6 Evaluation of Water Replacement Strategies

This chapter discusses the available strategies to replace the water transferred to Williamson County. It provides an overview of the evaluation and selection process, and the decision criteria applied in this process. The chapter introduces a long-term and a short-term cost model and concludes with recommended strategies.

This chapter is a summary of a Technical Memoranda: *"Evaluation Criteria and Selection Process for HB1437 Water Replacement Strategies*", *and "Estimates of the Conservation Charge for HB1437 Water Replacement Strategies"* presented in Attachments 18 and 19 respectively.

6.1 Water Needs and Demand Forecasts

The Brazos River Authority submitted a schedule to reflect the total water demand from lower Colorado River supplies for Williamson County for the period 2005-2025. The demand was then projected using a linear trend to the maximum demand of 25,000 acre-feet per year (Tables 6.1, 6.2, 6.3, and 6.4). Attachment 19 provides details of the projections and adjustments.

Table 6.1 BRA Projected Water Demands for HB1437 Water, AF/yr

Entity	Reserved Capacity (mgd)	Year			
		2005	2015	2020	2025
Round Rock	11,444 (10.3)	0	6,658	11,444	11,444
Georgetown	6,944 (6.2)	0	0	0	0
CTSUD	3,472 (3.1)	600	2,200	3,472	3,472
Uncommitted	2,540 (2.3)	0	0	0	0
Liberty Hill	600 (0.5)	0	600	600	600
Total	**25,000 (22.5)**	**600**	**9,458**	**15,516**	**15,516**

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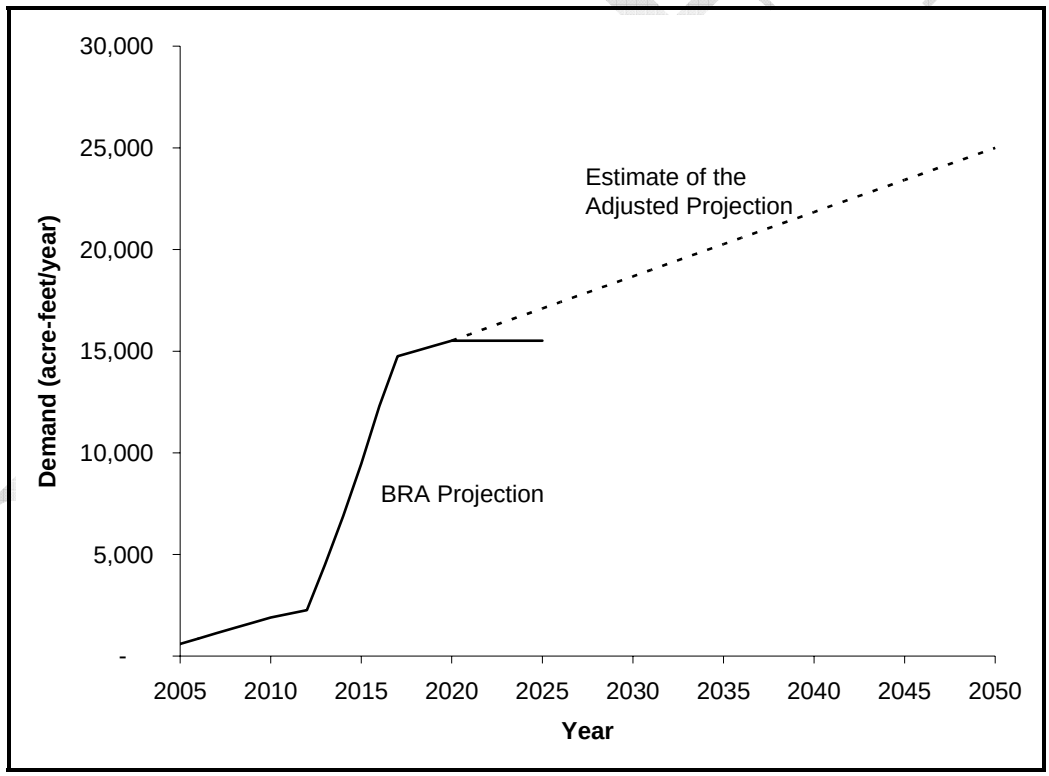
Table 6.2 Williamson County Water Demand Distribution in 2050

Williamson County Water Customers	Projected Demand in 2050 (AF)	Projected Demand in 2050 (rounded off in AF)
Chisholm Trail Special Utility District (CTSUD)	3,472	3,500
Georgetown	6,944	7,000
Round Rock	11,444	11,500
Liberty Hill	600	600
Allocated Total	**22,460**	**22,600**
Unallocated	2,540	2,400
Total	**25,000**	**25,000**

Table 6.3 Williamson County Projected Water Demand



Source: Modified from a water demand schedule developed by the Brazos River Authority.

Table 6.4 Projected Water Demands from 2000 to 2050

Year	CTSUD	Georgetown	Liberty Hill	Round Rock	Total Demand
2000	0	0	0	0	0
2005	600	0	0	0	600
2010	1,400	0	500	0	1,900
2015	2,200	0	600	6,700	9,500
2020	>3,500	>0	>600	>11,400	15,500
2025[1]	>3,500	>0	>600	>11,400	17,100
2030[1]	>3,500	<6,900	>600	>11,400	18,700
2035[1]	>3,500	<6,900	>600	>11,400	20,300
2040[1]	>3,500	<6,900	>600	>11,400	21,800
2045[1]	>3,500	<6,900	>600	>11,400	23,400
2050	>3,500	<6,900	>600	>11,400	25,000

1. The demand projections given by BRA are only projected on a yearly basis through 2025. Therefore, the project team assumed a linear projection between the 2020 projection and the ultimate water demand of 25,000 acre-feet in 2050, which results in the total demands shown between 2021 and 2049. It is assumed that one or more of the Williamson County water users will continue to increase their demands above the level shown for 2020. This is reflected in the shaded portion of the table by the demands shown with a 'greater than' (>) symbol.

2. Based on the demand projections of the Brazos River Authority, Georgetown will demand up to 6,900 acre-feet of water after 2025.

3. Since the Brazos River Authority provided accurate demand projections up until 2025, it is not possible to estimate the demand distribution among different water customers beyond 2025. Table 5.2 provides an estimate of the adjusted projection of the total water demand up until 2050.

6.2 Strategies Evaluated

The following strategies were evaluated as potential sources of water replacement.

1. Balancing reservoir in Garwood Irrigation Division
2. Automated check structure and control system in Garwood Irrigation Division
3. Precision land leveling
4. Groundwater development – LCRA Garwood Irrigation Division
5. Conjunctive use of groundwater in Garwood Irrigation Division
6. Groundwater development – LCRA Lakeside Irrigation Division
7. Groundwater development – LCRA Gulf Coast Irrigation Division
8. Groundwater from Alcoa mine in Milam County

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9. Brushy Creek wastewater treatment plant return flow
10. Reservoir on San Bernard River
11. Purchase unused portion of Allen's Creek Reservoir
12. Reducing urban outdoor water use
13. Purchasing adjoining basin irrigation water rights
14. Purchase Colorado River irrigation water rights
15. Reduced irrigation for second rice crop in Colorado River basin
16. Canal lining in LCRA irrigation districts
17. Conservation of stormwater
18. Desalination

6.3 Evaluation Criteria

The following decision criteria were used to evaluate the above-mentioned water replacement strategies.

- Volume
- Reliability
- Quality
- Cost to the customer
- Risk
- Environmental impacts
- Location
- Timing
- Water levels in the Highland Lakes
- Equity
- Permits or other required procedural steps
- Soft versus hard water replacement
- Ease of implementation
- Phased implementation
- Reduce the reliance on surface water in agricultural irrigation

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6.4 Water Replacement Strategies and the Screening Process

The first project presentation at the public meeting in Burnet introduced 11 decision criteria for selecting among water replacement strategies. Based on the public recommendations at Burnet, four other criteria were added to the original list.

A total of 15 decision criteria were presented at the Wharton and Georgetown public meetings. Of the 15 decision criteria, public comments emphasized ease of implementation, cost, and farm-based demand management. According to these criteria, a strategy that the LCRA and farmers can implement voluntarily would be easier to implement than an option that requires the LCRA to contract with third parties. A strategy that has a lower cost of water to the customer is better than an option that produces higher cost water. Based on the feedback from the public and project staff, a primary screening of alternatives was done based on five primary screening criteria – phased implementation, implementation time can be accelerated (<5years), sustainable yield, permit/third party approval required, and surcharge rate. Table 6.4 shows how each strategy was rated based on the primary screening criteria.

The process for evaluation of water replacement strategies, as described in Attachment 18, included the following steps:

- Primary Screening Criteria Applied
    - First Tier Strategies Identified
    - Second Tier Strategies Identified
    - Some Strategies Eliminated from Consideration
- Secondary Screening Criteria Applied
- Detailed Evaluation of First and Second Tier Strategies
- Preferred Strategies Identified

Primary screening revealed that of the 18 water replacement strategies, seven can be implemented directly by the LCRA and farmers. They require no contracts between the LCRA and third party institutions and do not require any permits from third party institutions. These are precision land leveling, automated check structure(s) and data system(s), balancing reservoir(s), conjunctive use of groundwater in irrigation districts, groundwater development in the Lakeside Division, reduced irrigation for second crop, and canal lining.

Of the 18 replacement strategies, nine are low cost in terms of the expected surcharge rates. These include: precision land leveling; automated check structure(s) and data system(s); balancing reservoir(s); conjunctive use of groundwater in irrigation districts; groundwater development in the Lakeside Division; reduced irrigation for second crop; groundwater development in the Garwood Division; groundwater development in the Gulf Coast Division; and Brushy Creek return flow.

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The LBJ School adopted as an operational definition of "low cost" a test of the estimated surcharge rate. If the surcharge rate is equal to or more than the market price of water (100 percent), it "does not satisfy the criterion" and it is not low cost. If the surcharge rate is more than 50 percent and less than 100 percent of the market cost of water, then it "partially satisfies the criterion" of low cost. If the surcharge rate is equal to or less than 50 percent of the market cost of water, then the option "satisfies the criterion" of low cost.

Fourteen water replacement strategies can be implemented with sufficient speed to be used in practice to balance water transfers to Williamson County. These are precision land leveling, automated check structure(s) and data system(s), balancing reservoir(s), conjunctive use of groundwater in irrigation districts, groundwater development in Lakeside, reduced irrigation for second crop, canal lining, reduced urban outdoor water use, groundwater development in Garwood, groundwater development in Gulf Coast, groundwater from Alcoa, adjoining basin irrigation water rights, and purchase of Colorado River irrigation water rights. With each alternative there are remaining uncertainties regarding the potential administrative complications.

Of the 18 water replacement strategies, fifteen can be implemented in phases. These are: precision land leveling; automated check structure(s) and data system(s); balancing reservoir(s); conjunctive use of groundwater in irrigation districts; groundwater development in Lakeside; reduced irrigation for second crop; canal lining; reduced urban outdoor water use; groundwater development in Garwood; groundwater development in Gulf Coast; groundwater from Alcoa; Brushy Creek return flow; adjoining basin irrigation water rights; purchase Colorado River irrigation water rights; and capture of municipal storm water.

Sixteen strategies could provide sustainable yield. These are: precision land leveling; automated check structure(s) and data system(s); balancing reservoir(s); conjunctive use of groundwater in irrigation districts; groundwater development in Lakeside; reduced irrigation for second crop; canal lining; reduced urban outdoor water use; groundwater development in Garwood; groundwater development in Gulf Coast; groundwater from Alcoa; Brushy Creek return flow; adjoining basin irrigation water rights; purchase Colorado River irrigation water rights; San Bernard reservoir; and desalination.

Based on the primary screening, six water replacement strategies – identified here as "first tier strategies" – produce favorable results with all five decision criteria. These are: precision land leveling; automated check structure(s) and data system(s); balancing reservoir(s); conjunctive use of groundwater in irrigation districts; groundwater development in Lakeside; and reduced irrigation for second crop. Two water replacement strategies – second tier strategies – required permits or third-party approvals, but satisfied the remaining criteria. These are groundwater development in Garwood, and groundwater development in Gulf Coast.

Ten water replacement strategies were eliminated from consideration based on the fact that they did not satisfy two or more of the decision criteria. These options are: reduced urban outdoor water use; groundwater from Alcoa; adjoining basin irrigation water rights; purchase Colorado River irrigation water rights; San Bernard reservoir; purchase unused portion of Allen's Creek reservoir; capture of municipal stormwater; desalination; canal lining; and Brushy Creek return flow. Table 6.4 illustrates the primary screening.

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Staff used the secondary criteria to evaluate first and second tier strategies. These secondary criteria include: volume; reliability; water quality; risk; environmental impact; location; timing; lake water levels; equity; and reduced reliance on surface water in agricultural irrigation. Table 6.5 shows how first and second tier strategies were rated based on the secondary screening criteria. A more detailed discussion of inferences on decision criteria is available in the “An Evaluation of Comments from the First Round of Public Meetings” section. Attachment 18 provides a detailed discussion of the evaluation and selection process of water replacement strategies.

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Table 6.4 Primary Screening Results

ID	Water Replacement Strategy	Conservation Charge est. (%)	Phased Implementation	Accelerated Implementation (<5yrs)	Sustainable Yield	No Permit or Third Party Approval Required
1	Balancing Reservoirs	34% ●	◉	●	●	◉
2	Automated Check Structures and Control Systems	27% ●	◉	●	●	●
3	Precision Land Leveling	29% ●	●	●	◉	◉
4	Groundwater Development – Garwood	71% ◉	●	●	◉	○
5	Conjunctive Use of Groundwater in Garwood Irrigation Division	50% ◉	●	●	●	◉
6	Groundwater Development – Lakeside	50% ●	●	●	◉	◉
7	Groundwater Development – Gulf Coast	63% ◉	●	●	◉	○
8	Groundwater from Alcoa	>100% ○	◉	●	◉	○
9	Brushy Creek Return Flow	71% ◉	◉	○	○	○
10	San Bernard Reservoir	>100% ○	○	○	●	○
11	Purchase Unused Portion of Allen's Creek Reservoir	>100% ○	○	○	○	○
12	Reduced Urban Outdoor Water Use	>100% ○	●	●	◉	○
13	Adjoining Basin Irrigation Water Rights	>100% ○	◉	◉	◉	○
14	Purchase Colorado River Irrigation Water Rights	>100% ○	●	●	●	○
15	Reduced Irrigation for Second Crop	23% ●	●	●	●	◉
16	Capture of Municipal Stormwater	N/A	●	○	○	○
17	Desalination	>100% ○	○	○	●	○
18	Canal Lining	>100% ○	●	●	●	●

Satisfies Criterion ●

Partially Satisfies Criterion ◉

Does Not Satisfy Criterion ○

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Table 6.5 Secondary Screening Results

Water Replacement Strategy	**Volume of Water Produced (af/y)**	**Reliability**	**Water Quality**	**Risk**	**Environ-mental Impact**	**Location of Water**	**Timing**	Lake Water Levels	Equity	Reduced Reliance of Agric. on SW
Precision Land Leveling	25,000	●	●	⦿	●	●	●	●	●	●
Balancing Reservoirs in Garwood Irrigation Division	12,000	●	●	●	⦿	●	●	●	●	●
Automated Check Structures and Control Systems in Garwood	12,000	●	●	●	●	●	●	●	●	●
Groundwater Development – Lakeside	25,000	●	●	⦿	⦿	●	●	●	○	●
Conjunctive Use of Groundwater in Garwood Irrigation Division	11,400	●	●	⦿	●	●	●	●	⦿	●
Reduced Irrigation for Second Crop	25,000	●	●	●	●	●	●	●	●	●
Groundwater Development– Garwood	25,000	●	●	⦿	⦿	●	●	●	○	●
Groundwater Development – Gulf Coast	25,000	●	●	⦿	⦿	●	●	●	○	●

Satisfies Criterion ● Partially Satisfies Criterion ⦿ Does Not Satisfy Criterion ○

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6.5 Public Input

No consistent insight could be drawn about water replacement strategies from the first round of meetings. Comments mostly emphasized on-farm water conservation strategies.

There was strong farmer opposition to groundwater development as a water replacement strategy. Three new water replacement strategies – canal lining, conservation of storm water, and desalination – were recommended to add up to a total 18 water replacement strategies to be considered.

No consistent insight could be drawn about water replacement strategies from the second round of public meetings. Some comments emphasized alternative sources of water replacement. Some comments addressed implementation and feasibility issues regarding precision land leveling and groundwater development.

6.6 Cost Model

This section discusses the cost model used to compute expenditures associated with the implementation of water replacement strategies. It describes: general cost assumptions used in computing the expenditures associated with water replacement strategies, strategy-specific expenditures, and cost components. Attachment 19 provides a more detailed discussion of the estimates of conservation charge.

6.6.1 Cost and Expenditure Assumptions

Five general assumptions were used in estimating water cost and other implementation expenditures associated with each water replacement strategy. Below (Table 6.6) is a brief list of these assumptions.

Table 6.6 General Cost Assumptions

- The amortization period or term of the loan necessary to fund capital expenditure components is set at 30 years.
- The interest rate for the amortization or loan period for the capital expenditure components is set at 6 percent.
- The expenditure for management and reporting (M&R) is equivalent to one full-time employee at $50,000 per year, and each strategy will require this level of management and reporting.[1]
- The interest accrued on the balance of the Agricultural Water Conservation Fund annually is 4 percent.
- The percentage rate used to determine the net present value of the expenditures of implementing the strategies is 6 percent.

[1] The reduced irrigation for second crop water conservation strategy is an exception to this assumption. Since a 10 percent administration fee is already included in its water cost estimate, adding an additional $50,000 per year would have been redundant.

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In addition to these assumptions, Regional Planning guidance from TWDB was employed when appropriate. Attachment 18 provides a more detailed discussion of general and strategy-specific assumptions for each water replacement strategy considered.

6.6.2 Water Cost Components

The cost for Williamson County to transfer water from the Lower Colorado River Basin as described in HB 1437 and the LCRA/BRA contract is comprised of three parts: normal use cost, reserve water cost, and agricultural conservation fund cost.

6.6.2.1 Normal Water Cost

The normal water cost is a flat rate charged to all LCRA customers per acre-foot of firm water used from the Highland Lakes. This rate – $115 per acre-foot – is common to all water replacement strategies. The normal water cost for any water replacement strategy is calculated by multiplying the flat rate by the projected demand for a given year.

6.6.2.2 Reserve Water Cost

The reserve water cost is a flat rate – 50 percent of the normal water cost or $57.50 per acre-foot – based on the total volume of water committed to or held in reserve for a customer minus the amount used by that customer. The reserve water cost for any water replacement strategy is calculated by multiplying the reserve water rate by the unused demand for a given year.

6.6.2.3 Agricultural Water Conservation Fund Cost

According to HB 1437, the Agricultural Water Conservation Fund is to be used to pay all costs associated with the methods and approaches required to assure no net loss in the Lower Colorado River Basin after the water transfer to Williamson County. These costs may include planning, design, construction, operation, maintenance, monitoring, reporting and administration. The conservation charge is calculated by multiplying a preset surcharge rate by the sum of normal and reserve water costs. HB 1437 established a floor rate for the surcharge of 10 percent and authorized the LCRA Board of Directors to set the surcharge rate. The LCRA Board set the initial surcharge rate at 25 percent.

There are three requirements of the conservation fund – cash flow requirements, capitalization approach, and maintenance and reporting.

6.6.2.3.1 Cash flow requirements

In no year should there be an operating deficit in the conservation fund. Thus, the Lower Colorado River basin users should not be asked to financially subsidize any water transfer and/or mitigation expenses.

6.6.2.3.2 Capitalization Approach

The Conservation Fund should pay for all costs, including any long-term financing, from existing revenues without additional overages by LCRA. Thus, there should be enough funds in the conservation fund to pay for the initial investments.

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6.7 Recommended Strategies and Implementation

6.7.1 Strategies

Based on engineering analysis and public input, the following water replacement strategies are recommended for development of water replacement alternatives.

- Balancing Reservoirs in LCRA Irrigation Districts
- Automated Check Structures and Control Systems in LCRA Irrigation Districts
- Precision Land Leveling
- Conjunctive Use of Groundwater
- Reduced irrigation for Second Rice Crop
- Any combination of the above strategies

These recommended strategies are not exclusive of future strategies that may be identified or developed that could meet the intent of achieving no net loss under HB1437.

6.7.2 Implementation

Based on the results of the screening and evaluation processes, and the inferences on water replacement strategies, the LBJ School recommends that the LCRA Board consider the following 2-tiered - short-term and long-term – implementation approach.

- Short-term: Years 2005 – 2012
- Long-term: Years 2012 - 2050

A short-term strategy, years 2005 – 2012, is useful because it addresses the 2011 contract termination clause in the BRA/ LCRA water contract, and allows for the collection of operational data to verify conservation yields and operation costs necessary for reliable planning and implementing of long-term alternatives.

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