Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Austin Integrated Water Resource Planning Community Task Force

Packet Index

September 4, 2018

Austin Integrated Water Resource Planning Community Task Force
September 4, 2018 – 4:00 p.m.
Waller Creek Center, Room 104
625 East 10th Street
Austin, Texas 78701

For more information go to:
Austin Integrated Water Resource Planning Community Task Force

AGENDA

Voting Members:

Sharlene Leurig - Chair	Marianne Dwight	Sarah Richards
Jennifer Walker – Vice Chair	Diane Kennedy	Lauren Ross
Todd Bartee	Perry Lorenz	Robert Mace
Clint Dawson	Bill Moriarty	

Ex Officio Non-Voting Members:
Austin Water: Greg Meszaros
Austin Energy: Kathleen Garrett
Austin Resource Recovery: Sam Angoori
Neighborhood Housing and Community Development: Rebecca Giello
Office of Innovation: Kerry O'Connor
Office of Sustainability: Lucia Athens
Parks and Recreation: Sara Hensley
Watershed Protection: Mike Personett

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1. **CALL TO ORDER – September 4, 2018, 4:00 p.m.**

2. **CITIZEN COMMUNICATION**

   The first 10 speakers signed up prior to the meeting being called to order will each be allowed a three-minute allotment to address their concerns regarding items not posted on the agenda.

3. **APPROVAL OF MEETING MINUTES**
   a. Approval of the meeting minutes from the August 7, 2018 Task Force meeting (5 minutes)

4. STAFF BRIEFINGS, PRESENTATIONS, AND OR REPORTS

a. Recent Activities and Near-Term Schedule Update – City Staff (30 minutes)
    a. Task Force Discussion and Input
b. Staff Presentation on Draft Plan Report Version 4 - City Staff (60 minutes)
    a. Task Force Discussion and Input

5. SUBCOMMITTEE REPORTS

6. VOTING ITEMS FROM TASK FORCE

a. Discuss and consider action on changes to proposed meeting dates (10 minutes)

7. FUTURE AGENDA ITEMS

8. ADJOURN

Note: Agenda item sequence and time durations noted above are subject to change.

The City of Austin is committed to compliance with the American with Disabilities Act. Reasonable modifications and equal access to communications will be provided upon request. Meeting locations are planned with wheelchair access. If requiring Sign Language Interpreters or alternative formats, please give notice at least 2 days (48 hours) before the meeting date. Please call Austin Integrated Water Resource Planning Community Task Force, at 512-972-0194, for additional information; TTY users route through Relay Texas at 711.

For more information on the Austin Integrated Water Resource Planning Community Task Force, please contact Marisa Flores Gonzalez at 512-972-0194.

MINUTES

Austin Integrated Water Resource Planning Community Task Force **REGULAR MEETING**
August 7, 2018

The *Austin Integrated Water Resource Planning Community Task Force* convened in a Special Called Meeting on August 7, 2018 at Waller Creek Center, Conference Rm 104, 625 E 10th Street, in Austin, Texas.

Members in Attendance:

Jennifer Walker – Vice Chair	William Moriarty	Sarah Richards
Diane Kennedy	Lauren Ross	
Clint Dawson	Sharlene Leurig	

Ex-Officio Members in Attendance:
Chris Herrington, Lucia Athens, Kathleen Garrett, Josh Rudow

Staff in Attendance:
Kevin Critendon, Daryl Slusher, Teresa Lutes, Marisa Flores Gonzalez, Mark Jordan, Helen Gerlach, Geneva Guerrero, Mark Jordan, Sarah Hoes, Heather Cooke, Tony Davee, John Burke, Angela Richter, Simon Schmitz, Jordan Furnans, Rick Coronado, Vanessa Puig-Williams

Additional Attendees:
Ron Anderson

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1. CALL TO ORDER

Jennifer Walker, Acting Chair, called the meeting to order at 4:22 p.m.

2. CITIZEN COMMUNICATION: GENERAL

David Foster from Clean Water Action shared comments related to the timing of strategies and interaction with CodeNext, as well as communication with Council.

Bill Bunch of Save Our Springs shared comments related to timing of strategies, interaction with CodeNext, and comments on the Lady Bird Lake inflows strategy.

3. APPROVAL OF MEETING MINUTES

The meeting minutes from the July 3, 2018 Austin Integrated Water Resource Planning Community Task Force regular meeting were approved on Member Moriarty's motion and Member Ross second Member Richards abstained on a 7-0-1-3 vote with Member Leurig, Member Mace and Member Dwight were absent.

4. STAFF BRIEFINGS, PRESENTATIONS, AND/OR REPORTS

a. Update on Near Term Schedule by City staff, followed by Task Force discussion and input.
b. Presentation on Draft Plan Report by City staff, followed by Task Force discussion and input.

Acting Chair Jennifer Walker adjourned the meeting at 7:22 pm.

PRESENTATION

Austin WATER

WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Water Forward Task Force Meeting

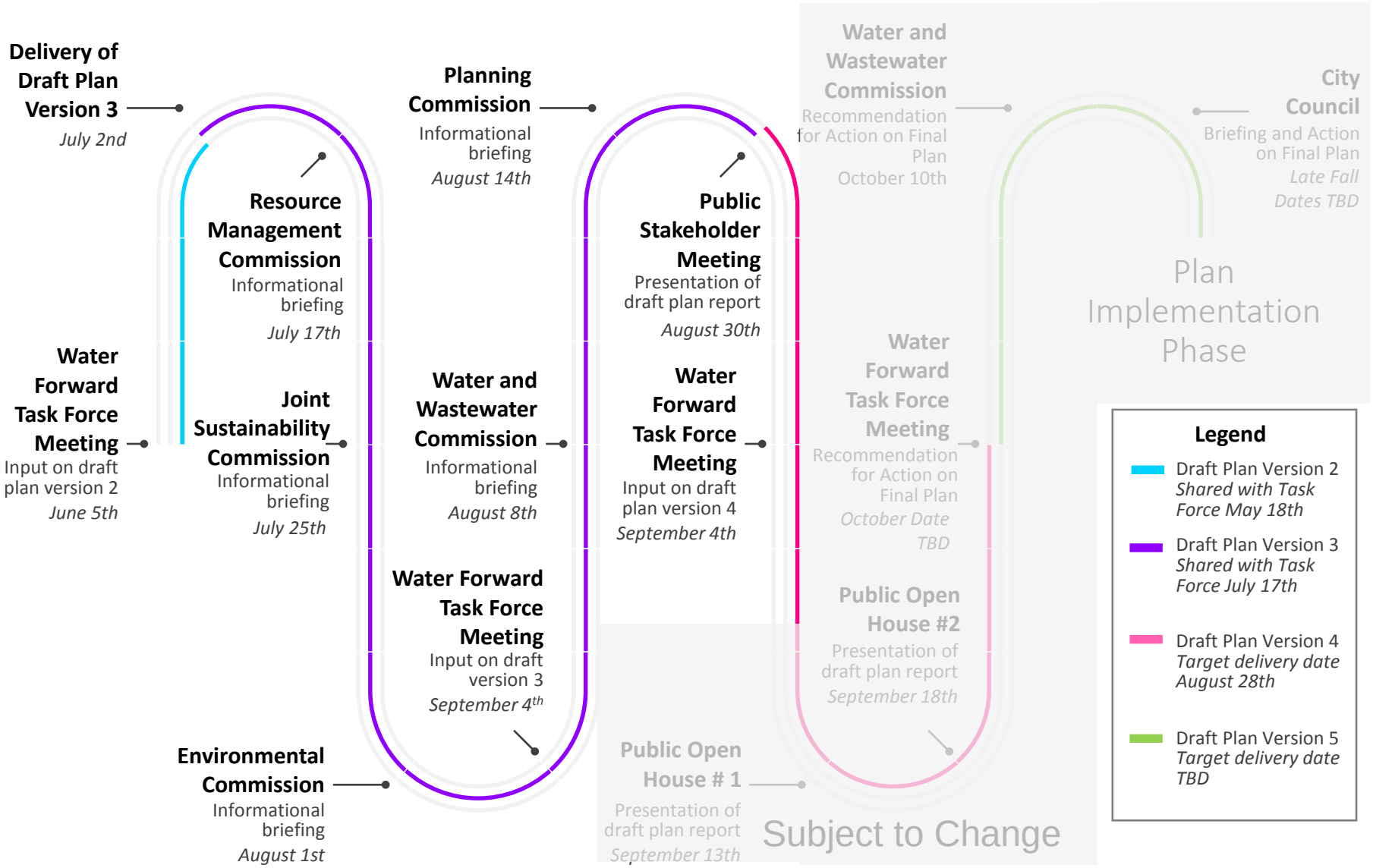
September 4, 2018

Agenda

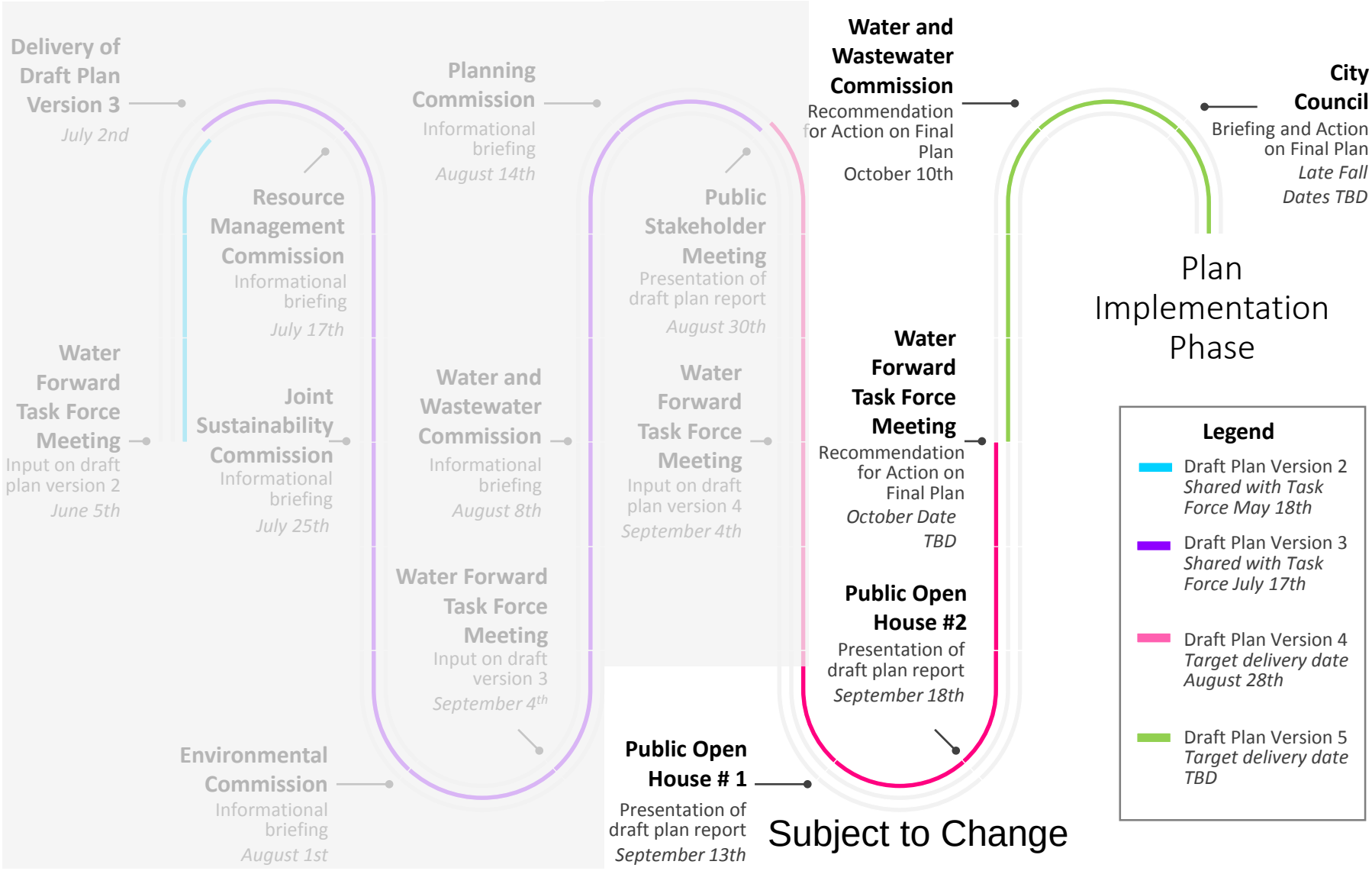
- Recent Activities and Near-Term Schedule Update
  - Task Force Discussion and Input
- Staff Presentation on Draft Water Forward Plan Report V4
  - Task Force Discussion and Input

Recent Activities and Near-Term Schedule Update

Recent Activities



Recent Activities



Potential Meeting Date Adjustments

- October 2nd Task Force meeting
  - Proposed date: October 9th

Draft Water Forward Plan Report V4

Draft Water Forward Plan Report V4 Highlights

- We will be discussing Version 4 of the draft plan report
  - Provided via email August 29th
  - Printed excerpts of highlighted changes available for Task Force and public
  - Also posted to Boards and Commissions site
- Features
  - Rewritten Executive Summary
  - Edited descriptions of Aquifer Storage and Recovery and Indirect Potable Reuse strategies

Austin WATER

BACKUP MATERIALS

SECTION 1: EXECUTIVE SUMMARY

For more than 100 years, Austin Water has been committed to providing clean, safe, reliable, high quality, sustainable, and affordable water services to our customers. Austin's Water Forward Integrated Water Resource Plan will support that enduring commitment for the next 100 years and beyond. The Water Forward plan recommendations were developed using a holistic planning approach that balances multiple objectives such as water reliability, social, environmental, and economic benefits, and ease of implementation. The guiding principles of Water Forward, which helped inform these objectives and provided direction throughout the planning process, are listed to the right.

The recommendation to develop an integrated water resource plan emerged from the historic drought Central Texas endured from 2008-2016. During the drought, the lakes that supply Austin's drinking water fell to historically low levels. While Austin successfully weathered the drought, the event highlighted the need to increase the sustainability, reliability, and diversity of Austin's water supplies through an integrated water resource plan. Water Forward addresses these issues by modeling potential climate change effects on Austin's water supplies and evaluating multiple future scenarios to plan for droughts worse than what we have experienced in the past. The recommended plan is the culmination of a robust effort that involved the Austin community, the Water Forward Task Force, an outside consultant team, City staff, and others.

In a changing climate and growing community, there will always be uncertainty and risks to manage. The Water Forward plan recommendations will be implemented using an adaptive management approach, which means that we are able to make adjustments to respond to changing conditions. Implementation of Water Forward recommendations will help Austin Water continue its commitment to providing clean, safe, reliable, and affordable water services to our customers.

1.1 Need for an Integrated Water Resource Plan (IWRP)

Austin's continued population growth and development, the historic 2008-2016 drought, and climate change pose challenges that require creative and robust solutions. An integrated water resource plan is an effective tool for planning how to address these challenges. The strength of this holistic planning method is that it allows the community to evaluate tradeoffs between potential solutions and to build solutions that achieve the most benefit in many objectives. To ensure that the plan reflects our community's

WATER FORWARD GUIDING PRINCIPLES

Austin's Water Forward is a program to develop a long-term integrated water resources plan for the next 100 years. The following represents the plan's guiding principles:

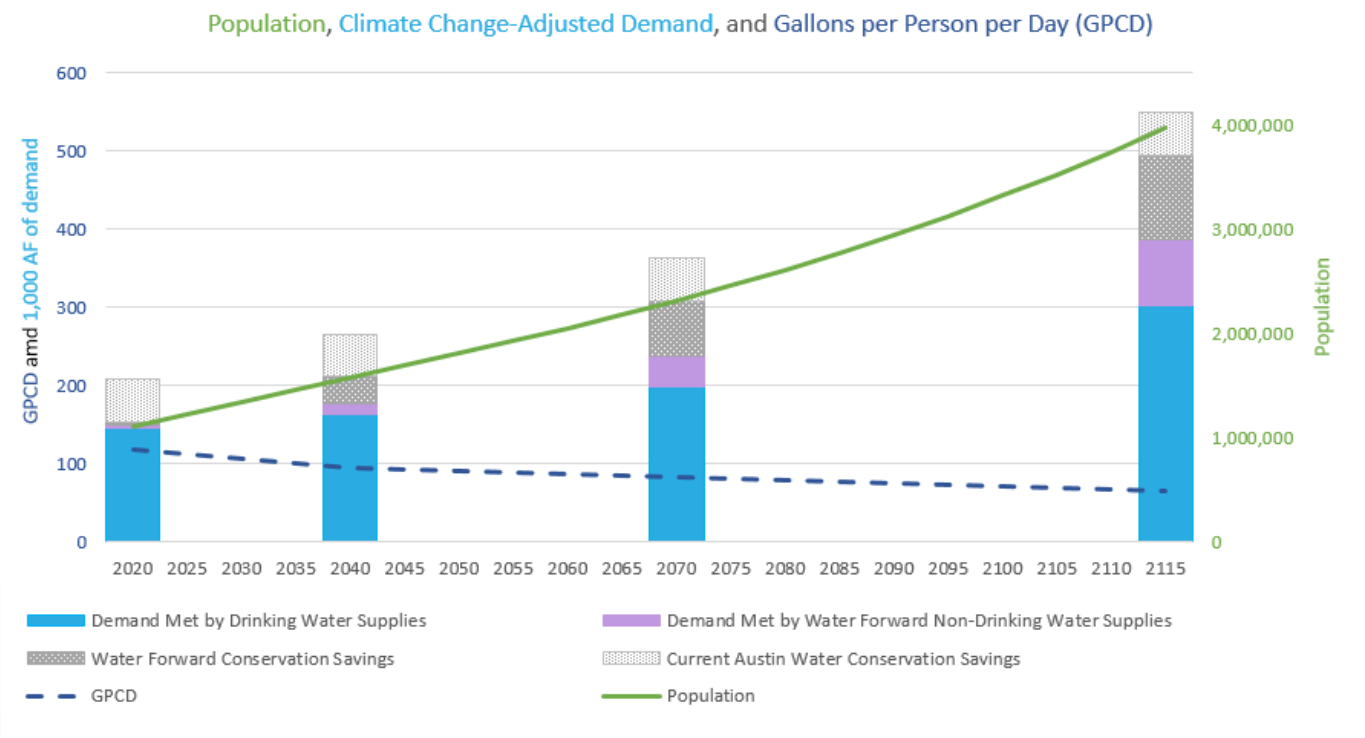
- *Recognizing that Colorado River water is Austin's core supply, continue a strong partnership between the City and LCRA to assure its reliability*
- *Continue Austin's focus on water conservation and water use efficiency*
- *Strengthen long-term sustainability, reliability, and diversity of Austin's water supply through maximizing local water resources*
- *Avoid severe water shortages during times of drought*
- *Focus on projects that are technically, socially, and economically feasible*
- *Continue to protect Austin's natural environment, including source and receiving water quality*
- *Ensure Austin's water supply continues to meet/exceed all federal, state and local public health regulations*
- *Align with Imagine Austin's "Sustainably Manage Our Water Resources Priority Program"*
- *Maintain coordination and communication with regional partners*
- *Engage the public and stakeholders throughout the plan development process*

values, the project team attended over 80 community events to gather feedback to inform the plan recommendations.

1.1.1 Population Growth

Austin has long been one of the fastest-growing cities in America. This growth is reflected in the Water Forward demand projections. Regional growth was also captured in river basin modeling that simulates future demands on the Colorado River and Highland Lakes. Water Forward includes conservation and supply strategies to meet the additional demand created by a growing City of Austin population (see **Figure 1-1**).

Figure 1-1 Population, Climate Change-Adjusted Demand, and GPCD for Water Forward Planning Horizons



1.1.2 Drought

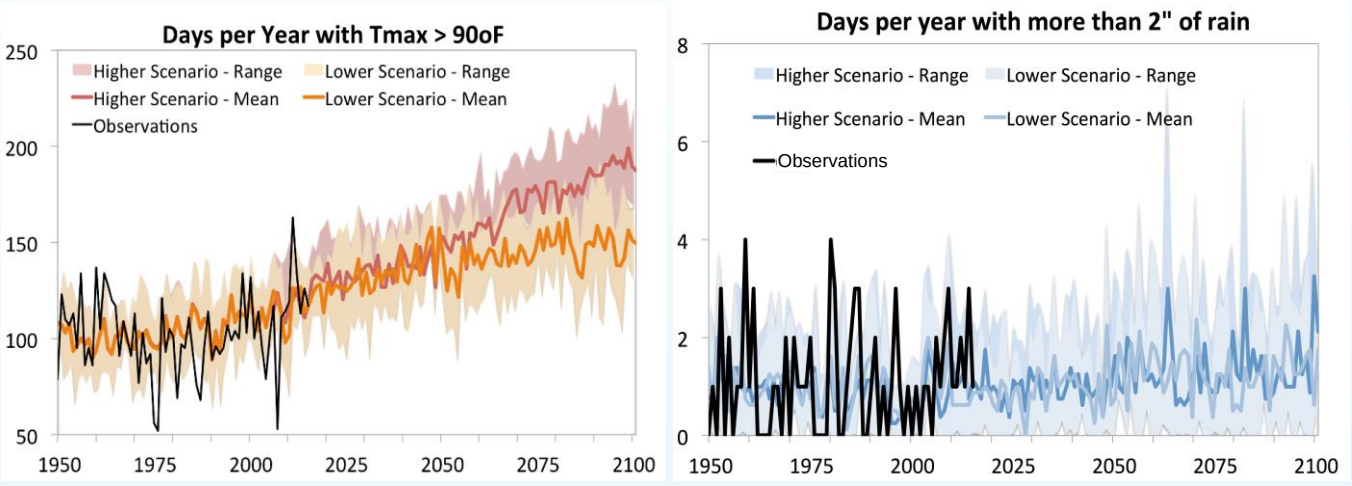
During the historic 2008-2016 drought, Austin's water management portfolio was made up of its Colorado River and Highland Lakes supply, reclaimed water supply, conservation water savings, and drought contingency plan water savings. The drought caused storage in the Highland Lakes to drop to near-record lows (see Figure 1-2 Lake Travis During the Historic 2008-2016 Drought) and the inflows that we rely on to refill the lakes were lower than they had ever been. During the drought, Austin was evaluating a number of emergency strategies on an accelerated schedule. With Water Forward, Austin has taken the opportunity to proactively develop demand management and supply strategies to avoid potential water shortages.

Figure 1-2 Lake Travis During the Historic 2008-2016 Drought

1.1.3 Climate Change

Climate scientists project that in the future the Austin region will see longer and deeper periods of drought punctuated by heavy rain events. **Figure 1-3** illustrate the projected increase in temperature and changing precipitation in the Austin region, which will likely have profound impacts on flood and drought patterns. Water Forward evaluated multiple future scenarios which considered climate change effects and droughts worse than those experienced in the past to ensure reliability of the plan recommendations through a range of possible futures.

Figure 1-3 Projected Increase in Temperature and Changes in Precipitation in the Austin Region



1.2 Water Forward Recommendations

The Water Forward plan includes strategies to conserve water, making our buildings and landscapes more water efficient. The plan recommends using Advanced Meter Infrastructure technology to alert customers to potential leaks and to help them manage their water consumption in close to real time. The plan recommends expanding an existing Austin Water rebate program to encourage existing development to transform their landscapes and recommends developing an ordinance to require water efficient landscapes for new single family homes. The plan also recommends expanding current Austin Water rebate programs to assist customers with the costs of "smart" controllers that help to make irrigation systems more efficient. The plan recommends reducing losses from pipes in the utility's water distribution system by enhancing Austin Water's current water loss reduction program. The plan recommends developing benchmarks for efficient water use for different types of development and developing water budgets that would require customers to meet efficient usage targets.

The plan also includes strategies to make use of all water, including rainwater, stormwater, graywater, air conditioning condensate, and wastewater (typically called "alternative waters") that can be treated and reused to meet non-drinking water demands. To do this, the plan recommends immediately beginning work to develop ordinances to require that new larger commercial and multifamily buildings use alternative water generated on-site or from the City's reclaimed water system for both indoor and outdoor non-drinking water purposes. Non-drinking water purposes include demands like toilet flushing and landscape irrigation.

To encourage existing development to use alternative water sources, the plan recommends expanding Austin Water's current rebate programs. The plan recommends modifying what is currently in code to require more new developments to connect to the City's reclaimed water system. The plan recommends expansion of the reclaimed water system to meet growing non-drinking water demands in the future.

Figure 1-7 Advanced Metering Infrastructure and Landscape Transformation

Figure 1-8 Alternative Water Sources Include Rainwater, Stormwater, Graywater, and Wastewater Reuse

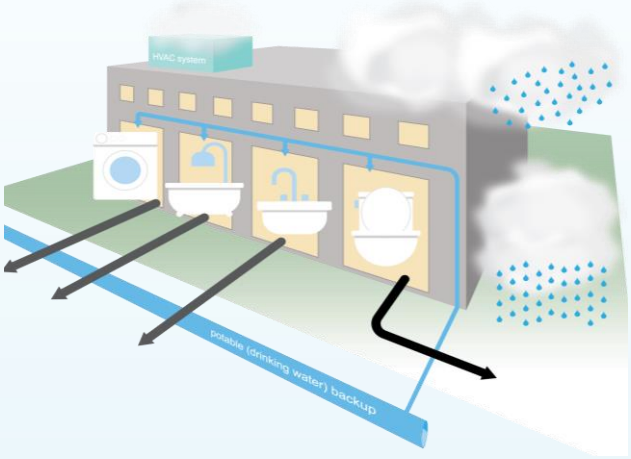
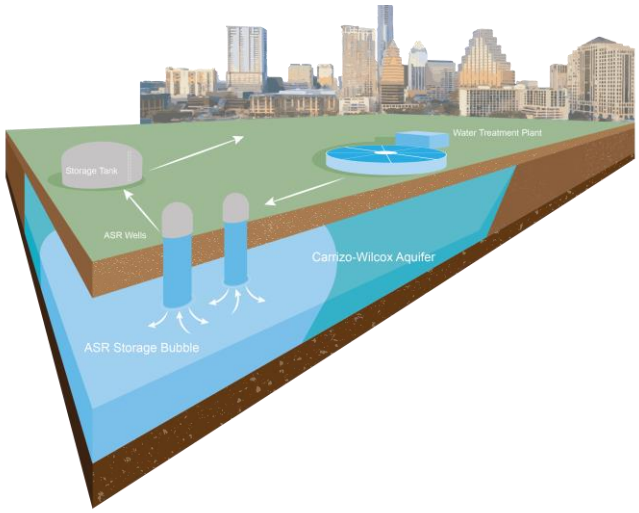
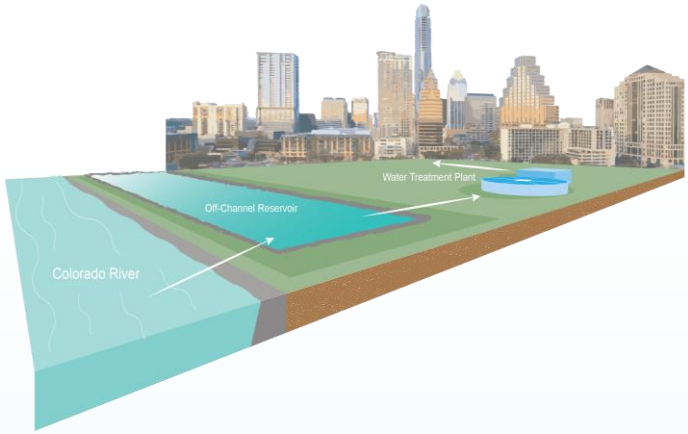


Figure 1-9 Aquifer Storage and Recovery



To see our community through future droughts, the plan recommends implementing storage strategies like Aquifer Storage and Recovery by 2040 and a new Off Channel Reservoir within the next fifty years. Storage strategies will allow Austin to store water during wet times so that water can be retrieved and used to meet drinking water demands during dry times. In the event of a severe drought, the plan recommends Indirect Potable Reuse. The plan also recommends the City bring on additional supplies by capturing local inflows to Lady Bird Lake in the near term and treating Brackish Groundwater further out into the future.

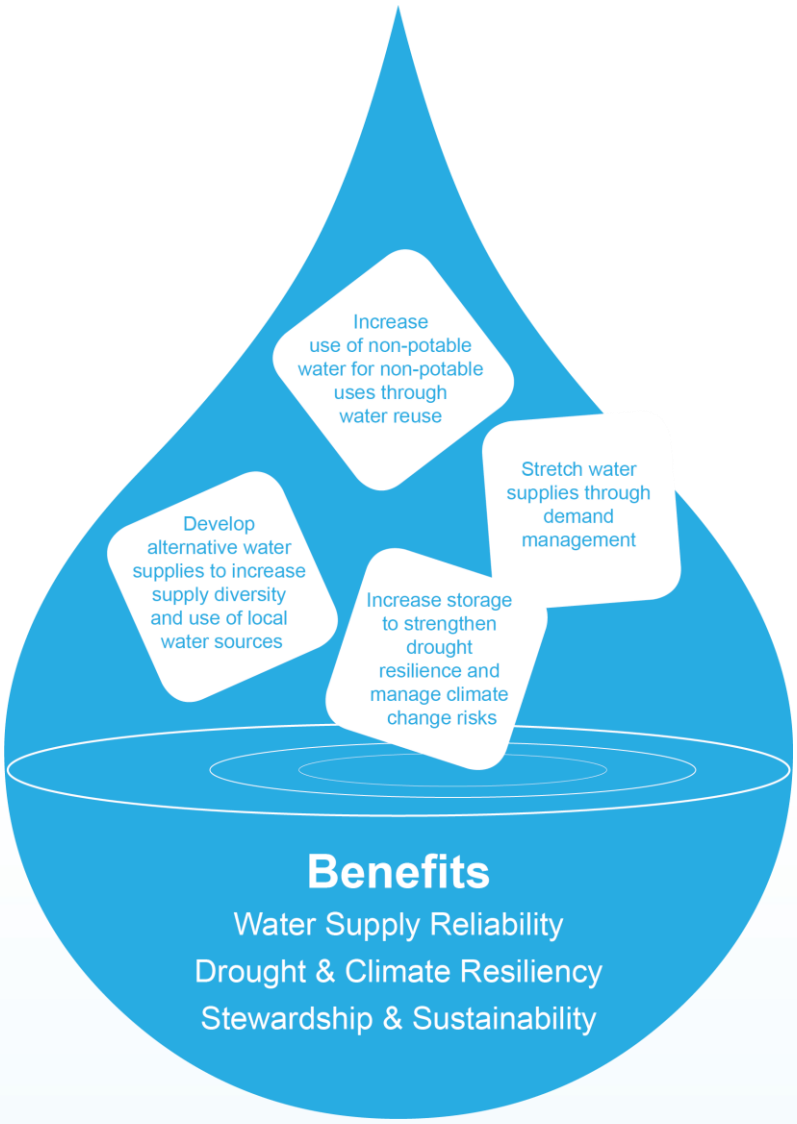
Figure 1-10 New Off Channel Reservoir



The Water Forward plan also reflects our continued commitment to Austin's core Colorado River supplies and implementation of best management practices. All of the Water Forward strategies are recommended as additions to Austin's current supplies, which include our core Colorado River supply, reclaimed water program, water conservation program, and drought contingency plan. As Austin's core supply, the City will continue to work with its regional partners to protect and enhance the Colorado River and Highland Lakes system supply.

1.3 Water Forward Plan Benefits

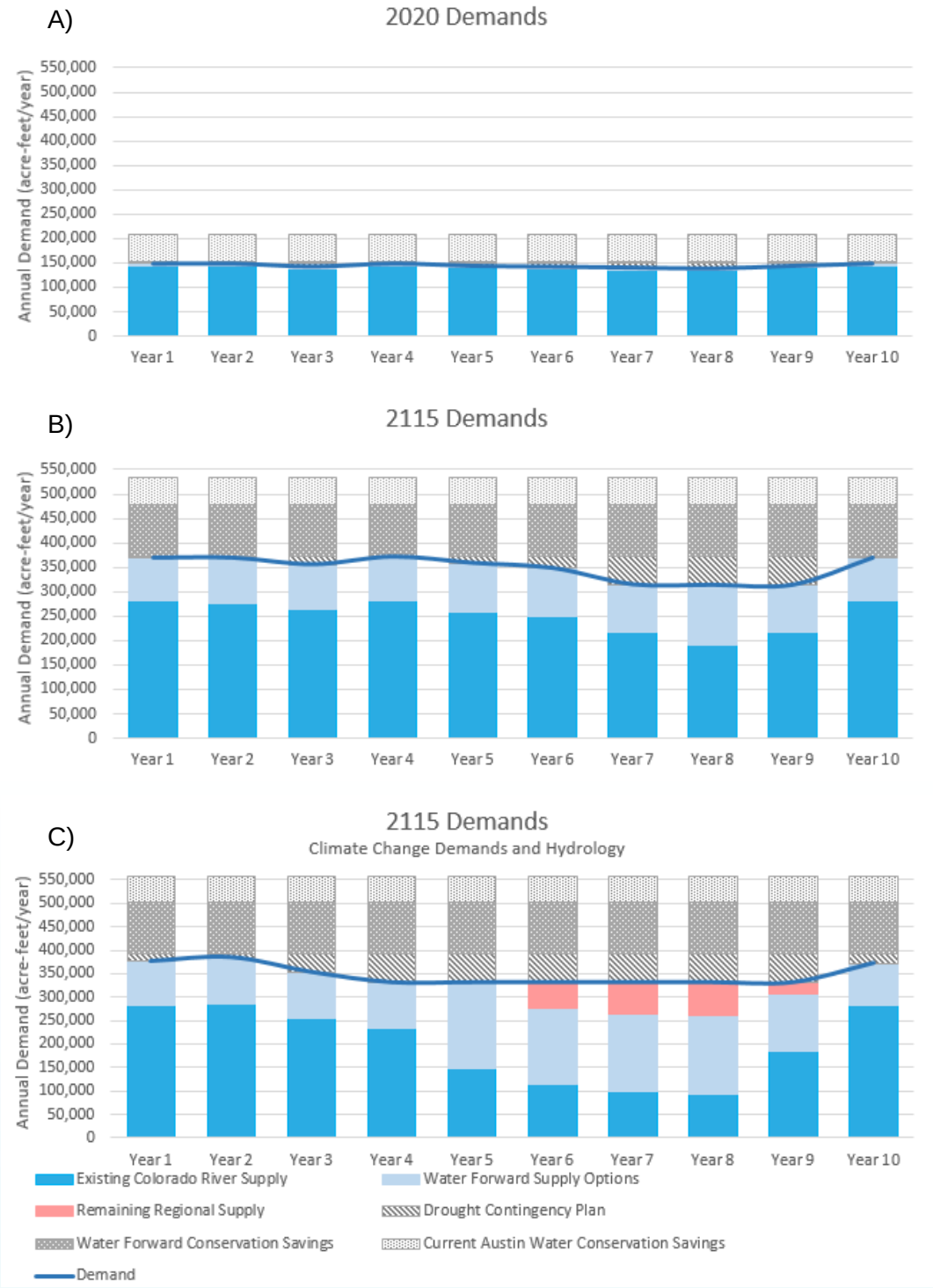
Figure 1-11 Water Forward Plan Benefits



Implementation of the recommended Water Forward strategies will be transformative for the City of Austin and provide many benefits for our community (see **Figure 1-11**). Water Forward's recommended strategies will help Austin stretch existing supplies through water use reductions, more efficient water use, and water reuse. Capturing and reusing water closer to the point of use adds to our supply diversity and resiliency while aligning with the value our community places on local water sources. Expanding reuse supplies, whether at the building scale or from the City's reclaimed water system, allows us to use non-drinking water to meet demands that don't require drinking water quality. This "fit for purpose" approach offsets demand for drinking water supplies while providing a source of supply that is less affected by changes in climate. In addition, increasing water supply reserves through Aquifer Storage and Recovery will help to provide water to the City through the longer periods of drought that we may experience in the future.

By diversifying Austin's water supply and demand management portfolio, Water Forward increases the City's ability to maintain a reliable supply for the next 100 years. **Figure 1-12a** and **Figure 1-12b** show modelling results that illustrate how the strategies perform through simulated droughts that mimic the severity of the historic 2008-2016 drought. **Figure 1-12a** shows that there is no shortage if demands are set at projected 2020 levels and Water Forward strategies are implemented. **Figure 1-12b** shows that with the Water Forward strategies implemented, the City's demands are also met when demands are set at the higher projected 2115 levels. In **Figure 1-12c**, the drought that was simulated to mimic the 2008-2016 drought was made more severe to reflect potential climate change impacts. Using this simulation, with demands set at higher 2115 levels and with the Water Forward strategies implemented, a portion of the City's demands are met with a future regional supply source. This result reinforces the need to work with the City of Austin's partners in the Colorado River Basin to protect and enhance our future supplies.

Figure 1-12 Water Forward Modelling Results for Drought and Climate Change Hydrologies



1.4 Adaptive Management Plan and Implementation

Austin Water plans to begin the implementation process immediately after City Council approval of the Water Forward Plan. During the next five years Austin Water will take actions that are described in more

detail in **Table 1-1 Water Forward Implementation Actions in the Next Five Years**. The Water Forward plan will be updated on a five year cycle, using new data about changing conditions to inform potential adjustments to the planned implementation strategy and ensuring that we are on a path to meeting our goals.

The estimated costs to implement the recommended options are presented in **Appendix J – Options Characterization Sheets**. The cost of implementing the recommended strategies could be funded through, among other methods, Austin Water revenues, low-interest loans or other outside funding, development costs, or shared community investments. In some cases, Austin Water investments could be combined with investments from the community, as in rebates and other incentive programs.

Implementing the Water Forward recommendations will require a thoughtful approach that protects public health, considers social equity, and maintains affordability and utility financial resilience. Austin Water is committed to implementing the Water Forward plan as quickly as possible, with appropriate time to hear from the community and develop implementation approaches that mitigate unintended consequences.

Future Water Forward efforts will continue the plan's emphasis on public outreach and community involvement. The plan recommends convening the Water Forward Task Force on a quarterly basis to support plan implementation efforts. With hard work and community support, implementation of Water Forward will create a more sustainable, reliable water supply for Austin for the next 100 years and beyond.

Table 1-1 Water Forward Implementation Actions in the Next Five Years

Ordinances	Incentives	Projects and Programs
• Develop and implement an alternative water ordinance for new larger commercial and multifamily development • Develop and implement a dual plumbing ordinance for new larger commercial and multifamily development • Expand current reclaimed water system connection requirements • Develop and implement a potential ordinance to require new development submittal of water use information • Monitor existing ordinances related to air conditioning condensate reuse and cooling tower and steam boiler efficiency	• Expand the current alternative water incentive program • Expand the current landscape incentive program • Expand the current irrigation efficiency incentive program	• Study and begin design, construction, and testing of an Aquifer Storage and Recovery pilot • Implement Advanced Metering Infrastructure • Enhance the current utility water loss reduction program • Expand the centralized reclaimed water system • Explore community scale decentralized reclaimed water options • Refinement of Indirect Potable Reuse strategy • Refinement of Capture Lady Bird Lake Inflows strategy • Begin preliminary analyses to support five-year Water Forward plan update
Convene the Water Forward Task Force on a quarterly basis and continue public outreach and engagement efforts throughout implementation.		

The recommended Water Forward strategies are presented in Table 1-2. Water Forward Recommended Options with Planning Horizon Yields and can generally be grouped into two categories: demand management options and supply options. Demand management options are strategies which reduce the demand on Austin's drinking water supply system, either by removing a demand (for example, transforming landscapes to require less water) or by offsetting drinking water demands (for example collecting rainwater to use for irrigation rather than drinking water). Supply options are strategies which produce additional water to meet demands. This water includes strategies for drinking water supplies and non-drinking water supplies where appropriate.

Table 1-2. Water Forward Recommended Options with Planning Horizon Yields

Recommended Options	Average/ Drought	Estimated Yield Capacity (Acre Feet per Year)[1]			
		2020	2040	2070	2115
Demand Management Options					
Advanced Metering Infrastructure (AMI)	Both	596	3,882	5,766	9,371
Water Loss Control	Both	3,108	9,326	10,918	13,064
CII Ordinances	Both	1,063	1,063	1,063	1,063
Benchmarking	Both	-	5,953	11,670	25,228
Landscape Ordinance	Both	-	3,038	7,428	15,050
Landscape Transformation Incentive	Both	-	321	633	929
Irrigation Efficiency Incentive	Both	42	205	427	394
Lot Scale Stormwater Harvesting	Both	-	329	869	2,275
Lot Scale Rainwater Harvesting	Both	-	1,550	4,032	9,251
Greywater Harvesting	Both	-	2,126	5,617	12,667
Building Scale Wastewater Reuse	Both	-	1,323	3,672	7,875
AC Condensate Reuse	Both	100	1,084	2,711	5,150
Demand Management Options Sub-Total	-	4,908	30,202	54,806	102, 317
Water Supply Options					
Aquifer Storage and Recovery	Drought	-	60,000	60,000	90,000
Brackish Groundwater Desalination	Both	-	-	5,000	16,000
Direct Non-Potable Reuse	Both	500	12,000	25,000	54,600
Indirect Potable Reuse (IPR) through Lady Bird Lake	Drought	-	11,000	20,000	20,000
Capture Local Inflows to Lady Bird Lake (infrastructure also included as part of IPR, above)	Average	-	3,000	3,000	3,000
Off Channel Reservoir	Both	-	-	25,000	25,000
Distributed Wastewater Reuse	Both	-	3,154	14,467	30,049
Sewer Mining	Both	-	1,000	2,211	5,284
Community Stormwater Harvesting	Both	-	158	236	504
Drought Supply Options	-	-	71,000	80,000	110,000
Average/Both Supply Options	-	500	19,312	74,914	134,437
Water Supply Options Sub-Total	-	500	90,312	154,914	244,437
OVERALL TOTAL	-	**5,408**	**120,512**	**209,720**	**346,754**

[1]Yield capacity represents the maximum annual yield for the option in ideal conditions. Actual yield will vary based on hydrology and need

7.2.1 Aquifer Storage and Recovery

Aquifer storage and recovery (ASR) is a strategy in which water can be stored in an aquifer during wetter periods and recovered at a later date. Storing water underground can improve drought preparedness in the same way storing water in a reservoir does, while eliminating the water loss due to evaporation that occurs in open above-ground reservoirs. Although some losses may occur using ASR through leakage or migration, the losses are much smaller than surface evaporation on an above-ground reservoir of similar size. ASR is currently being used by cities in Texas, such as San Antonio, Kerrville and El Paso. Exploring ASR as a potential water storage option was a recommendation of the 2014 Task Force.

Austin had previously initiated feasibility analyses to better understand the geology and hydrogeology characteristics of the Northern Edwards and Trinity Aquifers to evaluate potential for recharge and extraction. These analyses found that regulatory restrictions would prevent injecting into or transecting the Edwards Aquifer, making it difficult to proceed with ASR concepts in these aquifers in the Austin area. Also, the Carrizo Wilcox Aquifer has more favorable geologic characteristics for storage of water that would increase the amount of water that is able to be recovered from the aquifer. For these reasons, among others, in Water Forward the Aquifer Storage and Recovery concept that was evaluated was located in the Carrizo Wilcox Aquifer. This option includes facilities to pipe treated drinking water from Austin's distribution system to an ASR wellfield for injection and storage in the Carrizo-Wilcox aquifer. Facilities also include a pump station and storage tank to convey recovered water from the ASR wellfield to the city's distribution system.

Aquifer Storage and Recovery facilities would be planned to serve solely a storage function, allowing for maximization of surface water resources during drought periods. This concept is in keeping with the Water Forward guiding principle of maximizing locally available water resources. Site selection will depend on favorable hydrogeology to fulfill the ASR facility's intended storage purpose. In implementing this option, Austin Water would work to develop and test a pilot facility to assess potential site characteristics and ensure that the strategy's objective to store surface water in and recover surface from the aquifer is achievable. The ASR option is in no way intended to be a strategy to develop native groundwater. To be clear, the ASR injection and recovery wells are in no way intended to pump native groundwater from the Carrizo Wilcox Aquifer and convey that water to Austin via a transmission pipeline.

Potential implementation issues for ASR include:

- Understanding the potential migration of stored water and mixing with the native groundwater,
- Protection of stored surface water from recovery by others, and
- Navigating changing regulatory requirements for ASR.

7.2.2 Brackish Groundwater Desalination

Brackish groundwater is defined as groundwater containing between 1,000 and 10,000 milligrams per liter (mg/L) of total dissolved solids (TDS). Desalination is often required to remove dissolved solids from brackish groundwater, or brackish water can be blended with another low-TDS source water to reduce total TDS levels. The specific process used to desalinate water varies depending upon the total dissolved solids, the temperature, and other physical characteristics of the source water, but always requires disposal of concentrate, called brine, that has a higher total dissolved solids content than the source water. The City of El Paso has been treating 27.5 MGD of brackish groundwater since 2007, while the San Antonio

The option evaluated for this study would directly convey highly treated reclaimed water through a pipe from one treatment train at South Austin Regional WWTP to the Ullrich WTP. The effluent would be treated on-site at Ullrich WTP using a new advanced water treatment train, potentially including microfiltration and reverse osmosis. The treated water would then be blended with raw water prior to being pumped back to the headworks of Ullrich WTP for treatment through the conventional water treatment process to produce potable drinking water. Although direct potable reuse offers benefits such as a climate resilient supply, it presents significant regulatory uncertainty – which can impact when and if direct potable reuse projects can be implemented.

Potential implementation issues for direct potable reuse include:

- Regulatory uncertainty, and
- Challenges with public opinion and the need for public education on water safety.

7.2.5 Indirect Potable Reuse with Capture Local Inflows to Lady Bird Lake

7.2.5.1 Indirect Potable Reuse (IPR) through Lady Bird Lake

Indirect potable reuse (IPR) was evaluated in Water Forward as an emergency strategy to be used infrequently during only the most severe drought situations. During deep drought periods, when combined storage of the Highland Lakes is lower than at any point in the historical period of record, IPR would be an emergency supply to meet potable water demands. The term “indirect” in the name of this option means that rather than conveying highly treated reclaimed water directly to a water treatment plant, reclaimed water is conveyed indirectly through a natural buffer like a stream to the point of final treatment to potable drinking water quality. The City of Wichita Falls recently implemented an IPR project in response to drought which sends up to 16 million gallons per day (MGD) of wastewater to Lake Arrowhead, which provides a buffer prior to treatment at the surface water treatment plant.

The representative option evaluated for this plan would convey highly treated reclaimed water from one treatment train at South Austin Regional WWTP to Lady Bird Lake through a reclaimed water transmission main and subsequently divert this water through a new intake pump and piping system downstream of Tom Miller Dam to be conveyed to Ullrich WTP. This concept could utilize a reclaimed main from South Austin Regional WWTP to Lady Bird Lake that is already included in the Reclaimed System Master Plan. This approach would supplement water releases from Lakes Buchanan and Travis to extend water supplies during severe drought only. This option is a drought strategy that would be recommended for implementation only in the event of 400,000 AF of combined storage or less in Lakes Buchanan and Travis, which is well after the lakes have dropped below emergency and crisis levels. This option would be utilized for the shortest possible time to meet urgent supply needs. Should this option be required to be utilized in a deep drought emergency for the survival of the City, Austin Water would perform outreach to educate and notify the public about the use of the strategy, develop robust protocols to guide operations for the period when the strategy is in use, perform monitoring to ensure drinking water quality standards are met, and monitor water quality in Lady Bird Lake. During the plan implementation phase, Austin Water will work to develop specific protocols regarding the implementation and use of the indirect potable reuse strategy in emergency conditions.

Potential implementation issues for indirect potable reuse include:

- Challenging permitting process, and
- Challenges with public opinion and the need for public education on water safety.

7.2.5.2 Capture Local Inflows to Lady Bird Lake (infrastructure also included as part of IPR, above)

As the IPR option would only be used on an infrequent basis during severe drought conditions, the intake and pumping components could be used on a more frequent basis to capture spring flows to Lady Bird Lake when available. Lady Bird Lake inflows would be conveyed to Ullrich WTP for treatment and distribution. The average annual yield for the Capture Local Inflows to Lady Bird Lake strategy is estimated to be approximately 3,000 AFY. Water availability for the Capture Local Inflow to Lady Bird Lake option would be intermittent and seasonal, with availability more likely in the months of November through February when downstream agricultural irrigation operations are offline and environmental flow requirements are the lowest for the year.

Potential implementation issues for Capture Local Inflows include:

- Water availability would be intermittent and seasonal

7.2.6 Additional Supply from Lower Colorado River Authority (LCRA)

Water from the Colorado River through its water rights and firm contract with LCRA is the primary source of all raw water for Austin; this water is treated and used to meet Austin's demands. This option would involve securing additional supply from the LCRA through a new or amended contract. Currently LCRA has approximately 54,600 acre-feet of water available for contracting (50,000 acre-feet of which is the LCRA Board of Director's reserve amount and is subject to contracting approval by the LCRA Board of Directors). The additional LCRA supply would be accessed using existing and future treatment and transmission infrastructure. There could be additional supply available for contracting over time as LCRA plans to continue to develop additional supplies in the future.

Potential implementation issues for contracting more LCRA supply include:

- Future availability of water includes uncertainties.

7.2.7 Off-Channel Storage Reservoir

This strategy would involve the construction of a new off-channel reservoir in the Austin region that Austin Water would own and operate. An off-channel reservoir is constructed away from the main stem river channel and is filled by pumping water in from the main river channel to the reservoir. This type of reservoir requires additional infrastructure, such as impoundment structures and pump stations to move water from the main river channel.

The off-channel reservoir option being considered would use source water from the Colorado River during times when water is available. The approximate size of this reservoir would be up to 25,000 AF. An evaporation suppressant could be applied during summer months to reduce water lost through evaporation. The off-channel reservoir could also be used conjunctively with ASR, allowing further storage and evaporation management opportunities.

Potential implementation issues for an off-channel storage reservoir include:

9.1.3.9 D12 – AC Condensate Reuse Ordinance

Require collection and reuse of condensate water from Air Handling Units (AHUs) for cooling systems from new development with cooling capacity over 200 tons. Targeted Customer Sectors, End Uses, and Development Types (new, existing, or both):

- Sectors: MFR, COM, COA
- End Uses: Cooling
- New and existing development

9.1.3.10 S1 – Aquifer Storage and Recovery

Aquifer storage and recovery (ASR) is a strategy in which water (ex: potable drinking water) can be stored in an aquifer during wetter periods and recovered for use during drier periods. The Carrizo-Wilcox ASR option includes facilities to pipe treated drinking water from the City of Austin's distribution system to an ASR wellfield for injection and storage in the Carrizo-Wilcox aquifer. Facilities also include a pump station and storage tank to convey recovered water from the ASR wellfield to the City of Austin distribution system. To date, only preliminary costs for an ASR pilot are include in the AW capital improvements.

Austin had previously initiated feasibility analyses to better understand the geology and hydrogeology characteristics of the Northern Edwards and Trinity Aquifers to evaluate potential for recharge and extraction. These analyses found that regulatory restrictions would prevent injecting into or transecting the Edwards Aquifer, making it difficult to proceed with ASR concepts in these aquifers in the Austin area. Also, the Carrizo Wilcox Aquifer has more favorable geologic characteristics for storage of water that would increase the amount of water that is able to be recovered from the aquifer. For these reasons, among others, in Water Forward the Aquifer Storage and Recovery concept that was evaluated was located in the Carrizo Wilcox Aquifer.

Aquifer Storage and Recovery facilities would be planned to serve solely a storage function, allowing for maximization of surface water resources during drought periods. This concept is in keeping with the Water Forward guiding principle of maximizing locally available water resources. Site selection will depend on favorable hydrogeology to fulfill the ASR facility's intended storage purpose. In implementing this option, Austin Water would work to develop and test a pilot facility to assess potential site characteristics and ensure that the strategy's objective to store surface water in and recover surface from the aquifer is achievable. The ASR option is in no way intended to be a strategy to develop native groundwater. To be clear, the ASR injection and recovery wells are in no way intended to pump native groundwater from the Carrizo Wilcox Aquifer and convey that water to Austin via a transmission pipeline.

9.1.3.11 S2 – Brackish Groundwater Desalination

Desalination is the process of removing dissolved solids from seawater or brackish groundwater, often by forcing the source water through membranes under high pressure. The specific process used to desalinate water varies depending upon the total dissolved solids, the temperature, and other physical characteristics of the source water but always requires disposal of concentrate that has a higher total dissolved content than the source water. Disposal may take the form of an injection well, evaporation beds, or an ocean outfall diffuser.

9.1.3.12 S3 – Direct Non-Potable Reuse (Centralized Reclaimed Water System)

Through its Water Reclamation Initiative (WRI) program, AW provides highly treated wastewater effluent for non-potable uses such as irrigation, cooling, manufacturing, and toilet flushing. Austin's direct reuse (purple pipe) system currently supplies approximately 4,600 AF per year. To meet projected demands, an additional 28,000 AFY are needed for direct municipal purposes by year 2070. An additional 10,500 AFY were projected for steam electric needs in Travis County. AW will continue implementation of the centralized reclaimed water (purple pipe) system master plan with consideration of potential expansion. Implementation of both centralized and decentralized reclaimed options will be informed by and will coordinate with one another.

- Centralized and Decentralized Reclaimed Water
    - This includes the Centralized Reclaimed Water (Purple Pipe) System and decentralized reclaimed options: community scale distributed wastewater reuse and community scale sewer mining.
    - Initial steps for decentralized reclaimed options will include additional refinement of geospatial analysis and potential project identification. Later steps will include design and construction of decentralized reclaimed projects.

9.1.3.13 S5(a) – Indirect Potable Reuse through Lady Bird Lake

Indirect potable reuse (IPR) was evaluated in Water Forward as an emergency strategy to be used infrequently during only the most severe drought situations. During deep drought periods, when combined storage of the Highland Lakes is lower than at any point in the historical period of record, IPR would be an emergency supply to meet potable water demands. This option would convey highly treated reclaimed water from one treatment train at South Austin Regional WWTP to Lady Bird Lake through a reclaimed water transmission main and subsequently divert this water through a new intake pump and piping system downstream of Tom Miller Dam to be conveyed to Ullrich WTP. This concept could utilize a reclaimed main from South Austin Regional WWTP to Lady Bird Lake that is already included in the Reclaimed System Master Plan. This approach would supplement water releases from Lakes Buchanan and Travis to extend water supplies during severe drought only. This option is a drought strategy that would be recommended for implementation only in the event of 400,000 AF of combined storage or less in Lakes Buchanan and Travis which is well after the lakes have dropped below emergency and crisis levels. This option would be utilized for the shortest possible time to meet urgent supply needs. Should this option be required to be utilized in a deep drought emergency for the survival of the City, Austin Water would perform outreach to educate and notify the public about the use of the strategy, develop robust protocols to guide operations for the period when the strategy is in use, perform monitoring to ensure drinking water quality standards are met, and monitor water quality in Lady Bird Lake. During the plan implementation phase, Austin Water will work to develop specific protocols regarding the implementation and use of the indirect potable reuse strategy in emergency conditions.

9.1.3.14 S5(b) – Capture Local Inflows to Lady Bird Lake

As the IPR option would only be used on an infrequent basis during severe drought conditions, the intake and pumping components could be used on a more frequent basis to capture spring flows to Lady Bird Lake when available. Lady Bird Lake inflows would be conveyed to Ullrich WTP for treatment and distribution. This option would allow for the capture of available spring flows, including flows from Barton Springs that flow into Lady Bird Lake, and other stormwater flows when they are not needed downstream

for environmental flow maintenance or for downstream senior water rights. The average annual yield for the Capture Local Inflows to Lady Bird Lake strategy is estimated to be approximately 3,000 AFY. Water availability for the Capture Local Inflow to Lady Bird Lake option would be intermittent and seasonal, with availability more likely in the months of November through February when downstream agricultural irrigation operations are offline and environmental flow requirements are the lowest for the year.

9.1.3.15 S7 – New Off Channel Reservoir w/ Lake Evaporation Suppression

This strategy would involve the construction of a new off-channel reservoir in the Austin region. The approximate size of this reservoir would be about 25,000 AF. An evaporation suppressant would be applied during summer months to reduce water lost through evaporation.

9.1.3.16 S9 – Community Scale Distributed Wastewater Reuse

Distributed Wastewater Reuse is defined for the purpose of this project as the collection of wastewater from the sewerage system in new development areas, treatment to Type 1 quality, and reuse at the local/community scale. These facilities would be completely separate from the centralized wastewater collection system. Facilities may be located at the site of existing local WWTP, or at new potential sites. Reuse via a dual (purple) pipe system will supply irrigation, landscaping, toilet, laundry (clothes washing), and cooling demands. Treatment plants are sized to meet demand and peak wet weather flow. Reuse from this option is not considered for outdoor end uses in Critical Water Quality Zones, floodplains, or the Edwards Aquifer Recharge Zone.

9.1.3.17 S10 – Community Scale Sewer Mining

Local Wastewater Scalping (or 'Sewer Mining') is defined for the purpose of this project as involving the extraction of wastewater from the existing centralized wastewater collection system, treatment to Type 1 quality, and reuse at the local/community scale. The treatment plant is situated close to both the demand and to the sewer extraction point, to reduce reticulation and pumping costs. This can be located either within existing open space or within a new development. Reuse via a dual (purple) pipe system will supply irrigation, landscaping, toilet and potentially also laundry (clothes washing) and cooling demands. Treatment plant wastes (sludge) from the treatment process are discharged to the centralized wastewater collection system for subsequent treatment at the downstream WWTPs. Reuse from this option is not considered for outdoor end uses in Critical Water Quality Zones, floodplains, or the Edwards Aquifer Recharge Zone. All scenarios assume back-up supply from the centralized water distribution system.

9.1.3.18 S11 – Community Scale Stormwater Harvesting

Stormwater harvesting is defined for the purpose of this project as the collection of stormwater runoff from urban areas (e.g. impervious surfaces including roads, pavements and roofs), for treatment and reuse for irrigation/landscaping or reuse for dual pipe systems at the community scale. Implementing stormwater harvesting in new developments provides an opportunity to plumb buildings with internal connections for toilet flushing, clothes washing or to cooling towers. Retrofitting existing buildings with internal connections to a dual supply source can be cost prohibitive and/or practically difficult, and so it is assumed for the purposes of this study that stormwater harvesting for existing developed areas would be used solely for irrigation/landscaping of public open space.

9.1.4 Dual Plumbing Ordinance

Option Description: In Phase 1, stakeholder process will explore requiring dual plumbing for new large Commercial and Multifamily development (with a potable backup). In Phase 2, stakeholder process will

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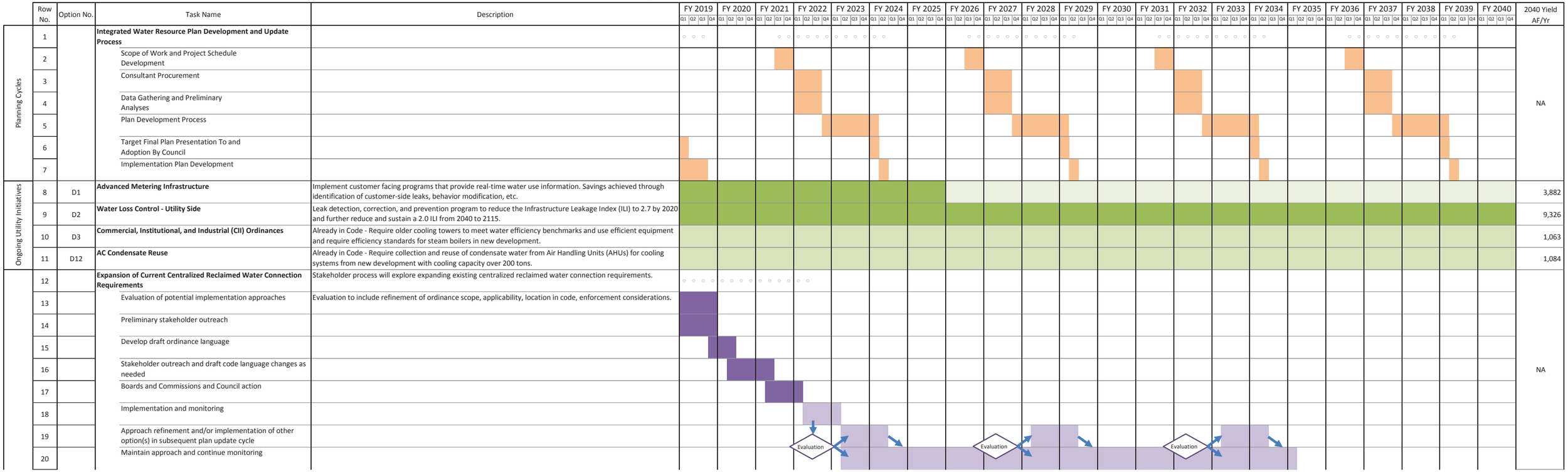
NOTE: All process steps are not included on this informational visual.

	Row No.	Option No.	Task Name	Description	2040 Yield AF/Yr
Planning Cycles	1		**Integrated Water Resource Plan Development and Update Process**		NA
	2		Scope of Work and Project Schedule Development		
	3		Consultant Procurement		
	4		Data Gathering and Preliminary Analyses		
	5		Plan Development Process		
	6		Target Final Plan Presentation To and Adoption By Council		
	7		Implementation Plan Development		
Ongoing Utility Initiatives	8	D1	**Advanced Metering Infrastructure**	Implement customer facing programs that provide real-time water use information. Savings achieved through identification of customer-side leaks, behavior modification, etc.	3,882
	9	D2	**Water Loss Control - Utility Side**	Leak detection, correction, and prevention program to reduce the Infrastructure Leakage Index (ILI) to 2.7 by 2020 and further reduce and sustain a 2.0 ILI from 2040 to 2115.	9,326
	10	D3	**Commercial, Institutional, and Industrial (CII) Ordinances**	Already in Code - Require older cooling towers to meet water efficiency benchmarks and use efficient equipment and require efficiency standards for steam boilers in new development.	1,063
	11	D12	**AC Condensate Reuse**	Already in Code - Require collection and reuse of condensate water from Air Handling Units (AHUs) for cooling systems from new development with cooling capacity over 200 tons.	1,084
	12		**Expansion of Current Centralized Reclaimed Water Connection Requirements**	Stakeholder process will explore expanding existing centralized reclaimed water connection requirements.	NA
	13		Evaluation of potential implementation approaches	Evaluation to include refinement of ordinance scope, applicability, location in code, enforcement considerations.	
	14		Preliminary stakeholder outreach		
	15		Develop draft ordinance language		
	16		Stakeholder outreach and draft code language changes as needed		
	17		Boards and Commissions and Council action		
	18		Implementation and monitoring		
	19		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	20		Maintain approach and continue monitoring		



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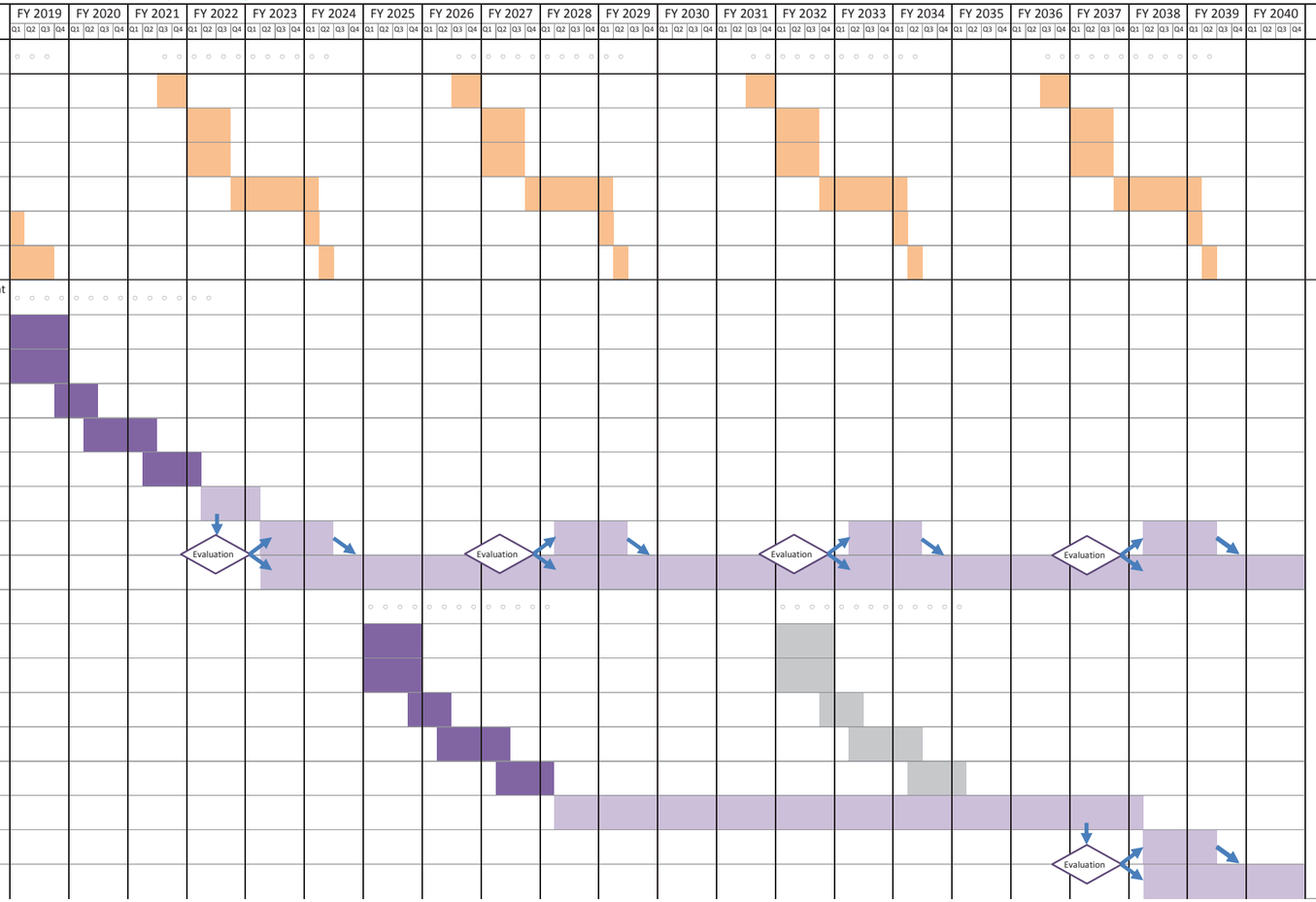
	4		Data Gathering and Preliminary Analyses		
	5		Plan Development Process		
	6		Target Final Plan Presentation To and Adoption By Council		
	7		Implementation Plan Development		
	21	D8, D9, D10, D11, S11	**Phase 1 Dual Plumbing Ordinance Development**	Stakeholder process will explore requiring dual plumbing for new large Commercial and Multifamily development (with a potable backup).	NA
	22		Evaluation of potential implementation approaches	Evaluation to include refinement of ordinance scope, applicability, location in code, enforcement considerations.	
	23		Preliminary stakeholder outreach		
	24		Develop draft ordinance language		
	25		Stakeholder outreach and draft code language changes as needed		
	26		Boards and Commissions and Council action		
	27		Implementation and monitoring		
	28		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	29		Maintain approach and continue monitoring		
	30		**Phase 2 Dual Plumbing Ordinance Development**	Stakeholder process will explore expanding ordinance's applicability to potentially include mid-size new commercial and multifamily (with a potable back-up required).	
	31		Evaluation of potential implementation approaches	Evaluation to include refinement of ordinance scope, applicability, location in code, enforcement considerations.	
	32		Preliminary stakeholder outreach		
	33		Develop draft ordinance language		
	34		Stakeholder outreach and draft code language changes as needed		
	35		Boards and Commissions and Council action		
	36		Implementation and monitoring		
	37		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	38		Maintain approach and continue monitoring		



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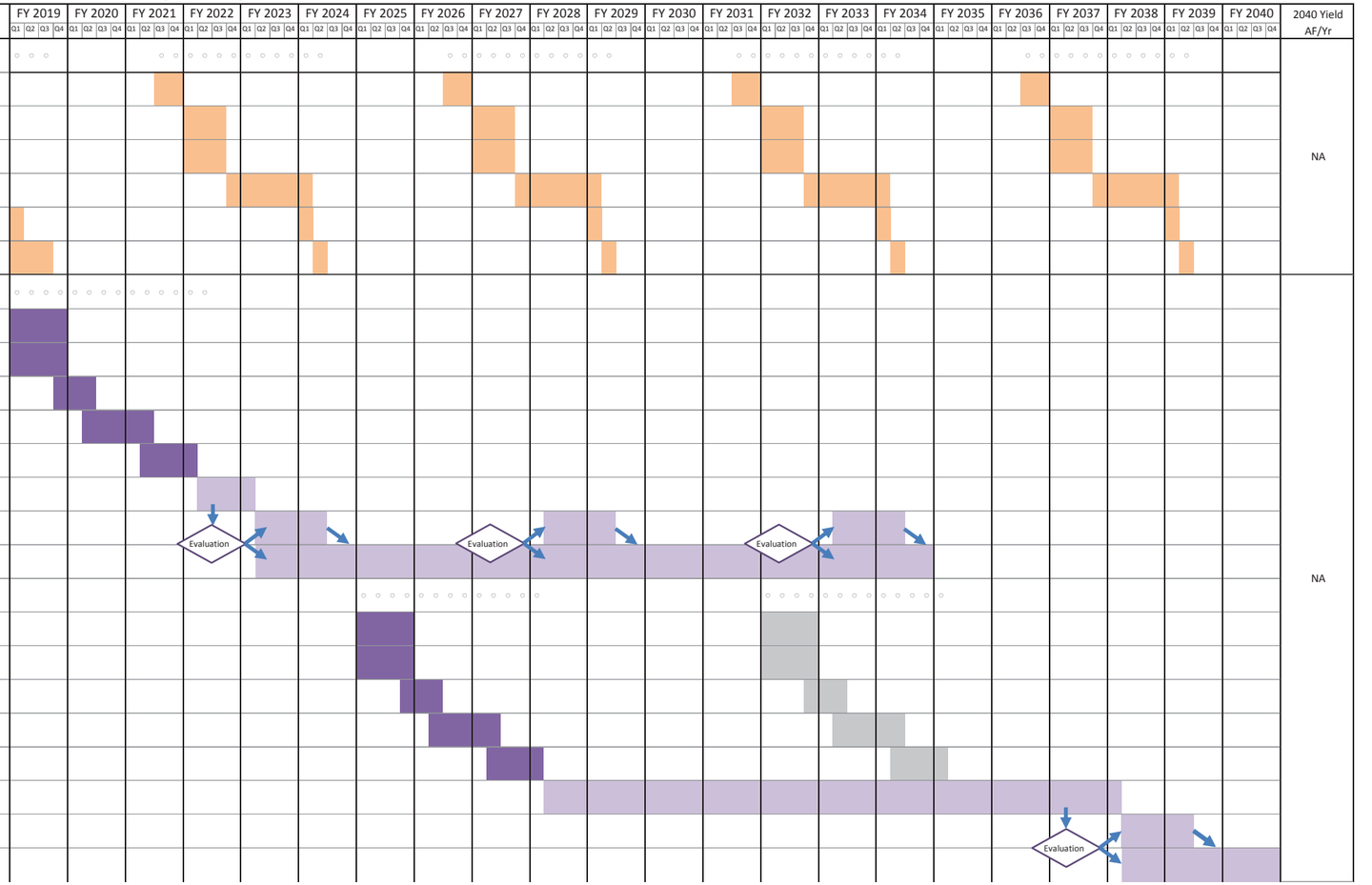
	4		Data Gathering and Preliminary Analyses		
	5		Plan Development Process		
	6		Target Final Plan Presentation To and Adoption By Council		
	7		Implementation Plan Development		
	39	D8, D9, D10, D11, S11	**Phase 1 Alternative Water Ordinance Development**	Stakeholder process will explore requiring use of alternative waters for new large Commercial and Multifamily development (with a potable backup).	NA
	40		Evaluation of potential implementation approaches	Evaluation to include refinement of ordinance scope, applicability, location in code, enforcement considerations.	
	41		Preliminary stakeholder outreach		
	42		Develop draft ordinance language		
	43		Stakeholder outreach and draft code language changes as needed		
	44		Boards and Commissions and Council action		
	45		Implementation and monitoring		
	46		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	47		Maintain approach and continue monitoring		
	48		**Phase 2 Alternative Water Ordinance Development**	Stakeholder process will explore expanding ordinance's applicability to potentially include mid-size new commercial and multifamily (with a potable back-up required).	
	49		Evaluation of potential implementation approaches	Evaluation to include refinement of ordinance scope, applicability, location in code, enforcement considerations.	
	50		Preliminary stakeholder outreach		
	51		Develop draft ordinance language		
	52		Stakeholder outreach and draft code language changes as needed		
	53		Boards and Commissions and Council action		
	54		Implementation and monitoring		
	55		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	56		Maintain approach and continue monitoring		



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	5		Plan Development Process		
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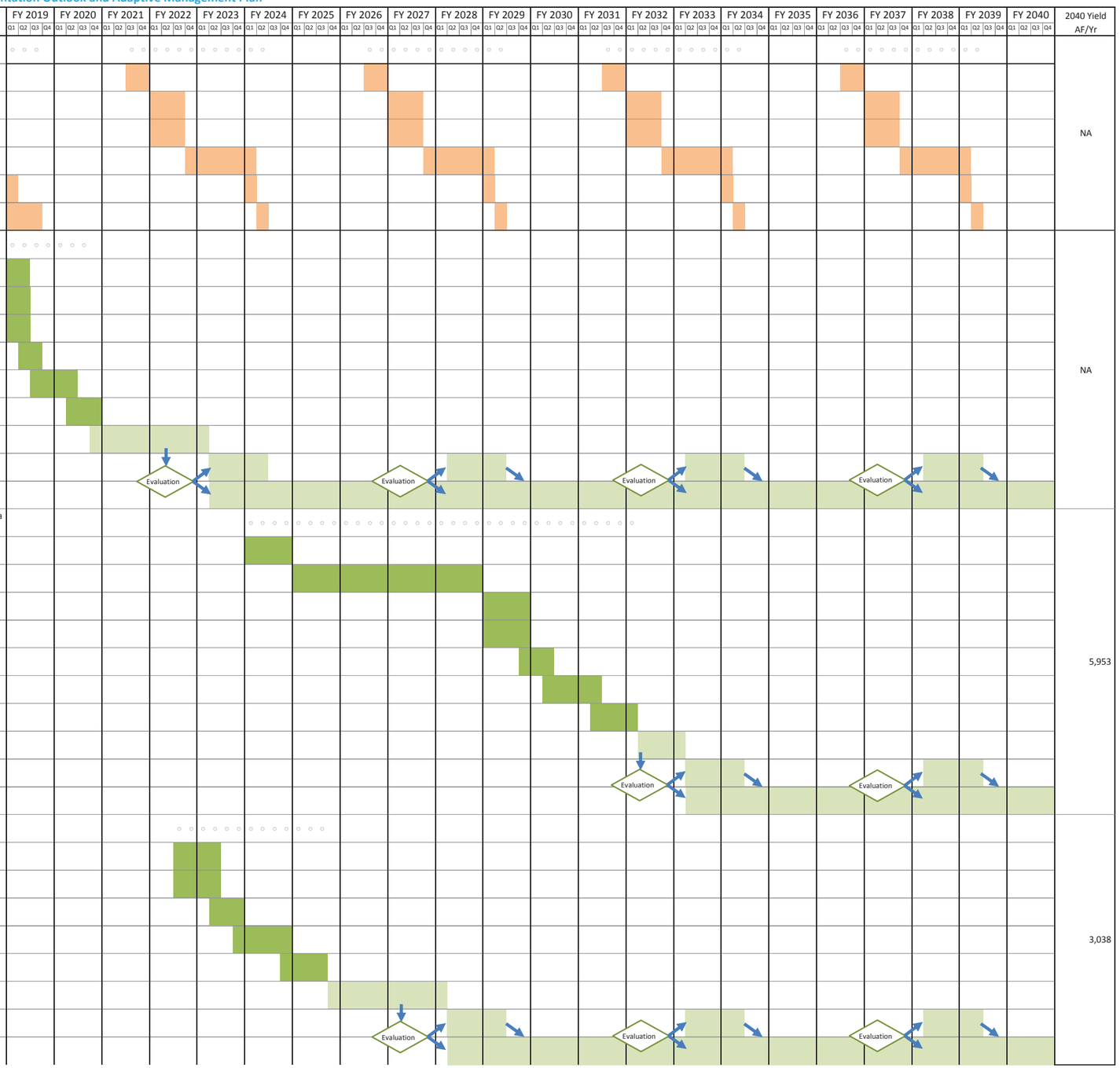
	7		Implementation Plan Development		
Developer or customer installed, owned, and operated	57		**Phase 1 Development-focused Water Use Benchmarking and Budgeting - Submittal Process Development**	Stakeholder process to explore requiring submittal of water use estimates for new development.	NA
	58		Development of water usage calculator		
	59		Evaluation of potential implementation approaches	Determination if an ordinance is needed - If so, process will include refinement of ordinance scope, applicability, location in code, enforcement considerations	
	60		Preliminary stakeholder outreach		
	61		Develop draft ordinance language if needed		
	62		Stakeholder outreach and draft code language changes as needed		
	63		Boards and Commissions and Council action		
	64		Implementation	City staff will provide potential water use efficiency and alternative water recommendations and information on available incentive and rebate programs.	
	65		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	66		Maintain approach and continue monitoring		
	67	D4	**Phase 2 Development-focused Water Use Benchmarking and Budgeting Ordinance Development**	Stakeholder process will explore requiring new development to submit a water usage estimate and comply with a water budget - compliance mechanism to be determined.	5,953
	68		Public stakeholder process in advance of benchmark development	Stakeholder process will explore development of benchmarks to be applied to buildings developed post-2025.	
	69		Data gathering and development of water usage database		
	70		Evaluation of potential implementation approaches (refinement of ordinance scope, applicability, location in		
	71		Preliminary stakeholder outreach		
	72		Develop draft ordinance language		
	73		Stakeholder outreach and draft code language changes as needed		
	74		Boards and Commissions and Council action		
	75		Implementation and monitoring	Starting in FY 2032, water budgets will be applied to development built post-2025.	
	76		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	77		Maintain approach and continue monitoring		
	78	D5	**Landscape Transformation Ordinance**	Stakeholder process will explore requiring single-family residential to limit turf-grass area and include additional requirements for existing COM and MFR ordinance	3,038
	79		Evaluation of potential implementation approaches (refinement of ordinance scope, applicability, location in		
	80		Preliminary stakeholder outreach		
	81		Develop draft ordinance language		
	82		Stakeholder outreach and draft code language changes as needed		
	83		Boards and Commissions and Council action		
	84		Implementation and monitoring		
	85		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	86		Maintain approach and continue monitoring		



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	4		Data Gathering and Preliminary Analyses		
	5		Plan Development Process		
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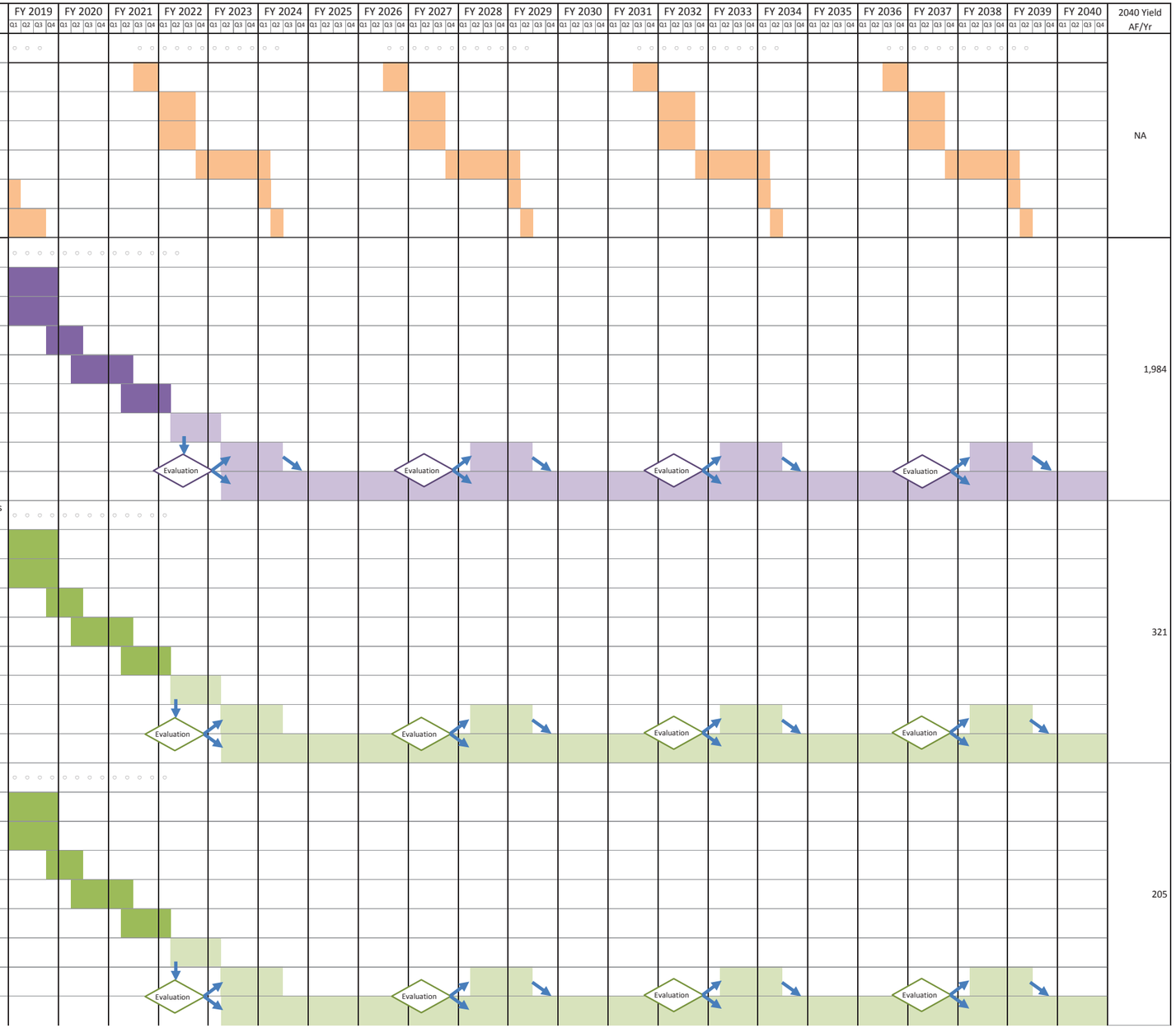
	7		Implementation Plan Development		
	87	D8, D9, D10, D11, S11	**Alternative Water Incentive**	Expansion of existing rebate program - incentive would encourage the use of rainwater harvesting, stormwater harvesting, graywater reuse, and blackwater reuse.	1,984
	88		Evaluation of potential implementation approaches	Evaluation to potentially include amount and/or type of incentive to offer.	
	89		Preliminary stakeholder outreach		
	90		Program development and cost-benefit analysis		
	91		Stakeholder outreach and incentive program refinement as needed		
	92		Boards and Commissions Input		
	93		Program implementation and monitoring		
	94		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	95		Maintain approach and continue monitoring		
	96	D6	**Landscape Transformation Incentive**	Expansion of existing rebate program - incentive would encourage water use efficiencies and reduce water needs for outdoor irrigation through regionally appropriate landscapes	321
	97		Evaluation of potential implementation approaches	Evaluation to potentially include amount and/or type of incentive to offer.	
	98		Preliminary stakeholder outreach		
	99		Program development and cost-benefit analysis		
	100		Stakeholder outreach and incentive program refinement as needed		
	101		Boards and Commissions Input		
	102		Program implementation and monitoring		
	103		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	104		Maintain approach and continue monitoring		
	105	D7	**Irrigation Efficiency Incentive (Expand existing rebate program)**	Expansion of existing rebate program - incentive would encourage use of include irrigation system controllers.	205
	106		Evaluation of potential implementation approaches	Evaluation to potentially include amount and/or type of incentive to offer.	
	107		Preliminary stakeholder outreach		
	108		Program development and cost-benefit analysis		
	109		Stakeholder outreach and incentive program refinement as needed		
	110		Boards and Commissions Input		
	111		Program implementation and monitoring		
	112		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	113		Maintain approach and continue monitoring		



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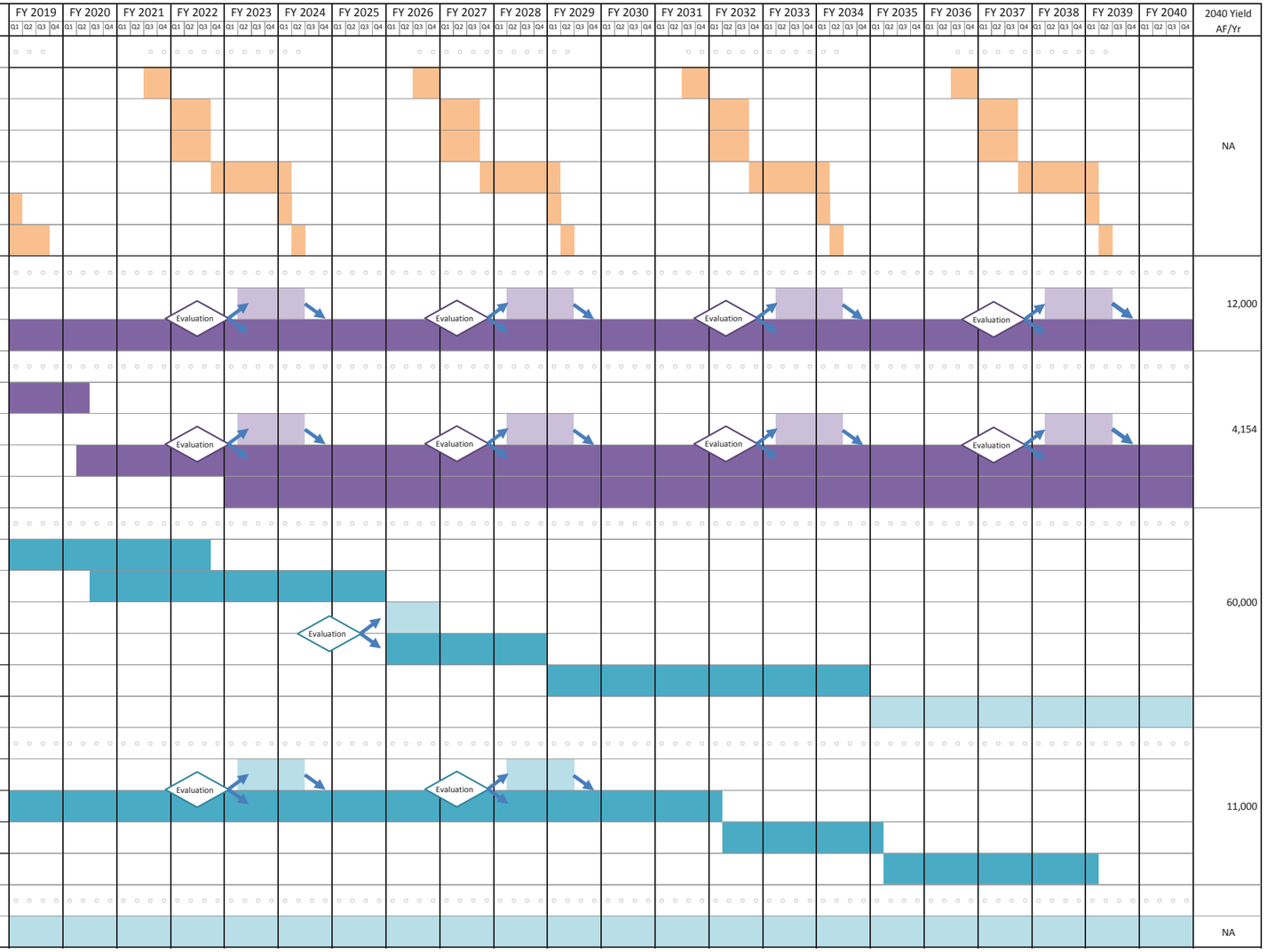
	7		Implementation Plan Development		
Potentially a combination	114	S3	**Centralized Reclaimed System (Direct Non-Potable Reuse)**	Implementation to focus on Reclaimed Master Plan through 2040.	12,000
	115		Approach refinement and/or implementation of other option(s) identified in plan update cycle		
	116		Maintain approach and continue implementation		
	117	S9, S10	**Decentralized Reclaimed (Community Scale Distributed Wastewater Reuse and Sewer Mining)**		4,154
	118		Refinement of decentralized option analysis		
	119		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	120		Future additional decentralized reclaimed project identification		
	121		Decentralized reclaimed project design and construction	Implementation will consider timing and location of new development opportunities.	
Utility constructed, owned and operated	122	S1	**Aquifer Storage and Recovery**		60,000
	123		Further Study and Modeling, Permitting, Land Acquisition	Initial steps will include further study for pilot and full project, further modelling for operational considerations, land acquisition, legal and permitting considerations, and piloting	
	124		Pilot Design, Construction, and Testing		
	125		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	126		Design of full-scale ASR facility		
	127		Construction of full-scale ASR facility		
	128		ASR fill/refill cycles		
	129	S5	**Indirect Potable Reuse (IPR) through Lady Bird Lake Capture Local Inflows to Lady Bird Lake**	Note: IPR option could be accelerated if required in a drought situation.	11,000
	130		Approach refinement and/or implementation of other option(s) in subsequent plan update cycle		
	131		Alternatives Analysis, Permitting, and Public Outreach		
	132		Design		
	133		Construction		
	134	S7, S2	**New Off Channel Reservoir and Brackish Groundwater Desalination**		NA
	135		Continued study and refinement of option	This phase to include public outreach and possible exploratory land acquisition efforts.	



Attachment 1: Summary of Portfolio Composition

	#	Options	Decentralized Option Parameters						Maximize Conservation and Environmental Stewardship							Minimize Cost							Maximize Water Supply Reliability and Climate Resiliency							Minimize Implementation Challenges							Maximize Local Control							Hybrid 1							Hybrid 2						
			Sub-Option / Scenario	SFR	MFR	COM	COA	End Uses	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)	On?	Implement. Year	Decent. Saturation Rate	2020 Yield (AF/Yr)	2040 Yield (AF/Yr)	2070 Yield (AF/Yr)	2115 Yield (AF/Yr)
Demand Management Options	D1	AMI							✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371	✔	2020		596	3,882	5,766	9,371
	D2	Water Loss Control							✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064	✔	2020		3,108	9,326	10,918	13,064
	D3	CII Ordinances							✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063	✔	2020		1,063	1,063	1,063	1,063
	D4	Benchmarking							✔	2020		-	5,953	11,670	25,228	✔	2020		-	5,953	11,670	25,228				-	-	-	-	✔	2020		-	5,953	11,670	25,228	✔	2020		-	5,953	11,670	25,228	✔	2020		-	5,953	11,670	25,228	✔	2020		-	5,953	11,670	25,228
	D5	Landscape Ordinance							✔	2020		-	3,038	7,428	15,050	✔	2020		-	3,038	7,428	15,050				-	-	-	-	✔	2020		-	3,038	7,428	15,050	✔	2020		-	3,038	7,428	15,050	✔	2020		-	3,038	7,428	15,050	✔	2020		-	3,038	7,428	15,050
	D6	Landscape Incentive							✔	2020		-	321	633	929	✔	2020		-	321	633	929				-	-	-	-				-	-	-	-				-	-	-	-	✔	2020		-	321	633	929	✔	2020		-	321	633	929
	D7	Irrigation Incentive							✔	2020		42	205	427	394	✔	2040		-	205	427	394				-	-	-	-	✔	2040		-	207	434	401				-	-	-	-	✔	2020		42	205	427	394	✔	2020		42	205	427	394
	D8	Lot Scale Stormwater Harvesting	Outdoor		Y			IRR	✔	2020	20%	-	180	496	1,391				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2020	20%	-	180	496	1,391	✔	2020	20%	-	180	496	1,391
			Outdoor			Y		IRR	✔	2020	20%	-	149	373	885				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2020	20%	-	149	373	885	✔	2020	20%	-	149	373	885
			Dual pipe		Y			IRR TL CW				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
			Dual pipe			Y		IRR TL CW HVC				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
	D9	Lot Scale Rainwater Harvesting	Outdoor	Y				IRR	✔	2020	40%	-	937	2,410	5,088				-	-	-	-				-	-	-	-	✔	2040	20%	-	468	1,205	2,544				-	-	-	-	✔	2020	40%	-	937	2,410	5,088	✔	2020	40%	-	937	2,410	5,088
			Outdoor		Y			IRR	✔	2020	10%	-	54	151	425				-	-	-	-				-	-	-	-	✔	2040	20%	-	107	302	850				-	-	-	-	✔	2020	10%	-	54	151	425	✔	2020	10%	-	54	151	425
			Outdoor			Y		IRR	✔	2020	10%	-	82	209	498				-	-	-	-				-	-	-	-	✔	2040	30%	-	247	626	1,493				-	-	-	-	✔	2020	10%	-	82	209	498	✔	2020	10%	-	82	209	498
			Dual pipe	Y				IRR TL CW				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	20%	-	917	2,350	4,819				-	-	-	-				-	-	-	-
			Dual pipe		Y			IRR TL	✔	2020	20%	-	195	556	1,562				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2020	20%	-	195	556	1,562	✔	2020	20%	-	195	556	1,562
			Dual pipe			Y		IRR TL HVC	✔	2020	20%	-	281	706	1,678				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2020	20%	-	281	706	1,678	✔	2020	20%	-	281	706	1,678
			Potable	Y				ALL				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
	D10	Gray Water Harvesting	Outdoor	Y				IRR	✔	2020	10%	-	244	631	1,336				-	-	-	-	✔	2040	20%	-	488	1,262	2,672				-	-	-	-				-	-	-	-	✔	2020	10%	-	244	631	1,336	✔	2020	10%	-	244	631	1,336
			Outdoor		Y			IRR				-	-	-	-				-	-	-	-	✔	2040	20%	-	334	925	2,524				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
			Outdoor			Y		IRR				-	-	-	-				-	-	-	-	✔	2040	20%	-	229	665	1,558				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
			Dual pipe	Y				IRR TL CW	✔	2020	10%	-	571	1,461	2,860				-	-	-	-	✔	2040	10%	-	571	1,461	2,860				-	-	-	-				-	-	-	-	✔	2020	10%	-	571	1,461	2,860	✔	2020	10%	-	571	1,461	2,860
			Dual pipe		Y			IRR TL CW	✔	2020	20%	-	991	2,702	6,832				-	-	-	-	✔	2040	20%	-	991	2,702	6,832				-	-	-	-	✔	2040	10%	-	495	1,351	3,416	✔	2020	20%	-	991	2,702	6,832	✔	2020	20%	-	991	2,702	6,832
			Dual pipe			Y		IRR TL	✔	2020	15%	-	321	823	1,638				-	-	-	-	✔	2040	20%	-	428	1,098	2,185				-	-	-	-	✔	2040	10%	-	214	549	1,092	✔	2020	15%	-	321	823	1,638	✔	2020	15%	-	321	823	1,638
	D11	Building Scale Wastewater Reuse	Dual pipe		Y			IRR TL CW				-	-	-	-				-	-	-	-	✔	2040	10%	-	585	1,637	4,209				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
			Dual pipe			Y		IRR TL CW HVC	✔	2020	20%	-	1,323	3,672	7,875				-	-	-	-	✔	2040	30%	-	1,985	5,509	11,812				-	-	-	-				-	-	-	-	✔	2020	20%	-	1,323	3,672	7,875	✔	2020	20%	-	1,323	3,672	7,875
	D12	AC Condensate Reuse							✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150	✔	2020		100	1,084	2,711	5,150
Supply Options	S1	Aquifer Storage and Recovery							✔	2040		-	30,000	30,000	60,000	✔	2070		-	-	30,000	60,000				-	-	-	-	✔	2040		-	30,000	30,000	60,000	✔	2040		-	30,000	30,000	60,000	✔	2040		-	60,000	60,000	90,000	✔	2040		-	45,000	90,000	90,000
	S2	Brackish Groundwater Desal							✔	2070		-	-	5,000	10,000				-	-	-	-	✔	2040		-	5,000	5,000	10,000				-	-	-	-				-	-	-	-	✔	2070		-	-	5,000	16,000	✔	2,040		-	5,000	5,000	10,000
	S3	Direct Non-Potable Reuse							✔	2020		4,000	12,000	24,000	44,000	✔	2020		4,000	8,000	16,000	40,000	✔	2020		4,000	12,000	25,000	54,600	✔	2020		4,000	12,000	25,000	54,600	✔	2020		4,000	12,000	25,000	59,600	✔	2020		*4,000*	12,000	25,000	54,600	✔	2020		*4,000*	12,000	25,000	54,600
	S4	Direct Potable Reuse										-	-	-	-				-	-	-	-	✔	2040		-	20,000	20,000	20,000				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-
	S5	Indirect Potable Reuse w/ Capture Local Inflows to Lady Bird Lake										-	-	-	-	✔	2040		-	10,000	10,000	20,000	✔	2040		-	10,000	10,000	20,000	✔	2070		-	-	10,000	20,000	✔	2070		-	-	10,000	20,000	✔	2040		-	11,000	20,000	20,000	✔	2,040		-	20,000	20,000	20,000
	S6	LCRA Additional Supply										-	-	-	-	✔	2020		-	-	-	-				-	-	-	-	✔	(95,720)		-	-	-	30,000				-	-	-	-				-	-	-	-				-	-	-	-
	S7	Off Channel Reservoir							✔	2070		-	-	25,827	25,827	✔	2040		-	25,827	25,827	25,827				-	-	-	-	✔	2070		-	-	25,827	25,827	✔	2070		-	-	25,827	25,827	✔	2070		-	-	25,000	25,000				-	-	-	-
	S8a	Seawater Desal (Import Option)										-	-	-	-	✔	2040		0	0	0	0	✔	2070		-	-	40,000	84,000				-	-	-	-				-	-	-	-				-	-	-	-	✔	2,115		-	-	-	50,000
	S8b	Conventional Groundwater (Import Option)																	-	10,000	20,000	45,000																										-	-	-	-				-	-	-	-
	S9	Distributed WW Reuse	Dual pipe	Y	Y	Y	Y	IRR TL CW HVC	✔	2040	70%	-	3,154	14,467	30,049	✔	2040	20%	-	1,055	8,025	16,989	✔	2070	70%	-	3,154	14,467	30,049	✔	2070	20%	-	1,055	8,025	16,989	✔	2040	90%	-	3,391	15,144	31,602	✔	2040	70%	-	3,154	14,467	30,049	✔	2040	70%	-	3,154	14,467	30,049
	S10	Sewer Mining	Outdoor				Y	IRR	✔	2040	40%	-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	40%	-	-	-	-	✔	2040	40%	-	-	-	-
			Dual pipe	Y	Y	Y	Y	IRR TL CW HVC	✔	2040	30%	-	1,000	2,211	5,284				-	-	-	-	✔	2040	50%	-	1,417	3,012	7,168				-	-	-	-	✔	2040	50%	-	1,255	2,673	6,357	✔	2040	30%	-	1,000	2,211	5,284	✔	2040	30%	-	1,000	2,211	5,284
	S11	Community Stormwater	Outdoor				Y	IRR	✔	2040	30%	-	48	48	48				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	70%	-	73	73	73	✔	2040	30%	-	48	48	48	✔	2040	30%	-	48	48	48
			Outdoor	Y	Y	Y	Y	IRR	✔	2040	30%	-	109	188	455				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	80%	-	21	43	101	✔	2040	30%	-	109	188	455	✔	2040	30%	-	109	188	455
			Dual pipe	Y	Y	Y	Y	IRR TL CW HVC				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	80%	-	174	324	700				-	-	-	-				-	-	-	-
	S12	Community Rainwater	Dual pipe	Y	Y	Y	Y	IRR TL CW HVC				-	-	-	-				-	-	-	-				-	-	-	-				-	-	-	-	✔	2040	100%	-	16	17	24				-	-	-	-				-	-	-	-