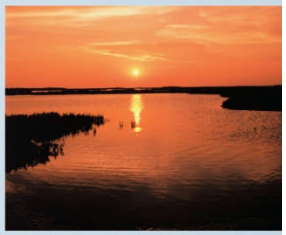
Water Supply Resource Plan
October 2010







LCRA
ENERGY • WATER • COMMUNITY SERVICES

Water Supply Resource Plan – October 2010
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1.0 Plan Summary

The Water Supply Resource Plan (WSRP) establishes a general overview of possible strategies and options LCRA may choose to pursue in the future to help meet projected future firm water needs in the lower Colorado River basin through the year 2100. The plan identifies water supply options, their potential costs, and when these options may need to be available to help meet these growing demands. The WSRP can serve as a guide to help LCRA staff and the LCRA Board of Directors identify when to begin the process of more fully considering potential water supply options. LCRA staff currently estimates that LCRA's existing water supplies will conservatively yield 600,000 acre-feet per year of firm water supply through the planning period. This estimate is based on the best technical, legal and regulatory assumptions available at the time the estimate was derived. The plan establishes an implementation lead time (i.e., "margin of safety") trigger to ensure that the LCRA Board will have sufficient time to consider if and when to pursue development of any specific water supply options. This trigger is reached when LCRA's contractual commitments for firm supply reach a level that leaves LCRA with enough water to make additional commitments for about 20 years (which is currently about 150,000 acre-feet of remaining uncommitted supply or when LCRA's contractual commitments for water supply exceed 450,000 acre-feet).

This plan does not establish any new Board policy nor does it change any of the Board's existing policies, or authorize staff to pursue any specific water supply strategies or options. In any future evaluation of water supply options, LCRA will take into consideration impacts to existing and future customers and whether the project is viable and fiscally prudent. Before any specific water supply project is implemented, it must be approved by the LCRA Board and included in LCRA's annual Business Plan.

In the summer of 2008, LCRA hosted a public input process to start the water supply planning effort. The process included three public meetings and an online survey to gain insight into the public's favored water supply options and its key priorities to help guide the planning process. The feedback LCRA received suggested that it should study more than 20 different water supply options. Additionally, the public's priorities and values were clean water, environmental protection, recreation needs, availability, affordability, and the support of economic growth, and other concerns. The recommended water supply options and priorities from the 2008 public input process can be found beginning on page 17.

Population projections were prepared using local, state, and federal data to estimate growth in each county in the water supply planning area (see page 12). The WSRP planning area is essentially the lower Colorado River watershed within the Region K planning area in the State Water Plan. A map showing the planning area can be found on page 11. Projected municipal firm demand was calculated by combining population projections and Region K water use data. Existing and projected industrial demands, domestic demands around the Highland Lakes, and losses associated with conveying water to downstream customers were added to the municipal demands to estimate the total demand of about 670,000 acre-feet per year that LCRA anticipates it will need to meet in the year 2100 (see Section 8 on pages 13 to 16).

More than 20 water supply options were studied and are summarized on pages 19 through 21. Options range from amending LCRA's existing water rights, which could cost about $5 million, to constructing an off-channel reservoir in the lower basin and conveying the raw water to the Travis County area, which could cost about $1.6 billion. The estimated costs for the water supply options vary greatly and each has its own benefits and challenges. Some of the supply options could take a relatively short time to implement while others could take several decades to implement through the design, permitting, real estate acquisition, and construction process. Actual costs could vary considerably from the estimates in this plan.

Potential water supply strategies were developed and analyzed that use multiple water supply options to help meet firm water demands to 2100. This was done because, in some cases, a single water supply approach could not meet firm water needs to 2100. The strategies are as follows:

Strategy I – Using LCRA's existing supplies to meet future demands

This strategy makes use of all water supplies currently owned and controlled by LCRA. These include the Highland Lakes and firm water gained by amending the four downstream water rights now used primarily for irrigation, without construction of any significant additional infrastructure to use these rights. This strategy yields about 600,000 acre-feet per year of firm water supply and can meet projected firm demands for about 50-years or more. It does not achieve the goal of meeting firm demands to the year 2100; however, it is the lowest cost approach for extending supplies into the future. A summary of Strategy I can be found beginning on page 22.

Strategy II – Using existing supplies and conserving for our future

This strategy includes using the existing supplies identified in Strategy I and adding enhanced conservation and reuse water supply options to meet firm water demands to the year 2100. Three different conservation approaches were evaluated and a summary of each approach can be found on pages 26 through 30. Each offers additional agricultural reliability and water for the environment not found in Strategy I. Costs range from about $225 million to $525 million.

Strategy III – Using existing supplies, conserving, and building for our future

Strategy III incorporates the use of existing supplies from Strategy I, LCRA's current conservation program, and various water supply projects. Four different approaches were studied and a summary of each can be found on pages 31 through 36. These include an off-channel reservoir, pipeline to the Travis County area, brackish groundwater desalination, aquifer storage and retrieval, and importing groundwater from outside the basin. Costs range from about $720 million to $1.6 billion.

Public Input – 2010

The draft WSRP was shared with the LCRA Board of Directors in June 2009, and staff sought formal public input on the draft plan beginning in January 2010. Through three public meetings and an online survey, the public shared its thoughts on the proposed water supply strategies, preferred water supply options and the greatest challenges to securing reliable future water supplies. The public also identified how much more it would be willing to pay for additional supplies. The 2010 public input is detailed on page 41 and is summarized as follows:

- There were similar water supply perspectives throughout the basin. LCRA heard that it should pursue conservation and new water supply projects to develop a diverse portfolio of water supplies to meet future demands and manage cost.
- Interests and priorities changed since 2008. Water availability and water for future generations became a higher priority.

Margin of Safety

The margin of safety triggers the process for staff to work with the Board to identify and evaluate specific water supply options for further Board consideration. Initiation of these more specific discussions with the Board would begin when LCRA's contractual commitments for firm supply has reached a level that leaves LCRA with enough water to make additional commitments to new or existing customers for about 20 more years . Under today's current annual average rate of growth of new firm water contracts, this would equate to about 150,000 acre-feet of remaining uncommitted supply or when LCRA's contractual commitments for water supply exceed 450,000 acre-feet. When the margin of safety is reached, staff would seek direction from the LCRA Board of Directors on whether to conduct a more detailed evaluation of any specific water supply options, including the feasibility, affordability and impacts to existing and future customers. After this evaluation process, the Board would consider if and when it should pursue the acquisition or development of water. LCRA's current raw water commitments of about 458,000 acre-feet per year already surpass the margin of safety threshold of 450,000 acre-feet per year. Therefore, the LCRA staff will begin the discussion with the LCRA Board of Directors to identify and evaluate water supply options for further Board consideration. While 2010 contractual commitments exceed the margin of safety, actual water use in 2008 was about 152,000 acre-feet per year or about 33% of the current supplies that have been contractually committed. This means LCRA's current supplies are sufficient to meet all firm customer demands today. Please refer to pages 38 through 40 for more details on the margin of safety.

Recommended Plan

The recommended plan is based on the public input and study findings and is consistent with the public's top priorities of ensuring water availability now and in the future, providing clean water, and protecting the environment. The plan relies on the water supply options that can be found in the three water supply strategies and creates a trigger for initiating further LCRA Board discussion of future water supply options about 20-years ahead of when contractual commitments would be made against those supplies. The plan proposes to build diversification and flexibility into the LCRA's water supply system while working in partnership with our customers and stakeholders. The next steps to meet water needs within the LCRA water supply planning area to the year 2100 are:

<u>Near-Term (2010-2020)</u>

- Initiate the process to amend the LCRA's remaining downstream water rights by amending the Gulf Coast and Lakeside run-of-river rights to allow multiple beneficial uses at their existing authorized diversion points.
- Continue pursuit at the Texas Commission on Environmental Quality (TCEQ) of:
    - Amending the Garwood water right to allow diversion of water at multiple locations, and
    - A permit to divert, store, and use unappropriated flows for multiple purposes in the basin.
- Maintain the option to purchase and build on the Pierce Ranch off-channel reservoir site.
- Explore various financial options to pay for new water supply approaches in a cost effective manner.
- Initiate and complete in fiscal year 2011, with the help of our agricultural customers, a set of potential water supply strategies to help meet agricultural water needs in the lower basin.
- Implementation of LCRA's current water conservation program:
    - Work closely with the City of Austin and other customers to develop and/or expand their programs;
    - Continue HB 1437 agricultural conservation programs, and
    - Pursue state and federal grants/funding to expand agricultural conservation.
- Seek partnerships with customers to develop direct wastewater reuse programs.
- Continue resource management activities such as:
    - Continue LCRA's water quality programs to manage erosion, pollution, and wastewater effluent to ensure that the Highland Lakes continue as some of the cleanest and clearest lakes in Texas, and
    - Provide technical assistance with local and state soil and water conservation districts and private landowners to manage brush upstream of the Highland Lakes.

- Pursue additional water supplies with Board approval that can benefit existing and future customers:
    - Potential acquisition of additional surface water rights in the Colorado River;
    - Enhanced conservation programs;
    - Potential acquisition of groundwater, and
    - Potential water supply project(s) developed by LCRA or presented by a third party.
- Monitor water supply technology advancements such as desalination and aquifer storage and recovery.
- Update the WSRP on a regular basis to coincide with the Region K and LCRA Water Conservation planning processes and regularly update the LCRA Board of Directors and the public. This will include the evaluation of:
    - Actual water demands and commitments;
    - Amount of water saved in water conservation efforts and costs to obtain savings;
    - Updated growth and water demand projections;
    - Updated water availability analyses and projections;
    - Updated water supply options and potential costs;
    - Potential climate variability data, modeling, and information;
    - Changing economic conditions;
    - New technologies that could produce water at a lower cost;
    - Improved energy generation with reduced water use, and
    - Changing regulatory and legislative conditions.

<u>Mid- to Long-Term (2020-2100)</u>

- Continue water conservation programs for municipal and agricultural activities
- Continue resource management activities
- Expand partnerships with LCRA customers to implement more water conservation saving measures and reuse
- Continue the pursuit of alternative approaches to fund water supply development
- Continue to monitor technology advancements in water supply development
- Pursue water supply options as needed based on the growth of water commitments
- Pursue any other type of new technology or alternative type of water supply option identified in future updates in the water supply planning effort

- Continue to update the water supply plan on a regular basis to coincide with the Region K and LCRA Water Conservation planning processes.

2. Plan Purpose

The Water Supply Resource Plan is LCRA's planning framework and guidance document to:

- Meet future firm water needs through the year 2100;
- Project where those needs will be;
- Estimate when and how those needs will be met;
- Plan for and determine whether existing interruptible customers, environmental needs, and lake levels may be affected; and
- Estimate overall potential cost to implement selected water supply strategies.

The purpose of the Water Supply Resource Plan is:

- To set a long-term strategy that best serves the water needs in the lower Colorado River basin;
- To prepare for population growth in the Central Texas area that is greater than what was projected in the 2006 State Water Plan (Region K, Lower Colorado Regional Water Planning Group);
- To prepare for requests for new contracts to supply significant amounts of water to existing and proposed power generation facilities; and
- To address other water uses not accounted for in the Region K plan, including conveyance losses when water is released to customers in the lower basin and domestic use around the Highland Lakes.

3. Plan Development

LCRA began the water supply planning process in the summer of 2008 by hosting community meetings and an online survey to obtain public input on potential water supply options to meet firm water demands. (*Firm water is the amount of water that can be supplied from the Highland lakes and the lower Colorado River during a repeat of the drought of record, or the worst recorded drought in the lower Colorado River basin.).* LCRA then developed population projections for each of the 15 counties in the water planning area; coordinated information with county administrators and elected officials; prepared water demand projections; evaluated the suggested water supply options and prepared conceptual approaches and cost estimates; reviewed the impact of meeting firm water demands on the agricultural interests in the lower basin, environmental needs, and lake levels; and provided updates to the LCRA Board of Directors. From this effort, three water supply strategies were developed. A number of approaches were studied within each strategy resulting in a total of eight water supply approaches presented in this draft plan.

To complement the current regional and state water planning processes, information developed for the WSRP, such as population and water demand projections, were provided to Region K (Lower Colorado Regional Water Planning Group) in the spring of 2009. In addition, investigated water supply options were also shared. LCRA has a representative on the Region K Group and will continue to remain involved in the Region K water plan update that is anticipated to be complete in 2010.

Due to the long-range nature of the WSRP, LCRA will monitor demands in the planning area and update the plan routinely in conjunction with the Region K planning process and the LCRA Water Conservation Plan to ensure that the latest information is incorporated into those plans.

4. Water Supply Resource Plan Guiding Principles

Guiding principles are based on public input, recommendations from the LCRA Board of Directors and staff, and LCRA's water management policies. The principles guided the evaluation and potential use of various water supply options.

1. Include the 50,000 acre-feet reserved in LCRA's Water Management Plan as supply available to meet future in-basin demands;
2. Use all water supplies owned and controlled by LCRA to meet future projected demands, including those that can be made available from lakes Travis and Buchanan and through amendment of the four downstream run-of-river water rights held by LCRA now used primarily for irrigation;
3. Evaluate new water supply sources in conjunction with the existing supplies available from the Colorado River;

4. Provide a margin of safety for risks and uncertainties considering unexpected water demand, drought worse than a drought of record, climate variability, lake sedimentation, legislative changes, regulatory changes, escalating costs, changing economic conditions, or other unforeseen circumstances, Continue to explore methods of optimizing use of water from the Colorado River watershed, balancing needs for water supply, economic growth, and the environment;
5. Consider development of supply sources in addition to the run-of-river rights and Highland Lakes to diversify supplies and provide a strong foundation for meeting future needs;
6. Manage and protect existing supplies through watershed management strategies and conservation as priority actions for LCRA's long-term water plan; and
7. Develop partnerships and regional cooperation as critical strategies in implementing the Water Supply Resource Plan.

5. Water Planning Assumptions

The following are some of the key assumptions used in the planning process:

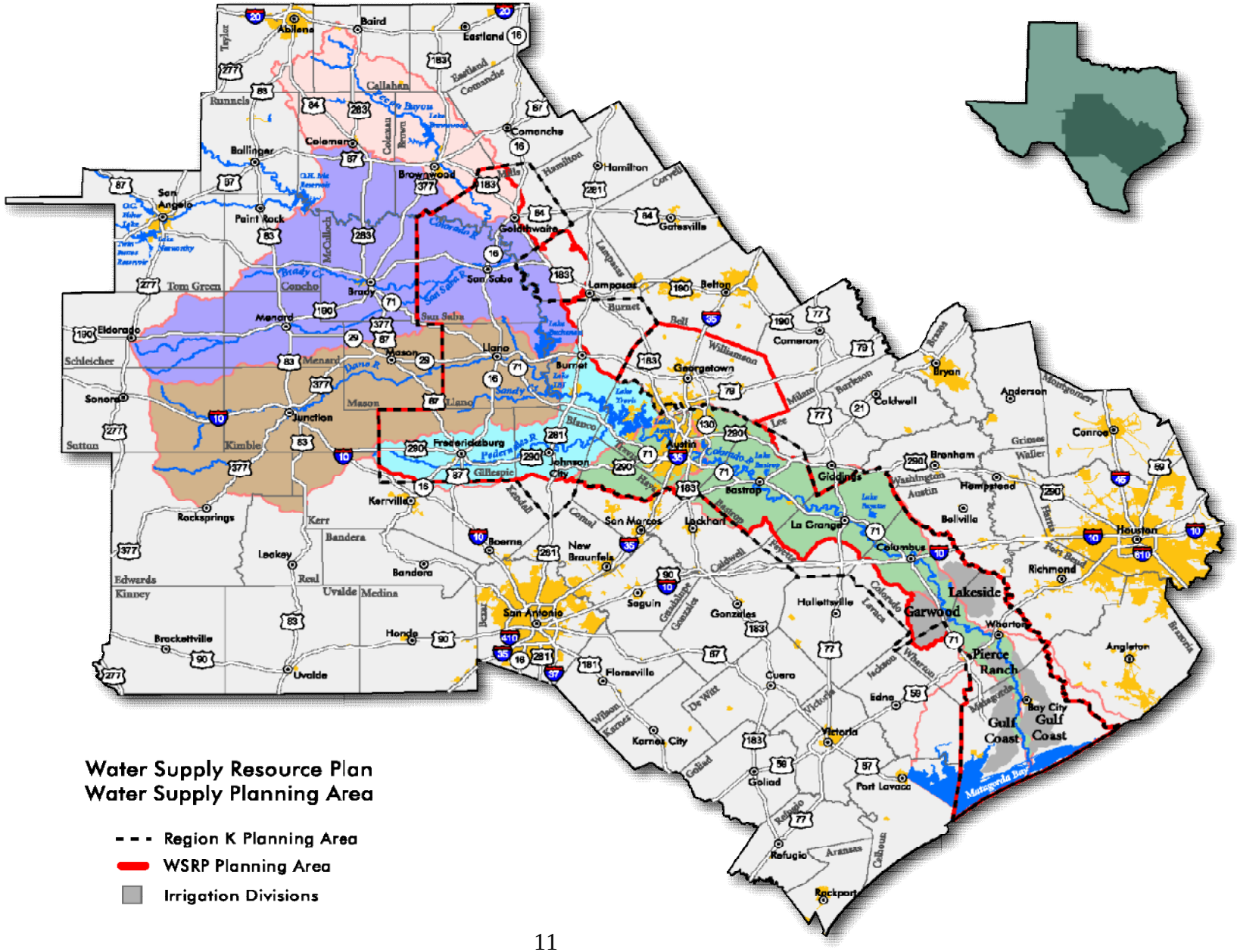
1. Demands for municipal, industrial, steam-electric, and other needs were calculated based on the amount of water that would be needed during a drought of record to ensure that ample supplies would be available during a similar drought;
2. Communities and utilities that rely on groundwater, and areas where Region K projections indicate sufficient groundwater will be available through the planning period, would not require water from LCRA;
3. LCRA agricultural operations in the lower basin would use 2,000 acre-feet per year of groundwater to help meet their total irrigation demand and the remainder of their needs would be met to the extent possible by water from the Colorado River;
4. For agricultural demands, the 2006 Region K projections adjusted for climate variables (i.e. rainfall, evaporation, etc.) over the modeling period of 1940-1998, were used as the baseline;
5. Non-Garwood (Lakeside, Gulf Coast, Pierce Ranch) agricultural demands were reduced over the planning period when water was needed to meet firm demands. The amount supplied to Garwood was reduced consistent with the purchase agreement;
6. The Texas Commission on Environmental Quality (TCEQ) monthly water availability model was used to determine water availability on a monthly basis for LCRA's existing water rights (lakes Buchanan and Travis and the downstream run-of-river water rights). This is the modeling platform used by the TCEQ in permitting water rights in the state;
7. The TCEQ approved LCRA Water Management Plan was used as a guide to balance water supplies between environmental flow needs and providing water to agriculture;
8. Remaining downstream run-of-river water rights (i.e. Lakeside and Gulf Coast) would be amended to allow them to be used for multiple purposes (i.e. municipal, industrial, agricultural, and other uses);

9. If implemented, desalination and groundwater projects would be used conjunctively with surface water to remain inside LCRA's current legal authority;
10. Water availability analyses included conservation and reuse for the City of Austin, consistent with the provisions of the 2007 Settlement Agreement between LCRA and the City of Austin; and
11. The water provided by contract to Williamson County under the provisions of House Bill 1437 will continue to be provided through the full planning period.

6. Water Supply Planning Area

The water supply planning area includes portions of the lower Colorado River watershed and is generally consistent with that part of the Region K planning area within the Colorado River basin. This 15-county water planning area differs from the 33-county LCRA water service area because the counties outside the Region K planning area generally rely on groundwater or other local sources of supply to meet their present water demands. In addition, these counties are not currently identified as high-growth areas, thus, existing supplies are projected to be adequate to meet projected water supply demands. Counties outside the WSRP planning area can use data and projections from the State Water Planning process to assess whether adequate supplies are available to satisfy their demands. In the next update to this plan, LCRA will review available information and determine whether the planning area needs to be expanded to include the entire water service area. On the following map, the red boundary denotes the WSRP water planning area for this plan, while the black dashed line indicates the boundary for the Region K planning effort.

Two areas outside of the lower Colorado River watershed and within the Brazos River basin have been included in the water supply planning area because LCRA has contracts to provide water in those areas. The first area is Williamson County, where existing water contracts with the cities of Cedar Park and Leander allow for the potential distribution of water within their water service areas and a contract with the Brazos River Authority allows for the potential distribution of water throughout the county. The second area is the LCRA Lometa Water System, which is located partially within Lampasas County in the Brazos River basin. The projected amount of water to be needed from LCRA in the future does not exceed the amount of the existing contracts.


Water Supply Resource Plan
Water Supply Planning Area
Region K Planning Area
WSRP Planning Area
Irrigation Divisions

7. Population Projections

LCRA estimated population changes through the year 2100 that are based on a review of data from the 2006 Region K Water Plan, the Texas State Data Center, U.S. Census Bureau, Capital Area Planning Council of Governments (CAPCOG), Houston-Galveston Area Council (H-GAC), and data provided by several counties. A number of counties exhibited growth rates higher than projected in the 2006 Region K Plan. While there has been rapid population growth in Central Texas over the recent past, the State Demographer has indicated it would be difficult to sustain long-term rapid growth since the land has a certain carrying capacity, i.e. only so much land can be developed. For the rapidly developing Austin metropolitan area, LCRA used population projections that best correlated with U.S. Census Bureau and/or substantiated county data and for the latter part of the planning period used the Texas State Data Center's 1990-2000 Half Migration Rate extrapolated to 2100.

*Population Summary**

County	2010 Projected Population	2100 Projected Population	Population Increase
Bastrop	84,600	420,000	335,400
Blanco	11,000	30,000	19,000
Burnet	47,300	168,000	120,700
Colorado	22,655	34,400	11,745
Fayette	24,826	54,300	29,474
Gillespie	24,727	37,700	12,973
Hays	166,342	751,000	584,658
Llano	24,514	48,000	23,486
Matagorda	41,924	65,600	23,676
Mills	5,773	8,200	2,427
San Saba	6,935	12,100	5,165
Travis	1,003,600	2,550,000	1,546,400
Wharton	43,560	58,300	14,740
Williamson	352,811	1,650,000	1,297,189

* Summary reflects the projected population for the entire county and does not deduct the population being served from another source of supply; thus, the population anticipated to receive water from LCRA will be less than above, specifically in Hays and Williamson counties

where the majority of each county is outside the Region K and LCRA's water supply planning area and the plan does not contemplate serving the entire population in these two counties.

8. Water Demand Projections

It was assumed that cities currently using groundwater would continue to do so to the extent that water is available. The projections show how much firm water demand LCRA may be expected to meet in the future, not demand that is currently being met by groundwater or other available local sources.

As part of the long-term water supply planning process, it is important for LCRA to evaluate and substantiate if and when projected water demands will exceed existing available supplies. This is particularly important because of changing conditions such as: increased population growth in the LCRA WSRP Planning Area; recurring drought cycles; potential industrial and power plant growth in the region; possible impacts associated with climate variability; and the need to evaluate future contractual obligations that may extend beyond the current 50-year planning horizon of Region K as well as potential obligations that could exceed this planning horizon.

The projected water demands build on the approved 2006 Region K plan and include the following:

1. Municipal demands developed using substantiated revised population estimates based on recent growth patterns to estimate growth through 2040 or 2060, then using the State Demographer's recommended methodology to develop population projections to 2100. Municipal demands for each decade were calculated based on population projections using the same per capita water use approach used in 2006 Region K plan;
2. New and pending contracts for municipal demand;
3. Region K industrial demand, and new and pending contracts for industrial use;
4. Domestic use on the Highland Lakes, and
5. Conveyance losses from the point of release of water from the Highland Lakes to the point of delivery for existing contracts.

The total demands that would be met or supplemented by LCRA supplies total approximately 930,000 acre-feet per year in year 2100 as shown below. The total demands to be met or supplemented by LCRA include demands for the City of Austin and others. Recent water availability modeling indicates that the amount of LCRA supply necessary to meet LCRA supplied demands total approximately 670,000 acre-feet per year in 2100.

Projected Water Demand (acre-feet)

Planning Scenario	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Projected demands to be met or supplemented by LCRA	331,468	434,453	537,438	660,500	708,000	747,608	798,806	841,306	887,091	930,364
Projected LCRA supplied demand based on updated water availability modeling	157,983	242,194	326,404	410,614	459,030	507,446	546,910	586,375	628,201	670,027

Water availability modeling was run for the decades 2010, 2030, 2060, 2080, and 2100. To assign projected demands to the remaining decades in the planning period, interpolation of available results was performed to arrive at the numbers for the remaining decades.

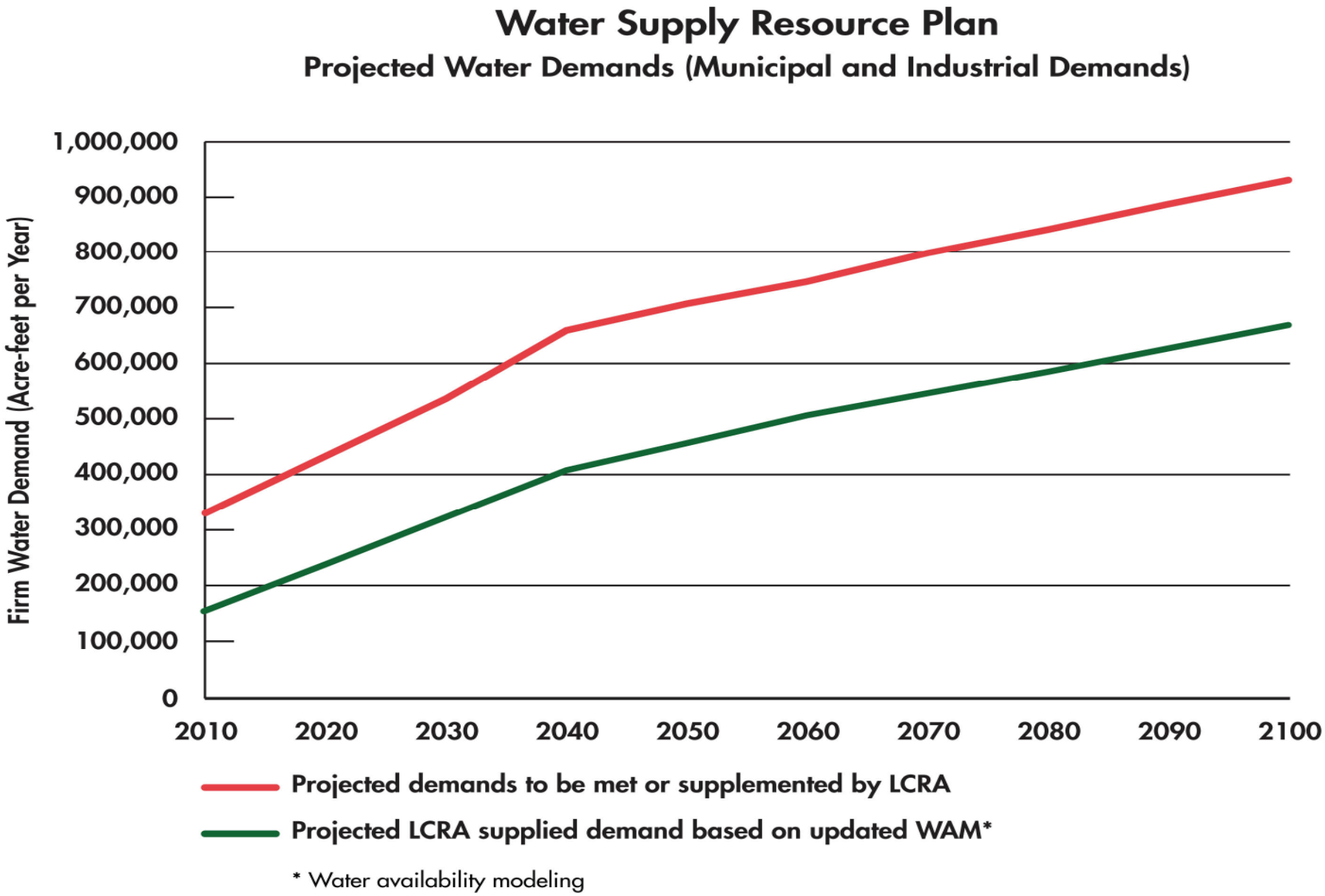
Water Availability Model (WAM) is a computer simulation of the allocation of available flows of a river or stream to water right holders based on the priority date(s) for each right and any special conditions on that water right (i.e. in-stream flows, bay and estuary flows, water quality, domestic and livestock, etc). This simulation is done with a hydrologic dataset of "naturalized" stream flows based on historic gauged flows in the watershed. The dataset used for the Colorado River basin reflects the stream flows from 1940-1998. This is known as the period of record (POR). Within this period of record is the drought of record (DOR). The drought of record reflects the worst hydrologic period of flows in the basin since records have been kept for that watershed. The drought of record for the lower Colorado River basin is considered to have occurred from 1947 to 1957. This is commonly referred to as the 1950's drought.

*Total Projected Water Demand to be Met or Supplemented by LCRA (acre-feet)**

County	2010 Projected Demand	2100 Projected Demand	Demand Increase
Bastrop	12,850	44,315	31,465
Blanco	115	3,393	3,278
Burnet	5,332	20,475	15,143
Colorado	17	22	5
Fayette	21,396	46,073	24,677
Gillespie	39	1,260	1,221
Hays	5,419	27,015	21,596
Lampasas (Lometa system)	600	882	282
Llano	4,420	20,463	16,043
Matagorda	27,469	84,541	57,072
Mills	24	297	273
San Saba	22	23	1
Travis	211,300	577,867	366,567
Wharton	586	1,738	1,152
Williamson	15,741	67,000	51,259

* Excludes domestic water use from the lakes and downstream conveyance loss

The greatest growth in demand is expected in Travis County, where demand is expected to increase by almost 270 percent, followed by Matagorda, Williamson, Bastrop, Fayette, and Hays counties. Thus, growth in Travis County and adjacent counties is projected to cause the largest increase in water demand in the lower Colorado River basin. From another perspective, in 2010, 75 percent of the firm water demand is in the Highland Lakes area and by 2100 water demand for this area is projected to increase to 85 percent of the total basin firm water demand. The Highland Lakes area includes Bastrop, Blanco, Burnet, Hays, Llano, Travis, and Williamson counties.


Water Supply Resource Plan
Projected Water Demands (Municipal and Industrial Demands)
Firm Water Demand (Acre-feet per Year)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Projected demands to be met or supplemented by LCRA
Projected LCRA supplied demand based on updated WAM*
* Water availability modeling

9. Public Input Summary – Water Supply Options and Priorities

LCRA held public meetings in July and August 2008 in Burnet, Wharton, and Austin. In addition to these meetings, an online survey provided another venue for the public to provide input on potential water supply options as well as its priorities and concerns about water supply planning. More than 200 people attended the meetings, and LCRA received nearly 500 online survey responses. From these sources, the public shared 154 priorities regarding water supply planning and 189 water supply options. The water supply options were categorized into 23 water supply strategies with the most frequently recommended options and water supply priorities presented in the following table.

Summer 2008
WSRP Public Input Summary – Water Supply Options and Priorities

Most frequently suggested water supply options (in ranked order)	Most frequently mentioned priorities relating to water supply sources (in ranked order)
Conservation	Clean water, protect the environment
Desalination	Recreation, lifestyle
Wastewater reuse	Availability
Rainwater collection	High quality water supply
Groundwater	Manage growth
On-channel reservoirs	Affordable
Brush management	Jobs, economic growth
Condensation capture	Water for future generations
Inter-basin transfer	Honest and truthful water management
Cloud seeding	Preserve lakeside residents' lifestyle
Off-channel reservoirs	Partnerships, community involvement
Dredge the Highland Lakes	Balance human needs with the environment
System operations including use downstream water rights	Equitable availability and use
Rate structures to manage water use	
Divert Llano River floodwater to Lake Buchanan	

10. Water Supply Option Evaluation

LCRA developed cost estimates, land/easement requirements, feasibility, risks, permitting requirements, benefits, challenges, and other parameters to aid in the selection of appropriate water supply options to meet long-term firm water demands.

Please see the following tables to review the potential water supply options and their characteristics.

Firm Water Supply Options

Water Supply Option	Approximate Water Volume* (acre-feet/year)	Estimated Total Development Cost ($)	Cost** per Acre-foot ($)	Regulatory Requirements	Easement / Land Acquisition	Development Time (years)
Wastewater reuse, community based (example project)	1,120	$5.7 M	$450	Moderate	Moderate	< 5
Groundwater, Gillespie County area	1,120	$14.9 M	$1,188	Moderate	Moderate	< 5
Amend remaining downstream water rights to allow multiple purposes of use	~150,000	$5 M	$30 to $50	Moderate	None	5 to 10
Groundwater combined with surface water, aquifer storage, recharge, and recovery, pipeline to Travis County	22,400	$367 M	$2,230	Substantial	Significant	5 to 10
Groundwater and surface water Carrizo-Wilcox (conjunctive), pipeline to Travis County	22,400	$331 M	$1,900	Substantial	Significant	5 to 10
Imported groundwater by third party	35,000	$1.3 B	1,200	Substantial	Significant	5 to 10
Desalination, seawater, pipeline to Bay City area	22,400	$463 M	$2,890	Substantial	Significant	5 to 10
Desalination, brackish groundwater, pipeline to Bay City area (Gulf Coast aquifer)	22,400	$177 M	$1,120	Substantial	Significant	5 to 10
Dredge the Highland Lakes, Sometimes Islands (Lake Travis)	56 to 746	$132 M to $2.7 B	$172,000/ $263,000	Moderate	Moderate	5 to 10
Dredge the Highland Lakes, Lake Buchanan headwaters	620	$11 M to $14 M	$17,000 to $23,000	Moderate	Minimal	5 to 10
Off-channel reservoir, Pierce Ranch site, pipeline to Travis County	75,000 / 100,000	$1.7 / $1.9 B	$2,450 / $2,150	Substantial	Significant	> 10
Municipal conservation (current, ~10% reduction in demand)	~40,000	$110 M	$450	No permits	None	40*** (ongoing)
Municipal conservation (enhanced, ~20% reduction in demand)	~80,000	$220 M	$450	No permits	None	40***

* Water volume selected to evaluate supplies in relation to each other and does not reflect the potential amount of available water, i.e. volume of water from the Gulf of Mexico is potentially unlimited.

** Amortized over a 30-year period, includes operation and maintenance costs. Thirty-year amortization not applied to conservation programs and amendment of downstream water rights.

*** Water savings can be achieved over 40 years of implementing the various conservation options.

Non-firm Water Supply Options

Water Supply Option	Approximate Water Volume* (acre-feet/year)	Estimated Total Development Cost ($)	Cost** per Acre-foot ($)	Regulatory Requirements	Easement/ Land Acquisition	Development Time (years)
Agricultural conservation in irrigation operations (Garwood savings nearly firm)	118,000	$225 M to $300 M	$130 to $190	Moderate	Significant	40*** (ongoing)
Brush management, potential inflow to Lake Travis	22,400	$3.5 M	$17	Minimal	Minimal	5 to 10
Brush management with groundwater recharge	1,120	$3.9 M	$280	Moderate	Minimal	5 to 10

Other Studied Water Supply Options

Cost estimates and firm yield were not developed for the following water supply options due to supply constraints or other challenges.

Supply	Constraint or Other Issues
Cloud seeding	Entities performing this activity are not able to provide statistical analysis of the benefit of cloud seeding.
Rainwater harvesting	Typically applied at the home or business by owner, may be able to implement on a development scale if alternate water sources are available during drought. Can be a component of a water conservation program.
Condensation capture	Typically applied at a business, office or industrial site by the owner, can be part of a water conservation program. Largest water savings can be achieved during summer months when demand is highest.
On-channel reservoir (reviewed four sites)	Based on anticipated environmental and community impacts, permitting will be difficult and landowner and public resistance can be significant. To assess firm water supply at each site, a detailed study will be necessary. Amount of water potentially available is limited.
Lower Colorado River Channel Dams	Nine locations were studied in 1997 with an estimated firm yield of about 10,000 to 15,000 acre-feet per year, however environmental permits and water rights could be difficult to obtain. Sedimentation could result in high maintenance costs and/or short term project benefits.
Inter-basin transfer (reviewed two sites)	Very challenging permit process, undetermined amount of available water at this time, requires an inter-basin transfer yield analysis that may involve reservoir expansion and will require pipeline construction.
Rate structures to manage water use	Communities and utilities have demonstrated that significant rate increases promote water conservation, dependent upon the level of rate increase. An analysis will be performed in the future to assess varying rate structures.
Divert Llano River floodwater to Lake Buchanan	May provide some flood relief in the lower Llano River area and could potentially increase Lake Buchanan levels; however firm yield is reduced because evaporative losses are greater on Lake Buchanan than Lake Travis. Costly venture to construct conveyance system through granite and requires numerous easements.
Wastewater effluent near the Highland Lakes as a potential supply	Could negatively impact Highland Lakes water quality per the LCRA Colorado River Environmental Models Study of Lake Travis. Cannot directly link wastewater facility permit volume to firm yield since much effluent is currently reused for beneficial purposes.

* Water volume selected to evaluate supplies in relation to each other and does not reflect the potential amount of available water, i.e. volume of water from the Gulf of Mexico is potentially unlimited.

** Amortized over a 30-year period, includes operation and maintenance costs. Thirty-year amortization not applied to conservation programs and amendment of downstream water rights.

*** Water savings can be achieved over 40 years of implementing the various conservation options.

11. Strategy I – Using LCRA's Existing Supplies to Meet Future Demands

As noted in the guiding principles, all water supplies currently owned and controlled by LCRA will be used to meet future projected demands, including supplies that can be made available from lakes Travis and Buchanan and through amendment of the four downstream water rights now used primarily for irrigation. See the following graphic that depicts this overall water supply system.

To evaluate the amount of water that can reasonably be derived from LCRA's existing water rights, the Texas Commission on Environmental Quality's Water Availability Model was used by LCRA's consultant. Modeling was performed in conjunction with the projected water demands and per the assumptions previously identified. Additional water availability modeling details can be found in the attached appendix.

As shown on the following chart, firm water demands are first met from the Highland Lakes, which currently have a computed firm supply of about 445,000 acre-feet/year. **It is anticipated that projected firm water demands may be met from the Highland Lakes until about 2030**.

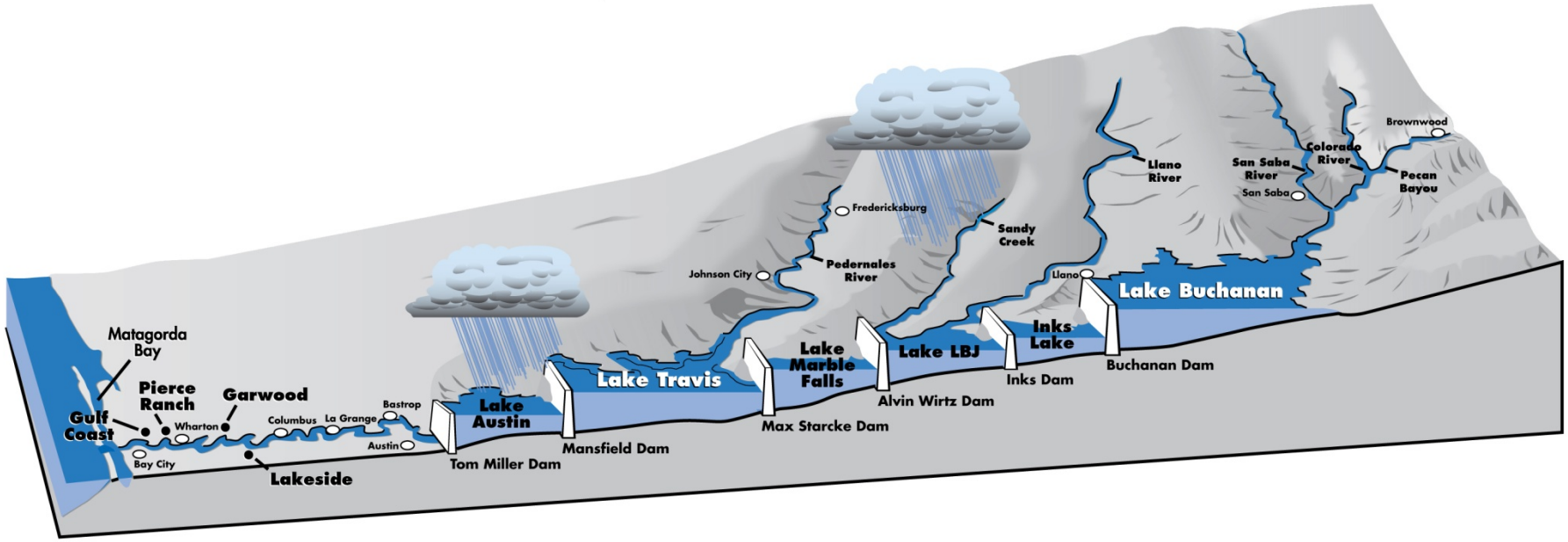
Through amendments of the remaining downstream water rights and the assumptions that LCRA staff has made about what type of regulatory conditions would be placed on such amendments, the downstream run-of-river water rights of more than 636,000 acre-feet/year would yield a significant quantity of firm supplies. Based on analyses of using the Highland Lakes and downstream water rights conjunctively, there is a total supply of about 600,000 acre-feet of water available to meet firm water demands. **This supply may meet firm demands until about 2080.**

However, future droughts may be more severe than the historical drought of record and if so could reduce the amount of firm supplies that LCRA currently has available. LCRA will continue to monitor and manage water supplies during droughts and if necessitated by a severe drought will modify the water supply availability estimate in future plan updates.

Current LCRA Water Supplies

Lakes Buchanan and Travis are our water supply reservoirs. Their total volume is more than two million acre-feet (651 billion gallons). Based on the drought of record (the worst drought on record) LCRA can provide about 445,000 acre-feet (145 billion gallons) of firm water per year from the lakes through a repeat of that drought.

An important part of the system includes run-of-river water rights located downstream of Austin that total 636,000 acre-feet per year. These rights allow LCRA to take water from the river downstream and, when the remaining rights are amended, can yield a significant quantity of firm supplies. The Highland Lakes combined with the run-of-river water rights can provide a firm yield of about 600,000 acre-feet (195 billion gallons) per year.



After the remaining downstream water rights are amended, they could be used to meet most of the industrial and power generation demands in the lower basin. The primary benefit of this approach is that using these downstream water rights to help meet lower basin firm demands allows water supplies to remain in the Highland Lakes to serve areas with the highest anticipated growth. This can potentially delay or eliminate the need for pump stations or additional reservoirs to move water from the lower basin to the Austin area. By providing water supply near the area of demand, water can be supplied in an economical manner to manage long-term raw water costs to our customers. Another possible benefit would be that using the downstream water rights, to the extent water is available, could allow for the extended use of interruptible water supplies from the Highland Lakes for the downstream irrigation operations.

Estimated cost to amend water rights in today's dollars = $ 3-5 million over a five to ten-year period

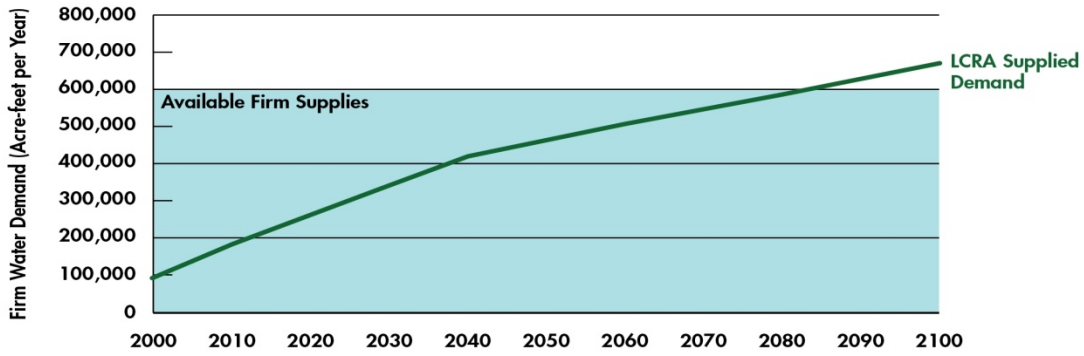
To show how this strategy meets firm water demands and affects agricultural reliability, lake levels, and environmental flows, please see the following summary sheet.

Agricultural reliability is defined as the average volume of water supply provided over the period of interest based on the projected agricultural demand. For example, if the projected agricultural demand is 300,000 acre-feet per year in 2060 and if the water modeling analyses indicates that 90 percent of the water will be provided, then agricultural activities are estimated to receive, on average, 270,000 acre-feet/year of water.

Lake levels were evaluated per the recreation threshold elevation established in the "Lake Recreation Impact Study: A Feasibility Level Study of Alternative Operating Plans for Lakes Buchanan and Travis", completed in 2007. The recreation elevation is defined as 660 feet above mean seal level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Environmental flow criteria used for Matagorda Bay and the river were developed by the Matagorda Bay Health Team.

Strategy I: Using LCRA's existing water supplies to meet future demands



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	95	99	Exceeds	Meets	Meets	29	26
2060	79	94	39	78	Meets	Meets	Meets	35	36
2080	67	89	14	14	Exceeds	7% less	3% less	33	34
2100	67	89	0	0	Exceeds	9% less	3% less	31	32

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses

Benefits

- Meet firm demands to nearly 2080
- Minimal permitting requirements
- Least-cost water supply approach
- Does not require pumping from lower basin to Central Texas

Challenges

- Does not provide firm supply to 2100
- Not diversified supply system, rely entirely on Highland Lakes and river, no storage in the lower basin
- Water rights amendment requests may be a contested case process
- Lake levels fluctuate more often
- Decreases amount of water available for agricultural purposes

Investments

Water rights amendments estimated cost = $3 to $5 million

12. Strategy II – Using Existing Supplies and Conserving for Our Future

Enhanced water conservation programs to reduce firm water demands

Because LCRA's existing supplies can potentially meet projected firm water demands within the planning area until 2080, there is time to implement an enhanced water conservation program to reduce firm water demands and extend existing water supplies until 2100. In this approach, enhanced conservation in the municipal, industrial, power generation, and agricultural sectors could be implemented to supplement water from lakes Travis and Buchanan and LCRA's four downstream water rights, as amended. An enhanced conservation strategy is consistent with the target in the 2007 TWDB State Water Plan of meeting about 23 percent of the state's water needs through conservation programs. While this approach may be perceived by some as aggressive, other communities in Texas, namely San Antonio, and other cities in the United States, including Seattle and Tampa, have reduced water demands by considerably more than the 2007 State Water Plan target. Enhanced conservation would require LCRA to almost double the amount of water savings identified in the current LCRA water conservation plan adopted in the spring of 2009.

In this conservation-based strategy it is presumed that the downstream run-of-river water rights will be amended to allow multiple purposes of use. The conservation-based approaches were studied to help reduce water use to satisfy firm water demands to the year 2100:

Plan C-1 Enhanced conservation alone, estimated total cost in today's dollars = $225 million

- Water demand reduction targets: municipal at ½ percent per year for 40 years for about a 20 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years.

Plan C-2 Enhanced conservation plus agricultural conservation in the lower basin, estimated total cost in today's dollars= $450 to $525 million

- Water demand reduction targets: municipal at ½ percent per year for 40 years for about a 20 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years.
- Conservation in LCRA's downstream agricultural divisions to reduce demand by about 118,000 acre-feet per year (similar to the data and information in the recent agricultural conservation studies).

Plan C-3 Enhanced conservation and expanded direct wastewater reuse, estimated total cost in today's dollars= $325 million

- Water demand reduction targets: municipal at ½ percent per year for 40 years for about a 20 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years.
- Expand direct wastewater reuse programs in the Highland Lakes area to reduce municipal water demand by an additional 10 percent.

Municipal and Industrial Conservation Programs could include the following activities by working in partnership with our raw water customers: leak detection and repair programs, incentives and rebates to replace in-home and business water fixtures and appliances, increased regulatory programs/landscape ordinances implemented by LCRA's raw water customers to minimize landscape areas and use appropriate soil, plants, and turf, condensation capture, rainwater harvesting, standards for new construction requiring water-conserving features, and technology changes in energy generation. The conservation program costs identified above are not reflective of all conservation program costs in the basin. For example, the City of Austin and other communities will continue and/or expand their water conservation programs to conserve water in their communities and manage water rates. These communities are contemplated in the report to fund their own water conservation programs. As these water conservation practices become more widespread; enforcement, replacement, and operation costs will be covered by the local utility.

Agricultural Conservation Programs in the lower basin will include the continuation of the HB 1437 programs and could include use of new rice varieties, on-farm practices, precision grading, multiple field inlets, conservation tillage, tail-water recovery, canal lining, delivery system improvements, conservation ponds, and structure replacements. In the upper basin, expanded brush management through cooperation with ongoing programs at LCRA and state and federal agencies can increase the amount of water flowing into the Highland Lakes during years of normal or above normal rainfall.

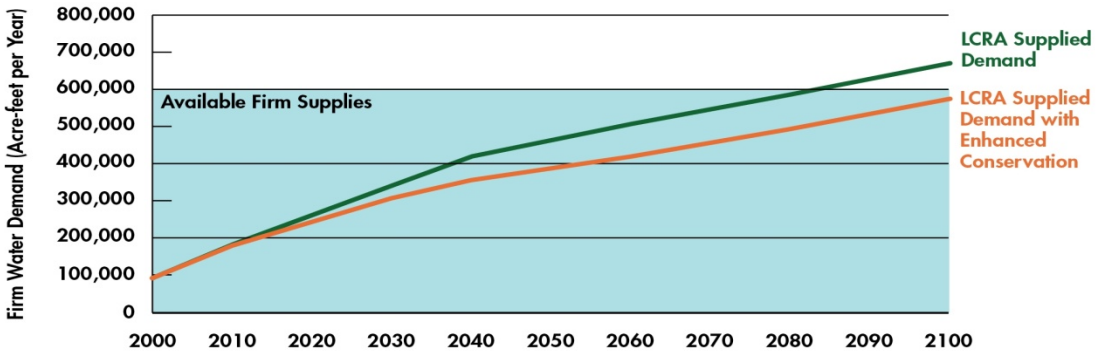
HB 1437- In 1999, the Texas Legislature passed House Bill 1437 to provide up to 25,000 acre-feet of surface water per year for use in Williamson County under certain conditions. The legislation requires "no net loss" of water in the Colorado River watershed and authorizes a surcharge on sales of the water to fund strategies to ensure that at least an equal amount of water is conserved, replaced or offset. LCRA has entered into a contract with the Brazos River Authority to provide this water to Williamson County communities and develop conservation strategies as required by HB 1437 with input from an Agriculture Water Conservation Fund Advisory Committee, a nine-member group of farmers and agricultural experts from Colorado, Wharton and Matagorda counties.

Wastewater Reuse Programs are based upon the beneficial reuse of about 10 to 15 percent of the local water demand in the Highland Lakes area. A reuse program would include activities such as the installation of distribution systems to convey effluent directly from the wastewater treatment plants to irrigate golf courses, greenways, parks, common grounds, playing fields, potential irrigation of residential lots and other local needs. This level of reuse would be in addition to the levels currently planned by the City of Austin.

To show how each approach meets firm water demands and affects agricultural reliability, lake levels, and environmental flows, please see the following summary sheets.

Strategy II, C-1: Using existing supplies and conserving for our future

Enhanced municipal conservation



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	29	25
2060	86	97	65	91	Meets	Meets	Meets	34	34
2080	66	89	43	80	Meets	Meets	Meets	34	36
2100	67	88	8	8	Exceeds	9% less	3% less	34	36

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Initiate water conservation programs in 2010 to 2012 timeframe, continue for about 40 years
- Reduce firm demands by about 80,000 acre-feet per year in 2060

Benefits

- Meet firm demands to 2100
- Low cost compared to other water supply approaches
- Consistent with the public's top-ranked water supply option (conservation)
- No permits required to implement conservation program
- No easements/land acquisition necessary
- Reduced water usage can help utilities delay or avoid water and wastewater treatment plant expansions
- Allows existing supplies to be extended well into future

Challenges

- Program implementation over a 40-year period
- Requires partnerships with customers to implement programs
- Will require raw water customers to implement landscape and other ordinances
- Do not have control over per capita water use reduction

Investments
(over a 40- to 50-year period)

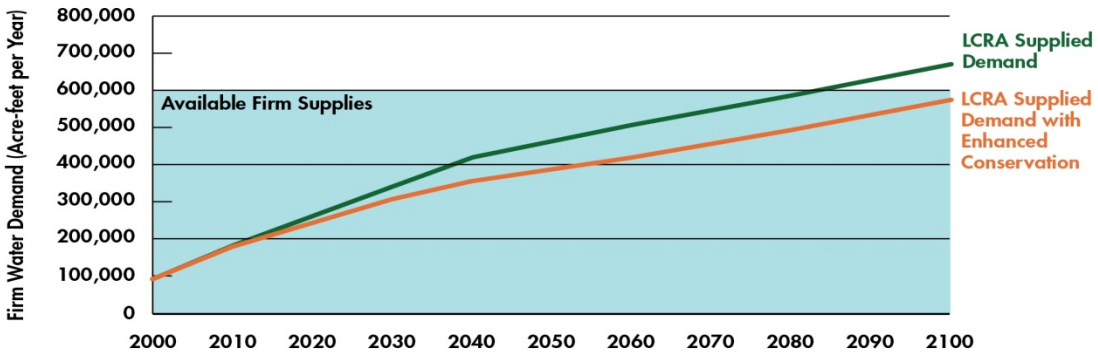
Water rights amendments cost = $3 to $5 million
Conservation program cost = $220 million
Total estimated cost = $225 million

Other

San Antonio, Seattle, and Tampa have reduced per capita water demand by nearly half through aggressive conservation programs over 25 years.

Strategy II, C-2: Using existing supplies and conserving for our future

Enhanced municipal conservation plus agricultural conservation



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	25	19
2060	100	100	94	99	Exceeds	Meets	Meets	32	30
2080	88	97	77	94	Exceeds	Meets	Meets	33	34
2100	67	88	30	37	Exceeds	9% less	3% less	35	35

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Initiate water conservation programs in 2010 to 2012 timeframe, continue for about 40 years
- Agricultural conservation to save about 118,000 acre-feet per year
- Reduce firm demands by about 80,000 acre-feet per year in 2060

Benefits

- Meet firm demands to 2100
- Consistent with the public's top-ranked water supply option (conservation)
- No permits required to implement municipal and industrial conservation programs
- No easements/land acquisition necessary for municipal/industrial conservation program
- Slight benefit to lake levels in the early years

Challenges

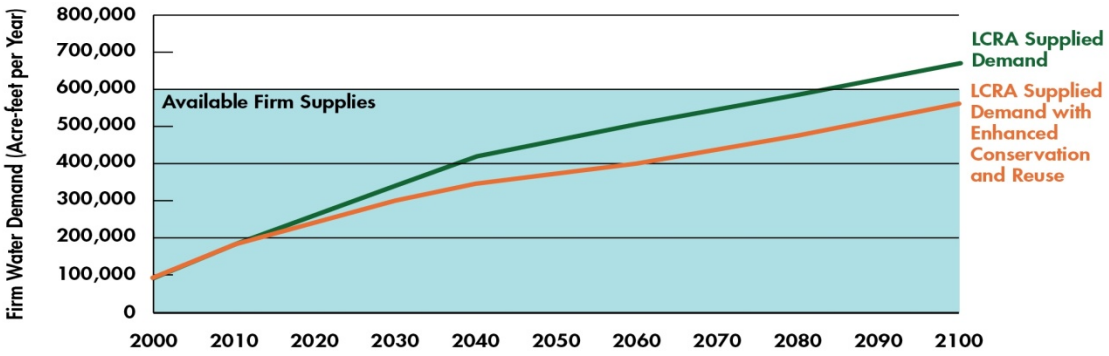
- Program implementation over a 40-year period
- Requires partnerships with customers to implement programs
- Will require raw water customers to implement landscape ordinances
- Do not have control over per capita water use reduction
- Agricultural water savings generate a minimal increase in firm supplies, primarily reduce interruptible water use
- Significant land and easement requirements for agricultural conservation projects
- Funding agricultural conservation programs

Investments
(over a 40- to 50-year period)

Water rights amendments cost = $3 to $5 million
Conservation program cost = $220 million
Agricultural conservation cost = $225 to $300 million
Total estimated cost = $450 to $525 million

Strategy II, C-3: Using existing supplies and conserving for our future

Enhanced municipal conservation plus direct wastewater reuse



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	28	24
2060	97	99	79	95	Exceeds	Meets	Meets	31	31
2080	80	95	63	90	Meets	Meets	Meets	34	34
2100	68	88	36	73	Meets	4% less	1% less	35	37

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Initiate water and reuse conservation programs in 2010 to 2012 timeframe, continue for about 40 years
- Through partnerships with our customers initiate local reuse projects
- Reduce firm demands by about 150,000 acre-feet per year in 2060

Benefits

- Meet firm demands to 2100
- Consistent with the public's top-ranked water supply options
- No permits required to implement municipal and industrial conservation program
- Significant reduction in water usage can help utilities delay or avoid water and wastewater treatment plant expansion
- Increased reliability to interruptible agricultural customers

Challenges

- Program implementation over a 40-year period
- Requires partnerships with customers to implement programs/leak detection and repair and wastewater reuse projects
- Will require raw water customers to implement landscape ordinances
- Do not have control over per capita water use reduction
- Continually identifying new beneficial uses for increasing effluent volumes
- Presumes entities receiving effluent will implement on-site distribution system

Investments

Water rights amendments cost = $3 to $5 million
Conservation program cost = $220 million
Wastewater reuse projects cost = $100 million
(not including Austin's planned projects)
Total estimated cost = $325 million

13. Strategy III – Using Existing Supplies, Conserving and Building for Our Future

Current LCRA water conservation program in conjunction with water supply projects or purchases

This strategy begins with LCRA's current water conservation program, through which about half of the enhanced conservation goal described above would need to be achieved. Numerous water supply options were investigated in the water planning process and noted in the above section titled "Water Supply Options." From this list, several water supply options were assembled to help meet long-term water demands. Again, as with the enhanced water conservation approaches, these potential approaches work in combination with the Highland Lakes and amendment of the remaining downstream water rights.

In this conservation- and project-based strategy, four approaches were studied to reduce water use in combination with additional water supply projects to satisfy firm water demands to the year 2100:

Plan CB-1 *Current conservation program plus an off-channel reservoir, estimated total cost in today's dollars = $880 million*

- Current water conservation to yield the following reductions: municipal at ¼ percent per year for 40 years for about a 10 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years, and
- Construction of an off-channel reservoir in the lower basin with a total storage capacity of about 210,000 acre-feet and associated structures to help meet water needs in the lower basin.

Plan CB-2 *Current conservation program plus an off-channel reservoir, and pipeline to Travis County, estimated total cost in today's dollars = $ 1.615 billion*

- Current water conservation to yield the following reductions: municipal at ¼ percent per year for 40 years for about a 10 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years;
- Construction of an off-channel reservoir in the lower basin with a total storage capacity of about 210,000 acre-feet and associated structures, and
- Construction of a pipeline from the off-channel reservoir to a point near State Highway 130 in Travis County to convey 75,000 acre-feet of water per year, the pipeline may also be able to receive diverted river water from other points upstream of the reservoir.

Plan CB-3 *Current conservation program plus a brackish groundwater desalination plant on the Gulf Coast aquifer, and Bastrop County aquifer storage/retrieval, estimated total cost in today's dollars = $ 707 million*

- Current water conservation to yield the following reductions: municipal at ¼ percent per year for 40 years for about a 10 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years;
- Construction of a brackish groundwater desalination facility on the Gulf Coast aquifer to provide approximately 33,600 acre-feet per year of treated water and a pipeline to the Bay City area to help meet lower basin needs, and

- Construction of a surface water/aquifer storage and retrieval project in Bastrop County to provide about 22,000 acre-feet per year of treated water and a pipeline to the Travis and Bastrop County area.

Plan CB-4 *Current conservation program plus importing groundwater from outside the basin, estimated total cost in today's dollars = $ 1.415 billion*

- Current water conservation to yield the following reductions: municipal at ¼ percent per year for 40 years for about a 10 percent total reduction; industrial, about a 5 percent reduction over 40 years; power plants, about a 5 percent reduction over 40 years, and
- Importation of groundwater in the amount of about 35,000 acre-feet per year to a delivery point in eastern Travis County, through a purchase contract rather than LCRA constructing and operating the well-field and pipeline network.

Municipal and industrial conservation programs could include the following activities by working in partnership with our water customers: leak detection and repair programs; incentives and rebates to replace in-home and business water fixtures and appliances; landscape ordinances to minimize landscape areas and use appropriate soil, plants, and turf; standards for new construction requiring water-conserving features, condensation capture, rainwater harvesting; and seeking technology changes in energy generation.

Off-Channel reservoir or reservoirs in the lower basin would include one or multiple off-channel reservoirs in the lower basin to capture unappropriated flows from the river during high flow events; retain unused irrigation or other water released from the Highland lakes; and help firm up the downstream run-of-river water rights. For the purpose of this planning effort, a single reservoir with a storage capacity of about 210,000 acre-feet located on the Pierce Ranch was used to develop this option since extensive planning to develop a preliminary design and cost estimate for such a facility had already been done.

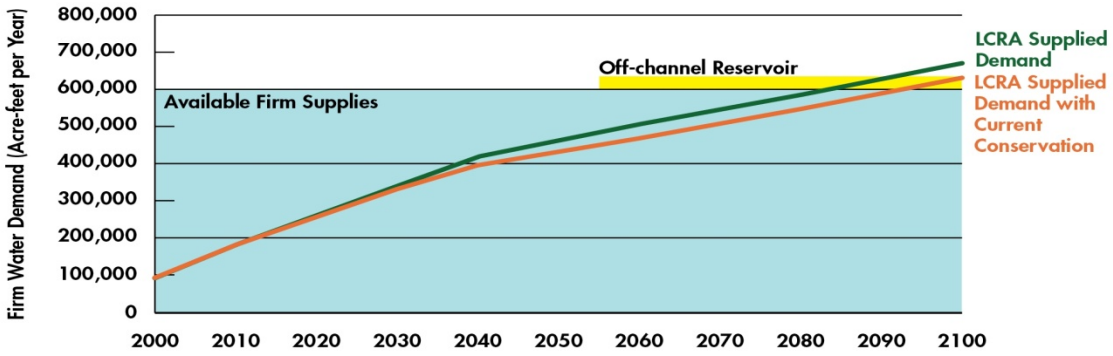
Pipeline from the off-channel reservoir to eastern Travis County would include pump stations and other facilities to convey raw water through a pipe that is 54 inches in diameter over a distance of 124 miles with the potential to supply raw water to customers along the route.

Other water supply projects besides importing groundwater include brackish groundwater desalination and Bastrop County aquifer storage, retrieval and recharge projects that respectively provide about 33,600 and 22,000 acre-feet per year of treated water to meet industrial needs along the Gulf Coast and municipal demands in the counties of Bastrop and Travis. These projects would consist of brackish groundwater pumped from the Gulf Coast aquifer or Colorado River, pipelines, treatment plants, and, for the aquifer storage and retrieval project, a well field to inject and later pump water. Another option is the importation of groundwater in the amount of about 35,000 acre-feet per year from outside the basin to an eastern Travis County delivery point.

To show how each approach meets firm water demands and affects agricultural reliability, lake levels, and environmental flows, please see the following summary sheets.

Strategy III, CB-1: Using existing supplies, conserving, and building for our future

Current municipal conservation plus off-channel reservoir



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	28	25
2060	89	97	65	91	Meets	Meets	2% less	34	34
2080	77	94	38	68	Meets	Meets	3% less	36	36
2100	67	89	0	0	Exceeds	9% less	6% less	34	34

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Continue recently approved LCRA water conservation programs for about 40 years
- Off-channel reservoir with storage volume ~ 210,000 acre-feet to aid in meeting lower basin needs, project begins in 2050 to 2060 timeframe

Benefits

- Meet firm demands to 2080
- No permits for conservation program
- Divert a portion of river flows into off-channel reservoir when available to provide a more reliable supply for lower basin customers
- Allows more water to remain in storage in the Highland Lakes to serve Central Texas

Challenges

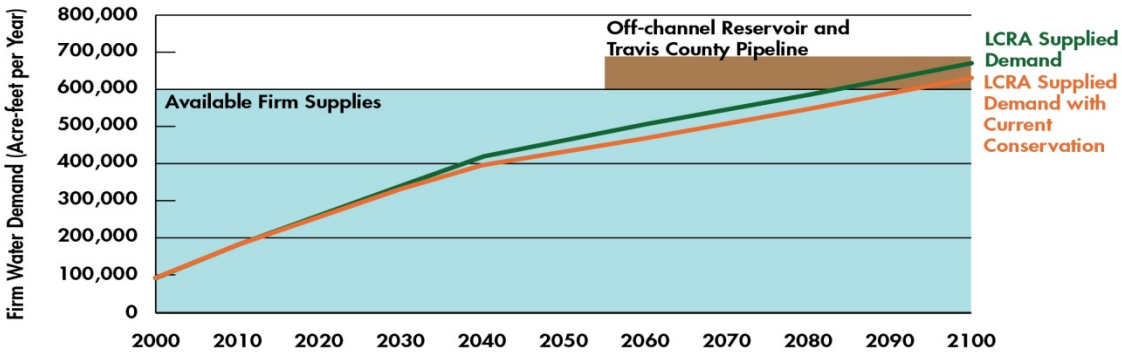
- Current conservation program over a 40-year period
- Numerous permit requirements
- Land and easement requirements
- Evaporation of stored water from reservoir
- Operation and maintenance costs
- Does not meet firm water demands to 2100

Investments

Water rights amendments cost = $3 to $5 million
Conservation program cost = $110 million
Off-channel reservoir cost = $765 million
Total estimated cost = $880 million

Strategy III, CB-2: Using existing supplies, conserving, and building for our future

Current municipal conservation plus off-channel reservoir and pipeline to Travis County



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	24	19
2060	99	99	79	95	Meets	Meets	Meets	31	29
2080	86	97	58	85	Meets	Meets	Meets	35	36
2100	77	93	36	65	Does Not Meet	2% less	3% less	36	36

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Continue recently approved LCRA water conservation programs for about 40 years
- Off-channel reservoir with storage volume ~ 210,000 acre-feet to aid in meeting lower basin needs and a pipeline 124 miles in length to convey 75,000 acre-feet per year to Travis County, project begins in 2050 to 2060 timeframe

Benefits

- Meet firm demands to 2100
- No permits for conservation program
- Divert a portion of river flows into off-channel reservoir when available to provide a more reliable supply for lower basin customers
- Provide additional raw water to growing Central Texas region when needed
- Allows more water to remain in storage in the Highland Lakes to serve Central Texas
- Increased reliability to interruptible agricultural customers

Challenges

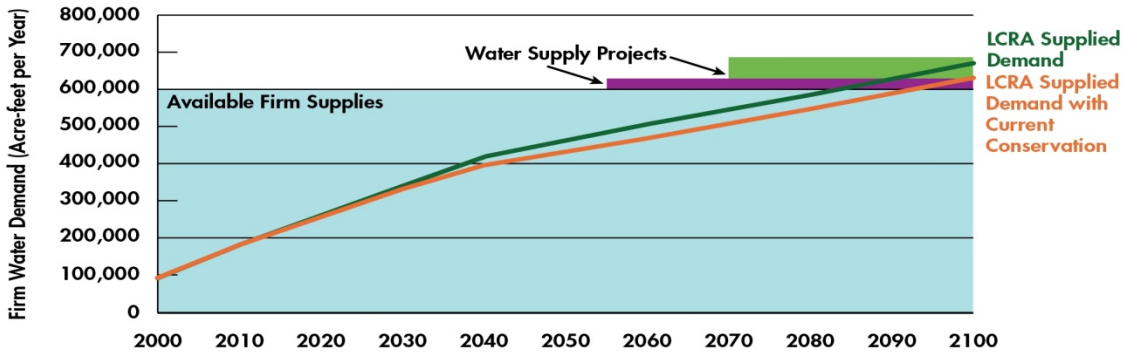
- Current conservation program over a 40-year period
- Significant number of permit requirements
- Significant land and easement requirements
- Evaporation of stored water from reservoir
- Operation and maintenance costs

Investments

Water rights amendments cost = $3 to $5 million
Conservation program cost = $110 million
Off-channel reservoir and pipeline cost = $1.5 billion
Total estimated cost = $1.615 billion

Strategy III, CB-3: Using existing supplies, conserving, and building for our future

Current municipal conservation, brackish groundwater desalination, and Aquifer Storage, Recharge Retrieval (ASR)



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	27	24
2060	88	97	64	91	Meets	Meets	Meets	34	34
2080	77	94	40	75	Meets	Meets	Meets	35	36
2100	67	88	0	0	Exceeds	10% less	5% less	34	36

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Continue recently approved LCRA water conservation programs for about 40 years
- Bastrop County Aquifer Storage, Recharge Retrieval (ASR) Project, 22,400 acre-feet per year, pipeline to Travis County
- Brackish groundwater desalination facility in Matagorda County, 33,600 acre-feet per year, pipeline to Bay City area

Benefits

- Meet firm demands to 2100
- Diversified approach
- No permits for conservation program
- With ASR, available water can be stored underground and recovered later (no evaporation, unlike surface water storage)

Challenges

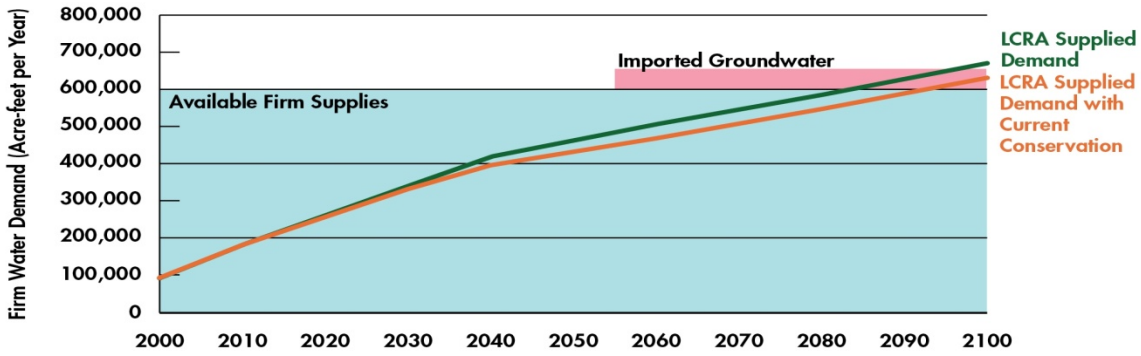
- Current conservation program over a 40-year period
- Significant number of permits necessary for both projects
- Significant land and easement requirements
- ASR river flow diversions could reduce surface water flows downstream of Bastrop
- Disposal of salt from the desalination project

Investments

Water rights amendments cost = $3 to $5 million
Conservation program cost = $110 million
Bastrop ASR project cost = $367 million
Brackish groundwater desalination project cost = $239 million
Total estimated cost = $721 million

Strategy III, CB-4: Using existing supplies, conserving, and building for our future

Current municipal conservation, importing groundwater



Year	Ag Reliability (%) Garwood		Ag Reliability (%) Non-Garwood		Matagorda Bay Inflow Volume*	Matagorda Bay Threshold Criteria (Minimum Monthly Inflow)	Colorado River Instream Subsistence Flow Criteria	% of Time Lake Levels Less than Recreation Threshold**	
	Drought of Record	Period of Record	Drought of Record	Period of Record				Travis	Buchanan
2010	100	100	100	100	Exceeds	Meets	Meets	18	13
2030	100	100	100	100	Exceeds	Meets	Meets	27	24
2060	87	97	63	90	Meets	Meets	Meets	34	34
2080	77	94	41	76	Meets	Meets	Meets	35	36
2100	67	88	0	0	Exceeds	9% less	3% less	34	36

* Goal for average annual inflow volume is between 1,400,000 and 1,500,000 acre-feet per year.

** Recreation threshold is defined at 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan.

Details

- Amend remaining downstream water rights to allow multiple uses
- Continue recently approved LCRA water conservation programs for about 40 years
- Imported groundwater delivered to Travis County area

Benefits

- Meet firm demands to 2100
- Diversified approach
- No permits for conservation program
- With groundwater, no evaporative losses

Challenges

- Current conservation program over a 40-year period
- Significant groundwater permitting required (drilling, production, transfer)
- Significant land and easement requirements
- Local acceptance of moving water out of rural areas
- Significant conveyance requirements
- Current flux of groundwater regulations
- Long-term reliability
  - Short-term permits
  - Sustainability of pumping
  - Uncertainty of long-term firm supply

Investments

Water rights amendments cost = $3 to $5 million
Conservation program cost = $110 million
Imported groundwater cost = $1.3 billion
Total estimated cost = $1.415 billion

14. Summary of Water Planning Strategies

A comparison of water supply approaches is listed below (all water supply approaches rely on lakes Buchanan and Travis and downstream run-of-river water rights to the fullest extent possible).

Approach	Total Cost ($)	Provides Firm Water Until	Agricultural Reliability Drought of Record	Matagorda Bay Average Annual Inflow Volume	Colorado River Subsistence Flow Criteria	Lake Levels Below Recreation Elevation (Average*)
Use of Highland Lakes & downstream water rights	$ 3-5 M	2080	Water shortages begin after 2030	Meets/exceeds in all years	Meets until about 2080	LT ~ 32 % LB ~ 32 %
C-1 Enhanced conservation (M&I)	$ 225 M	2100	Water shortages begin between 2030 and 2060	Meets/exceeds in all years	Meets until 2100	LT ~ 33 % LB ~ 33 %
C-2 Enhanced conservation (M&I), agricultural conservation	$ 450 to $ 525 M	2100	Water shortages begin around 2060	Exceeds in all years	Meets until 2100	LT ~ 31 % LB ~ 30 %
C-3 Enhanced conservation (M&I), direct wastewater reuse	$ 325 M	2100	Water shortages begin between 2030 and 2060	Meets/exceeds in all years	Meets until 2080	LT ~ 32 % LB ~ 32 %
CB-1 Current conservation (M&I) and off-channel reservoir	$ 880 M	2080	Water shortages begin between 2030 and 2060	Meets/exceeds in all years	Meets until about 2060	LT ~ 33 % LB ~ 32 %
CB-2 Current conservation (M&I), off-channel reservoir, pipeline to Travis Co.	$1.615 B	2100	Water shortages begin around 2060	Does not meet in 2100	Meets until 2080	LT ~ 32 % LB ~ 30 %
CB-3 Current conservation (M&I), brackish groundwater desalination, aquifer storage and retrieval	$721 M	2100	Water shortages begin between 2030 and 2060	Meets/exceeds in all years	Meets until 2080	LT ~ 33 % LB ~ 32 %
CB-4 Current conservation (M&I) and importing groundwater	$ 1.415 B	2100	Water shortages begin between 2030 and 2060	Does not meet in 2100	Meets until about 2100	LT ~ 33 % LB ~ 33 %

M&I = municipal and industrial, LT = Lake Travis, LB = Lake Buchanan
* Average over the planning period of 2010 to 2100

Recreation elevation is defined as 660 feet above mean sea level (msl) for Lake Travis and 1,012 msl for Lake Buchanan. Using current information, Lake Travis is below the threshold about 18 percent of the time, while Lake Buchanan is below its threshold about 13 percent of the time.

15. Margin of Safety for Developing Additional Supply

The following graphic was developed to provide the Board, LCRA's customers and the public a visual representation or status of the:

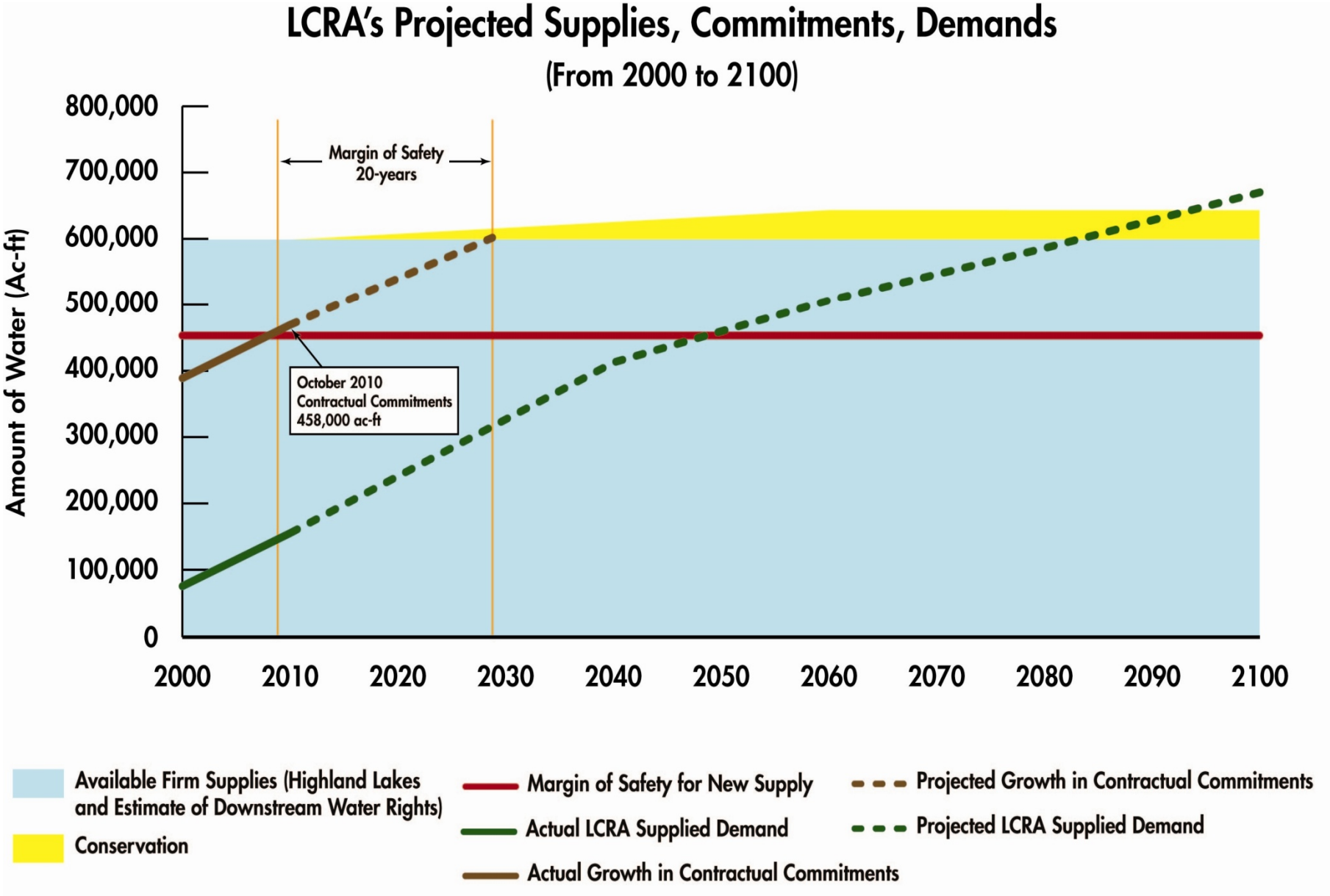
- Amount of water that LCRA has determined could be reasonably available[1] from its existing supplies during the Water Supply Resource planning period - an estimated 600,000 acre-feet per year (shaded blue area);
- Actual firm demands in the 2000-2010 timeframe (dark green line) and projected demands that LCRA believes it may be called upon to provide over the 2010-2100 timeframe (dashed dark green line);
- Current level of conservation that is projected to occur based on the recently approved LCRA water conservation plan (shaded yellow area);
- A margin of safety (red line) is shown that establishes a "trigger point" at which staff would further discuss with the LCRA Board of Directors whether to pursue any specific water supply projects. The margin of safety trigger is reached when LCRA's contractual commitment for firm water supplies reach a level that leaves LCRA with less than a 20-year supply to commit (or about 150,000 acre-feet of remaining uncommitted supply)[2]. When the margin of safety is reached, staff would initiate further discussions with the LCRA Board concerning specific future water supply options; and
- Actual annual average rate of growth in new contracts for firm water supply (solid brown line) and the rate of growth in new firm water contracts projected out into the future (dashed brown line).

This graphic is not meant to portray that the LCRA Board would only make a decision on whether to pursue additional water supplies at some future date when the projected rate of growth in firm water contracts reaches the margin of safety line. LCRA was created to be a regional provider of water supply for the lower Colorado River region and has had a long history of developing or acquiring water supplies for future firm water use in its service area well in advance of the actual need for such supplies, *i.e.* construction of the Highland Lakes, acquisition of the four downstream water rights, application to appropriate excess flows, and amendments to existing water rights. LCRA has been and will continue to help provide water supplies to meet the needs in its service area. In assessing the appropriate timing for

[1] This would involve amending the remaining downstream water rights to allow for multiple purposes of use (municipal, industrial, agricultural and others) and to allow water from these rights to be diverted from different locations or used at different places.

[2] This margin of safety is based on the actual annual average rate at which LCRA has contracted to supply firm water over the past 15 years (since 1994) multiplied times 20 years.

acquisition of new supplies, LCRA will continually evaluate and may pursue additional supplies at the direction of the Board of Directors. In considering development of additional water supplies, LCRA may take into account such factors as potential changes in the regulatory environment that could alter the availability or cost of a particular water supply, the risk that the water supply of interest may be acquired by third parties to meet a demand outside LCRA's service area, viability of the project, implications or potential effects of such projects on customer rates, and other factors.


LCRA's Projected Supplies, Commitments, Demands
(From 2000 to 2100)
Amount of Water (Ac-ft)
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Margin of Safety
20-years
October 2010
Contractual Commitments
458,000 ac-ft
Available Firm Supplies (Highland Lakes and Estimate of Downstream Water Rights)
Conservation
Margin of Safety for New Supply
Actual LCRA Supplied Demand
Actual Growth in Contractual Commitments
Projected Growth in Contractual Commitments
Projected LCRA Supplied Demand

16. 2010 Public Input Summary – Draft Plan Feedback

LCRA held public meetings in February and March 2010 in El Campo, Burnet, and Austin. In addition to these meetings, an online survey was available for the public to provide input on the draft Water Supply Resource Plan. About 140 people attended the meetings and LCRA received more than 220 online survey responses. The following summarizes the public input:

Preferred Water Supply Strategies

Strategy I – Maximizing LCRA's existing supplies	4%
Strategy II – Using existing supplies and enhanced conservation	42%
Strategy III – Using existing supplies, current conservation, and water supply projects	54%

Water Supply Priorities

The table below lists in ranked order the most frequently mentioned priorities relating to water supply sources. It is interesting to note that the priorities changed from the summer of 2008. Potentially, the last two years of drought modified people's priorities relating to water availability.

Ranked order priorities in 2008	**Ranked order priorities in 2010**
Clean water, protect the environment	Availability
Recreation, lifestyle	Clean water, protect the environment
Availability	Water for future generations
High quality water supply	Manage growth
Manage growth	High quality water supply
Affordable	Preserve lakeside residents' lifestyle
Jobs, economic growth	Equitable water availability and use

Summary of greatest challenges affecting assurance of high quality, affordable, and available water supplies

Common themes from the meetings and survey, not listed in priority order:

Population growth, unknown future drought conditions, getting people to conserve as needed, regional versus local mindset, politics, pricing water appropriately, cost of new supplies, conveyance of water to where it is needed, balancing agriculture with firm demands, maintaining high water quality, water for the environment, enforcement, legal issues, and leadership willing to make hard decisions.

Other notable information

We heard through the online survey that 90 percent of the respondents were willing to conserve water to delay or decrease the need for new supplies. In addition, a majority of respondents were willing to pay up to 20 percent to 30 percent more on their water bill to assure ample water supply for future generations.

17. Appendix (Detailed Planning Assumptions)

- **Water demands** -The following sources were used for projections for future water demands:
    a. Scenario II municipal, industrial, and other firm water demands for LCRA customers that the Board directed staff to use in December 2008. Includes increased population growth in planning area, domestic use around lakes, conveyance losses for downstream contracts, and increased steam-electric demands.
    b. For LCRA agricultural demands the 2006 Region K projections, as adjusted for weather conditions over the modeling period of 1940-1998, were used as the baseline. A reduced amount of water was made available for agricultural needs for non-Garwood (Lakeside, Gulf Coast, and Pierce Ranch) users over time, as firm demands increased. The amount supplied to Garwood was reduced consistent with the Garwood water rights purchase agreement and anticipated Garwood agricultural demands.
    c. All other surface water demands in the Colorado basin for non-LCRA customers (i.e. municipal, industrial, agricultural, mining, livestock, etc…) were set equal to the maximum authorized annual diversions stipulated in existing water rights.

    In developing the projected demands, LCRA has coordinated with county officials, groundwater conservation districts, the state demographer and Region K.

- **Water modeling** - The Texas Commission on Environmental Quality (TCEQ) water availability model for the Colorado River basin, modified to reflect current water rights operations and agreements, was used to analyze available surface water supplies on a monthly basis for LCRA's existing water rights (lakes Buchanan and Travis and the downstream run-of-river water rights). This is the basic modeling platform used by the TCEQ in permitting water rights in the state. Although these are the best models available today, there are uncertainties associated with such modeling.
- **Uncertainties -** Staff has tried to mitigate uncertainties as much as possible by using conservative assumptions. Uncertainties exist not only in hydrologic modeling and future climatic variability, but also in potential regulatory, legislative, and economic factors. To address uncertainties, a proposed trigger or decision-point mechanism is being recommended relating to LCRA's level of contractual commitments in the future and the amount of LCRA's available supplies. This will help identify when LCRA should consider developing additional supplies to assure it will have water available to commit when requested by new or existing customers.
- **Environmental needs -** Staff used the philosophy from the approved Water Management Plan as a guide in developing environmental flow assumptions. Mainly, after satisfying LCRA's firm municipal and industrial demands, available water supplies were generally balanced between meeting environmental flow needs and providing agricultural water. To address certain possible future regulatory constraints, additional environmental flow (in-stream flows and flows to Matagorda Bay) conditions were used, where appropriate, based on the type of water rights appropriation or amendment being proposed. Staff used the best science available from recent studies, where applicable, in its analyses and evaluations.
- **Use of downstream water rights -** It is assumed that LCRA's remaining downstream run-of-river water rights (i.e. Lakeside and Gulf Coast) would be amended to allow them to be used for multiple beneficial purposes (i.e. municipal, industrial, agriculture, and other uses.) These amendments would provide the flexibility to meet some of the downstream demands from such water rights, thereby extending the available supplies from the Highland Lakes and associated lake levels. This, in turn, may further extend the availability of interruptible stored water that could be made available for downstream irrigation use.
- **Williamson County -** It is assumed that the water provided by contract to Williamson County through House Bill 1437 would continue to be provided through the full planning period. In addition, all existing contracts are assumed to be renewed.
- **Water right purchase agreements -** Assumptions include conditions to which LCRA agreed when the Garwood and Pierce Ranch water rights were purchased. Some of these conditions may affect when these water rights could be fully used for other uses. To plan for this contingency, the assumption is that Garwood will still be using about 50,000 acre-feet of water for agricultural purposes in 2100.
- **Groundwater or desalination as additional supply -** Providing water directly from a desalination or groundwater project as a sole source of supply for a lone customer might be outside of LCRA's current legal authority. Therefore, this plan assumes that desalination and groundwater projects would be used conjunctively with surface water.

- **Used other studies for comparison -** Staff compared results from the water availability modeling for each decade to the potential effects on lake levels for lakes Buchanan and Travis, and environmental flow criteria developed by the Matagorda Bay Health Team. Staff used data and information, where appropriate, from recent studies.
- **City of Austin -** Water availability analyses included direct and indirect reuse for the City of Austin consistent with the provisions of the 2007 Settlement Agreement with Austin.
- **Climate variability-** During the water supply community conversations in 2008, the public suggested that LCRA should factor climate variability into its planning. The drought of the 1950's may not apply when predicting water availability during severe droughts in the future. To address this issue and other uncertainties, conservative assumptions are being used and a proposed trigger or decision-point mechanism is being proposed to assure that LCRA will have ample supplies on line well in advance of projected future demands. In addition, the LCRA will update this report on a cyclic basis to track hydrologic and weather patterns and if water supply conditions change, LCRA will reflect those changes in future reports and, if needed, initiate action to develop new water supplies.