

## 4H. Summary of Special Studies

### 4H.1 Biennium Studies

In 2007, the Texas Water Development Board (TWDB) authorized the Region C Water Planning Group (RCWPG) to conduct several biennium studies to further evaluate water supply strategies in Region C. Of the nine projects proposed by the RCWPG, the TWDB approved funding for four projects as part of the biennium studies. Additional funding for these four projects was provided by the Tarrant Regional Water District, Athens Municipal Water Authority, and City of Fort Worth. The studies looked at issues of particular importance to North Central Texas, including water conservation and reuse practices, the availability of water from the Toledo Bend Reservoir in East Texas, direct and indirect water reuse case studies and potential water management strategies to address rapid population growth and other changing conditions in localized areas of the region. The results of these biennium studies were presented to TWDB as separate documents. The results of the studies were incorporated into development of the *2011 Region C Water Plan*.

#### Water Conservation and Reuse Study

Conservation and reuse are major recommended strategies in the *2006 Region C Water Plan*, and it is important that the projected water savings can be reasonably achieved within the timeframe specified in the Region C plan. The *Region C Water Conservation and Reuse Study* <sup>(1)</sup> was conducted to provide additional information on the performance of water conservation and reuse in the region and consider recommendations for the *2011 Region C Water Plan*. The major components of the study included a survey of all water user groups and wholesale water providers, telephone interviews with selected providers, case studies of conservation practices for different size municipalities, and detailed updates of selected reuse projects. The study also examined the potential impacts of increased conservation and reuse on return flows, which may impact instream flows, and the potential impacts of future development patterns on conservation.

Approximately half of the water users surveyed provided information on their water conservation practices. The data provided through the surveys and other sources were used

to assess quantities of water saved. While the data did not allow calculations of water saved by Best Management Practices (BMPs), the analysis did indicate that water conservation programs are reducing the water use that would have occurred without such measures.

Compared to the recommendation in the *2006 Region C Water Plan*, the water providers in Region C are on-target or ahead of schedule for implementing the recommended conservation strategies. Seasonal outdoor water use continues to be a factor in water use in Region C and it is often targeted for conservation savings. The conservation practices with the highest implementation rates include practices that are directly implemented by the provider and address system-wide savings, such as education programs, water pricing, water audits and enacting ordinances. These strategies were also consistently rated as the more effective conservation measures. Rebate programs are a strategy that is currently not being implemented by very many Region C providers.

When evaluated at the individual city level, the selection and implementation of conservation practices appear to vary by size and location of the city. This is partly due to different budget levels and customer types. For small towns, budgets are limited and the Best Management Practices implemented are those that coincide with standard water system operation and maintenance (price increases, conservation pricing and leak detection and repair). These strategies have been shown to be effective for small towns. As the size of the city increases, the larger budgets and staff may allow increased focus on implementing additional conservation measures. Both the mid-size and large cities evaluated as part of the case studies employ (or plan to employ) education programs, water waste prohibition, residential customer audits, Industrial/Commercial/Institutional (ICI) audits and/or specific ICI conservation programs. These measures are in addition to those conservation measures implemented as part of standard operations. The large cities also target outdoor water use through time of day watering restrictions and requiring rain/freeze sensors on automatic sprinkler systems.

Reuse continues to be a major component of the region's water conservation plan. The *2006 Region C Water Plan* reported existing year 2010 reuse of almost 100,000 acre-feet per year, with future reuse strategies totaling 771,000 acre-feet per year by 2060. Many of these reuse strategies have been implemented bringing the existing reuse in Region C in 2010 to

just under 204,000 acre-feet per year increasing to 330,695 acre-feet per year in 2060. Considering the current and planned future projects, Region C has the largest reuse program in the state.

Based on these data, it is clear that conservation and reuse continue to be a major focus for water providers in Region C. The strategies currently being implemented reflect the recommended strategies in the 2006 water plan, and it is recommended that the strategies included in the municipal water user groups' basic and expanded packages continue to serve as the primary means for achieving water conservation savings in the region. Below are the recommendations from the *Region C Water Conservation and Reuse Study*. The first three have been implemented in the 2011 regional plan and the remaining ones continue to be recommendations for future implementation.

1. The "Water Conservation Pricing" and "Water Waste Prohibition" strategies have been moved from the Expanded Package to the Basic Package. Both of these BMPs have minimal costs and are relatively easy to implement.
2. The "ICI general rebate" strategy has been eliminated from the Expanded Conservation Package due to low implementation rates and institutional challenges of administering these programs.
3. A new "Landscape Watering Restriction" strategy has been added to the Expanded Conservation Package. In particular, the time-of-day lawn watering has become widely implemented in Region C and could be used as a model for implementation.
4. Contact North Central Texas Council of Governments (NCTCOG) to determine their interest in and feasibility to coordinate Region-wide public education/conservation efforts for entities who are not already involved in such programs.
5. Consider other strategies currently being used in the region for possible inclusion in the Expanded Conservation Package.
6. Encourage regional coordination of public education efforts.
7. Develop, in cooperation with other regions and the TWDB, a program to gather information and data about water savings and costs, and perform a quantitative assessment of water savings and cost per implemented water conservation strategy.
8. Monitor water conservation technology developments and review new strategies for possible inclusion in subsequent updates of the Region C Water Supply Plan.

#### Toledo Bend Study

This study was led by the Region I Water Planning Group. The Region C consultant team reviewed the study, titled *East Texas Region Special Study No. 1: Inter-Regional Coordination*

on the Toledo Bend Project <sup>(2)</sup>, and provided input. To meet projected water demands in Region C, the *2007 State Water Plan* recommended moving water from the Toledo Bend Reservoir in East Texas to water providers in North Texas via a pipeline project. This project, as currently proposed, involves transporting up to 400,000 acre-feet per year of water to water providers in Region C, with the potential to increase this amount to 600,000 acre-feet per year. The project also recommends transporting 100,000 acre-feet per year to customers of the Sabine River Authority in Region D.

Since the development of this strategy for the 2006 regional water plans, there has been on-going development of water supplies by the Region C providers and the East Texas Region. This study was conducted to better understand these changes and the impacts to the proposed Toledo Bend Pipeline Project.

The Toledo Bend Pipeline Project is considered viable, but it is not expected to be developed until 2060. Due to this extended timeframe, additional analysis will likely be needed, which may have significant implications on the project's preliminary design and cost. The study indicates that the major participants are currently pursuing other water supply projects and recommends that the East Texas region should continue to monitor the demand for water from sources in its region and coordinate with adjoining regions to best utilize its resources.

The Toledo Bend Pipeline Project continues to be a recommended water management strategy for two Region C water providers (North Texas Municipal Water District and Tarrant Regional Water District), and an alternative strategy for two others (Dallas Water Utilities and Upper Trinity Regional Water District), in the *2011 Region C Water Plan*.

### Reuse Pilot Project Studies

This study examined direct and indirect reuse in Region C, in order to develop guidance documents for future reuse projects. Reuse is increasingly important statewide and in Region C. In the *2006 Region C Water Plan* the year 2060 available reuse supply was listed as 103,429 acre-feet per year. In the *2011 Region C Water Plan* the year 2060 available reuse supply has increased to 330,695 acre-feet per year, more than triple the amount from the 2006 Plan.

Direct reuse occurs when treated wastewater is delivered from a wastewater treatment plant to an end user, with no intervening discharge to waters of the state. Direct reuse requires a notification to the Texas Commission on Environmental Quality (TCEQ), which is routinely accepted so long as requirements to protect public health are met. Direct reuse is most commonly used to supply water for landscape irrigation (especially golf courses) and industrial uses (especially cooling for steam electric power plants).

The *Direct, Non-Potable Reuse Guidance Document* <sup>(3)</sup> developed as part of the study is designed to provide guidance for implementation of future direct water reuse projects, including the identification of technical and regulatory issues that must be addressed in the planning and design of such projects.

As a case study for the guidance document, the RCWPG refined the implementation plans for two city of Fort Worth direct reuse projects: a Central System to serve potential customers between the Village Creek Wastewater Treatment Plant and the Central Business District, and a Southern System to serve potential customers in the industrial area near the intersection of I-20 and I-35W. The direct reuse guidance document provides general guidance for water suppliers regarding regulations for reuse water, types of reclaimed water, reclaimed water quality requirements, identification of potential reclaimed water users, site selection, conceptual design of a reclaimed water production facility and conveyance systems, analysis of costs and benefits, and permitting issues.

The RCWPG also developed an *Indirect Reuse Guidance Document* <sup>(4)</sup>, which provides general guidance and a case study implementation plan for the Athens Municipal Water Authority and City of Athens to transport reclaimed water from the Athens wastewater treatment plants to Lake Athens to augment its raw water supply. Indirect reuse occurs when treated wastewater is discharged to a stream or reservoir and is then diverted for reuse. The discharged water mixes with ambient water in the stream or reservoir as it travels to the point of diversion. Indirect reuse can provide water supplies for municipal use, as well as irrigation and industrial supplies.

The guidance document identifies technical and regulatory issues to be addressed in the planning and design of the augmentation of surface water supplies with reclaimed water. The state does not have specific regulations for indirect use, since planned augmentation of

raw water supplies with reclaimed water is relatively new in Texas. Rather, indirect reuse is regulated by other state permits and standards.

The document's recommendations for indirect reuse in Texas include a multi-barrier approach to manage the uncertainties associated with augmentation of raw water supplies with reclaimed water including advanced wastewater treatment, limits on the blend of reclaimed and natural water, requirements on the detention time in the receiving water, and advanced water treatment. The indirect reuse guidance document provides general guidance for water suppliers regarding regulations and guidelines for indirect reuse, a multiple-barrier approach to indirect reuse, water quality evaluations, allowable reclaimed water augmentation rates, opportunities for indirect reuse, conceptual design of a conveyance system, cost analysis, and permitting issues.

### Regional System Implementation Plans

The remaining special studies conducted by the RCWPG during the 2007-2008 period looked at changing conditions in localized areas. The first of these, the *Water Supply Study for Ellis, Johnson, Southern Dallas and Southern Tarrant Counties* <sup>(5)</sup>, was commissioned to review recent population growth in the four-county area, make adjustments to projections as a result of the growth and update the current and future water plans of the water user groups and wholesale water providers in the study area based on revised projections.

This study was needed because the TWDB-approved population projections for Ellis and Johnson Counties that were used by the RCWPG in developing the *2006 Region C Water Plan* did not take into account subsequent population projections developed by the North Central Texas Council of Governments (NCTCOG), which were significantly higher than those of the TWDB. More recent population estimates have indicated that future growth in the area may fall between the two sets of projections.

The study provided the opportunity to revise water management strategies to reflect new demand projections and current planning by area water suppliers. The study concluded that the significant changes in water supply should be expected in the coming decade, including:

- Increased reliance on surface water supplies, rather than groundwater.

- Substantial additional supplies from the Sokoll water treatment plant currently under construction in Ellis County.
- Additional supplies from Midlothian's proposed water treatment plant.
- More treated water supplies from Tarrant Regional Water District (TRWD) customers.
- Cleburne's development of additional reuse supplies for manufacturing and mining use and development of a desalination plant for Lake Whitney water.
- Increased supply from Dallas with the growth of current customers and the completion of the Red Oak connection.

The study also recommended a variety of additional water management strategies to ensure an adequate future supply in the rapidly growing area.

Another localized study, the *Water Supply Study for Parker and Wise Counties* <sup>(6)</sup>, focused on the years 2010 through 2030, detailing revisions and updates to the *2006 Region C Water Plan* that will be needed to account for steadily increasing population growth projections. The resulting report concluded that, for most water user groups in the area, increasing the amount of supply from TRWD sources was the only change necessary to meet higher projected demands.

Most of the recommendations for revisions to the population and demand projections and water management strategies from these two localized county studies have been incorporated into the *2011 Region C Water Plan*.

#### **4H.2 Summary of 2011 Special Studies**

The scope of work for the *2011 Region C Water Plan* includes six special studies. One of the studies is related to the use of saline water to meet future demands in Region C. The other five studies are aimed at analyzing approaches to developing countywide water management strategies as well as approaches for implementation of the water management strategies. Countywide water systems are comprised of separate projects that are completed over a period of time by various WUGs, and these separate projects were coordinated whenever practical. The county studies cover the following counties: Cooke and Grayson Counties (one report), Fannin, Freestone, Navarro, and Kaufman. These studies have been produced as stand-alone documents. The complete texts of these reports are also located in Appendices R through W of the *2011 Region C Water Plan*. The appendices of

these reports are not included in Appendices R through W as the information is found in other portions of the *2011 Region C Water Plan*.

## Saline Water Study

The complete text of the Draft *Saline Water Special Study* <sup>(7)</sup> is located in Appendix R. This section summarizes the findings of that report. The Region C Regional Water Planning Group is committed to the exploration and promotion of viable water sources and water management strategies to meet the region's water needs. Region C's water conservation strategies, including reuse, have emerged as key water management strategies. An additional emerging strategy that is being considered by Region C as a potential source is the utilization of brackish surface and groundwater. There are a number of issues associated with the viability of brackish water such as water quality considerations (desalination and inland concentrate disposal), regulatory considerations, and costs.

The 2001 and 2006 Region C Water Plans included brackish water from several sources including the Red River, Possum Kingdom Lake, Lake Texoma, and the Brazos River. In order to evaluate the potential to utilize additional water from these and other sources, a "Study on the Use of Saline Water and Refinement of Costs" was included as Task 4.d in the scope for the 2011 Region C Water Plan. The purpose of this study is to further define the sources available to Region C, review the regulatory requirements, review and evaluate strategies for concentrate disposal, and evaluate the potential applicability of brackish sources to Region C.

With continued advancements in desalination and the potential for blending with fresh water supplies, there is value in considering additional brackish supplies as potential future sources to Region C. In Texas, brackish water sources have not historically been sought out and researched with the same intensity as fresh water sources. Accordingly, research associated with the feasibility, potential quantities, and quality of brackish water supplies has not been as extensive as that for fresh water supplies.

Historical analysis of brackish groundwater and surface water near Region C has been limited. Further coordination with other regional water planning groups should occur to identify brackish surface water supplies that may be utilized by Region C. Unallocated water



has been identified in the Brazos and Red Rivers, although storage and water quality concerns would need to be addressed to utilize this water. Additional supplies of surface water in Lake Texoma (in addition to the planned projects by NTMWD and GTUA) are not available at this time. Executing agreements with the state of Oklahoma for a share of their Texoma water and/or Congressional action to reallocate additional water for municipal supply may provide an opportunity for identifying additional supplies. Coordination with power interests on Lake Texoma may also provide an opportunity for identifying additional supplies. There are a number of challenges associated with these actions and storage and allocation issues would have to be addressed for this to represent a viable additional source.

Volumes of brackish groundwater have been identified, but groundwater availability models to determine yield information have not been developed. Preliminary analysis by the TWDB indicates that approximately 85,000,000 acre-feet of brackish groundwater supplies may be present within the Region C area, although this estimate is based on generalized aquifer characteristics, and is not intended to represent precise availability values. Further study is needed to determine the specific location of significant brackish groundwater sources within Region C, as well as their location in relationship to areas of need. Additionally, before considering a brackish groundwater water supply project, extensive pilot studies, including monitoring of test wells, would need to be conducted. As area GCDs continue to develop rules and regulations, coordination might aid in providing additional information on regional brackish water supplies.

Prior to the utilization of any brackish water supply, a detailed water quality evaluation of the source water should be conducted to aid during the design phase of a project. In addition to dissolved solids, potential distribution system water quality issues associated with the use of brackish supplies include: taste and odor (algae), staining (Magnesium), discolored water, elevated coliform or heterotrophic plate counts (HPC), pathogens, disinfection byproducts (DBPs), bromated DBPs, elevated total organic carbon, and contaminants listed on the Contaminate Candidate List 3. These considerations may be associated with brackish supplies themselves, or when mixing two dissimilar waters in a distribution system.

The issue of brine concentrate disposal represents a major consideration for inland use of brackish water. Concentrate disposal techniques utilized by local inland desalination plants include surface water discharge (Robinson – 1.80 MGD facility and the Brazos River Authority – 6 MGD facility), sanitary sewer disposal (Sherman – 7.50 MGD facility), and deep well injection (El Paso – 27.5 MGD facility). The identification of potential feasible concentrate disposal techniques is site specific and should be investigated prior to the implementation of any project. Water suppliers in Region C may benefit from the development of additional data (i.e. subsurface information for deep well injection) that would aid in the evaluation of appropriate project specific concentrate disposal techniques. Additionally, studies should be conducted to determine whether disposal of concentrate could be achieved in concert with brackish source water management projects.

With the exception of the concentrate disposal requirements, many regulatory requirements for a desalination facility are the same or identical to those for a conventional treatment facility. Regulatory requirements have traditionally played an important role in project feasibility, schedule, and cost, and should be considered a priority during the planning stages of a project. Items such as site selection, raw water sources, and concentrate disposal options will affect the type of permits required, the magnitude of environmental investigations, and the time allotted for permitting.

This study does address the potential costs associated with facility construction, concentrate disposal, and operation and maintenance costs associated with desalination. However, in order to utilize additional brackish water sources in Region C, extensive pilot testing, yield analysis, and regulatory/permitting evaluations will need to be conducted at an additional cost to determine feasibility. In addition to desalination related studies, studies associated with blending of brackish and fresh water sources may provide further opportunities for utilizing brackish water within the region.

#### Cooke and Grayson County Water Supply Study

The complete text of the Draft *Cooke-Grayson County Water Supply Study* <sup>(8)</sup> is located in Appendix S. This section summarizes the findings of that report.

## **Cooke County**

Cooke County is projecting lower population in the *2011 Region C Water Plan* through each planning period than was projected in the *2006 Region C Water Plan*. Cooke County is projecting higher demand in the *2011 Region C Water Plan* than was projected in the *2006 Region C Water Plan* for 2020 through 2060, but lower demand in 2010. There are a total of 13 WUGs in Cooke County. Population projections were decreased for two municipal WUGs. Demand projections were increased for two municipal WUGs and were decreased for one municipal WUG. Cooke County demands for non-municipal WUGs were not changed. Water management strategies (WMSs) have been revised to meet the higher municipal demands. WMSs were updated based on information obtained from meetings with various water user groups in Cooke County as well as from surveys mailed to every WUG in Region C. Gainesville utilizes the only significant existing surface water supply in Cooke County (Moss Lake).

Proposed surface water supplies listed as WMSs include expansion of treatment and transmission capacity of Moss Lake to meet a part of the demands for all of the municipal WUGs in Cooke County except Muenster. Muenster will develop treatment capacity for Lake Muenster as a WMS. The plans for Cooke County, as determined by this special study, are discussed in greater detail in Section 4F.2.

## **Grayson County**

Grayson County is projecting lower population in the *2011 Region C Water Plan* than was projected in the *2006 Region C Water Plan* for 2010 through 2050, but the same population in 2060. Grayson County is projecting lower demand in the *2011 Region C Water Plan* than was projected in the *2006 Region C Water Plan* for every decade in the planning period. There are a total of 25 WUGs in Grayson County. Population projections were decreased for ten municipal WUGs. Demand projections were increased for one municipal WUG (Southmayd in 2060 only) and were decreased for eleven municipal WUGs. Demands were increased for one non-municipal WUG (steam electric power). Additional water from Lake Texoma will be used to meet the additional steam electric power demands. WMSs were updated based on information obtained from meetings with various water user groups in Grayson County as well as from surveys mailed to every WUG in Region C. There are two

current Wholesale Water Providers providing water in Grayson County (Sherman and Greater Texoma Utility Authority (GTUA)). Sherman operates a WTP treating Lake Texoma water and purchases raw water from GTUA (Lake Texoma).

Proposed surface water supplies listed as water management strategies include expansion of the treatment and transmission capacity for Lake Texoma water. The treatment and transmission capacity of Sherman will be increased to meet a part of the future demands of 11 WUGs. New WTPs are proposed in north and northwest Grayson County (operated by GTUA) to meet a part of the future demands of 7 WUGs. Howe and Van Alstyne are currently supplied through the Collin-Grayson Municipal Alliance (CGMA) pipeline (NTMWD and GTUA). The capacity of the pipeline will be expanded to meet most of the future demands of these WUGs. The plans for Grayson County, as determined by this special study, are discussed in greater detail in Section 4F.8.

#### Fannin County Water Supply Study

The complete text of the Draft *Fannin County Water Supply Study* <sup>(9)</sup> is located in Appendix T. This section summarizes the findings of that report. Fannin County is projecting higher population and lower demands in the *2011 Region C Water Plan* through each planning period than was projected in the *2006 Region C Water Plan*. There are a total of 17 WUGs in Fannin County. Population projections were increased for two municipal WUGs and were decreased for one municipal WUG. Demand projections were increased for two municipal WUGs and were decreased for three municipal WUGs. Demands were increased for one non-municipal WUG (steam electric power). Additional water from Lake Texoma will be used to meet the additional steam electric power demands. Water management strategies (WMSs) have been revised to meet the lower municipal demands. WMSs were updated based on information obtained from meetings with various water user groups in Fannin County as well as from surveys mailed to every WUG in Region C. There is no current major water supplier in Fannin County. The only existing surface water supply in Fannin County (Lake Bonham) is used to supply the City of Bonham (after treatment by NTMWD).

Proposed surface water supplies listed as WMSs include the new Lower Bois d'Arc Creek Reservoir (through NTWMD) and Lake Ralph Hall (through UTRWD). In most cases, for WUGs that need future supply, the water management strategy was to obtain supply from NTMWD. One WUG in Fannin County (Ladonia) has a water management strategy to obtain water from UTRWD (Lake Ralph Hall). The plans for Fannin County, as determined by this special study, are discussed in greater detail in Section 4F.6.

#### Freestone County Water Supply Study

The complete text of the Draft *Freestone County Water Supply Study* <sup>(10)</sup> is located in Appendix U. This section summarizes the findings of that report. Freestone County is projecting lower growth in the near term than was previously projected. Growth from 2010 to 2030, as projected in the 2011 Region C Water Plan, is less than the projections in the 2006 Region C Water Plan <sup>(2)</sup>. Ten WUGs are located in Freestone County. Population and demand projections were increased for one municipal WUG and decreased for one municipal WUG. Steam electric power demand projections were also decreased based on new information. Water management strategies (WMSs) have been revised to meet the projected higher long term demands.

The majority of WUGs in Freestone County rely on groundwater from the Carrizo-Wilcox Aquifer. Final Managed Available Groundwater values for the aquifers located within the Mid-East Texas Groundwater Conservation District (METGCD) are not yet available. When looking at the groundwater supplies allocated within the METGCD's boundaries (Leon, Madison, and Freestone Counties) the total pumping through 2060 is well below the pumping used to calculate the drawdowns in the DFCs. The largest water user in the county is steam electric power which uses mostly surface water. Surface water sources including Lake Fairfield, Lake Livingston, and Tarrant Regional Water District (TRWD) sources are used to meet the steam electric power demands for Freestone County. The plans for Freestone County, as determined by this special study, are discussed in greater detail in Section 4F.7.

## Navarro County Water Supply Study

The complete text of the Draft *Navarro County Water Supply Study* <sup>(11)</sup> is located in Appendix V. This section summarizes the findings of that report. Navarro County is projecting higher growth in the near term than was previously projected. Growth from 2010 to 2040, as projected in the *2011 Region C Water Plan*, is greater than the projections in the *2006 Region C Water Plan*. There are a total of 18 WUGs in Navarro County. Population and demand projections were increased for three municipal WUGs and were decreased for three municipal WUGs. Demands were increased for one non-municipal WUG (steam electric power). There were no steam electric power demands in the *2006 Region C Water Plan*, but new power plants have recently been planned for development in Navarro County. Corsicana has agreed to supply raw water to the new power plants. Water management strategies (WMSs) have been revised to meet the higher near term demands. WMSs were updated based on information obtained from meetings with various water user groups in Navarro County as well as from surveys mailed to every WUG in Region C. Corsicana is the major water supplier in Navarro County. In most cases, for WUGs that needed future supply, the water management strategy was to increase the supply from Corsicana.

The current surface water sources for WUGs in the study area include Lake Halbert, Navarro Mills Reservoir (through TRA), Richland-Chambers Reservoir (through TRWD), and Lake Bardwell (through Ennis). Surface water supplies listed as WMSs include Tarrant Regional Water District (TRWD) sources through TRA. Several WUGs are considering groundwater as a future supply and new wells were listed as WMSs for these WUGs. The plans for Navarro County, as determined by this special study, are discussed in greater detail in Section 4F.12.

## Kaufman County Water Supply Study

The complete text of the Draft *Kaufman County Water Supply Study* <sup>(12)</sup> is located in Appendix W. This section summarizes the findings of that report. Kaufman County is projecting lower demand throughout the planning period than was previously projected. This is mainly due to the decrease in steam electric power demand projections. Considering

only municipal demand projections, demand projections decreased in 2010 from the 2006 Plan and increased from 2020 to 2060. Kaufman County's designation as a non-attainment county for air quality has led to a decrease in projected demands. There are 28 WUGs in Kaufman County. Changes in population or demand projections from the *2006 Region C Water Plan* <sup>(2)</sup> were made to 14 municipal WUGs and one non-municipal WUG.

Water management strategies (WMSs) have been revised to meet the higher long term demands. Many of the WUGs plan on continuing to use their current supply source and increasing the amount supplied to them. A few of the WUGs plan on pursuing alternative or additional water sources. The majority of WUGs in Kaufman County rely solely on surface water provided by North Texas Municipal Water District (NTMWD), Tarrant Regional Water District (TRWD), and Dallas Water Utilities (DWU). Additional sources in the county include Lake Tawakoni and reuse. Lake Terrell is owned by the City of Terrell and was once used as a supply source for the City of Terrell. Terrell has recently increased their supply from NTMWD and has discontinued the use of Lake Terrell as a municipal water supply. Terrell is considering building a pipeline from Lake Terrell to Lake Tawakoni and selling the water to SRA or NTMWD, selling water for local irrigation purposes, or leaving the lake as is. Terrell has applied for TWDB planning funds to look into other alternative uses of Lake Terrell. The plans for Kaufman County, as determined by this special study, are discussed in greater detail in Section 4F.11.

## CHAPTER 4H LIST OF REFERENCES

- (1) Freese and Nichols, Inc., Alan Plummer Associates, Inc., and Chiang, Patel and Yerby, Inc.: *Region C Water Conservation and Reuse Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2009.
- (2) Schaumburg and Polk, Inc., Freese and Nichols, Inc., and Alan Plummer Associates, Inc.: *East Texas Region Special Study No. 1: Inter-Regional Coordination on the Toledo Bend Project*, prepared for the East Texas Regional Water Planning Group, March 2009.
- (3) Freese and Nichols, Inc., and Alan Plummer Associates, Inc.: *Direct, Non-Potable Reuse Guidance Document*, prepared for the Region C Water Planning Group, Fort Worth, April 2009.
- (4) Freese and Nichols, Inc., and Alan Plummer Associates, Inc.: *Indirect Reuse Guidance Document*, prepared for the Region C Water Planning Group, Fort Worth, April 2009.
- (5) Freese and Nichols, Inc., Alan Plummer Associates, Inc., Chiang, Patel and Yerby, Inc., and HDR, Inc.: *Water Supply Study for Ellis, Johnson, Southern Dallas and Southern Tarrant Counties*, prepared for the Region C Water Planning Group and the Tarrant Regional Water District in Cooperation with the Brazos G Water Planning Group, Fort Worth, April 2009.
- (6) Freese and Nichols, Inc.: *Water Supply Study for Parker and Wise Counties*, prepared for the Region C Water Planning Group, Fort Worth, April 2009.
- (7) Alan Plummer Associates, Inc. and Freese and Nichols, Inc.: *Draft Saline Water Special Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.
- (8) Alan Plummer Associates, Inc., Freese and Nichols, Inc., and CP&Y, Inc.: *Draft Cooke-Grayson County Water Supply Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.
- (9) Alan Plummer Associates, Inc., Freese and Nichols, Inc., and CP&Y, Inc.: *Draft Fannin County Water Supply Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.
- (10) Freese and Nichols, Inc., Alan Plummer Associates, Inc., and CP&Y, Inc.: *Draft Freestone County Water Supply Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.



- (11) Freese and Nichols, Inc., Alan Plummer Associates, Inc., and CP&Y, Inc.: *Draft Navarro County Water Supply Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.
- (12) Freese and Nichols, Inc., Alan Plummer Associates, Inc., and CP&Y, Inc.: *Draft Kaufman County Water Supply Study*, prepared for the Region C Water Planning Group, Fort Worth, April 2010.