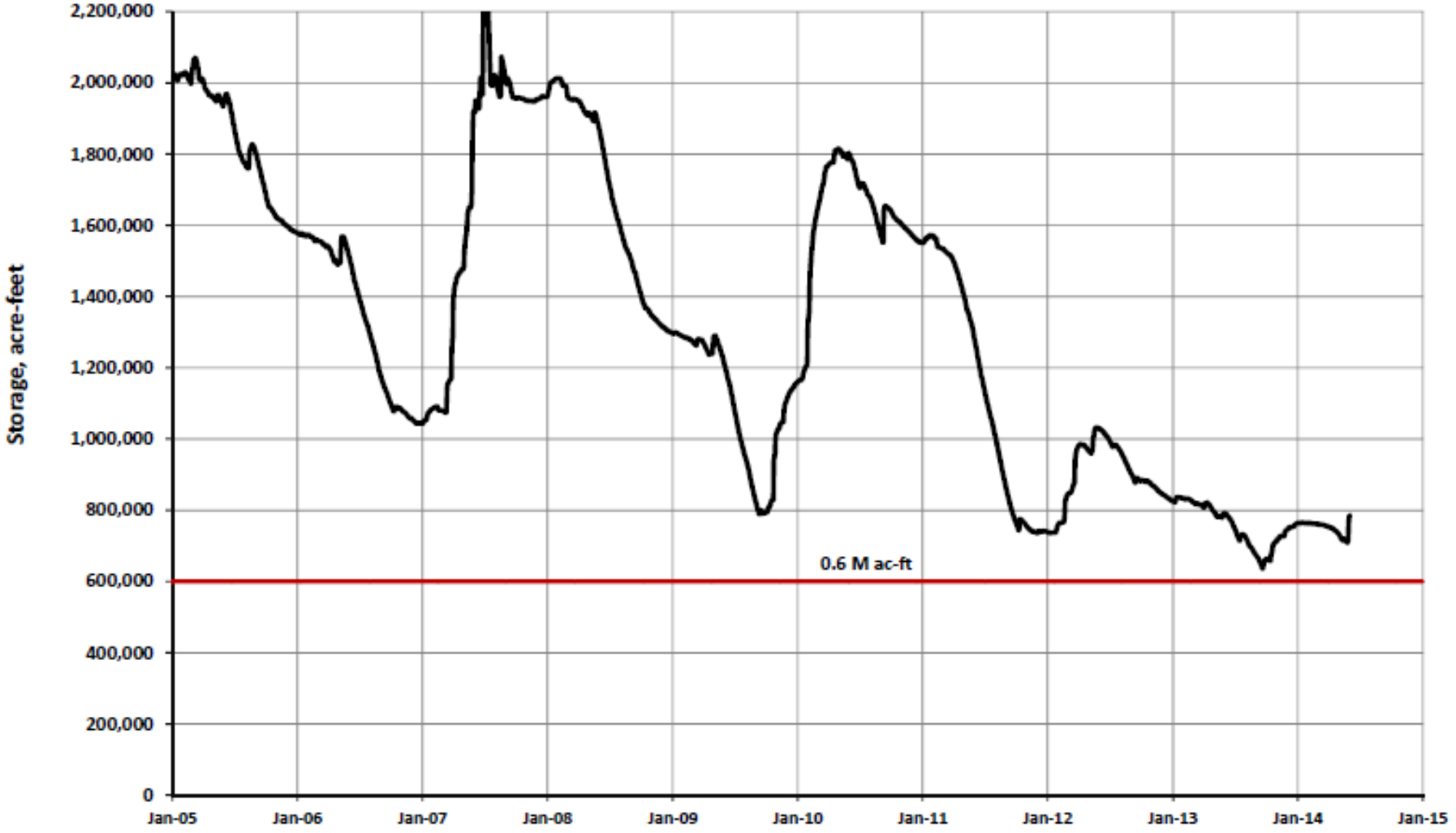
LCRA
ENERGY · WATER · COMMUNITY SERVICES

* Projections take into account emergency drought relief measures affirmed by TCEQ on February 26, 2014.

Attachment C

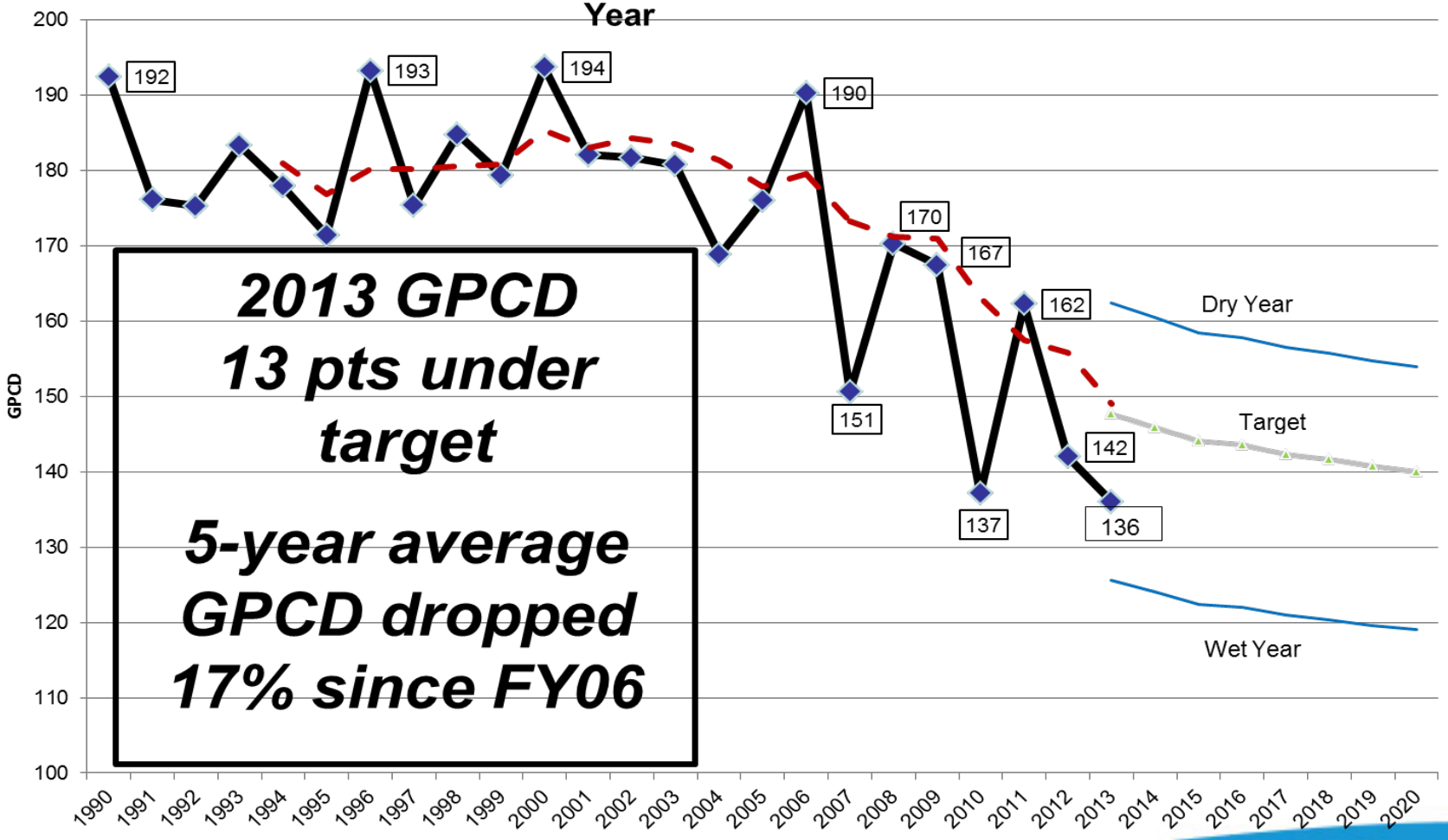
Combined Storage of Lakes Buchanan and Travis

January 1, 2005 through June 1, 2014



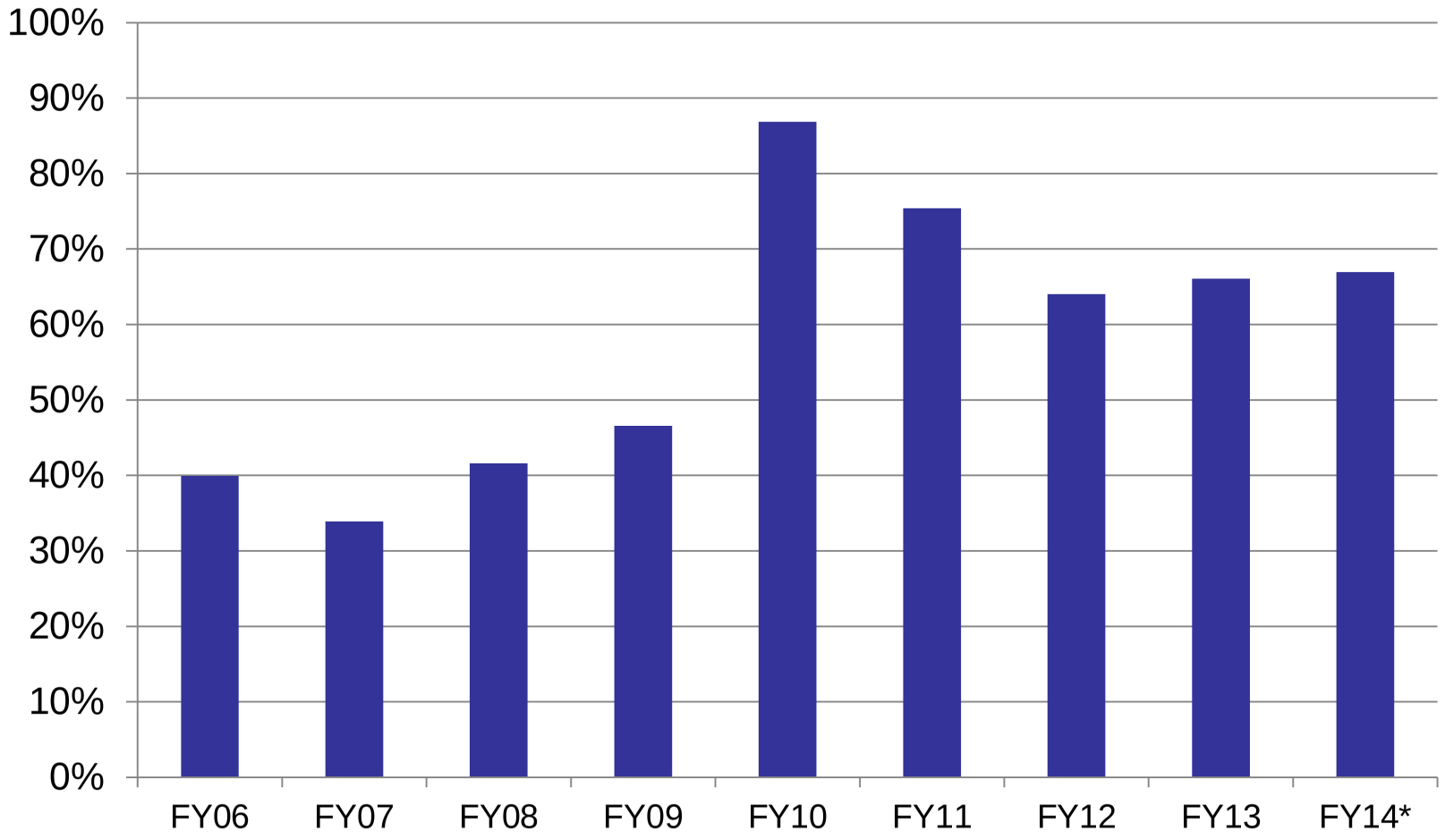
Austin Water
Clearly Reliable

Austin Conservation History and Expected GPCD Progress by Fiscal Year



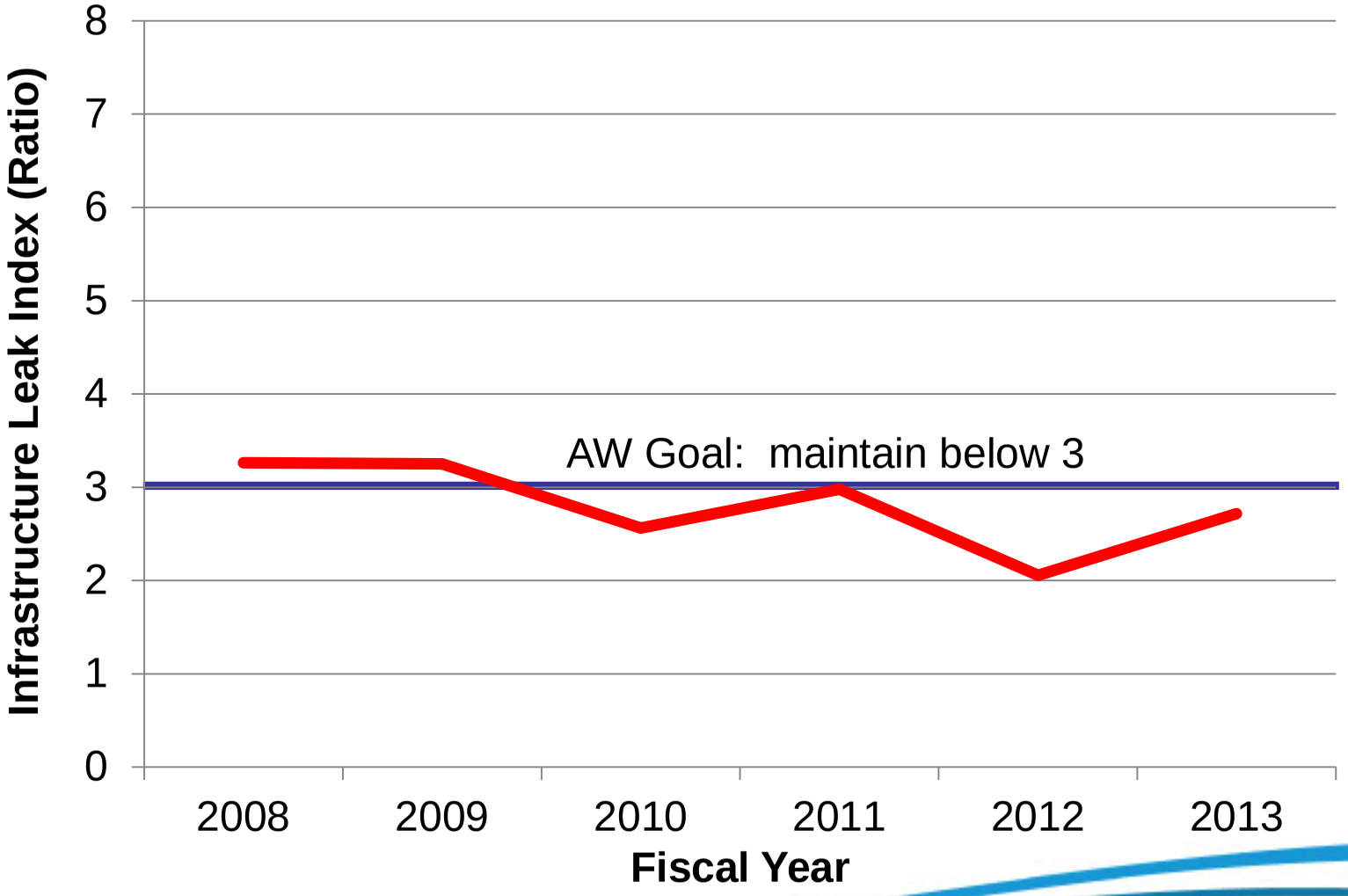
Improvement in Leak Repair Times

Percent Leak Work Orders Repaired in One Day or Less

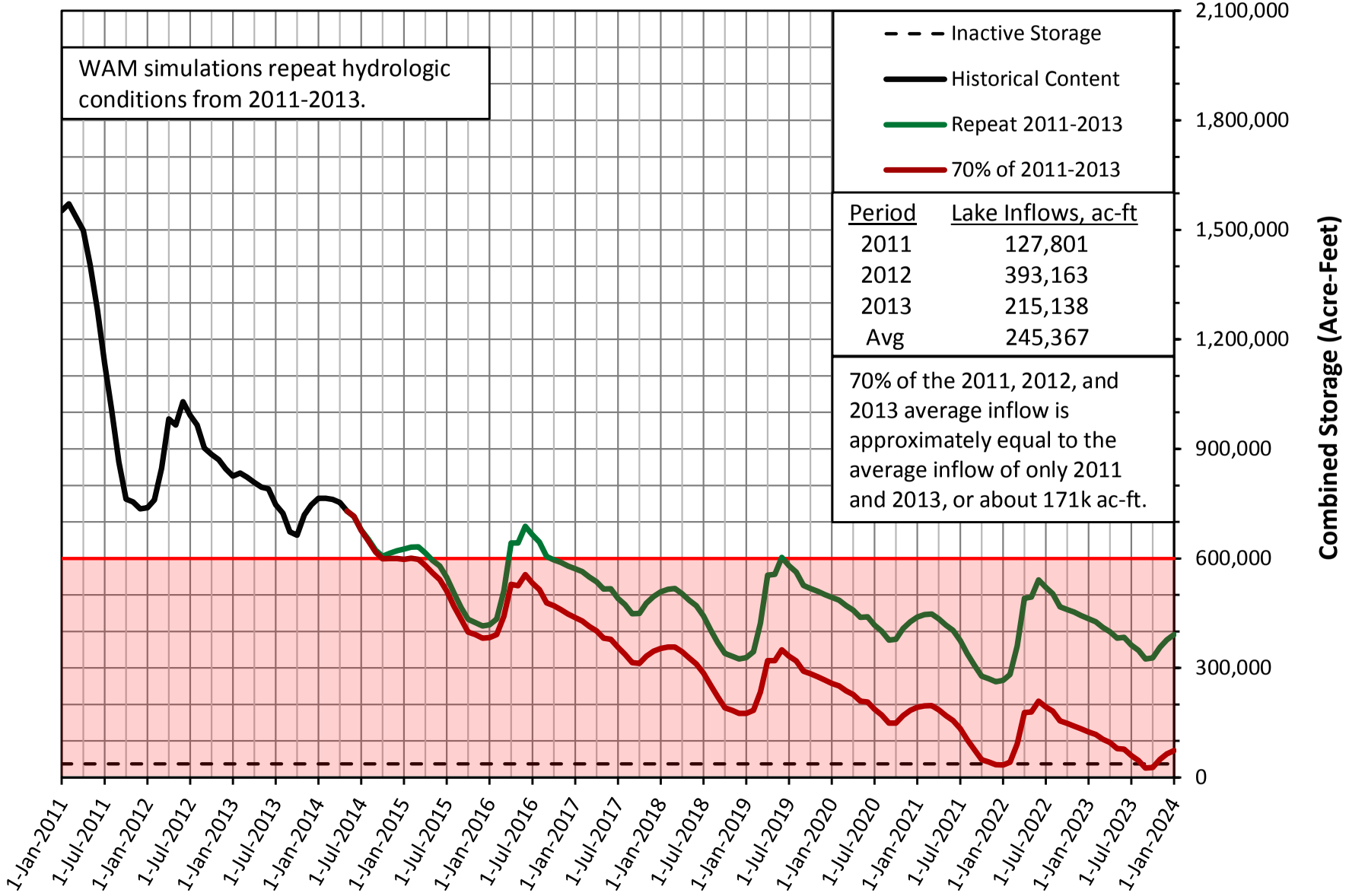


*Partial Year

Austin Water
Infrastructure Leak Index Ratio



Simulated Combined Storage of Lakes Buchanan and Travis
May 1, 2014 Start



Attachment H

Preliminary COA Drought Response Decision Matrix

Subject to Change Updated: 5-Jun-14

Category	Option Description	Annual HL Benefit at 95th Pctl (ac-ft) Low	Annual HL Benefit at 95th Pctl (ac-ft) High	Cumulative Demand Reduction (multi-year) (ac-ft)	Water Rights/Supply Contract Req'd?	Coordinating Entities	Land Purchase Req'd?	Timing	Discharge Permit Req'd?	Drought Only Supply	Cost Basis Supply Quantity (ac-ft/yr)	Est. Capital Cost	Est. Annual Cost	Est. Unit Cost (Supply Basis) at 95th Pctl ($/kgal)	Est. Unit Cost at 95th Pctl ($/ac-ft)
Demand-side Management	Drought Response Stage 3**	17,000	19,000		N	N/A	N	If needed - is in DCP	N	Y	* (see footnote below)	$0	* (see footnote below)	* (see footnote below)	* (see footnote below)
	Interim Drought Response - Hand-watering only**	33,000	36,000		N	N/A	N	Directors Authority	N	Y	* (see footnote below)	$0	* (see footnote below)	* (see footnote below)	* (see footnote below)
	Emergency Drought Stage 4**	42,000	45,000		N	N/A	N	If needed - is in DCP	N	Y	* (see footnote below)	$0	* (see footnote below)	* (see footnote below)	* (see footnote below)
	Mandatory Toilet Retrofit on Resale	128	128	1,280	N	RECA, BOR, BOMA	N	3-10 yrs	N	N	128	$0	$75,000	$2.39	$780
	Limit irrigated area in new residential development	178	178	1,246	N	HBA, RECA	N	3-5 yrs	N	N	178	$0	$150,000	$2.57	$840
	Require new facilities to capture A/C condensate for reuse	31	31	310	N	WPD	N	10 yrs	N	N	31	$0	$75,000	$7.50	$2,400
	Require retrofit of existing cooling towers to meet efficiency standards	73	73	292	N	RECA, BOMA	N	4 yrs	N	N	73	$0	$75,000	$3.15	$1,027
	Require home audits at time of sale	589	589	589	N	RECA, BOR, AE	N	10 yrs	N	N	589	$0	$75,000	$3.91	$1,270
	Mandatory irrigation audits for high users	371	371	742	N	N/A	N	2 yrs	N	N	371	$0	$150,000	$1.24	$404
	Implement smart meters for residential customers	986	986	4,928	N	AE	N	5 yrs	N	N	986	$95,500,000	$300,000	$6.04	$19,683
	Additional staff for marketing reclaimed water program	78	78	390	N	N/A	N	5 yrs	N	N	78	$0	$75,000	$2.95	$961
	Water budget rates (applied to irrigation-only meters)	1,000	1,000	2,000	N	AE, BOMA, RECA	N	2 yrs	N	N	1,000	$0	N/A	N/A	N/A
	Hot water on demand incentives	6	6	59	N	N/A	N	10 yrs	N	N	6	$0	$55,000	$29.00	$9,322
	Provide rebates for 0.8gpf toilets	29	29	145	N	N/A	N	1 yr	N	N	29	$0	$50,000	$52.00	$17,000
	Direct Reuse - Completing the Core	TBD	TBD		N	N/A	N	5-7 yrs	N	N	TBD	$41,395,000	$1,275,000	TBD	TBD
Operational Improvements	Operate Longhorn Dam Lift Gates	2,000	4,000		N	LCRA, AE	N	<6 Mos.	N	Y	3,000	$0	$25,000	$0.03	$8
	Reduced Lake Evaporation (Long & LBL)	800	1,200		N	TCEQ, TPWD	N	<6 Mos.	N	Y	1,000	$0	$275,000	$0.84	$275
	Walter Long Off-Channel Storage (Existing Capacity)	1,000	4,000		??	LCRA, AE, TCEQ	N	<6 Mos.	N	Y	2,500	$0	$160,000	$0.20	$64
	Relocate SAR Discharge Above Austin Gauge - Existing Reclaimed System	0	1,000		N	TCEQ, LCRA	N	1-2 yrs	Y	Y	500	$294,000	$57,000	$0.35	$114
	Lake Austin Operation	0	5,000		N	LCRA	N	<6 Mos.	N	Y	2,500	$0	$25,000	$0.03	$10
Enhanced Operations	Automate Longhorn Dam Gates	4,000	7,000		N	LCRA, AE	N	1-2 yrs	N	N	5,500	$750,000	$80,000	$0.04	$15
	Walter Long Off-Channel Storage (Enhanced Capacity)	8,000	20,000		??	LCRA, AE, TCEQ	N	1-2 yrs	Y	Y	14,000	$22,340,000	$2,561,000	$0.56	$183
	Capture Local Inflows in Lady Bird Lake	1,000	3,000		N	N/A	N	1-2 yrs	N	Y	2,000	$1,743,000	$669,000	$1.03	$334
	Aquifer Storage and Recovery - Northern Edwards	4,000	4,000		N	TCEQ	Y	3-5 yrs	N	N	4,000	$130,000,000	$4,000,000	$3.07	$1,000
	Indirect Potable Reuse - SAR to Lady Bird Lake[2]	20,000	20,000		??	TCEQ, LCRA	N	2-3 yrs	Y	Y	20,000	$30,485,000	$3,794,000	$0.58	$190
Alternative Groundwater Supplies	Existing BlueWater System[1] (Treat and Deliver)	12,000	12,000		Y	BlueWater	N	1 yr	N	Y/N	12,000	$26,448,000	$18,310,000	$4.68	$1,526
	Forestar[1]	10,000	10,000		Y	Forestar	N	2-3 yrs	N	Y/N	???	???	???	???	???
	Northern Edwards Wellfield[1]	1,000	1,500		N	N/A	Y	2 yrs	N	N	1,200	$7,624,000	$517,000	$1.32	$431
	Vista Ridge[1]	50,000	50,000		Y	SAWS	N	3 yrs	N	Y	???	???	???	???	???
	HCPUA[1]	25,000	25,000		Y	HCPUA	N	2-3 yrs	N	Y	25,000	???	???	???	???
Other Mid- and Long-term Supplies	Down Dip Brackish Edwards[1]	5,000	10,000		Y	TCEQ, BSEACD	Y	5 - 10 yrs	Y	Y/N	7,500	$90,000,000	$13,000,000	$5.32	$1,733
	Reclaimed Water Infiltration	20,000	40,000		N	TCEQ	N	5 - 10 yrs	??	N	30,000	$110,000,000	$20,000,000	$2.05	$667
	Colorado Bed and Banks Permit[1]	40,000	70,000		Y	LCRA, TCEQ	Y	10 - 15 yrs	N	N	55,000	$310,000,000	$38,000,000	$2.12	$691

[1] These alternatives represent a treated water supply and would not incur the water treatment costs the other alternatives would require

[2] Yield and unit cost calculation assumes extremely reduced downstream environmental flow requirements

* Drought Contingency Plan (DCP) Stage 3 and 4 implementation costs are included in the current Austin Water O&M budget. However, these costs do not address the community costs/impacts of additional restrictions.

** Estimated reductions are for total reductions off of the estimated demand under Stage 2.

Attachment I