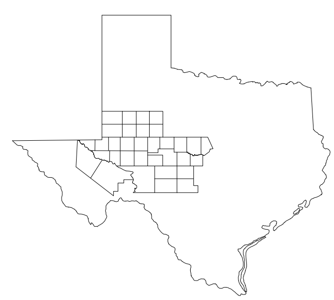
FINAL

STUDY OF THE ECONOMICS OF RURAL WATER DISTRIBUTION AND INTEGRATED WATER SUPPLY STUDY

April 2009

Prepared for

The Region F Water Planning Group



CMD07215

Freese and Nichols, Inc.

Region F
Water Planning Group

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Study of the Economics of Rural Water Distribution and Integrated Water Supply Study

April 2009

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STUDY OF THE ECONOMICS OF RURAL WATER DISTRIBUTION AND INTEGRATED WATER SUPPLY STUDY

1 EXECUTIVE SUMMARY

The Economics of Rural Water Distribution and Integrated Water Supply Study addresses several concerns raised during the development of the 2006 Region F Water Plan.

- *Reliability problems*. Several communities and rural systems in Coke and Runnels Counties experienced reliability problems during the recent drought. Most of these communities rely primarily on surface water.
- *Water quality problems.* McCulloch, Concho and parts of other counties rely primarily on supplies from the Hickory aquifer, which exceeds standards for radium. Other shallow groundwater supplies are vulnerable to contamination, primarily from agricultural activities. Both groundwater and surface water supplies may have high dissolved solids, exceeding secondary standards.
- *High costs of strategies to address problems.* Over the first two rounds of regional water planning, several strategies have been proposed to address water quality and reliability problems. These strategies included construction of an off-channel reservoir, raw and treated water pipelines, advanced treatment to remove radium, and other strategies. These strategies would be very expensive to implement, with unit costs ranging from $300 to $1,500 per acre-foot.

The Region F Water Planning Group and the Texas Water Development Board selected this study as part of the first biennium of the 2008 Region F Water Plan. The study concentrated on rural water providers in a seven-county area in the eastern portion of Region F. Figure 1 is a map showing the study area. The objective of this study was to examine the factors that impact costs of rural water systems and how those factors might affect the ability of these systems to function as part of regional solutions.

Key findings of the study include:

- The primary factors that affect the economics of rural water systems in the study area are a limited economic base, lack of water supply alternatives, extensive infrastructure for small populations, and difficulties in meeting regulatory requirements.

- One of the most important factors in the capability of rural systems to initiate new strategies appears to be population density and the expectation for growth. Systems such as the Brookesmith Special Utility District were designed with larger water lines that anticipate additional water use. The near term water quality problems associated with oversized lines is expected to be offset by future growth and flexibility in operation. On the other hand, systems in areas with lower population densities and less expectation of growth were, by necessity, built with smaller lines. Although appropriate for these systems, the smaller lines mean that additional growth may require new infrastructure. These systems may not have the flexibility to add new sources of water or add emergency connections without construction of new infrastructure. Therefore regionalization or other integration strategies are unlikely to be cost-effective for these systems.
- If regionalization or integration strategies are pursued, water providers in the study area will most likely need to rely on volunteer construction of water lines to reduce costs.
- Attractive alternatives to regionalization or integration strategies include rainwater harvesting, point-of-use or point-of-entry treatment, and bottled water programs. The EPA considers bottled water programs to be a temporary measure. A utility implementing a bottled water program should understand that an alternative way to comply with drinking water standards will be required at some time in the future.

2 INTRODUCTION

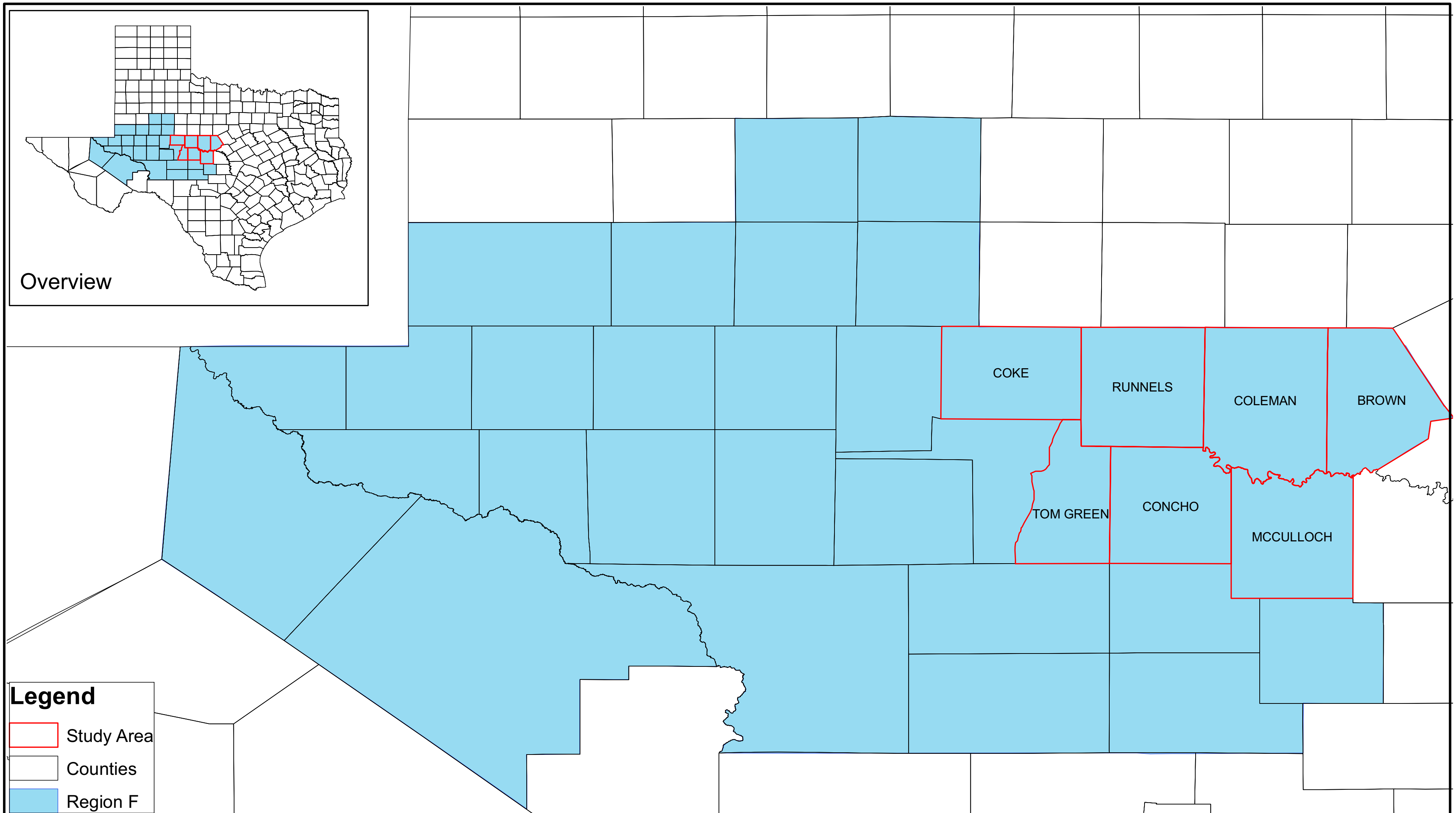
The *Study of the Economics of Rural Water Distribution and Integrated Water Supply Study* was selected by the Region F Water Planning Group and the Texas Water Development Board as a special study to be conducted during of the first biennium of the third round of regional water planning. The results of this study will be considered for inclusion in the 2011 Region F Water Plan. The study concentrated on rural water providers in a six-county area in the eastern portion of Region F. Figure 1 is a map showing the study area.

2.1 Authorization and Objectives

This study was authorized by the Region F Regional Water Planning Group and is funded through a Research and Planning Grant sponsored by the Texas Water Development Board.

The Economics of Rural Water Distribution and Integrated Water Supply Study addresses several concerns raised during the development of the 2006 Region F Water Plan.

- *Reliability problems*. Several communities and rural systems in Coke and Runnels Counties experienced reliability problems during the recent drought. Most of these communities rely primarily on surface water.
- *Water quality problems.* McCulloch, Concho and parts of other counties rely primarily on supplies from the Hickory aquifer, which exceeds standards for radium. Other shallow groundwater supplies are vulnerable to contamination, primarily from agricultural activities. Both groundwater and surface water supplies may have high dissolved solids, exceeding secondary standards.
- *High costs of strategies to address problems.* Over the first two rounds of regional water planning, several strategies have been proposed to address water quality and reliability problems. These strategies included construction of an off-channel reservoir, raw and treated water pipelines, advanced treatment to remove radium, and other strategies. These strategies would be very expensive to implement, with unit costs ranging from $300 to $1,500 per acre-foot.



Rural Water Distribution and Integrated Water Supply Study

Area Map

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SCALE	1:15,000
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FIGURE 1

Development of new surface water supplies is very costly and it is unlikely to occur because most of the water in the Colorado Basin has already been appropriated to other users. Groundwater of sufficient quality or quantity is not available in much of the area. Most of the area relies on water from rural systems because the local groundwater supplies available to rural residents are unreliable, of poor quality, or are expensive to access because of the depth to the aquifer (Hickory aquifer).

Typically, regional strategies are the most cost-effective because of economies of scale. However, previous Region F studies in the area have shown that regional strategies that move water from locations with more reliable or better quality water supplies are very expensive to implement. The small amount of water needed and the large distances involved in transporting the water tends to reduce the benefits of economies of scale. Individual strategies to meet needs are limited because of the lack of alternative sources and the small economic base to absorb the cost of implementation.

The objective of this study was to examine the factors that impact costs of rural water systems and how those factors might affect the ability of these systems to function as part of regional solutions.

The study was divided into two phases. The first phase looked at the economics of rural water supply. This phase gathered basic information on the systems in the area and the costs of providing water, including costs of water purchase, treatment, distribution and maintenance. The cost data were compared to basic factors such as system size, miles of pipeline, population density, and supply source to identify the factors that most impact the economics of water supply distribution in the area. Chapter 4 includes basic descriptive information on the study area collected in the first phase. Chapter 5 describes the results of costs analysis.

The second phase looked at potential integration scenarios where rural systems in the study area might be able to approach meeting water supply needs on a regional basis using existing infrastructure to the largest extent possible. The integration scenarios are described in Chapter 6. Also included in the study was an examination of alternative water supply strategies, such as point-of-use or point-of-entry treatment, rainwater harvesting, and use of volunteer labor for construction. Chapter 7 discusses these alternative strategies. Chapter 8 includes a summary of the study findings and recommendations resulting from the study.

3 METHODOLOGY

The Region F Water Planning Group established the Rural Systems Work Group to facilitate the collection and review of the data for this study. Work Group members included planning group members and interested public. A list of the members of the Rural Systems Work Group is shown in Table 1.

Table 1
Rural Systems Work Group Members

Work Group Member	Representing
Wendell Moody (chair)	Public
Brent Wrinkle	Upton County
Terry Scott	Agriculture
Robert Moore	Runnels County
Richard Gist (Vice-Chair)	Water Utility
Ken Dierschke	Agriculture
John Grant	CRMWD
Will Wilde	San Angelo

3.1 Data Gathering

Sources of Available Data

Data was obtained from available governmental sources and information provided by local water providers within the study area. The primary source of data on public water supply systems in Texas is the Texas Commission on Environmental Quality (TCEQ) Water Utility Database[1]. Information on sources of water, wholesale customers and historical population and water use was obtained from the Texas Water Development Board (TWDB). Most of these data were provided as part of the regional water planning process. Information on income and home value was obtained from the U.S. Census Bureau[2].

Data from these sources were entered into a database for further analysis. Appendix A contains a copy of this database.

Data on rainwater harvesting were obtained from the TWDB and TCEQ. Information on point-of-use treatment, point-of-entry treatment, and bottled water programs were obtained from TCEQ and the Environmental Protection Agency (EPA). Information on using volunteer construction of infrastructure was obtained from the TWDB.

Survey

A survey of water providers in the study area was developed to verify data obtained from other sources and to acquire additional information. Thirty-three surveys were sent to both rural water supply systems and communities within the study area. (For the purposes of this study, a rural water supply system covers a relatively large area with a low population density, while a community is a town or subdivision that covers a relatively small area and has a higher population density.) Twenty surveys were completed and returned. Communities were included because most of the rural systems obtain water from communities and any regional solutions could impact both communities and rural systems.

Copies of the completed surveys may be found in Appendix B.

Site Visits

As follow-on to the survey, FNI made site visits to four of the larger rural water providers: Brookesmith Special Utility District (SUD), Coleman County SUD, Millersview-Doole Water Supply Corporation (WSC) and North Runnels WSC. These site visits collected additional information on these utilities and discussed potential ideas for regionalization scenarios that would include these systems. The regionalization scenarios are discussed later in this report.

Information on Distribution Systems

Freese and Nichols Inc. contacted Jacob and Martin LTD., who helped design many of the rural systems in this study. Jacob and Martin provided system maps of four rural systems: Brookesmith SUD, Coleman County WSC, Millersview- Doole, and North Runnels WSC. The system maps were used to develop the integration scenarios.

3.2 Data Analysis

The primary tool used in the economic analysis was a conceptual model of a rural water supply system developed using an Excel spreadsheet. Given a service area and population density, this model will calculate the miles of pipeline, average water use, and cost data for a theoretical rural system. The data used to develop the model were developed using regression techniques on actual data collected from rural systems in the study area.

3.3 Integration Scenarios

Conceptual designs and cost estimates for integration scenarios are based on standard methods developed by FNI for regional water planning. Cost estimates follow guidance for regional water planning from the TWDB for the special studies.

4 DESCRIPTION OF STUDY AREA

The study area encompasses all or part of seven counties in the eastern part of Region F: Coke, Runnels, Coleman, Brown, Concho, McCulloch and the eastern portion of Tom Green County. Figure 2 is a map showing the study area and the boundaries of major rural water providers in the area.

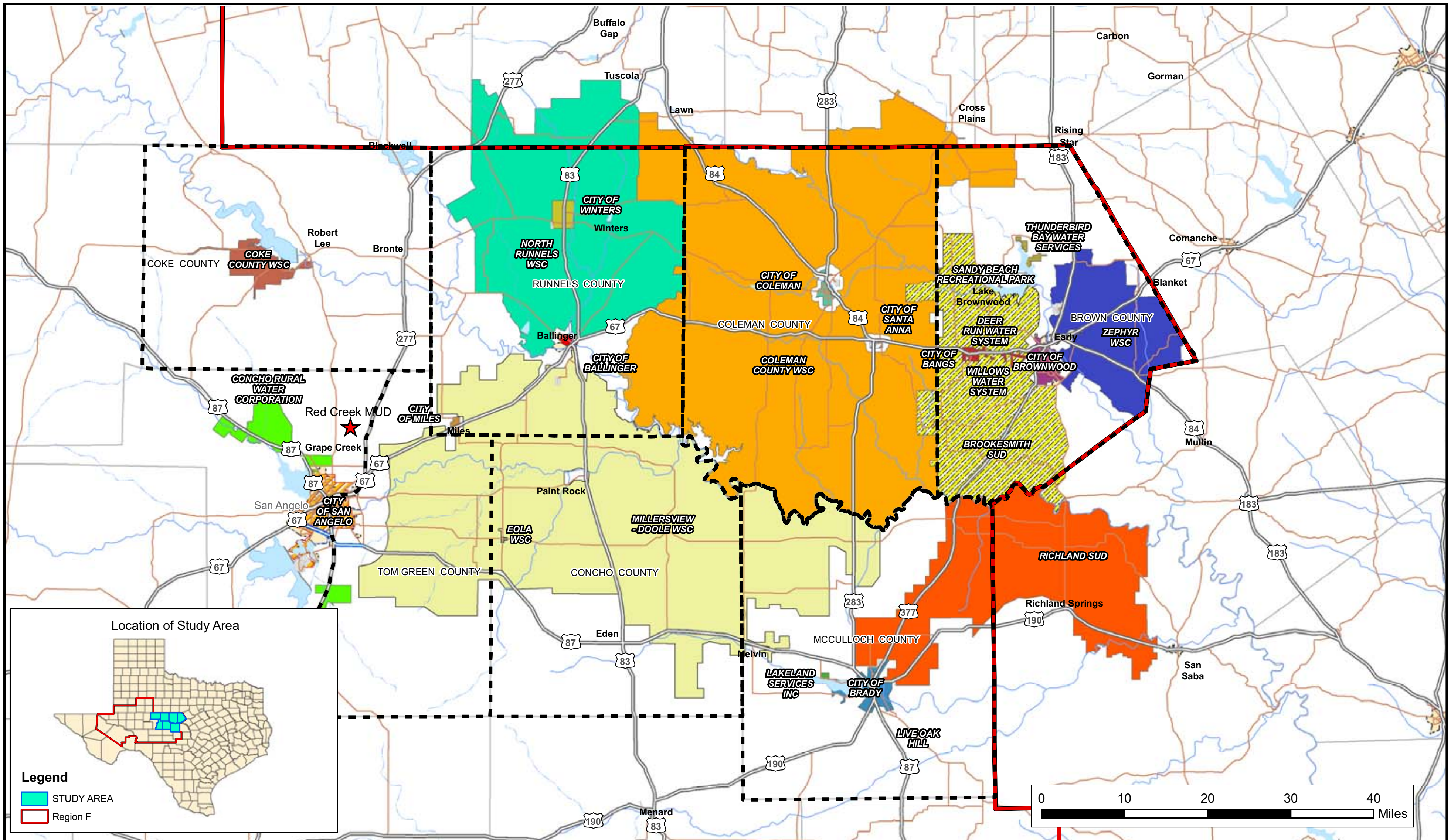
4.1 Economic Data

Economic data for the area are from countywide summaries available from the U.S. Census Bureau. Table 2 contains 2002 payroll data from the 2006 Region F Plan[3]. Most of the payroll in the area is in Tom Green and Brown Counties. Note that the data in Table 2 do not contain income derived directly from agriculture, which is most likely a major source of income for users of these rural systems. Table 3 compares market value data from the 2007 Census of Agriculture[4] for the study area to statewide totals. These data show that only Tom Green County ranks above statewide average for market value. Most of the study area is significantly below the statewide average. Table 4 compares countywide economic data from the U.S. Census Bureau for the study area to statewide estimates[5]. (Data for individual rural water suppliers are not available.) The percentage of the population in poverty is higher than the statewide percentage in five of the eight counties. Median household income is lower than the statewide median in all counties.

One of the factors that appears to have a significant impact on the economics of a rural system is population density. Table 5 shows the 2006 population and population density estimates for the study area[2,6]. As shown on this table, there is a significant difference between the population densities in Tom Green and Brown Counties (which contain the cities of San Angelo and Brownwood, respectively) and the other counties in the study area.

Rural Systems

Table 6 is a summary of data on rural water systems gathered from responses to the survey. These systems have service areas that range from 12 square miles for Red Creek Municipal Utility District (MUD) to over 1,400 square miles for the Coleman County SUD. In most cases the miles of pipeline increases with service area except for Concho Rural WSC. This system has additional miles of pipeline to bring water from outside its service area. The



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		DATE October 21, 2008	
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Table 2
2002 County Payroll by Category ($1000)

Category	Brown	Coke	Coleman	Concho	McCulloch	Runnels	Tom Green
Forestry, Fishing, Hunting, and Agricultural Support	(D)	(N)	183	(N)	(D)	(D)	1,187
Mining	1,710	(D)	(D)	281	(D)	1,272	19,255
Utilities	3,392	(D)	1,455	(D)	(D)	1,469	12,008
Construction	11,038	398	2,280	(D)	1,011	1,208	52,927
Manufacturing	103,921	(D)	995	(D)	7,138	27,807	136,195
Wholesale Trade	12,027	(D)	1,024	(D)	(D)	3,003	40,728
Retail Trade	35,902	1,716	3,646	879	6,621	5,949	108,477
Transportation and Warehousing	1,321	(D)	1,307	(D)	2,218	1,311	11,646
Information	6,090	127	1,037	(D)	444	371	115,103
Finance and Insurance	10,681	1,108	4,001	1,051	2,364	2,792	46,276
Real Estate, Rental, and Leasing	1,417	(D)	297	(N)	1,059	120	10,396
Professional, Scientific and Technical Services	3,244	(D)	(D)	(D)	1,606	1,115	42,050
Management of Companies and Enterprises	(D)	(N)	(D)	(N)	(N)	(D)	12,594
Admin, Support, Waste Mgmt, Remediation Services	5,327	(D)	(D)	(D)	182	559	35,397
Educational Services	(D)	(D)	(D)	(D)	(N)	(D)	3,649
Health Care & Social Assistance	64,763	(D)	6,583	3,362	6,000	7,511	200,763
Arts, Entertainment, & Recreation	599	135	104	(D)	(D)	64	4,976
Accommodation & Food Services	10,595	188	1,362	549	1,896	908	37,488
Other Services	9,923	255	1,068	(D)	1,172	1,626	31,250
Total Payroll	*281,950*	*3,927*	*25,342*	*6,122*	*31,711*	*57,085*	*922,365*
Total Employees	*11,842*	*556*	*1,428*	*649*	*1,837*	*2,735*	*35,429*

Notes: Data are from U.S. Census Bureau 2002 economic data as reported in the 2006 Region F Plan[3]
D = Data withheld to avoid disclosing data for individual companies
N = Data not available

Table 3
Agricultural Income from the 2007 USDA Agricultural Census

County	Market Value of Production	Percent Crops	Percent Livestock	State Rank*	Market Value of Production - Average Per Farm
Statewide	$21,001,074,000	31%	69%		$84,874
Brown	$35,885,000	16%	84%	144	$20,791
Coke	$13,639,000	4%	96%	207	$31,719
Coleman	$20,035,000	27%	73%	181	$19,975
Concho	$21,192,000	48%	52%	178	$50,669
McCulloch	$18,100,000	31%	69%	188	$26,081
Runnels	$53,840,000	57%	43%	94	$56,495
Tom Green	$132,990,000	38%	62%	30	$112,704
Study Area Total	*$295,681,000*	*37%*	*63%*		*$46,171*

* Out of 254 counties

Table 4
2005 Economic Data for Study Area

Name	Poverty Estimate All Ages	Poverty Percent All Ages	Median Household Income
Texas	3,886,632	17.5	42,165
Brown County	7,344	20.3	33,990
Coke County	485	14.7	30,657
Coleman County	2,036	24.1	27,187
Concho County	495	20.9	32,122
McCulloch County	1,804	23.1	28,944
Mills County	717	14.7	32,984
Runnels County	2,261	21.2	30,070
Tom Green County	16,993	17.2	37,203

Data are from the U.S. Census Bureau's Small Area Income and Poverty Estimates program[5].

Table 5
Comparison of 2006 U.S. Census Bureau & Population Densities to TWDB Population Data

County	**USCB Density** (People/Sq. Mi.)	USCB 2006 Population	2000 Census Data	TWDB 2006
Texas	90	23,507,783	20,851,790	23,202,668
Brown	41	38,970	37,674	38,666
Coke	4	3,623	3,864	3,794
Coleman	7	8,761	9,235	9,178
Concho	4	3,654	3,966	4,259
McCulloch	7	8,016	8,205	8,223
Mills	7	5,184	5,151	5,143
Runnels	10	10,724	11,495	11,564
Tom Green	68	103,938	104,010	108,813

Source: US Census Bureau[2] and the Texas Water Development Board[6]
TWDB 2006 populations interpolated from TWDB population projections

Table 6
Summary of Data for Rural Water Systems

Utility Name	Source of Water	Area Served (sq. mi.)	Miles of Pipeline	Number of Connections	Population	Population Density (people/sq. mi.)	Average Water Use (MGD)
Brookesmith SUD	Purchased treated water (BCWID)	382	550	3,218	9,654	25.3	0.972
Zephyr WSC	Purchased treated water (BCWID)	236	197	1,374	4,122	17.5	0.350
Coleman Co SUD	Purchased treated water (BCWID, City of Coleman)	1,460	850	2,200	5,000	3.4	0.317
North Runnels WSC	Purchased treated water (City of Winters, City of Ballinger)	650	500	728	2,184	3.4	0.127
Richland SUD	Self-supplied groundwater (Hickory aquifer, Ellenberger aquifer), purchased treated water (City of Brady)	190	330	382	764	4.0	0.160
Millersview-Doole WSC	Self-supplied groundwater (Hickory aquifer), purchased treated water (San Angelo)*	1,262	639	1,488	3,200	2.5	0.790
Red Creek MUD	Self-supplied groundwater (Lipan aquifer)	12	11	267	600	50.0	0.043
Concho Rural Water Corporation	Self-supplied groundwater (Lipan aquifer, E-T aquifer)	53	590	1,694	5,082	95.9	0.464

* Purchased water from San Angelo is only available in the far western part of the Millersview-Doole service area.

two smallest systems (Red Creek and Concho Rural WSC) have relatively high population densities. The two systems in Brown County, Zephyr WSC and Brookesmith SUD, have higher population densities than the other large systems responding to the survey. Even though Millersview-Doole WSC serves part of Tom Green County, it has a low population density. Millersview-Doole WSC supplies the eastern portion of the county, which has a lower density than the urban area of San Angelo in the center of the county.

Table 6 compares the same data for rural communities in the study area. Note that these communities have much higher population densities than the rural systems. The exception is Lakelands Services, which has a density in line with the smaller rural systems. However, because of the small service area of one square mile, this system was classified as a community rather than a rural system.

4.2 Sources of Water

Much of the groundwater in the area is unreliable or of poor quality. The Lipan aquifer covers much of Tom Green, Concho and McCulloch Counties. Supplies from the Lipan aquifer are vulnerable to surface contamination, impacted by agricultural water use and drought, and subject to contamination by more saline water from deeper formations. As a result, entities like Millersview-Doole were formed to access more reliable supplies from the Hickory aquifer. The Hickory is relatively deep so individual wells into the aquifer are rare because of the expense of drilling the wells. Unfortunately, most of the water from this source has been found to contain radium concentrations that exceed drinking water standards. Treatment for radium is relatively expensive, and disposal of the hazardous by-products of the treatment process is problematic. Water from other unclassified aquifers in the area tends to be vulnerable to both drought and contamination.

Because of limited groundwater supplies, many entities in the area have developed surface water supplies. Surface water supplies include relatively small reservoirs such as Lake Ballinger, Lake Winters, Hords Creek Reservoir and Brady Creek Reservoir, moderately sized reservoirs such as Lake Coleman and Lake Brownwood, or larger reservoirs such as Lake Spence and Lake Ivie. The smaller reservoirs have small drainage areas and are vulnerable to drought. Much of the supplies from the larger reservoirs are committed to meet demands in

Table 7
Summary of Data for Rural Communities

Utility Name	Source of Water	Area Served (sq. mi.)	Miles of Pipeline	Number of Connections	Population	Population Density (people/sq. mi.)	Average Water Use (MGD)
City of Blanket	Self-supplied groundwater (Trinity aquifer), purchased treated water (BCWID)	0.6	9	178	402	699	0.040
May WSC	Self-supplied groundwater (Other aquifer)		3	125	300		0.023
City of Coleman	Self-supplied surface water (Lake Coleman, Hords Creek Reservoir)	5.0	95	2,620	5,127	1,025	1.368
City of Ballinger	Self-supplied surface water (Lake Ballinger, Lake Ivie)	2.0	50	2,491	4,243	2,122	0.489
Rowena WSC	Purchased treated water (City of Ballinger)		18	196	386		0.043
City of Bronte	Self-supplied groundwater (Other aquifer), self-supplied surface water (Oak Creek Reservoir)	1.4	35	626	1,076	748	0.181
City of Paint Rock	Self-supplied surface water (Concho River)	1.7	9	144	325	196	0.036
Lakelands Services	Self-supplied groundwater (Hickory aquifer, Other aquifer)	1.0	5	26	51	51	0.004
Lohn WSC	Self-supplied groundwater (Hickory aquifer)		16	70	200		0.023
City of Melvin	Self-supplied groundwater (Hickory aquifer)	0.5	10	127	155	329	0.050
Rochelle WSC	Self-supplied groundwater (Hickory aquifer)		20	124	188		0.028
City of Eden	Self-supplied groundwater (Hickory aquifer, Other aquifer)	2.4		646	3,000	1,236	0.310

other parts of Region F. Only Lakes Coleman and Brownwood may have supplies that could be used to meet demands elsewhere in the area.

Surface water supplies in the area may have water quality problems as well. Lakes Spence and Ivie have levels of dissolved solids that exceed secondary drinking water standards. Brady Creek Reservoir may have water quality problems as well, requiring advanced treatment to make use of the water.

5 ECONOMICS OF RURAL WATER DISTRIBUTION SYSTEMS

A survey of water providers in the study area was developed to verify data obtained from other sources and to acquire additional information regarding the costs of operating a water supply system in the study area. Thirty-three surveys were sent to both rural water supply systems and communities within the study area. Twenty surveys were completed and returned. Copies of the completed surveys may be found in Appendix B.

5.1 Survey Results

Table 8 is a summary of factors that impact costs identified by the survey recipients. Energy costs, operation and maintenance, and regulatory compliance were the most frequently mentioned factors.

Table 9 shows the cost data from the surveys for water purchase, treatment, distribution, maintenance and other costs for the rural water systems. Table 10 has the same information for communities. Figure 3 and Figure 4 compare unit costs for rural systems and communities, respectively[*].

Based on the information received from the surveys, the cost of purchased water is a significant part of the cost of running many systems. There is a wide range of unit costs for these systems, and a wide range of costs in each category. Some systems have very high unit costs that are over $10 per 1,000 gallons. Some of the variation can be explained by differences in the ways that the individual systems responded to the survey. For example, budget categories for treatment of water within the distribution system itself may be included in the distribution category by some systems and in the treatment category for other systems.

[*] Unit costs are the sum of costs for each category divided by the amount of water supplied. Unit costs and total costs were not provided by survey participants.

Table 8
Survey Data - Factors Impacting Costs

Entity	Water Purchase	Treatment (raw water) [a]	Energy Costs (Fuel & Electricity)	Operation & Maintenance [b]	Unaccounted-For Water [c]	Regulatory Compliance [d]	Regulatory Fees	Other	Comments
Brookesmith SUD	X		X		X	X	X		
Zephyr WSC	X		X						
City of Blanket			X	X					
May WSC			X	X					
City of Bronte			X			X			
City of Coleman		X		X					
Coleman Co SUD			X		X	X			
City of Eden			X	X		X			
City of Paint Rock		X	X	X		X	X		
Richland SUD						X			
Lakelands Services	X		X				X		
Lohn WSC									No response
City of Melvin			X			X		X	Revenue source for city
Rochelle WSC						X	X	X	Postage & office supplies
City of Ballinger	X	X	X						
North Runnels WSC			X			X			
Rowena WSC	X			X		X			
Concho Rural Water Corporation				X		X	X	X	
Red Creek MUD				X		X	X	X	Material costs
Millersview-Doole WSC				X	X			X	Cost to develop new source

a - Treatment costs include chemicals to treat raw water or disinfect groundwater
b - Includes replacement of existing facilities
c - Includes leaks and theft
d - Regulatory compliance includes chemicals to maintain water quality in distribution systems, water testing, & flushing.

Table 9
Survey Cost Data for Rural Systems

Rural System	Purchase	Treatment	Distribution	Maintenance	Other	Total	Total/kGal [a]	Average Monthly Water Bill
Brookesmith SUD	$ 388,864	$ 10,000	$ 1,522,271	$ 126,685	$ 596,491	$2,644,311	$ 7.45	$ 48.00
Zephyr WSC	$ 285,000	$ -	$ 800,000	$ 40,000	$ 160,000	$1,285,000	$ 10.05	$ 47.30
Coleman Co SUD	$ 600,000	$ -	$ 600,000[b]	$ -	$ 300,000	$1,500,000	$ 12.96	$ -
North Runnels WSC	$ 175,000	$ 30,000	$ 32,000	$ 48,000	$ 189,500	$ 474,500	$ 10.23	$ 58.99
Richland SUD	$ -	$ 10,489	$ 68,573	$ 106,649	$ 280,345	$ 466,056	$ 7.97	$ 48.44
Millersview-Doole WSC	$ 326,500	$ 22,500	$ 195,000	$ 188,000	$ 999,110	$1,731,110	$ 6.00	$ 90.75
Red Creek MUD	$ 15,000	$ 8,000	$ 15,000	$ 10,000	$ 13,500	$ 61,500	$ 3.92	$ 38.00
Concho Rural Water Corporation	$ -	$ 23,000	$ 175,000	$ 75,000	$ 195,000	$ 468,000	$ 2.76	$ 35.00

a Unit costs were not provided by survey participants. It is the sum of the costs for the individual categories divided by the amount of water supplied.
b Coleman County SUD combined treatment and distribution costs

Table 10
Survey Cost Data for Communities

Community	Purchase	Treatment	Distribution	Maintenance	Other	Total	Total/kGal [a]	Average Monthly Water Bill
City of Blanket	$ 3,000	$ 1,000	$ 12,000	$ 13,000	$ -	$ 29,000	$ 1.98	$ 25.85
May WSC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15.00
City of Coleman	$ -	$ 750,000	$ 500,000	$ -	$ -	$1,250,000	$ 2.50	$ -
City of Ballinger	$ 205,512	$ 475,118	$ 349,631	$ -	$ -	$1,030,261	$ 5.77	$ 55.99
Rowena WSC	$ 61,317	$ -	$ -	$ 6,841	$ 7,500	$ 75,658	$ 4.82	$ 35.00
City of Bronte	$ 9,000	$ 8,500	$ 52,500	$ 13,500	$ 121,353	$ 204,853	$ 3.10	$ 31.50
City of Paint Rock	$ 18,000	$ 33,000	$ 15,000	$ 20,000	$ 54,000	$ 140,000	$ 10.65	$ 70.00
Lakelands Services	$ 2,000	$ 300	$ 4,000	$ 2,000	$ 7,500	$ 15,800	$ 10.81	$ 55.00
Lohn WSC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00
City of Melvin	$ -	$ 5,000	$ 2,500	$ 2,500	$ 53,000	$ 63,000	$ 3.45	$ 31.85
Rochelle WSC	$ -	$ 4,500	$ 7,200	$ 7,000	$ 15,000	$ 33,700	$ 3.30	$ 29.20
City of Eden	$ -	$ 69,000	$ 91,291	$ -	$ 240,105	$ 400,396	$ 3.54	$ 22.00

a Unit costs were not provided by survey participants. It is the sum of the costs for the individual categories divided by the amount of water supplied.

Figure 3
Comparison of Unit Costs for Rural System

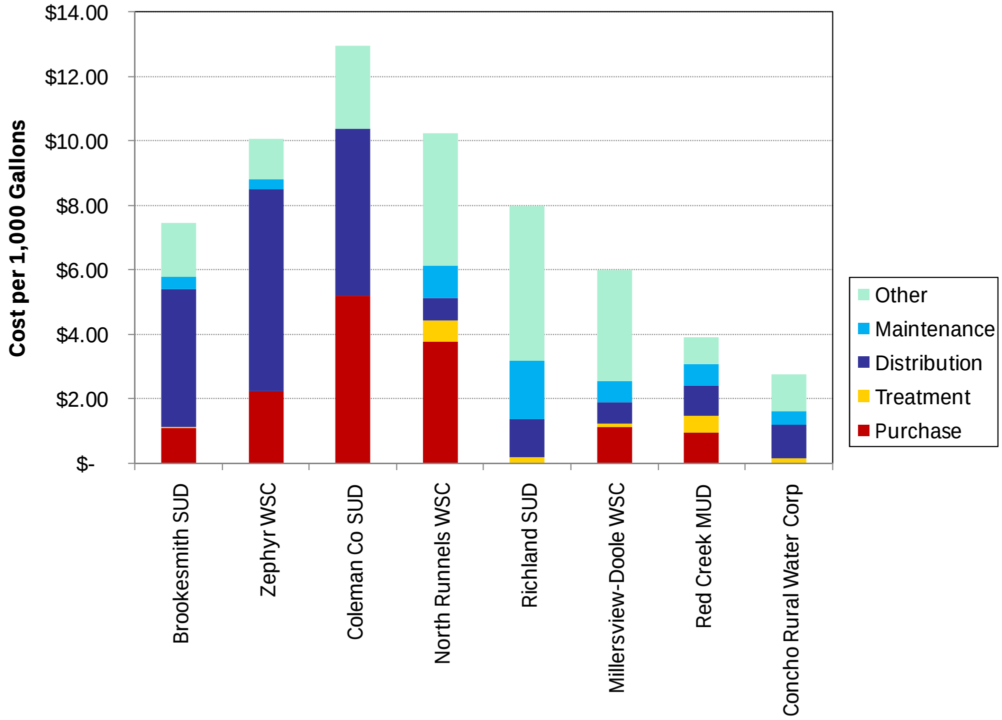
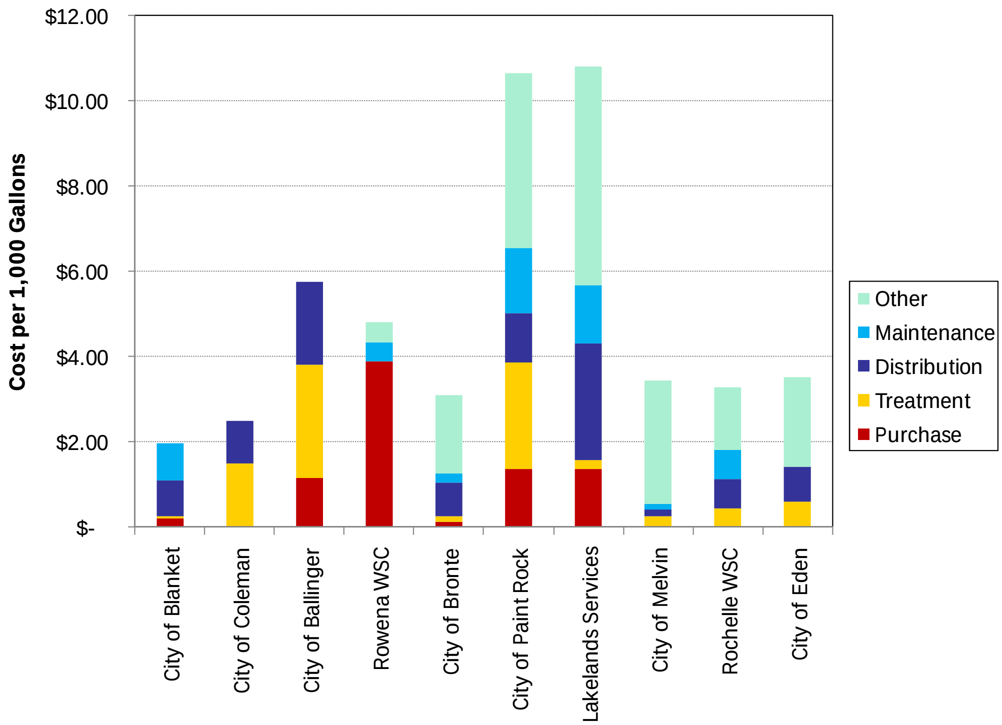


Figure 4
Comparison of Unit Costs for Communities



5.2 Site Visits

The following information was gathered during site visits to Brookesmith SUD, Coleman County SUD, North Runnels WSC and Millersview-Doole WSC.

Current Plans for Expansion

Several systems in the study area are already in the process of expanding services. In Brown County, both Brookesmith SUD and Zephyr WSC are in the process of building or have recently completed new lines that will expand their service areas. In addition, Brookesmith has completed a long-anticipated connection to serve the City of Santa Anna in Coleman County. (Santa Anna had previously obtained water from Lake Brownwood using its own raw water line and treatment plant.) The connection to Santa Anna will also allow Brookesmith to provide water to the Coleman County SUD.

Coleman County SUD is in the process of completing the improvements that will allow their customers to take water from either the Brown County WID treatment plant (via Brookesmith) or the City of Coleman. A dispute with the City of Coleman over water quality and high water use during drought was the chief motivation for finding an alternative source.

Both North Runnels WSC and Millersview-Doole WSC are in the process of expanding infrastructure to provide water to a significant number of new customers within their existing service area. Both entities obtained funding to complete this expansion. However, delays in implementing the projects and significant increases in construction costs have hampered these entities from carrying out their plans.

As part of the above funding, Millersview-Doole also has plans to construct a new water treatment plant on Lake Ivie to replace water obtained from the Hickory aquifer. Because of the high chlorides in Lake Ivie, TCEQ required that this plant employ desalination to meet secondary drinking standards. Implementing a project of this complexity has been a significant concern for Millersview-Doole.

Size of Water Distribution Lines

The size of water lines reflects different approaches to developing a water supply system. Brookesmith SUD has a good array of 6-inch to 8-inch water lines. This system reflects the higher population density of Brown County and Brookesmith's anticipation of growth in rural areas of the county. Some of these lines currently may have only a few connections. As a result, these lines require more frequent flushing and require larger volumes of water to flush the lines than a smaller diameter line.

On the other hand, the other systems consist primarily of smaller 2-inch and 3-inch lines, which is appropriate for the lower population density of their service area. These entities do not anticipate a significant amount of growth within their service area and therefore elected to size their lines based on current customers. Less water is needed when flushing lines and flushing is not needed as frequently as would be required with larger lines. However, this lack of excess capacity could require additional infrastructure to add new customers or new sources of supply to their systems.

Maintaining Water Quality within the System

As mentioned above, maintaining water quality within a rural system can be more challenging than in a system that serves a higher density community. Lines may only have a few customers, leading to stagnation problems during the summer months. In addition, rural systems typically do not have loops that help reduce stagnation. As a result, rural systems usually flush their lines more frequently than urban systems. If lines are over-sized for their current demands, they require even more water than a system of smaller lines.

Brookesmith SUD, Coleman County SUD and North Runnels WSC all purchase treated water from other providers. In some cases, the treated water has quality problems. These water quality issues are beyond the control of these entities but still affect their customers and can lead to regulatory problems.

Unused Connections

All four entities interviewed in the site visits have a significant number of connections that have little or no water use. One of the trends in rural areas is that the 'family farm' may no longer have a permanent resident. In other cases, these connections may serve vacation homes or hunting cabins. Some infrequently used connections serve as a backup supply for livestock when tanks or other local sources become depleted. The utilities were unable to quantify water used by livestock.

Leak Detection and Water Theft

One of the unique aspects of rural systems is the difficulty in finding and repairing leaks. In more densely populated areas residents frequently see and report leaking water lines. However, in rural areas leaks are seldom observed by residents. In addition, the many miles of unobserved water lines make it relatively easy for unauthorized connections to the system.

Meeting Water Conservation Goals

Like all water suppliers in Texas, these rural systems are under pressure from the state to show implementation of water conservation strategies and reduced demand. However, as mentioned above, the frequent flushing required can make it difficult to reduce water use during the summer months. Furthermore, reduced demand could lead to additional stagnation problems that are already the result of infrequent use of water lines. Rural systems have more difficulty in identifying and addressing leaks and other losses than urban systems. Finally, many of the residents in the study area could be classified as low income and therefore less likely to have discretionary water use such as landscaping and swimming pools. All of these factors can make it difficult to identify and implement strategies to reduce water demand.

5.3 Analysis of Cost Data

The scope of work for this study calls for an analysis of the variables that impact costs based on data collected from the systems in the study area. The first step in the process was to use regression analysis to correlate cost data with factors such as service area, miles of pipeline, population, number of connections and water use. The results of this analysis are presented in Table 11. This table shows the R^2 of the correlation between these factors. The regression equations may be found in Appendix C. Values shaded in green show the highest correlation, values in yellow indicate a moderate correlation, and values in red show a low correlation. These data lead to the following conclusions:

- There is a good correlation between service area and miles of pipeline. This result would be expected as larger services areas require more pipelines to serve customers.
- There is a strong correlation between population, number of connections and water use. This result is also expected.

Table 11
R^2 of Correlation between Various Factors Affecting Rural Systems

Factor	Service Area	Miles of Pipeline	Population	No. of Connections	Water Use	Treatment Cost	Distribution Cost	Maintenance Cost	Other Costs	Total Cost
Service Area		0.86	0.06	0.11	0.07	0.26	0.2	0.52	0.33	0.1
Miles of Pipeline	0.86		0.43	0.55	0.63	0.54	0.08	0.68	0.41	0.34
Population	0.06	0.43		0.97	0.94	0.55	0.79	0.95	0.74	0.76
No of Connections	0.11	0.55	0.97		0.75	0.51	0.76	0.95	0.75	0.79
Water Use	0.07	0.63	0.94	0.75		0.85	0.51	0.68	0.71	0.98

- There is almost no correlation between service area or miles of pipeline and population, number of connections, or water use.
- Population, number of connections, and water use have a much stronger correlation to overall cost than either service area or number of miles of pipeline. Therefore it appears that traditional methods that use population and water demand to estimate cost are valid for these rural systems. The geographic area covered by the systems does not appear to be a strong factor influencing costs.

It seems logical that the geographic size of a system would have an influence on cost, but the data collected in this study do not show much influence. One of the factors that may be masking any correlation between service area and miles of pipeline and cost is the difference in population density between Brown County and the other counties served by rural systems. Two of the large systems, Brookesmith SUD and Zephyr WSC, have population densities of 25 and 17 people per square mile, respectively. Other systems of similar size have population densities in the 3 to 4 people per square mile range (See Table 6). A larger dataset or a dataset consisting of systems of similar population densities might be able to find a stronger correlation between geographic system size and cost.

5.4 Conceptual Rural System

The analysis above was used to develop a model of a conceptual rural system that combines the characteristics of the systems in the study area. This model evaluates how different factors contribute to the cost of operating a conceptual rural system. The conceptual system has the following characteristics:

- Uses purchased water or self-supplied groundwater without advanced treatment as a source. Although systems using self-supplied groundwater may have higher costs due to pumping water out of the ground, the difference was determined to be small when compared to the overall cost of operating the system.
- Has infrastructure that is proportional to the service area of the system. The number of miles of pipeline does not vary with population served.
- Has water use in direct proportion to population. Service area does not affect water use.
- Has operating costs that are directly proportional to water use. There is no variation of operating costs with the size of the system.

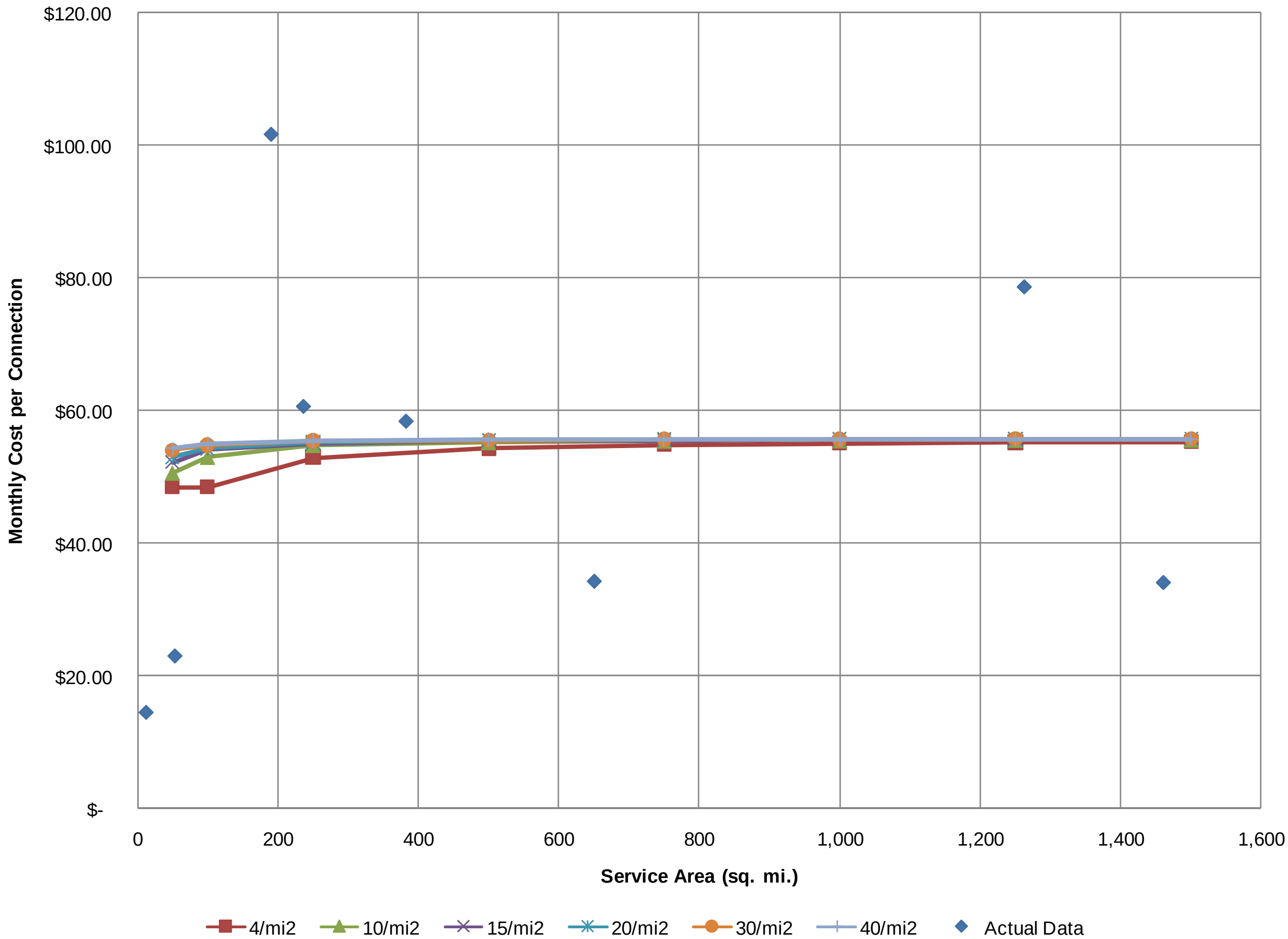
The two independent variables in this analysis are population density and service area size. Population density is used to calculate the number of customers for a given service area size. Once the number of customers was calculated, total water use and cost data were calculated using the regression analysis discussed above. The final calculation is a cost per connection, which allows comparison of costs between systems of various sizes. Figure 5 is a comparison of these unit costs for various population densities and service area sizes. The output of these analyses may be found in Appendix C.

Conceptual Model Results

Looking at the data in Figure 5 shows that there is almost no variation in unit costs based on system size or population density in the conceptual model. The typical calculated cost of about $55 per connection is relatively close to the average cost from actual data of $51 per connection. This result is consistent with the typical assumption that cost of operation is directly dependent on the amount of water provided and does not vary with the size of a system.

The conceptual model does not explain the scatter in the actual data for systems. As noted before, the data show a poor correlation between the geographic area of a system and costs. The conceptual model shows that the scatter in the data may not be explained by variations in population density among the systems. Apparently unidentified factors unique to each system have a significant impact on cost. Possible explanations include variations in level of indebtedness, need to build up funds to pay for infrastructure improvements, and variations in treatment cost. A larger dataset could potentially improve the results of this approach.

Figure 5
Comparison of Conceptual Cost per Connection for Systems of Various Sizes and Population Densities



6 INTEGRATION SCENARIOS

The primary reason for selecting the area for this study is the presence of water supply needs that have not been fully addressed through the regional water planning process. Residents of Runnels and eastern Coke County were particularly hard-hit by the recent drought. Analyses in previous Region F plans have shown that the supplies from the two main reservoirs in Runnels County, Lake Ballinger and Lake Winters, are not adequate to meet projected demands. Users that rely on the Hickory aquifer in McCulloch, Concho and eastern Tom Green face water quality problems that are expensive to address. On the other hand, Lake Brownwood in Brown County is one of the few sources in Region F that has excess supplies that could be used to meet other needs. In addition, Coleman County Water Supply Corporation (WSC) is in the process of obtaining treated water from Lake Brownwood. This potentially frees up some water from Lake Coleman for other users.

The 2006 Region F Water Plan examined construction of new pipelines to bring water from Lake Brownwood or the proposed San Angelo desalination project to the Runnels/Coke County area. The biggest roadblock to implementing these projects is that the demand is relatively small (2,800 acre-feet per year for the Lake Brownwood project) and the distance that the water needs to be moved is large (84 miles for the Lake Brownwood project). The high cost of these strategies prevented them from being recommended in the 2006 plan[3].

For this study, the focus shifted from the cities to the rural systems in the area. Most of the rural customers in study area are served by large rural water providers. Figure 2 shows the service area of these water providers. These water supply systems have developed because local groundwater supplies are either inadequate for rural residents, or are so deep that they cannot be tapped by individual households. It is possible that these rural systems could be interconnected to increase reliability or water quality in the area. Four potential integration strategies were identified in the course of the study:

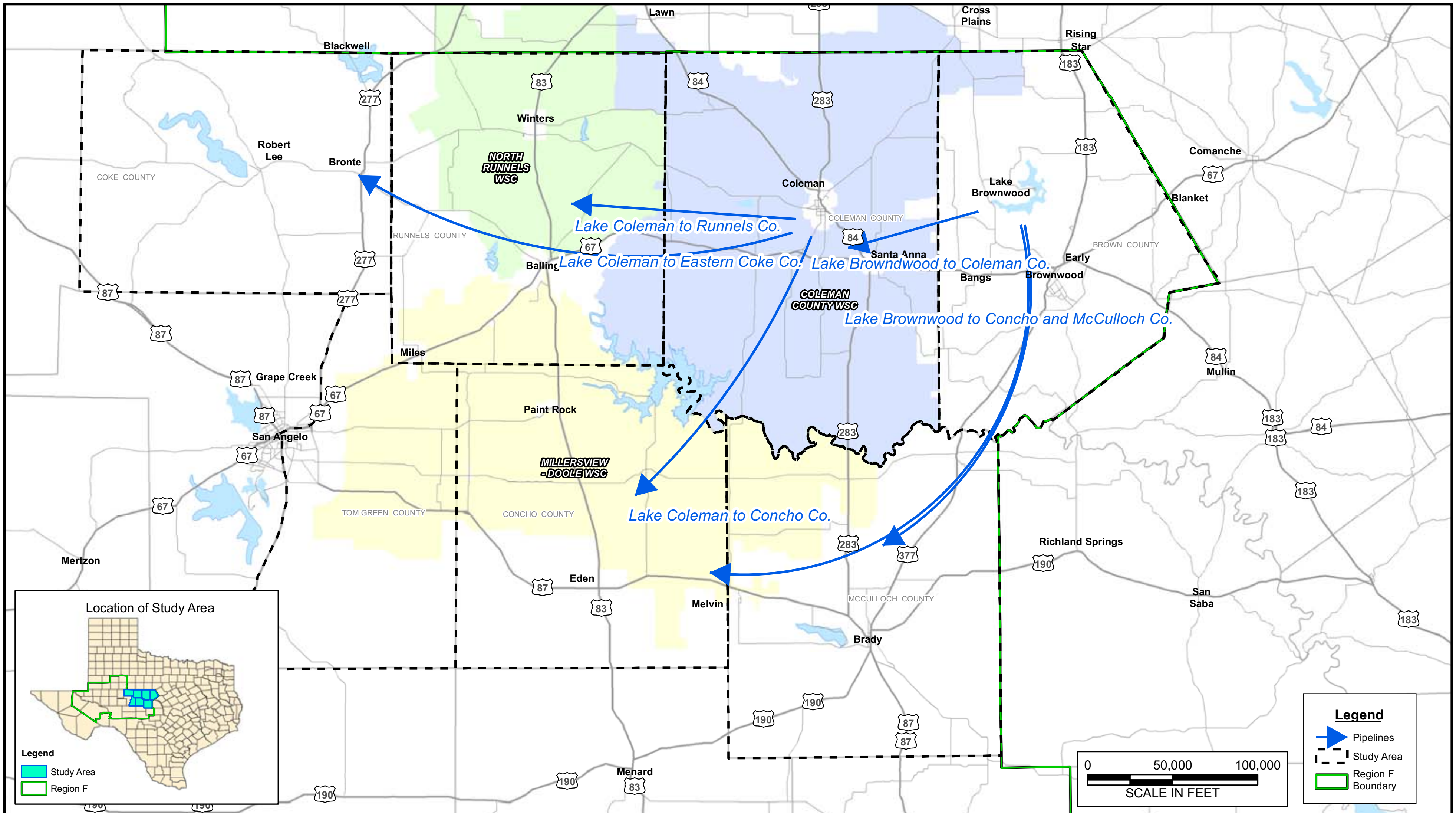
- Lake Coleman water to Runnels County
- Lake Coleman water to Concho, McCulloch and Runnels Counties
- Lake Coleman water to eastern Coke County

- Lake Brownwood water to McCulloch County

Figure 6 illustrates how water would move in these integration strategies. (The Lake Brownwood to Coleman County project is already being implemented. It is included in Figure 6 because it helps make the Lake Coleman strategies feasible.) Each of these strategies was discussed in site visits with Brookesmith SUD, Coleman County WSC, North Runnels WSC and Millersview-Doole WSC. The last two strategies, Lake Coleman to eastern Coke County and Lake Brownwood to McCulloch County were dropped from detailed consideration either because the strategies would not be feasible or the water suppliers in the area are pursuing other strategies. The strategies are discussed in more detail below.

6.1 Lake Coleman Water to Runnels County

North Runnels WSC currently obtains most of its water from the City of Winters. The 2006 Region F plan estimates that the supply from Lake Winters will not be adequate to meet both the needs of the City of Winters and North Runnels WSC. In this strategy, treated Lake Coleman water from the City of Coleman would be used to meet all or part of the demand for North Runnels WSC, thereby improving the reliability of supply for both the City of Winters and North Runnels WSC. If possible, the water could be delivered through the Coleman County WSC system. However, during site visits with Coleman County WSC and North Runnels WSC, it was determined that little if any existing infrastructure could be used to implement this strategy. Both Coleman County WSC and North Runnels WSC serve areas with a low population density. Appropriately the existing infrastructure consists mostly of 2 to 3-inch water lines, which would not be adequate for interconnecting the systems (see Section 5.2). Therefore the evaluation of this strategy calls for new infrastructure. The estimated project cost is about $10.4 million in 2006 dollars. Table 12 summarizes pertinent information about the strategy. Figure 7 shows the possible pipeline route. A detailed cost estimate is in Appendix F.



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Rural Water Distribution and Integrated Water Supply Study

Movement of Water in Proposed Integration Strategies

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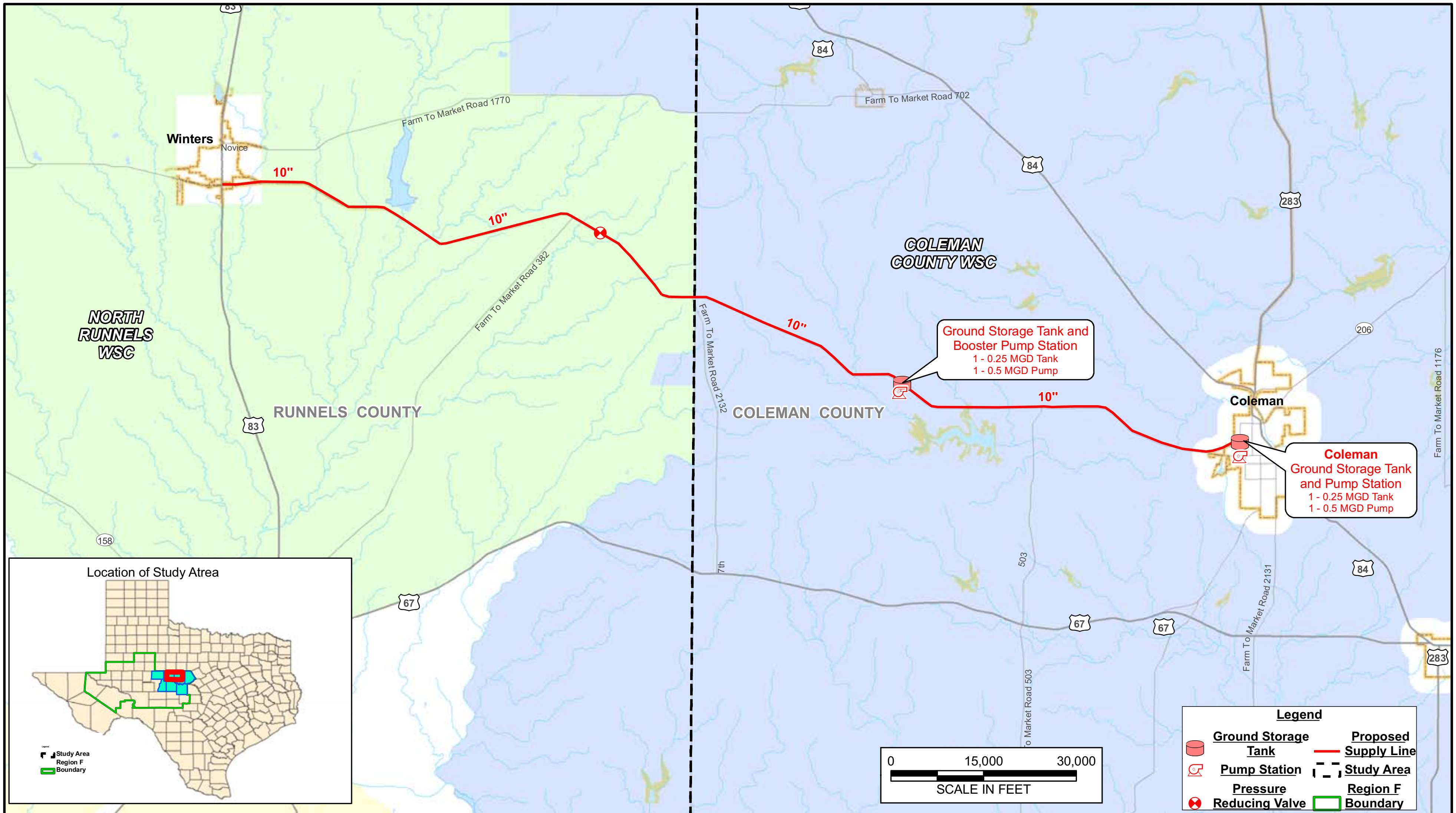
FIGURE



Rural Water Distribution and Integrated Water Supply Study

Lake Coleman Water to Runnels County

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FIGURE

Table 12
Lake Coleman Water to Runnels County

WUG Name	**Supply** (Ac-Ft/Yr)	**Pipe Size** (in.)	**Pipe Length** (mi.)	**Capital Cost** [a]	**Unit Cost during Amortization** [b] ($/Ac-Ft)	**Unit Cost after Amortization** [b] ($/Ac-Ft)
Runnels County Other (North Runnels WSC)	224	8	33.9	$10,388,400	$6,536	$2,491

a Capital costs include cost of construction, permitting and interest during construction. More detailed cost estimates are in Appendix F.
b Unit costs include water purchase cost, operation and maintenance. Unit costs during amortization include debt service.

Implementation Issues

It is anticipated that the water lines for this project would follow existing highway routes. The water supply comes from an existing source, Lake Coleman, and is relatively small compared to the yield of the reservoir. Therefore the impacts on the environment and natural resources would be low.

The high cost of this strategy implies that it would not be cost-effective to implement. The area is a rural agricultural area with a relatively small economic base. Implementation of this project could be an economic burden on the area.

Integration with Other Strategies

North Runnels WSC is included in the Region F Water User Group Runnels County Other. Table 13 shows the recommended Water Management Strategies from the 2006 Region F Plan for the Water User Groups (WUGs) associated with the Lake Coleman to Runnels County strategy. (The supply from Lake Brownwood to Coleman County SUD was already being implemented so it was included as an existing source in the 2006 Region F Plan.) Without subordination, Lake Coleman has no supply, so the subordination water management strategy is a pre-requisite for the Lake Coleman to Runnels County strategy. This strategy could complement or be a substitute for the reuse strategy identified for the City of Winters.

Table 13
Potentially Affected Strategies in Coleman and Runnels County

Strategy	Source(s) of Water	Water User Group(s)
Subordination	Lake Coleman, Lake Ballinger, Lake Winters, Lake Ivie	Runnels County Other, Ballinger, Coleman, Winters, Coleman County SUD, Manufacturing
Reuse	Reuse	Ballinger, Winters, Runnels County Other, Manufacturing
Municipal Conservation	Conservation	Ballinger, Coleman, Winters
Voluntary Redistribution	Lake Ivie	Runnels County Other, Ballinger, Manufacturing

6.2 Lake Coleman Water to Concho, McCulloch and Runnels Counties

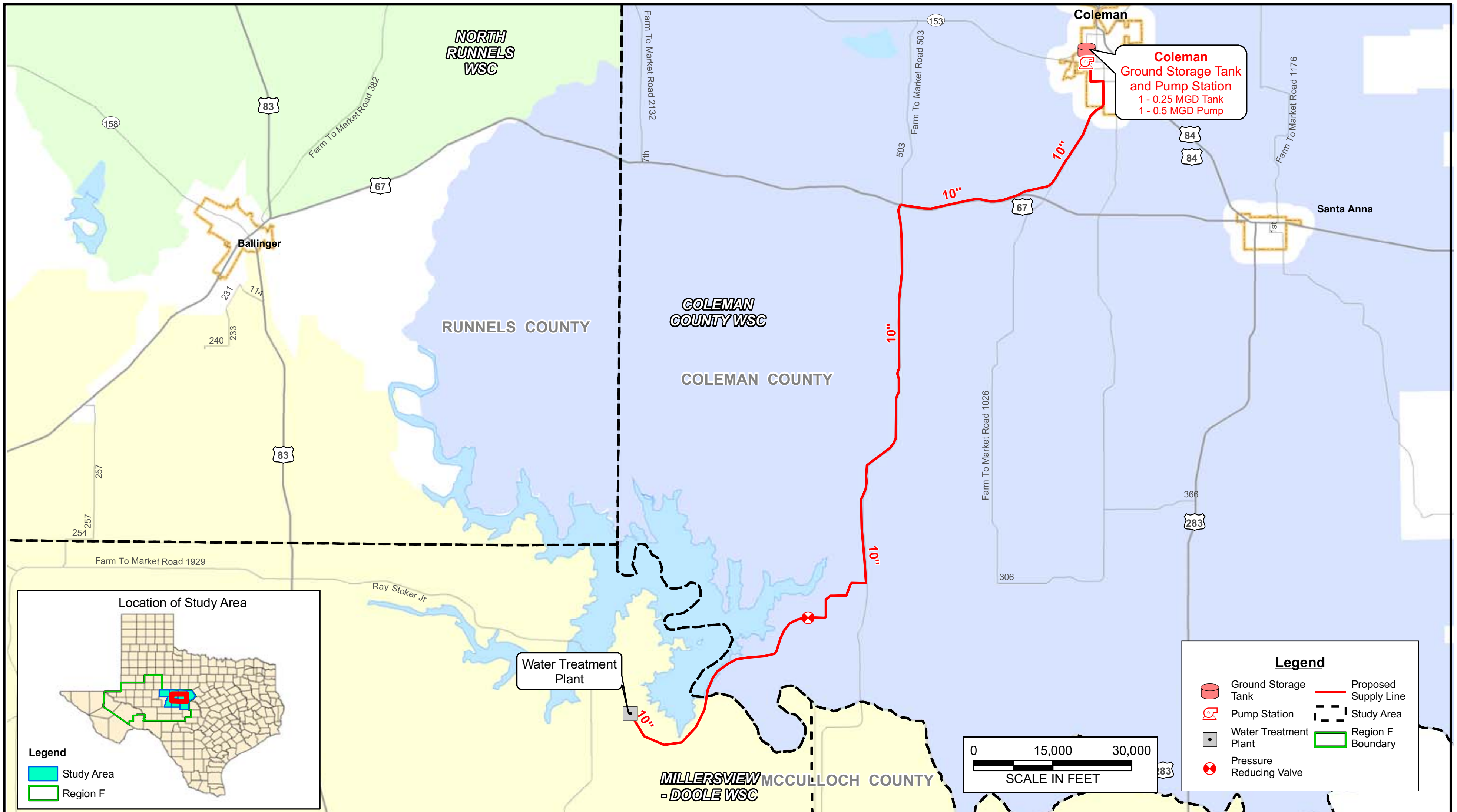
The Millersview-Doole WSC has one of the largest service areas in Region F, covering an area of 1,262 square miles in four counties. Most of the service area is supplied with water from the Hickory aquifer, which exceeds drinking water standards for radium. (A small part of the service area in Tom Green County obtains treated water from San Angelo.) Millersview-Doole is currently in the process of constructing a new water treatment plant for water from Lake Ivie. This project includes improvements to distribute the treated water to customers as well as providing service to new customers in the area.

An alternative to the construction of the water treatment plant would be to build a pipeline from the City of Coleman to the vicinity of the proposed water treatment plant. This pipeline would then be connected to the new infrastructure already planned or under construction. The estimated project cost is $11.3 million in 2006 dollars. Table 14 summarizes the strategy. A detailed cost estimate is in Appendix F. Figure 8 shows the possible pipeline route.

Table 14
Lake Coleman Water to Concho, McCulloch and Runnels Counties

WUG Name	**Supply** (Ac-Ft/Yr)	**Pipe Size** (in.)	**Pipe Length** (mi.)	**Capital Cost** [a]	**Unit Cost during Amortization** [b] ($/Ac-Ft)	**Unit Cost after Amortization** [b] ($/Ac-Ft)
Millersview-Doole WSC	443	10	34.4	$11,318,600	$4,381	$2,153

a Capital costs include cost of construction, permitting and interest during construction. More detailed cost estimates are in Appendix F.
b Unit costs include water purchase cost, operation and maintenance. Unit costs during amortization include debt service.



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Rural Water Distribution and Integrated Water Supply Study

Lake Coleman Water to Concho, McCulloch and Runnels Counties

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FIGURE

Implementation Issues

It is anticipated that the water lines for this project would follow existing highway routes. The water supply comes from an existing source, Lake Coleman, and is relatively small compared to the yield of the reservoir. Therefore, the impacts on the environment and natural resources would be low.

Currently, Millersview-Doole is pursuing the Ivie water treatment plant strategy. It is unlikely that this strategy will be implemented. The high cost of this strategy implies that it would not be cost-effective to implement. The area is a rural agricultural area with a relatively small economic base. Implementation of this project could be an economic burden on the area.

Integration with Other Strategies

Table 15 shows the recommended Water Management Strategies from the 2006 Region F Plan for the WUGs associated with the Lake Coleman to Concho County strategy. Without subordination, Lake Coleman has no supply, so subordination is a pre-requisite the Lake Coleman to Concho County strategy.

As mentioned above, Millersview-Doole is planning to continue pursuing the Ivie water treatment plant. Based on projections in the 2006 Region F Plan, this supply should be sufficient to meet Millersview-Doole's needs throughout the planning period. Therefore, obtaining water from Lake Coleman may not be needed.

Table 15
Potentially Affected Strategies in Coleman Concho, McCulloch and Runnels Counties

Strategy	Source(s) of Water	Water User Group(s)
Subordination	Lake Coleman, Lake Ivie	Coleman, Coleman County SUD, Millersview-Doole WSC
Municipal Conservation	Conservation	Coleman
Voluntary Redistribution	Lake Ivie	Millersview-Doole WSC

6.3 Other Potential Integration Strategies

Two other integration strategies were identified during this study: Lake Coleman water to eastern Coke County and Lake Brownwood water to McCulloch County. The eastern Coke County strategy would deliver water to the City of Bronte and others in the vicinity. This area experienced water supply reliability problems during the recent drought. The strategy could be implemented in conjunction with the Lake Coleman water to Runnels County strategy described above. However, since the project would require all new infrastructure to implement, it is unlikely that this project would be cost-effective. The City of Bronte has also pursued supplies from groundwater that probably makes this strategy unnecessary.

Most water users in McCulloch County rely on the Hickory aquifer, which exceeds water quality standards for radium. It is possible that Lake Brownwood water could be delivered to McCulloch County using existing infrastructure in the Brookesmith SUD system. However, since McCulloch County water providers are pursuing other strategies, this option was not investigated further in this study.

7 ALTERNATIVE PARADIGMS

The traditional water service paradigm involves a water utility that provides all of the water used in every household and commercial establishment within the utility's service area, regardless of the ultimate use of that water. Water used for landscape irrigation, toilet flushing, and other non-potable uses is treated to the same level as water used for human consumption. The utility is fully responsible for developing water supply sources, treatment to meet regulatory standards at a central treatment facility, and distribution of treated water to each household. The consumer is primarily responsible for turning on the faucet and paying water bills.

The alternative paradigms considered in this study look at alternatives that take into account the ultimate use of the water. Water for non-potable uses may not need to be treated to the same standards as water for human consumption. These paradigms may require more active participation by the consumer to reduce costs, somewhat like self-serve gasoline or checkout lines in a grocery store. The alternative paradigms considered in this study include:

- *Point-of-Entry treatment.* In this paradigm, rather than treating all of the water for each household at a central treatment facility, all or part of the treatment occurs at the point where the water enters a household.
- *Point-of-Use treatment.* Point-of-Use is similar to Point-of-Entry in that treatment occurs at the consumer end rather than in a centralized treatment facility. However, point-of-use treats only the water used for human consumption.
- *Volunteer construction of water service lines.* This paradigm uses community volunteers in the construction of new water supply lines rather than utility employees or contractors.
- *Bottled water programs.* In this paradigm, the water utility provides bottled water for human consumption at a central location.
- *Rainwater harvesting.* This paradigm uses rainwater collected from roofs or other structures to supplement or replace water from more traditional sources.

Each of these paradigms is described in greater detail below.

Another common alternative paradigm is the use of so-called gray water (i.e. water used for bathing or laundry) for other purposes such as landscape watering or toilet flushing. Gray water use is typically associated with new construction and can be expensive to implement in existing structures. Since this study focuses on existing users in generally low-income rural areas and not new construction, gray water use was not included in this study.

7.1 Point-of-Use and Point-of-Entry Treatment

In a traditional water utility, treatment is provided at a central facility. However, Point-of-Entry (POE) and Point-of-Use (POU) treatment rely on small treatment units located where the water is actually used. In POE treatment, all of the water entering a building is treated, while POU only treats water that is directly used for human consumption (i.e. drinking or cooking). POU units are typically installed under kitchen sinks.

These treatment strategies may be appropriate for smaller systems with contaminant compliance problems that cannot affordably be addressed using conventional treatment methods. Examples include arsenic, radionuclides, nitrate, certain metals, fluoride and synthetic organic chemicals. POE treatment may be used to remove microbial contaminants as well. The Safe Drinking Water Act specifically excludes POU for removing microbial contaminants. The cost savings are the result of having to treat less water than would need to be treated in a central facility. Appendix E contains several case studies where POU or POE treatment has been applied. Additional information on POU and POE treatment can be found in the EPA publication *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems*[7].

EPA regulations require that the utility be entirely responsible for maintenance of the treatment units. Because these units are located on private property and, in the case of POU units, possibly inside private residences, access will always be an issue for maintenance of the units. In certain situations this could be a barrier to applying this strategy. A summary of other regulations governing POU/POE treatment may be found in Appendix E.

Treatment Technologies

In Region F small systems may face elevated levels of fluoride, nitrate, arsenic, or radionuclides (both radon and radium). Typical treatment technologies for Region F include:

- *Reverse Osmosis* (RO) is probably the most common advanced treatment technology available for small systems. RO uses a selective membrane and pressure to remove a variety of contaminants. This technology can be used for both POE and POU systems, although EPA only recommends its use for POU. It is most suited for fluoride, arsenic and radium, but may also be suitable for removal of nitrates. Typical problems associated with RO systems include membrane fouling and waste disposal. It is possible that waste stream from the RO unit may require special handling.

- *Absorptive media* includes technologies such as activated alumina, granular ferric hydroxide and other specialty iron-based media. Activate alumina is generally used to treat for fluoride, but is also applicable for arsenic in an oxidized state. Problems that may occur are the pH of the inflow water which may need to be pre-treated for optimal removal of arsenic.
- *Ion exchange* includes cation and anion exchange used to treat for contaminants that maintain a charge. Ion exchange uses a salt which exchanges with the charged contaminants from the water leaving only the salt. Ion exchange is typically used for fluoride, antimony, chloride, selenium, uranium and may be used for POU radium removal. Water softening is a form of ion exchange. Potential problems associated with Ion exchange are maintenance requirements of refilling the salt and the higher concentration of salt in the waste stream. Resin fouling may occur if influent water has high concentrations of total suspended solids, iron, magnesium or copper.
- *Activated carbon* uses a filter to remove synthetic organic compounds and radon. Activated carbon may also improve the taste and odor of the water. Additional treatment such as UV may be used with activated carbon to treat for heterotrophic bacteria. Typical problems include colonization of the activated carbon by heterotrophic bacteria and the replacement of spent cartridges.

Additional information on treatment technologies may be found in Appendix D.

Costs of POE/POU Treatment

The EPA has developed a small system cost calculator[8] with their report using standard costs developed from the case studies included in *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems*. The calculator can be set to reflect the size of a system, the treatment type, and the contaminant of interest. Technologies in this calculator are limited to those identified by EPA for treatment of the contaminant by small systems.

One of the issues facing rural systems in Region F is the treatment of radionuclides. Treatment options for radium 226 and radium 228 include ion exchange, reverse osmosis and lime softening. However, the EPA cost calculator only has options for reverse osmosis for POU applications and cation exchange for POE applications. Three entities facing radium compliance issues, Richland SUD, the City of Melvin, the City of Eden and Live Oak Hills, were selected as examples using the EPA cost calculator.

Using the EPA created small system cost calculator for Richland SUD, the City of Melvin, the City of Eden and Live Oak Hills subdivision, the costs for POU treatment were estimated. Table 16 shows results for RO POU for these three entities, and Table 17 shows the same information for POE treatment using cation exchange. Each table shows the number of connections for each system, the cost per connection, total capital costs, the annual operation and maintenance costs and the total annual costs including the capital costs annualized over 10 years.

Table 16
Total Costs for POU Treatment using Reverse Osmosis

Entity	# Connections	$/Connection	$/1,000 gal	Total Capital Costs	Annual O&M Costs	Total Annual Costs
Richland SUD	382	$378.64	$4.56	$379,757	$90,571	$144,640
City of Melvin	127	$381.26	$4.59	$126,676	$30,385	$48,420
Live Oak Hills Subdivision	33	$402.40	$4.85	$34,928	$8,306	$13,279
City of Eden	646	$371.78	$4.37	$488,010	$152,966	$240,169

Table 17
Total Costs for POE Treatment

Entity	# Connections	$/Connection	$/1,000 gal	Total Capital Costs	Annual O&M Costs	Annual Costs
Richland SUD	382	$403.45	$4.86	$595,684	$69,307	$154,119
City of Melvin	127	$239.25	$4.89	$198,463	$23,315	$51,572
Live Oak Hills Subdivision	33	$428.48	$5.16	$53,876	$6,469	$14,140
City of Eden	646	$403.00	$4.74	$1,006,703	$117,006	$260,338

POE costs are higher than the cost of POU treatment. This is because POE treatment treats all water used in a building, while POU focuses primarily on water used for human consumption.

Table 18 compares the operation and maintenance costs for POU RO treatment to the annual budget for treatment provided by these entities in the Rural Systems Study survey. In every case the current budget is significantly less than the estimated costs for POE/POU treatment.

Table 18
Cost Comparison of current treatment to POU

Entity	Current Annual Costs	Annual O&M Costs (POU)
Richland SUD	$10,489	$90,571
City of Melvin	$5,000	$30,385
Live Oak Hills Subdivision	$300	$8,306
City of Eden	$69,000	$152,966

In its response to the Rural Systems Study survey, Richland SUD indicated the potential of using the Water Remediation Technology (WRT) removal system, a centralized system for treating Radium 226 and 228 at the water treatment facility. The WRT removal system will cost about $0.78/1000 gallons per year or $39,000 per year. The WRT treatment strategy is half the cost for operating and maintaining a POU system.

7.2 Community Volunteer Construction

In the traditional paradigm for a water utility, new projects are constructed either by utility staff or by a contractor. An alternative to this paradigm uses community volunteers to provide labor, equipment or supplies. This paradigm, also referred to as "sweat equity", has been successfully applied in the Colonia Initiative program, and has been applied in other communities such as the Cities of Breckenridge and Ballinger. Cost savings are the result of reduced labor costs associated with construction.

The State of Texas has two programs for providing water and wastewater infrastructure to economically disadvantaged communities, the Colonia Self-Help Program and the Community Self-Help Program. The Colonia program only applies to counties adjacent to the U.S. – Mexico border, so it does not apply to most of Region F. (The City of Eden has a special classification as a colonia[9].) The Community Self-Help Program could be a source of funding for utilities that qualify as Economically Disadvantaged Communities. An Economically Disadvantaged Community is in a county which has a median income that is less than 75 percent of the median state household income[5]. Coke, Coleman, McCulloch and Runnels Counties qualify under this criterion. If the median income of a county is above the 75 percent median, a water supplier may qualify for the program if it can prove that the median income of its service area is less than 75 percent of the state median. The TWDB has developed a survey that can be used for this purpose. Additional information on these programs may be found in Appendix G.

Cost Savings

We were unable to locate any studies associated with savings from self-construction of pipelines. The TWDB uses the cost savings provided by the consultant involved with the design of the project. At this time, the TWDB does not have a standard method for estimating the costs for projects using self-construction.

It is possible that the cost of the integration scenarios in Section 6 of this report could be reduced by using voluntary construction. However, it is unclear if the costs could be reduced sufficiently to make the projects cost-effective.

Case Study – City of Ballinger

Tommy New, the City Manager for the City of Ballinger, was contacted to discuss experience with using volunteer labor to construct a raw water pipeline. In 2004, during a major drought in the area, the City of Ballinger had exhausted their water supply. The City developed plans for a 14 mile emergency connection to the City of Abilene's O.H. Ivie pipeline. The City applied for a Texas Small Towns Environment Program (STEP) grant[10]through the Office of Rural Community Affairs (ORCA). The grant is available for communities where self-help is a feasible method for completion of the water or sewer project. The fund provides a maximum of $350,000 to each political subdivision for assistance in the project, while the additional funds (greater than 50% of the project cost) are contributed from the residents of the city or county. The additional matching funds may be in the form of in-kind funding through volunteer construction. The City of Ballinger and Runnels County each received $350,000 for the project through the STEP program. Mr. New estimates that the city spent $1 million on the project. The project was designed by a licensed engineer and an inspector from the engineering company was on site during the construction. Mr. New estimates that using a contractor for the project would have cost the city roughly $3 million. Based on his experience this was a cost effective and smooth project that other cities in the region might consider as an alternative to reduce construction costs.

7.3 Bottled Water Programs

In bottled water programs a utility provides water for consumption in a central location for customers to pick up at their convenience. The EPA and TCEQ both have regulations governing the use of bottled water by public water suppliers. Both agencies consider this as a temporary strategy to meet short term water needs when water is unavailable or unsafe to drink while long term solutions are developed. According to the EPA, bottled water may be used by a small system as part of a temporary variance for supply when water does not meet drinking water standards. In several of the case studies in *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems,* bottled water was provided while a long term solution was explored for the small system. The Code of Federal Regulations Chapter 40 Section 141.101 states:

> **§ 141.101 Use of bottled water.** Public water systems shall not use bottled water to achieve compliance with an MCL. Bottled water may be used on a temporary basis to avoid unreasonable risk to health.

Chapter 30 of the Texas Administrative Code 290 Subchapter F regulates bottled water use.

> **§290.106(j) Bottled water.** In accordance with 40 CFR §141.101, bottled water may be used on a temporary basis only and with approval by the commission in order to avoid unreasonable risk to health.

Applicability to Rural Systems

A bottled water program is a recommended strategy for the City of Eden, which is located in the study area. A bottled water program could be an attractive strategy for a smaller rural system. It may be more difficult to implement for a larger system, which would probably require multiple points of distribution.

Since the EPA considers bottled water programs to be a temporary measure, a utility considering a bottled water program should understand that an alternative way of complying with drinking water standards will be required at some time in the future.

7.4 Rainwater Harvesting

In the traditional water service paradigm, all of the water used for residential purposes, including landscape watering and other non-potable uses, comes from treated water provided by a utility. In parts of Texas rainwater harvesting has become an attractive alternative paradigm for replacing all or part of that use. Although rainwater harvesting may be used by a public utility, the most likely application in Region F would be for individual households or businesses. Additional information may be found in Appendix H.

Feasibility in Region F

According to the TWDB publications, an average rainfall of 20 inches or greater is required for rainwater harvesting. Figure 9 compares the long-term average precipitation data to the annual precipitation between 1997 and 2007 for the City of San Angelo, the City of Brownwood and Hords Creek Reservoir in Coleman County [11]. The City of San Angelo is on the western edge of the study area, while the City of Brownwood is in the eastern portion of the study area. Hords Creek Reservoir is near the center of the study area. The long-term average annual rainfall for all three locations is more than 20 inches per year. Beginning in 1998, most of Region F experienced a severe drought. The rainfall amounts for this period show that the western portion of the study area was more severely impacted than the eastern portion.

Figure 9
Comparison of Average Annual Rainfall to Rainfall from 1997 to 2007 at San Angelo, Brownwood and Hords Creek Reservoir

Potential Supply from Rainwater Harvesting

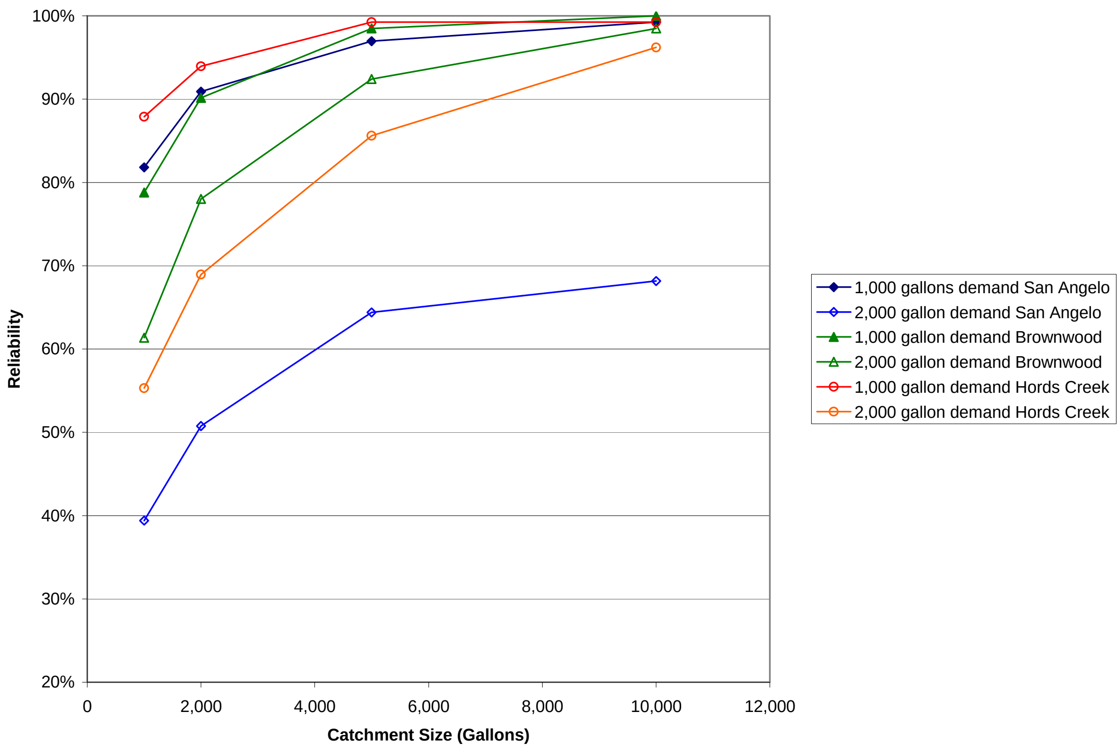
The TWDB has developed a rainwater harvesting calculator that may be used to size a system and estimate the available supply[12]. Using the calculator and the average rainfall at San Angelo, a 2,000 sq ft home will produce an average of 19,000 gallons of rainwater per year with a 10,000 gallon storage tank. According to TWDB, the average per capita use is 40 gallons per day for indoor use. The average per capita water use in the study area is 198 gallons per day, so the typical outdoor water use is 158 gallons per person per day. Most of this water use can be assumed to be for landscape irrigation. Assuming 2.5 people per household, a system with a 10,000 gallon storage tank could meet 43% of landscape irrigation needs and 30% of indoor use.

The TWDB calculator uses average rainfall to size a system and estimate supply, which reflects the long-term performance of a rainwater harvesting system. In order to assess the performance of a rainwater collection system during drought, the rainwater harvesting calculator was modified to estimate the monthly amount of water from a rainwater collection system from 1997-2007, most of which were drought years in the study area (See Figure 9). Based on a catchment area of 2,000 sq. ft. and a storage tank of 10,000 gallons, the system could provide 625 gallons per month without any shortages. A monthly demand of 2,000 gallons per month can be met 68% of the months. The system can meet a monthly demand of 1,000 gallons per month 99% of the time. Reducing the size of the storage tank to 5,000 gallons has a minimal impact on the ability to provide 1,000 gallons per month, reducing the reliability from 99% to 97%.

Figure 10 shows the reliability of the various systems for each city.

Where rainwater harvesting is used to supplement landscape irrigation, costs can be reduced by reducing the size of the storage tank. Based on the calculations, a significant amount of the outdoor use in Region F could be replaced using rainwater. Using the same assumptions about the roof area and storage tank size and an irrigation demand of 2,000 gallons per month from March to October, landscape irrigation demands could be met in 92% of the months from 1997 to 2007. Significantly higher outdoor water use would likely require supplemental water sources.

Figure 10
Reliability of Rainwater Harvesting Systems for the Period from 1997 to 2008



Assuming approximately 10% of the homes in the study counties (5,952 homes) install a rainwater system with a 10,000 gallon storage tank, rainwater harvesting could supply about 44.64 million gallons per year (137 acre-feet). Additional supply could be available during normal and wet periods. The cost to install 5,952 rainwater systems for an average Region F home of 2,000 sq. ft. would cost $92.3 million. The unit cost is approximately $2.07 per gallon of water produced. Reducing the storage tank volume to 5,000 gallons reduces the unit cost to $1.07 per 1,000 gallons, while only reducing the reliability by less than 2%. During normal and wet periods, the cost of water would be less. This cost assessment is based on an individual home and would apply proportionally to the number of homes participating.

The owner of the rainwater harvesting system is responsible for the operation and maintenance of the system. Most of the costs associated with maintenance are the costs to repair any malfunctioning portion of the system. Treatment of the water in the tank with chlorine is approximately $1 per month. Replacing plastic or vinyl gutters should cost about $0.30 per foot. The greatest cost would be incurred if the storage tank needs repairs or replacement. Depending on the material the storage tank may need to be replaced every ten years at the approximate cost of $1.50 per gallon.

Applicability to Rural Systems

Rainwater harvesting could provide some relief for rural systems that may experience reliability problems. However, not all of the savings from rainwater harvesting may be realized by the system, particularly if the system covers a large geographic area. Reduced demands from their systems could lead to water quality problems, requiring more frequent flushing of water lines.

8 CONCLUSIONS AND RECOMMENDATIONS

- The factors that affect the economics of rural water systems in the study area include:
  - *Limited economic base.* Much of the economic activity in the area is concentrated in the two major cities of San Angelo and Brownwood. With the exception of agriculture, other economic activities tend to be concentrated in towns. As a result, the economic base for the rural systems tends to be individual residences or farms. In this area, data indicate that incomes are relatively low compared to the rest of the state, and much of the population lives in poverty. Because the customer base of rural systems tends to have limited resources, it becomes difficult for these systems to finance improvements to their systems.
  - *Lack of water supply alternatives.* One of the reasons why much of the study area is served by rural water supply systems is that there are few available water supply alternatives. Accessing supplies of sufficient quantity or quality involves the construction of significant new infrastructure that may be beyond the economic means of a system's customers.
  - *Extensive infrastructure for small populations.* All of the rural systems serve large areas with low population densities. Many have densities of four people per square mile or less. The large service areas require many miles of pipeline; much more than the rural communities in the same area. As a result, these systems have relatively large maintenance costs and water quality issues that are not as pronounced in systems with higher density populations. In most cases water lines are small. This is appropriate for meeting the water supply needs of existing residents in an area, but it leaves little flexibility for using existing infrastructure to expand service or convey new supplies.
  - *Difficulties in meeting regulatory requirements.* Rural systems face particular challenges in meeting potentially conflicting regulatory requirements for water quality and conservation. Long water lines with few users often require frequent flushing, particularly in the summer months. Infrastructure changes to alleviate this problem (such as looping) may not be practical. Water conservation

strategies based on reduction in water use can actually exacerbate the problem. Leak detection, a primary water conservation strategy, often relies on the observances of customers of passers-by. This makes leak detection particularly difficult in rural areas where people may seldom visit the routes of water lines.

- The cost data collected in Phase I of this study was used to develop a conceptual model of a rural system to assist in identifying the factors that impact costs. However, the conceptual model does not fully explain the scatter in the actual data for systems. Apparently unidentified factors unique to each system have a significant impact on cost. Possible factors include variations in level of indebtedness, need to build up funds to pay for infrastructure improvements, and variations in treatment cost. A larger dataset could potentially improve the results of this approach.
- Four potential integration strategies were identified in the course of the study:
  - *Lake Coleman water to Runnels County.* This strategy could be used to relieve water supply reliability problems in Runnels County. However, the rural systems in the area do not have available infrastructure that could be used to implement the project. Because this project involves moving a small amount of water (244 acre-feet per year) over a relatively large distance (34 miles). With a cost of about $6,500 per acre-foot, this strategy is not cost-effective.
  - *Lake Coleman water to Concho, McCulloch and Runnels Counties.* This strategy was considered as an alternative to the Ivie water treatment plant in Concho County. As with the Lake Coleman to Runnels County strategy, the lack of available infrastructure that could be used to implement this strategy results in a very high implementation cost. Since Millersview-Doole WSC is pursuing the Ivie water treatment plant, this strategy is not necessary at this time.
  - *Lake Coleman water to eastern Coke County.* This strategy could relieve water supply reliability problems for the City of Bronte and others in eastern Coke County. However, this strategy is unlikely to be cost-effective because of the lack of available infrastructure to implement the project. The City of Bronte has

already pursued a new groundwater supply to improve the reliability of its water supply. Therefore this strategy was dropped from consideration.

- *Lake Brownwood water to McCulloch County.* This strategy was considered for water suppliers in McCulloch County that depend on the Hickory aquifer for water supply. However, since water suppliers in McCulloch County are already considering other options, this strategy was dropped from further analysis at this time.

- An important factor in the capability of rural systems to initiate new strategies appears to be population density and the expectation for growth. Brown County has higher population density than most of the study area and has a higher expectation for growth in rural areas. Brookesmith SUD was designed with larger water lines that anticipate additional water use. The near term water quality problems associated with oversized lines is expected to be offset by future growth and flexibility in operation. On the other hand, systems in areas with lower population densities and less expectation of growth were, by necessity, built with smaller lines. Although appropriate for these systems, the smaller lines result in a lack of excess capacity that limits the use of existing infrastructure to handle new growth or addition of new sources of water. As a result, adding a new source of water requires almost all new infrastructure to implement, increasing the cost.

- Because of the lack of economic resources to pay for new infrastructure, regionalization or other integration strategies are unlikely to be appropriate ways to solve water supply problems for rural systems in the study area. This problem is exacerbated by the lack of excess capacity in systems with large service areas and small population densities.

- If regionalization or integration strategies are pursued, water providers in the study area will most likely need to rely on volunteer construction of water lines to reduce costs. Volunteer construction of water lines has been successfully applied in programs funded by the state and federal governments to provide water to economically disadvantaged areas of Texas. It was demonstrated to be successful for communities in Region F and may be a useful way to reduce the cost of new projects for rural water providers.

- Attractive alternatives to regionalization or integration strategies include:
    - *Rainwater harvesting.* Rainwater harvesting could replace much of the water use for rural residents, particularly for outdoor water use. However, as with similar water conservation measures, the actual amount of water replaced by rainwater harvesting may not be realized by a rural water supply system. Reduced demands from their systems could lead to water quality problems, requiring more frequent flushing of water lines.
    - *Point-of-use and point-of-entry treatment.* Point-of-use and point-of-entry treatment could be a cost-effective way for small utilities facing water quality problems to meet drinking water regulations. Probably the most significant barrier to implementation of this strategy is the requirement that the local utility be responsible for all maintenance of the treatment systems. Before considering implementing this strategy, a utility should consider if access to equipment located on private property or inside private homes will be feasible.
    - *Bottled water programs.* A bottled water program is a cost-effective way to comply with drinking water regulations and has been applied successfully in Region F and throughout the nation for many years. However, the EPA considers bottled water programs to be a temporary measure. A utility implementing a bottled water program should understand an alternative way complying with drinking water standards will be required at some time in the future.
- Most of the alternative paradigms addressed in this study are local in scope and do not fit well in the context of regional planning context. Volunteer construction requires extensive community support. Only an individual utility can judge if there is sufficient support for implementing a project using this option. The use of rainwater harvesting relies on the willingness of individual home or business owners to install these systems. Pursuit of point of use treatment, point of entry treatment or bottled water programs is the decision of an individual utility. Region F can provide support for these strategies by including specific projects for utilities considering these strategies in the regional water

plan, and can support the concept in a general sense to facilitate other entities considering these strategies in the future.

9 LIST OF REFERENCES

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[6] Texas Water Development Board: Regional Water Planning Data Web Interface, available on-line at http://www.twdb.state.tx.us/data/db07/default.asp.

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[8] Environmental Protection Agency: Small System Cost Calculator, available on-line at http://www.epa.gov/OGWDW/smallsystems/compliancehelp.html

[9] Wendell Moody, Region F Water Planning Group Member from Concho County, personal communication.

[10] Office of Rural Community Affairs: Texas Small Towns Environment Program, available on-line at http://www.orca.state.tx.us/index.php/Community+Development/Grant+Fact+Sheets/Texas+Small+Towns+Environment+Program+%28STEP%29+Fund

[11] NOAA precipitation data, available on-line at http://www.weather.gov/climate/xmacis.php?wfo=sjt

[12] Texas Water Development Board: Rainwater Harvesting, available on-line at http://www.twdb.state.tx.us/iwt/Rainwater.asp

Appendix A

Rural System Study Database

Appendix A
Rural Systems Study Database

Utility Name	WUG Name	Primary County	Other County(ies)	Ident-ified Need? (Y/N)	Returned Survey? (Y/N)	CCN	Pop-ulation Served	Con-nection Count	Meter Count	People/m eter	Wholesale Customer(s)
Brookesmith SUD	Brookesmith SUD	Brown	Coleman, Mills	Y	Y	10435	9,654	3,218	3,218	3.0	Santa Anna, Coleman Co WSC
Zephyr WSC	Zephyr WSC	Brown		Y	Y	10440	4,122	1,374	1,374	3.0	City of Blanket
City of Bangs	Bangs	Brown		N		11093	1,400	802	802	1.7	Deer Run Water System
City of Blanket	County-Other	Brown		Y	Y		402	178	178	2.3	0
Deer Run Water System	County-Other	Brown		N		12131	108	33	33	3.3	
May WSC	County-Other	Brown		Y	Y	10985	300	125	125	2.4	0
Thunderbird Water Service	County-Other	Brown				11243	800	758	758	1.1	
City of Bronte	Bronte Village	Coke		Y	Y		1,076	626	530	1.7	0
City of Robert Lee	Robert Lee	Coke		Y			1,170	668	629	1.8	Coke Co WSC
Coke Co WSC	County-Other	Coke		Y		11382	681	227	218	3.0	
City of Coleman	Coleman	Coleman		Y	Y	10445	5,127	2,620	2,620	2.0	1
Coleman Co SUD	Coleman Co WSC	Coleman	Brown, Runnels, Callahan, Taylor	Y	Y	11308	5,000	2,200	2,200	2.3	0
City of Santa Anna	Santa Anna	Coleman		Y		10444	1,081	580	580	1.9	
City of Eden	Eden	Concho		Y	Y		3,000	646	588	4.6	
Millersview-Doole WSC	Millersview-Doole WSC	Concho	McCulloch, Runnels, Tom Green	Y	Y	11493	3,200	1,488	1,488	2.2	City of Paint Rock (emergency only)
Eola WSC	County-Other	Concho				10244	175	53	53	3.3	
City of Paint Rock	County-Other	Concho			Y		325	144	144	2.3	
City of Brady	Brady	McCulloch		N		11121	5,600	3,408	3,227	1.6	Richland SUD (emergency)
Richland SUD	Richland SUD	McCulloch	San Saba	Y	Y	11614	764	382	983	2.0	
Lakelands Services	County-Other	McCulloch		Y	Y	12253	51	26	26	2.0	
Live Oak Hills & Flag Creek Ranch W	County-Other	McCulloch		Y		12463	75	33	33	2.3	
Lohn WSC	County-Other	McCulloch		Y	Y	10459	200	70	70	2.9	
City of Melvin	County-Other	McCulloch		Y	Y		155	127	127	1.2	
Rochelle WSC	County-Other	McCulloch		Y	Y	10460	188	124	122	1.5	
City of Ballinger	Ballinger	Runnels		Y	Y	10277	4,243	2,491	2,491	1.7	N Runnels WSC, Rowena WSC
City of Miles	Miles	Runnels		Y		11053	1,116	372	372	3.0	
City of Winters	Winters	Runnels		Y		10229	2,880	1,313	1,313	2.2	N Runnels WSC
North Runnels WSC	County-Other	Runnels	Taylor	Y	Y	11128	2,184	728	728	3.0	
Rowena WSC	County-Other	Runnels		Y	Y	10230	386	196	196	2.0	0
Concho Rural Water Corporation	Concho Rural WSC	Tom Green		N	Y	11361	5,082	1,694	1,663	3.0	
Red Creek MUD	County-Other	Tom Green			Y		600	267	267	2.2	
Tom Green FWSD#2	County-Other	Tom Green					537	237	237	2.3	
Twin Buttes Water System	County-Other	Tom Green					81	26	5	3.1	

Utility Name	Wholsale Population	Wholsale Con-nection Count	Total Storage (MG)	Elevated Storage (MG)	Total Pro-duction (MGD)	Max Purchased Capacity (MGD)	Avg Daily Con-sumption (MGD)	Area served (sq mi)	Population Density (People/sq. mi.)	Source(s) of water (TWDB classification)
Brookesmith SUD			3.387	1.187	2.5	2.5	0.972	382	25	Lake Brownwood
Zephyr WSC		1	0.496	0.2	0.251	1.506	0.35	236	17	Lake Brownwood
City of Bangs	85	33	0.578	0.2	1.7		0.24	6	233	Lake Brownwood
City of Blanket			0.1	0.05	0.288		0.04	0.575	699	Trinity aquifer, Lake Brownwood
Deer Run Water System			0	0	0		0.013			Lake Brownwood
May WSC			0.04	0	0.115		0.023			Other aquifer
Thunderbird Water Service			0.305	0.085	0.144		0.079	3	267	Lake Brownwood
City of Bronte			0.939	0.075	2.264		0.181	1.439	748	Oak Creek Reservoir, Other aquifer
City of Robert Lee	550	346	0.575	0.1	2.59		0.264	1.14	1,026	Mountain Creek Reservoir, Spence
Coke Co WSC			0.12	0		0.24	0.04	31	22	Mountain Creek Reservoir, Spence
City of Coleman	3,000	7	2.4	1.75	3.154	0	1.368	5	1,025	Lake Coleman, Hords Creek Reser
Coleman Co SUD			0.954	0.457	1.224		0.317	1,460	3	Lake Coleman, Lake Brownwood
City of Santa Anna			0.665	0.645		0.5	0.17	2	541	Lake Brownwood
City of Eden		0	0.9	0.15	0.85		0.31	2.427	1,236	Other aquifer, Hickory aquifer
Millersview-Doole WSC	378	126	0.83	0.243	1.21	0.151	0.79	1,262	3	Hickory aquifer, City of San Angelo
Eola WSC			0.02	0	0.072		0.001			Hickory aquifer
City of Paint Rock			0.075	0.055	0.144	0.16	0.036	1.661	196	Concho River, Hickory aquifer
City of Brady	815	407	3.576	0.85	9.898	0.216	1.242	23	243	Brady Creek Res, Hickory aquifer
Richland SUD	5,433	2,854	0.15	0.15	0.432	0.144	0.16	190	4	Hickory aquifer (McCulloch Co), Ellenberger aquifer (San Saba Co), Brady Cr Res
Lakelands Services			0.038	0	0.023	0.043	0.004	1	51	Hickory aquifer, (SHALLOW WELLS CITY OF BRADY)
Live Oak Hills & Flag Creek Ranch V			0.02	0	0.036		0.006			Hickory aquifer
Lohn WSC			0.05	0	0.112		0.023			Hickory aquifer
City of Melvin			0.011	0.04	0.518		0.05	0.471	329	Hickory aquifer; POINT PEAK SHALE MEMBER (WILBERN'S FORMATION) & CAMBRIAN SYSTEM
Rochelle WSC			0.061	0	0.216		0.028			Hickory aquifer
City of Ballinger	600	8	7.15	2.65	2.5	0.45	0.489	2	2,122	Lake Ballinger, Lake Ivie
City of Miles			0.405	0.055	0		0.098	1	1,116	O.C. Fisher
City of Winters	2,000	724	0.7	0.3	1.728		0.386	9	320	Lake Winters
North Runnels WSC			0.212	0	0	0.79	0.127	650	3	Lake Balinger, Lake Ivie, Lake Winters
Rowena WSC			0.15	0.05	0.2	0.2	0.043			Lake Ballinger, Lake Ivie
Concho Rural Water Corporation			1.499	0	6.704		0.464	53	96	Lipan aquifer, E-T aquifer
Red Creek MUD			0.134	0.048	0.36	1.872	0.043	12	50	
Tom Green FWSD#2			0.348	0.073	0.676		0.054			
Twin Buttes Water System			0.01	0	0.029		0.002			E-T aquifer (?)

Appendix A
Rural Systems Study Database

Utility Name	Type of Source	Miles of pipeline	Purchase (if not self-supplied)	Treatment	Distribution	Maintenance	Other	Average Water Bill	Average Wastewater Bill
Brookesmith SUD	Purchased Treated Surface Water	550	$388,864.00	$10,000.00	$1,522,271.00	$126,685.00	$596,491.00	$48.00	N/A
Zephyr WSC	Purchased Treated Surface Water	197	$285,000.00		$800,000.00	$40,000.00	$160,000.00	$47.30	N/A
City of Bangs	Purchased Treated Surface Water								
City of Blanket	Self Supplied Groundwater, Purchased Treated Surface Water	9	$3,000.00	$1,000.00	$12,000.00	$13,000.00		$25.85	$0.00
Deer Run Water System	Purchased Treated Surface Water								
May WSC	Self Supplied Groundwater	3						$15.00	
Thunderbird Water Service	Purchased Raw Surface Water								
City of Bronte	Purchased Raw Surface Water, Self Supplied Groundwater	35	$9,000.00	$8,500.00	$52,500.00	$13,500.00	$121,353.00	$31.50	$7.50
City of Robert Lee	Purchased Raw Surface Water, Self Supplied Raw Surface Water								
Coke Co WSC	Purchased Treated Surface Water								
City of Coleman	Self Supplied Surface Water	95		$750,000.00	$500,000.00				
Coleman Co SUD	Purchased Treated Surface Water	850	$600,000.00		$600,000.00		$300,000.00		
City of Santa Anna	Purchased Treated Surface Water								
City of Eden	Self Supplied Groundwater		$0.00	$69,000.00	$91,291.00		$240,105.00	$22.00	$14.94
Millersview-Doole WSC	Self Supplied Groundwater, Purchased Treated Surface Water	639	$326,500.00	$22,500.00	$195,000.00	$188,000.00	$999,109.60	$90.75	
Eola WSC	Self Supplied Groundwater								
City of Paint Rock	Self Supplied Raw Surface Water, Purchased Groundwater	9.2	$18,000.00	$33,000.00	$15,000.00	$20,000.00	$54,000.00	$70.00	N/A
City of Brady	Self Supplied Groundwater, Self Supplied Raw Surface Water								
Richland SUD	Self Supplied Groundwater, Purchased Groundwater, Purchased Treated Surface Water	330	$0.00	$10,489.41	$68,573.13	$106,648.66	$280,345.11	$48.44	
Lakelands Services	Self Supplied Groundwater	5	$2,000.00	$300.00	$4,000.00	$2,000.00	$7,500.00	$55.00	
Live Oak Hills & Flag Creek Ranch V	Self Supplied Groundwater								
Lohn WSC	Self Supplied Groundwater	16						$40.00	
City of Melvin	Self Supplied Groundwater	10		$5,000.00	$2,500.00	$2,500.00	$53,000.00	$31.85	N/A
Rochelle WSC	Self Supplied Groundwater	20		$4,500.00	$7,200.00	$7,000.00	$15,000.00	$29.20	N/A
City of Ballinger	Self Supplied Raw Surface Water, Purchased Raw Surface Water	50	$205,512.00	$475,118.00	$349,631.00			$55.99	$16.00
City of Miles	Purchased Treated Surface Water								
City of Winters	Self Supplied Raw Surface Water								
North Runnels WSC	Purchased Treated Surface Water	500	$175,000.00	$30,000.00	$32,000.00	$48,000.00	$189,500.00	$58.99	
Rowena WSC	Purchased Treated Surface Water	18	$61,317.00			$6,841.00	$7,500.00	$35.00	None
Concho Rural Water Corporation	Self Supplied Groundwater	590		$23,000.00	$175,000.00	$75,000.00	$195,000.00	$35.00	
Red Creek MUD		11	$15,000.00	$8,000.00	$15,000.00	$10,000.00	$13,500.00	$38.00	
Tom Green FWSD#2									
Twin Buttes Water System	Self Supplied Groundwater								

Appendix B

Surveys

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: City of Ballinger
Contact Name: Tommy New
Phone: 325-365-5437 FAX: 325-365-3445 Email tommy.new@verizon.net
Website:
Mailing address: PO Box 497 zip 76821

---

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? NO

   What is the time frame for development of new sources?

   What percentage of your demand will this new source supply?
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 2491 Commercial: 334

   Wholesale: 8 Other (please specify):
4. How many miles of pipeline are in your system? 50 miles
5. What is your annual budget for:

   Water treatment? $475,118

   Water distribution? $349,631

   System maintenance? In budget

   Water purchase (if applicable)? $205,512

   Other (salaries, other operation costs, etc.) In budget
6. What is your average residential water bill (please specify monthly or annual)? $55.99
7. What is your average residential wastewater bill (please specify monthly or annual)? $16.00
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Cost of chemicals and raw water and electricity.

Thank you very much!

Please return completed surveys by November 5, 2007 to:

Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: City of Ballinger
Contact: Tommy New
Phone: 325-365-3511 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
4,243	2	2,248	2,248	N Runnels WSC	0.452	
Correct ☑	Correct ☑	Correct	Correct	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected 2491	Corrected 2491	Corrected Rowena WSC	Corrected .489	Corrected .874

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
1.058 7.15	0.408 2.65	2.88 2.5	.450	Lake Ballinger, Lake Ivie	Self Supplied Raw Surface Water, Purchased Raw Surface Water
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: City of Blanket
Contact Name: Jackie Mc Laughlin
Phone: 325-748-3171 FAX: 325-748-3171 Email blankettx@verizon.net
Website: -0-
Mailing address: P.O. Box 38
Blanket, TX 76432

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? No
   What is the time frame for development of new sources? ______
   What percentage of your demand will this new source supply? ______
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes No
   If yes, could you please provide us with a breakdown of the number of connections by use category?
   Residential: ______ Commercial: ______
   Wholesale: ______ Other (please specify): ______
4. How many miles of pipeline are in your system? 9
5. What is your annual budget for:
   Water treatment? 1,000.00
   Water distribution? 12,000.00
   System maintenance? 13,000.00
   Water purchase (if applicable)? 3,000.00
   Other (salaries, other operation costs, etc.) 13,000.00
6. What is your average residential water bill (please specify monthly or annual)? 4600.00 10/15
7. What is your average residential wastewater bill (please specify monthly or annual)? -0- 25.85 JJR
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)
   Maintance & Utilities

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: City of Blanket
Contact: Jackie Mc Laughlin
Phone: 325-748-3171 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
402	0.575	178	178	-0-	0.04	0.04
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.05	0	0.154		Trinity aquifer, Lake Brownwood	Self Supplied Groundwater, Purchased Treated Surface Water
Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☑
Corrected .10	Corrected .05	Corrected .288	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: City of Bronte
Contact Name:
Phone: 325/473-3501 FAX: 325/473-2048 Email brontetx@wcc.net
Website:
Mailing address: P.O. Box 370
Bronte, Tx 76933

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? No

   What is the time frame for development of new sources?

   What percentage of your demand will this new source supply?
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 488 Commercial: 43

   Wholesale: Other (please specify):
4. How many miles of pipeline are in your system? 35 miles
5. What is your annual budget for:

   Water treatment? $8500

   Water distribution? $52500

   System maintenance? $13500

   Water purchase (if applicable)? $9000

   Other (salaries, other operation costs, etc.) $121353
6. What is your average residential water bill (please specify monthly or annual)? $31.50
7. What is your average residential wastewater bill (please specify monthly or annual)? $7.50
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)

   Compliance with new Federal mandates, Utilities

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: City of Bronte
Contact: Pat Martindale
Phone: 325-473-3501 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
1,076	1.439	626	530		0.181	
Correct ☒	Correct ☒	Correct ☒	Correct ☒	Correct ☒	Correct ☒	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.939	0.075	2.264		Oak Creek Reservoir, Other aquifer	Purchased Raw Surface Water, Self Supplied Groundwater
Correct ☒	Correct ☒	Correct ☒	Correct ☐	Correct ☒	Correct ☒
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Brookesmith S.U.D.
Contact Name: Roger Sikes
Phone: (325) 646-5231 FAX: (325) 643-6108 Email roger@pgrb.com
Website: brookesmithsud.com
Mailing address: P.O. Box 27
Brownwood Tx 76804

---

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? NO

   What is the time frame for development of new sources? ______

   What percentage of your demand will this new source supply? ______

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 3218   Commercial: ______

   Wholesale: 1   Other (please specify): ______

4. How many miles of pipeline are in your system? 550 + miles

5. What is your annual budget for:

   Water treatment? 10,000

   Water distribution? 1,522,221

   System maintenance? 126,685

   Water purchase (if applicable)? 388,864

   Other (salaries, other operation costs, etc.) 596,491

6. What is your average residential water bill (please specify monthly or annual)? $148.00

7. What is your average residential wastewater bill (please specify monthly or annual)? NA

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) purchases water, Cost of fuel (truck + backhoes), Regulatory Fee Samples, Flushing to maintain water Quility + Residual, Water lost due to leaks + theft miles of pipe, Electricity for pumping water over distances

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Brookesmith SUD
Contact: Roger Sikes
Phone: 325-646-5731 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
8,445	382	2,815 3218	2,815 3218	Santa Anna, Coleman Co WSC	0.784	
Correct ☐	Correct ☑	Correct ☐	Correct ☐	Correct ☑	Correct ☐	Correct ☐
Corrected 9654	Corrected	Corrected 3218	Corrected 3218	Corrected	Corrected .972	Corrected 1.5 MGD

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
3.387	1.187	1.507 2.5 MGD	1.506 2.5 MGD	Lake Brownwood	Purchased Treated Surface Water
Correct ☑	Correct ☑	Correct ☐	Correct ☐	Correct ☑	Correct ☑
Corrected	Corrected	Corrected 2.5	Corrected 2.5	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: City of Coleman
Contact Name: Johnny Todd
Phone: 325-625-5412 FAX: 325-625-5837 Email Waterplant@WEB-ACCESS.NET
Website:
Mailing address: P.O. Box 592
Coleman Tex 76834

1. Please refer to the attached table.. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? NO

   What is the time frame for development of new sources? NA

   What percentage of your demand will this new source supply? NA

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 2008 Commercial: 553

   Wholesale: 7 Other (please specify):

4. How many miles of pipeline are in your system? 95

5. What is your annual budget for:

   Water treatment? ≈ $750,000.00

   Water distribution? ≈ $500,000.00

   System maintenance?

   Water purchase (if applicable)? NA

   Other (salaries, other operation costs, etc.) NA

6. What is your average residential water bill (please specify monthly or annual)?

7. What is your average residential wastewater bill (please specify monthly or annual)?

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Cost of treating water + maintaining + replacing old lines

Thank you very much!

Please return completed surveys by November 5, 2007 to:

Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: City of Coleman
Contact: Johnny Todd
Phone: 325-625-5412 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
5,127	5	2,620	2,620		1.368	2.5
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☐	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected 1	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
1.559	1.459	3.154	0	Lake Coleman, Hords Creek Reservoir	Self Supplied Surface Water
Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☑	Correct ☑
Corrected 2.4	Corrected 1.75	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Coleman County Special Utility District
Contact Name: Travis Rhoads
Phone: 325-625-2133 FAX: 325-625-2213 Email ccsud@verizon.net
Website:
Mailing address: 214 Santa Anna Ave.
Coleman, Tx. 76834

---

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources?

   What is the time frame for development of new sources?

   What percentage of your demand will this new source supply?

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 3/4 Commercial:

   Wholesale: Other (please specify): 1/4 - Livestock

4. How many miles of pipeline are in your system? 850

5. What is your annual budget for:

   Water treatment? N/A

   Water distribution?
   System maintenance? } 600,000

   Water purchase (if applicable)? 600,000

   Other (salaries, other operation costs, etc.) 300,000

6. What is your average residential water bill (please specify monthly or annual)?

7. What is your average residential wastewater bill (please specify monthly or annual)? N/A

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Disinfection, Leaks, Electricity, Fuel Costs

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Coleman Co WSC
Contact: Travis Rhoads
Phone: 325-625-2133 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
5,000	1460	2,135	2,135		0.317	
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected 2200	Corrected 2200	Corrected Ø	Corrected	Corrected .600

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.954	0.457	1.224		Lake Coleman, Lake Brownwood	Purchased Treated Surface Water
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Concho Rural Water Corp
Contact Name: B.F. Wiese
Phone: 325 658 2961 **FAX:** 325 658-2962 **Email** N/A
Website: N/A
Mailing address: 8174 Hwy 87 N
San Angelo Tx 76901

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? Yes

   JJR different well location 250-300 GPM

   What is the time frame for development of new sources? 1-2 yrs

   What percentage of your demand will this new source supply? 5%
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 1590 Commercial: 104

   Wholesale: Other (please specify):

   27 pump stations 2 water suppliers
4. How many miles of pipeline are in your system? 590
5. What is your annual budget for:

   Water treatment? 23000

   Water distribution? 125000

   System maintenance? 25000

   Water purchase (if applicable)?

   Other (salaries, other operation costs, etc.) 195000
6. What is your average residential water bill (please specify monthly or annual)? 35.00 mos.
7. What is your average residential wastewater bill (please specify monthly or annual)? —
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) (1) Power Cost (2) Water Testing (TCEQ) (3) Regulatory Fees (4) maintenance & repairs (5) Salaries

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: City of Eden
Contact Name: Celina Hemmeter
Phone: 325-869-2211 FAX: 325-869-5075 Email edencity@wcc.net
Website:
Mailing address: PO Box 915
EDEN TX 76837

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? Groundwater - Hickory Sandstone aquifer

   What is the time frame for development of new sources? 2011

   What percentage of your demand will this new source supply? 50%
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 499 Commercial: 89

   Wholesale: 0 Other (please specify):
4. How many miles of pipeline are in your system?
5. What is your annual budget for:

   Water treatment? 69,000 *

   Water distribution? 91,291

   System maintenance? * Budgeted as water operations / MAINT.

   Water purchase (if applicable)? n/A

   Other (salaries, other operation costs, etc.) 240,105
6. What is your average residential water bill (please specify monthly or annual)? 22.00/mo MINIMUM FOR WATER
7. What is your average residential wastewater bill (please specify monthly or annual)? 14.94/MO
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)

   see attached page

Thank you very much!

Please return completed surveys by November 5, 2007 to:

Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

THE STAR IN THE CENTER OF TEXAS
CITY of EDEN

December 13, 2007

Freese and Nichols, Inc
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, TX 76109

Dear Mr. Rice,

Factors that impact the cost of water for our existing system are constant repair and replacement of deteriorating and undersized water mains and laterals. Some of the mains and laterals are 75 years old. Other factors are the replacement of pumps every 8 to 10 years in two wells, the replacement of well lead pipes every 25 to 30 years, the power to lift 250 gpm, 800 ft. to produce an average daily use of 371,000 gallons, and the development of a reserve fund to develop a new water source.

The reserve is for a new well, pipeline to the treatment plant, anticipated RO treatment for radionuclides, and disposal of radioactive concentrate. The estimated depth of the well is 4,400 ft. Casing will extend to 1,500 ft. The required discharge is 250 gpm at a drawdown of 200 ft. The pipeline from the proposed well site to the water treatment plant is estimated at 8,000 ft. To meet TCEQ water standards will require treatment of 370,000 gal/day. The amount of concentrate produced and the disposal methods unknown.

I hope this information is helpful to your study. If you have any questions, pleas give us a call.

Sincerely,

Celina Hemmeter
City Secretary

Post Office Box 915
Eden, Texas 76837

Ph. (325) 869-2211
Fax(325) 869-5075

Survey Data

Utility: City of Eden
Contact: ~~Rosa L Schreiber~~ Celina Hemmeter
Phone: 325-869-2211 Fax: 325-869-5075 Email: edencity@wcc.net

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
2,561	2.427	646 *	582		0.283	
Correct ☐	Correct ☑	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected 3,000	Corrected	Corrected	Corrected 588	Corrected	Corrected .31	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.9	0.15	0.85		Other aquifer, Hickory aquifer	Self Supplied Groundwater
Correct ☑	Correct ☑	Correct ☑	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

* note that one connection serves a detention Center Facility of approx 1,300 people.

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Lakeland Services, Inc
Contact Name: Aubrey Bierman
Phone: 325-597-1125 FAX: None Email None
Website: None
Mailing address: 413 Co. Rd. 160 - Brady, TX 76825

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? No

   What is the time frame for development of new sources? ______

   What percentage of your demand will this new source supply? ______
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 26 Commercial: 0

   Wholesale: 0 Other (please specify): 0
4. How many miles of pipeline are in your system? 5
5. What is your annual budget for:

   Water treatment? $300

   Water distribution? $4000

   System maintenance? $2000

   Water purchase (if applicable)? $2000

   Other (salaries, other operation costs, etc.) 7500
6. What is your average residential water bill (please specify monthly or annual)? $55 Monthly
7. What is your average residential wastewater bill (please specify monthly or annual)? NA
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Cost of Water (Purchased) Electrical + TCEQ Fees

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Lakelands Services
Contact: Aubrey Bierman
Phone: 325-597-1125 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
51	1	~~25~~ 26	~~25~~ 26		0.004	
Correct ☑	Correct ☑	Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.038	0	0.023	0.043	~~Hickory aquifer~~ 1. Shallow Wells 2. City OF Brady	Self Supplied Groundwater
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Lohn WSC
Contact Name: Durelle Avery
Phone: 325-344-5537 FAX: ______ Email ______
Website: ______
Mailing address: P.O. Box 202
Lohn, TX 76852

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? no
   What is the time frame for development of new sources? N/A
   What percentage of your demand will this new source supply? N/A
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes No
   If yes, could you please provide us with a breakdown of the number of connections by use category?
   Residential: 70 Commercial: 3
   Wholesale: ______ Other (please specify): ______
4. How many miles of pipeline are in your system? 16 miles
5. What is your annual budget for:
   Water treatment? ______
   Water distribution? ______
   System maintenance? ______
   Water purchase (if applicable)? ______
   Other (salaries, other operation costs, etc.) ______
6. What is your average residential water bill (please specify monthly or annual)? $40.00 Monthly
7. What is your average residential wastewater bill (please specify monthly or annual)? —
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) ______

Thank you very much!

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4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Lohn WSC
Contact: Durelle Avery
Phone: 325-344-5537 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
200		66	66		0.023	
Correct ☑	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☐
Corrected	Corrected	Corrected 70	Corrected 70	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.05	0	0.112		Hickory aquifer	Self Supplied Groundwater
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: May WSC
Contact Name: Susan Edwards
Phone: (254)259-3410 FAX: ______ Email ______
Website: ______
Mailing address: PO Box 98
May, TX 76857

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? No

   What is the time frame for development of new sources? ______

   What percentage of your demand will this new source supply? ______
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: ______ Commercial: ______

   Wholesale: ______ Other (please specify): ______
4. How many miles of pipeline are in your system? 3 miles or less
5. What is your annual budget for:

   Water treatment? ______

   Water distribution? ______

   System maintenance? ______

   Water purchase (if applicable)? NA

   Other (salaries, other operation costs, etc.) ______
6. What is your average residential water bill (please specify monthly or annual)? $15.00 monthly
7. What is your average residential wastewater bill (please specify monthly or annual)? N/A
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)

   Energy costs, well and pump maitenance

Thank you very much!

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Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: May WSC
Contact: Susan L. Edwards
Phone: 254-259-3077 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
300		125	125	0	0.023	
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.04	0	0.115		Other aquifer	Self Supplied Groundwater
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: CITY OF MELVIN
Contact Name: MIKE HAGAN, CITY ADMINISTRATOR
Phone: 325 286 4222 FAX: 325 286 4204 Email amhag3@hotmail.com
Website:
Mailing address: P.O. BOX 777
MELVIN, TX. 76858

---

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? NO
   What is the time frame for development of new sources? N/A
   What percentage of your demand will this new source supply? N/A
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes / No
   If yes, could you please provide us with a breakdown of the number of connections by use category?
   Residential: ______ Commercial: ______
   Wholesale: ______ Other (please specify): ______
4. How many miles of pipeline are in your system? 10
5. What is your annual budget for:
   Water treatment? 5000.00
   Water distribution? } 2500.00
   System maintenance? }
   Water purchase (if applicable)? N/A
   Other (salaries, other operation costs, etc.) SALARIES 34,000.00 ELECTRICITY $19,000
6. What is your average residential water bill (please specify monthly or annual)? 31.85/MO.
7. What is your average residential wastewater bill (please specify monthly or annual)? N/A
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) ELEC. COST, WE HAVE ONLY (3) THREE SOURCES OF REVENUE (WATER GARBAGE TAXES) AND COST(S) TO REMEDY EXCEEDING RADIOLOGICAL MCL'S AS PER TCEQ.

Thank you very much!

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Fort Worth, Texas 76109
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Survey Data

Utility: City of Melvin
Contact: ~~Abe Rodriguez~~ MIKE HAGAN, CITY ADMINISTRATOR
Phone: 325-286-4222 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
155	0.471	127	127		~~0.09~~ 0.050	0.110
Correct ☑	Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
~~0.12~~	~~0.05~~	0.518		~~Hickory aquifer~~	Self Supplied Groundwater
Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☐	Correct ☑
Corrected .011	Corrected 0.04	Corrected	Corrected	Corrected	Corrected

POINT PEAK SHALE MEMBER (WILBERN'S FORMATION) & CAMBRIAN SYSTEM

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

From E Rebuck of TWDB

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Millersview - Doole WSC
Contact Name: Pru Rawls
Phone: 325-483-5438 FAX: 325-483-5462 Email mvdwsc@gmail.com
Website: None
Mailing address: Millersview - Doole WSC, P.O. Box 130, Millersview, TX 76862-0130

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? O. H. Ivie
   What is the time frame for development of new sources? 18 months
   What percentage of your demand will this new source supply? 50%
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes No
   If yes, could you please provide us with a breakdown of the number of connections by use category?
   Residential: ______ Commercial: ______
   Wholesale: ______ Other (please specify): ______
4. How many miles of pipeline are in your system? 639
5. What is your annual budget for:
   Water treatment? ______
   Water distribution? ______
   System maintenance? ______
   Water purchase (if applicable)? ______
   Other (salaries, other operation costs, etc.) ______
6. What is your average residential water bill (please specify monthly or annual)? ______
7. What is your average residential wastewater bill (please specify monthly or annual)? N/A
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) ______

Thank you very much!

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4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Millersview-Doole WSC
Contact: ~~Alfred Leal~~ Pru Rawls
Phone: ~~915~~ 325-483-5438 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
3,200	1262	~~1,245~~ 1488	~~1,245~~ 1488	City of Paint Rock	~~0.79~~ Emergency Only	
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.83	0.243	1.21	0.151	Hickory aquifer, ~~Lake Ivie~~ Lake Ivie is future source	Self Supplied Groundwater, Purchased ~~Raw Surface Water~~ treated water from San Angelo
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: North Runnels WSC
Contact Name: Keith Martin
Phone: (325)754-5000 FAX: (325) 754-2430 Email
Website:
Mailing address: PO Box 895
Winters, Tx. 79567-0895

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? No

   What is the time frame for development of new sources? N/A

   What percentage of your demand will this new source supply? N/A

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 704 Commercial: 24

   Wholesale: -0- Other (please specify): -0-

4. How many miles of pipeline are in your system? @ 500 miles

5. What is your annual budget for:

   Water treatment?

   Water distribution?

   System maintenance? M+S 30,000, M. Hire 500., R+M 5,000.

   Water purchase (if applicable)? 175,000.

   Other (salaries, other operation costs, etc.) 264,000.

6. What is your average residential water bill (please specify monthly or annual)? 58.99

7. What is your average residential wastewater bill (please specify monthly or annual)? N/A

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)

   ~~Gas~~ Fuel Increase
   Water Treatment - chlorine to chlorimines
   Flushing water to maintain residuals

Thank you very much!

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Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

728
x 3

Utility: North Runnels WSC
Contact: Keith Martin
Phone: 325-754-5000 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
1,500	608	728	728		0.127	
Correct ☑ KM	Correct ☐	Correct ☑	Correct ☑	Correct ☐	Correct ☑	Correct ☐
Corrected 2,184	Corrected 650	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.212	0	0	0.79	Lake Balinger, Lake Ivie, Lake Winters	Purchased Treated Surface Water
Correct ☑	Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: CITY OF PAINT ROCK / PWS # 0480012
Contact Name: SCOTT A. SPOONTS
Phone: 325-732-4330 FAX: 325-732-4330 Email PRWATER@WTXS.NET
Website: N/A
Mailing address: P.O. BOX 157
PAINT ROCK, TX. 76866

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? N/A

   What is the time frame for development of new sources? N/A

   What percentage of your demand will this new source supply? N/A

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: ____ Commercial: ____

   Wholesale: ____ Other (please specify): ____

4. How many miles of pipeline are in your system? 9.2 miles (APPROX.)

5. What is your annual budget for: $140000

   Water treatment? $33000

   Water distribution? $15000

   System maintenance? $20000

   Water purchase (if applicable)? $18000

   Other (salaries, other operation costs, etc.) $54000

6. What is your average residential water bill (please specify monthly or annual)? $70/MO.

7. What is your average residential wastewater bill (please specify monthly or annual)? N/A

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) OPERATING COSTS: CHEMICALS, ELEC., REPAIRS, & REGULATORY COSTS FOR "REQUIRED" ANNUAL CERTIFICATIONS, & INSPECTIONS, & OUTSIDE LOCAL & STATE LAB WORK

Thank you very much!

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Fort Worth, Texas 76109
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Survey Data

Utility: City of Paint Rock
Contact: Scott A Spoonts
Phone: 325-732-4330 Fax: 325-732-4330 Email: PRWATER@WTXS.NET

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
325	1.661	144	144		0.028	
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected 0	Corrected 0.036	Corrected .050

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.075	0.055	0.144	0.16	Concho River, Hickory aquifer	Self Supplied Raw Surface Water, Purchased Groundwater
Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Red Creek MUD
Contact Name: B. F. Wilcox
Phone: 325-658-2961 FAX: 325 658 2962 Email NA
Website: N/A
Mailing address: Box 38
Carlsbad TX 76934

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? —
   What is the time frame for development of new sources? —
   What percentage of your demand will this new source supply? —
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes No
   If yes, could you please provide us with a breakdown of the number of connections by use category?
   Residential: — Commercial: —
   Wholesale: — Other (please specify): — SJR
4. How many miles of pipeline are in your system? 11 12 sq mi
5. What is your annual budget for:
   Water treatment? 8000
   Water distribution? 15000
   System maintenance? 10000
   Water purchase (if applicable)? 15000
   Other (salaries, other operation costs, etc.) 13500
6. What is your average residential water bill (please specify monthly or annual)? 3800 mos
7. What is your average residential wastewater bill (please specify monthly or annual)? —
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) 1) Water Testing 2) Regulatory Fees 3) Cost of operation 4) material Cost

Thank you very much!

Please return completed surveys by November 5, 2007 to:
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Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Richland Special Utility Dist.
Contact Name: August Pope
Phone: 325-452-3210 FAX: 325-452-3210 Email rsud@centex.net
Website:
Mailing address: PO Box 217
Richland Springs TX 76871

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? ______

   What is the time frame for development of new sources? ______

   What percentage of your demand will this new source supply? ______

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: ______ Commercial: ______

   Wholesale: ______ Other (please specify): ______

4. How many miles of pipeline are in your system? 330 in [redacted] in Combine System

5. What is your annual budget for:

   Water treatment? ______

   Water distribution? ______

   System maintenance? ______

   Water purchase (if applicable)? ______

   Other (salaries, other operation costs, etc.) ______

6. What is your average residential water bill (please specify monthly or annual)? ______

7. What is your average residential wastewater bill (please specify monthly or annual)? ______

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Radium 226-228
   Gross Alpha

Thank you very much!

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Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

0.34

Survey Data

Utility: Richland SUD
Contact: August Pope
Phone: 325-452-3210 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
764	445 190	382	382		0.14 0.16	0.23
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected ✓	Corrected	Corrected	Corrected	Corrected ✓	Corrected ✓

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.15	0.15	0.432	0.216 0.144	Hickory aquifer, Ellenberger aquifer, Brady Cr Res Note	Self Supplied Groundwater, Purchased Groundwater, Purchased Treated Surface Water
Correct ☑	Correct ☑	Correct ☑	Correct ☐	Correct ☐	Correct ☐
Corrected	Corrected	Corrected	Corrected ✓	Corrected ✓	Corrected

Hickory in McCulloch Co
Ellenberger in San Saba Co

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

RICHLAND SPECIAL UTILITY DISTRICT
Po Box 217
Richland Springs, Texas 76871
325-452-3210

The Richland SUD is two (2) water systems within one CCN boundary. System ID # 1540008 is McCulloch County. System ID # 2060012 is San Saba County. The CCN ID #11614 contains both systems.

McCulloch County has 429 meters with 93 zero usage meters (See directors report pump #2). San Saba has 554 Meters with 115 zero usage meters (See directors report pump#1). Enclosed is an Enterprise Operating Fund pages from 2002 thru 2006 taken from our Annual Audit Reports.

Water Capacity Violations McCulloch County

TCEQ requires two sources of water for a system of 250 connections. We are over this number. Our pumping rate is 300gpm for our system and at the TCEQ requirement of 0.6gm/connection this would place the Richland SUD at 86% capacity. This is over the state 80% rule. The Richland SUD McCulloch County has to have more water.

Radium 226 and Radium 228, Gross Alpha Violation McCulloch County

The Richland SUD is evaluating two (2) methods at this time.

(1) The Richland SUD has just completed a new Ellenberger well in San Saba County. This well is flowing 500gpm with an estimated pumping rate if 1,500gpm without our present well will give a capacity of 1785gpm.To transfer Ellenberger water to McCulloch County is an estimated $5,500,000.00 that is if the Richland SUD does the construction.

(2) Water Remediation Technology (WRT) removal system works very well. The total capital costs $307,500.00 for equipment and building for a system

capable of treating 50,000,000gal/year at $0.78/1000 gallons or $39,000.00/year. The system will treat 300gpm. With WRT the Richland SUD would have to drill another Hickory well at an estimated cost of $750,000.00 to $1,000,000.00. The Richland SUD will limited to the 300/gpm so more WRT system would be required if the Richland SUD needed more than 50,000,000gal/year.

Comment

There is not easy way out of this mess or cheap way out. I hope this information will be helpful.

August Pope

Thanks

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Directors Report

RICHLAND SPEC. UTIL. DIST

Water Pumped This Month	**10,194,310**	**Gallons**
Water Sold This Month	**7,990,980**	**Gallons**
Water Used for Fire and Flushing Line	**660,490**	**Gallons**
Water Loss	**1,542,840**	**Gallons**
Water Loss (%)	**15.13**	**%**

	Amount ($)	**# Of Accounts**
Total Water	47,518.71	982
Total Late Charge	153.00	153
Total Adjustments	-4,634.26	25
Total METER PAYOUT	100.00	1
Total Tax	229.94	981
Total Current Charges	**43,367.39**	**982**
Amount Past Due 1-30 Days	3,702.55	70
Amount Past Due 31-60 Days	1,179.32	31
Amount Past Due Over 60 Days	5,720.25	37
Amount Of Overpayments/Prepayments	-2,096.65	153
Total Receivables	**51,872.86**	992
Total Receipts On Account	40,926.63	879
Net Change in Memberships	0.00	0
Amount of All Memberships	1,400.00	14
Turned Off Accounts (Amount Owed)	0.00	
Collection Accounts (Amount Owed)	1,077.67	17
Number Of Unread (Turned On) Meters		
Average Usage For Active Meters	8,146	982
Average Water Charge For Active Meters	48.44	981

Usage Groups Gallons	**# Of Accounts**	**Usage Gallons**	**% Of Usage**	**% Of Sales**
Over 50,000	25	2,767,800	34.64	20.17
40,001-50,000	10	456,270	5.71	2.70
30,001-40,000	17	595,570	7.45	3.73
20,001-30,000	32	761,500	9.53	5.32
10,001-20,000	109	1,596,310	19.98	13.49
8,001-10,000	46	412,040	5.16	4.42
6,001-8,000	63	430,760	5.39	5.42
4,001-6,000	92	458,180	5.73	7.11
2,001-4,000	110	325,580	4.07	7.45
1-2,000	273	186,970	2.34	17.24
Zero Usage	204	0	0.00	12.84
Total Meters	981	7,990,980	100.00	99.89

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Pump 1 Totals Report

RICHLAND SPEC. UTIL. DIST

Water Pumped This Month	**5,365,070**	**Gallons**
Water Sold This Month	**4,045,510**	**Gallons**
Water Used for Fire and Flushing Line	**349,710**	**Gallons**
Water Loss	**969,850**	**Gallons**
Water Loss (%)	**18.08**	**%**

	Amount ($)	**# Of Accounts**
Total Water	26,151.66	554
Total Late Charge	73.00	73
Total Adjustments	-4,581.51	22
Total METER PAYOUT	100.00	1
Total Tax	123.03	553
Total Current Charges	**21,866.18**	**554**
Amount Past Due 1-30 Days	1,501.03	35
Amount Past Due 31-60 Days	589.10	16
Amount Past Due Over 60 Days	3,328.09	18
Amount Of Overpayments/Prepayments	-1,054.19	64
Total Receivables	**26,230.21**	558
Total Receipts On Account	21,247.96	479
Net Change in Memberships	0.00	0
Amount of All Memberships	500.00	5
Turned Off Accounts (Amount Owed)	0.00	
Collection Accounts (Amount Owed)	659.72	8
Number Of Unread (Turned On) Meters		
Average Usage For Active Meters	7,316	554
Average Water Charge For Active Meters	47.29	553

Usage Groups Gallons	**# Of Accounts**	**Usage Gallons**	**% Of Usage**	**% Of Sales**
Over 50,000	11	1,458,300	36.05	20.45
40,001-50,000	2	87,430	2.16	0.95
30,001-40,000	8	281,010	6.95	3.20
20,001-30,000	20	467,300	11.55	5.97
10,001-20,000	56	818,610	20.24	12.65
8,001-10,000	25	225,120	5.56	4.37
6,001-8,000	31	212,220	5.25	4.85
4,001-6,000	45	220,670	5.45	6.29
2,001-4,000	56	158,240	3.91	6.82
1-2,000	175	116,610	2.88	20.08
Zero Usage	124	0	0.00	14.26
Total Meters	553	4,045,510	100.00	99.89

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Pump 2 Totals Report

RICHLAND SPEC. UTIL. DIST

Water Pumped This Month	**4,829,240 Gallons**
Water Sold This Month	**3,945,470 Gallons**
Water Used for Fire and Flushing Line	**310,780 Gallons**
Water Loss	**572,990 Gallons**
Water Loss (%)	**11.87 %**

	Amount ($)	**# Of Accounts**
Total Water	21,367.05	428
Total Late Charge	80.00	80
Total Adjustments	-52.75	3
Total Tax	106.91	428
Total Current Charges	**21,501.21**	**428**
Amount Past Due 1-30 Days	2,201.52	35
Amount Past Due 31-60 Days	590.22	15
Amount Past Due Over 60 Days	2,392.16	19
Amount Of Overpayments/Prepayments	-1,042.46	89
Total Receivables	**25,642.65**	434
Total Receipts On Account	19,678.67	400
Net Change in Memberships	0.00	0
Amount of All Memberships	900.00	9
Turned Off Accounts (Amount Owed)	0.00	
Collection Accounts (Amount Owed)	417.95	9
Number Of Unread (Turned On) Meters		
Average Usage For Active Meters	9,218	428
Average Water Charge For Active Meters	49.92	428

Usage Groups Gallons	**# Of Accounts**	**Usage Gallons**	**% Of Usage**	**% Of Sales**
Over 50,000	14	1,309,500	33.19	19.83
40,001-50,000	8	368,840	9.35	4.84
30,001-40,000	9	314,560	7.97	4.39
20,001-30,000	12	294,200	7.46	4.53
10,001-20,000	53	777,700	19.71	14.51
8,001-10,000	21	186,920	4.74	4.47
6,001-8,000	32	218,540	5.54	6.12
4,001-6,000	47	237,510	6.02	8.11
2,001-4,000	54	167,340	4.24	8.21
1-2,000	98	70,360	1.78	13.76
Zero Usage	80	0	0.00	11.09
Total Meters	428	3,945,470	100.00	99.86

Richland Special Utility District
Comparative Schedule of Revenues, Expenses, and Changes in Retained Earnings
Enterprise (Operating) Fund
Five Years Ended December 31, 2005

	2006 Amounts	2006 Percent of Fund Total Revenue	2005 Amounts	2005 Percent of Fund Total Revenue	2004 Amounts	2004 Percent of Fund Total Revenue
Operating Revenues:						
Water Sales	$474,018.19	93.2%	$413,000.29	87.7%	$371,788.60	86.3%
Late Fees	$1,604.00	0.3%	$1,424.00	0.3%	$1,355.00	0.3%
Impact Fee	$11,[illegible]	2.3%	$8,250.00	1.8%	$11,415.00	2.6%
Other Operating Income	$722.05	0.1%	$1,638.30	0.3%	$376.12	0.1%
Installation Fees & Expansion	$20,[illegible]	4.0%	$46,389.84	9.9%	$46,083.46	10.7%
Total Operating Revenues	$509,[illegible]	100.0%	$470,702.43	100.0%	$431,018.18	100.0%
Operating Expenses:						
Salaries	$156,243.69	30.7%	$138,466.92	29.4%	$136,818.95	31.7%
Training	$2,051.51	0.4%	$2,498.09	0.5%	$3,213.72	0.7%
Taxes	$10,672.92	2.1%	$11,909.14	2.5%	$11,684.34	2.7%
Maintenance Repairs	$42,700.66	8.4%	$37,388.84	7.9%	$41,755.40	9.7%
Insurance	$5,031.39	1.0%	$7,722.96	1.6%	$12,070.68	2.8%
Legal & Professional	$5,056.20	1.0%	$5,042.65	1.1%	$8,329.23	1.9%
Bad Debt Expense	$0.00	0.0%	$0.00	0.0%	$0.00	0.0%
Dues & Publications	$197.60	0.0%	$805.69	0.2%	$464.00	0.1%
Laboratory Analysis	$600.00	0.1%	$738.70	0.2%	$1,027.29	0.2%
Engineering Costs	$0.00	0.0%	$13,232.98	2.8%	$0.00	0.0%
Inspection	$1,022.50	0.2%	$1,022.50	0.2%	$1,022.50	0.2%
State Chemical Test	$1,314.00	0.3%	$729.60	0.2%	$309.00	0.1%
Radium Testing	$19.00	0.0%	$319.80	0.1%	$657.21	0.2%
Chemicals	$8,556.41	1.7%	$3,270.20	0.7%	$3,865.07	0.9%
Supplies	$23,657.34	4.6%	$18,979.05	4.0%	$22,138.17	5.1%
Automobile Expenses	$16,899.89	3.3%	$16,114.96	3.4%	$19,840.91	4.6%
Utilities	$68,573.13	13.5%	$55,375.32	11.8%	$50,933.15	11.8%
Interest Expense	$21,280.92	4.2%	$26,747.36	5.7%	$0.00	0.0%
Amortization of Bond Issuance Costs	$0.00	0.0%	$0.00	0.0%	$0.00	0.0%
Meter Installations	$22,307.77	4.4%	$33,158.32	7.0%	$33,896.17	7.9%
Election Expense	$0.00	0.0%	$0.00	0.0%	$0.00	0.0%
Depreciation Expense	$79,840.68	15.7%	$77,415.39	16.4%	$77,664.69	18.0%
Total Operating Expenses	$466,056.31	91.6%	$450,938.47	95.8%	$425,690.48	98.8%
Operating Income (Loss)	$42,952.39	8.4%	$19,763.96	4.2%	$5,327.70	1.2%
Non-Operating Revenue (Expenses):						
Interest on Temporary Investments	$14,283.97	2.8%	$5,983.54	1.3%	$8,966.35	2.1%
Gain on Sale of Equipment						
Total Non-Operating Revenue (Expenses)	$14,283.97	2.8%	$5,983.54	1.3%	$8,966.35	2.1%
Net Income (Loss)	$57,236.36	11.2%	$25,747.50	5.5%	$14,294.05	3.3%
Retained Earnings Balance January 1	$1,377,478.51	270.6%	$1,297,074.36	275.6%	$1,228,123.66	284.9%
Other Changes	$54,656.65	10.7%	$54,656.65	11.6%	$54,656.65	12.7%
Retained Earnings Balance December 31	$1,489,371.52	292.5%	$1,377,478.51	292.6%	$1,297,074.36	300.9%

The fiscal year ended December 31, 199[illegible] was the first year of operations for the Richland Special Utility District.

2003		2002	
Amounts	Percent of Fund Total Revenue	Amounts	Percent of Fund Total Revenues
$371,168.49	92.7%	$374,473.43	88.6%
$1,338.00	0.3%	$1,754.00	0.4%
$7,645.00	1.9%	$5,250.00	1.2%
$1,842.29	0.5%	$23,655.17	5.6%
$18,376.69	4.6%	$17,729.72	4.2%
$400,370.47	100.0%	$422,862.32	100.0%
$128,238.93	32.0%	$113,809.41	26.9%
$4,971.44	1.2%	$3,518.88	0.8%
$10,231.66	2.6%	$10,962.08	2.6%
$92,520.90	23.1%	$39,333.07	9.3%
$17,551.52	4.4%	$10,007.76	2.4%
$4,465.40	1.1%	$3,844.00	0.9%
$0.00	0.0%	$0.00	0.0%
$81.16	0.0%	$93.00	0.0%
$1,144.00	0.3%	$1,007.00	0.2%
$540.00	0.1%	$4,650.00	1.1%
$1,421.22	0.4%	$1,370.38	0.3%
$440.00	0.1%	$72.00	0.0%
$963.00	0.2%	$1,137.30	0.3%
$3,176.01	0.8%	$3,000.37	0.7%
$19,472.56	4.9%	$14,531.39	3.4%
$19,719.28	4.9%	$16,880.35	4.0%
$39,303.12	9.8%	$32,178.62	7.6%
$344.13	0.1%	$9,262.15	2.2%
$7,028.46	1.8%	$1,065.45	0.3%
$17,295.05	4.3%	$21,795.93	5.2%
$0.00	0.0%	$28.00	0.0%
$72,412.43	18.1%	$71,054.42	16.8%
$441,320.27	110.2%	$359,601.56	85.0%
($40,949.80)	-10.2%	$63,260.76	15.0%
$9,037.88	2.3%	$15,672.17	3.7%
$9,037.88	2.3%	$15,672.17	3.7%
($31,911.92)	-8.0%	$78,932.93	18.7%
$1,205,378.93	301.1%	$1,059,796.57	250.7%
$54,656.65	13.7%	$66,649.43	15.8%
$1,228,123.66	306.7%	$1,205,378.93	285.2%

Financial Statements

of
Richland Special Utility District
For the Period Ended August 30, 2007

Richland Special Utility District
Balance Sheet
August 30, 2007

Assets

Current Assets		
Edward D. Jones CD	$ 40,000.00	
Raymond James & Ass Inc	141,000.00	
City Natl Bank M/M	25,097.41	
Brady National Bank Debt Acct.	50.00	
Commercial Natl Bank - CD	27,243.12	
Brady National Bank Reserve	137,878.04	
Brady Natl Bank Maintenance	26,770.56	
BNB-Construction Acct	10,818.63	
City National Bank	10,469.29	
City NB-Construction	282.20	
Cash on Hand	3,867.68	
Transfers	300.00	
INTEREST RECEIVABLE	1,868.31	
Accounts Receivable	45,920.80	
Total Current Assets		$ 471,566.04
Fixed Assets		
Land	278,275.00	
Furniture	14,748.59	
Accum. Depr. _ Furniture	(19,111.84)	
Distribution System	2,867,466.87	
Capital Outlay	326,396.33	
Accum. Depr - Dist. System	(1,942,050.91)	
Equipment	157,039.23	
Accum Depr - Equipment	(61,151.61)	
Total Fixed Assets		1,621,611.66
Other Assets		
Bond Issuance Cost	15,981.70	
Accrued Amort-Bond Issue Cost	(8,938.93)	
Total Other Assets		7,042.77
Total Assets		$ 2,100,220.47

Richland Special Utility District
Balance Sheet
August 30, 2007

Liabilities and Equity

Current Liabilities				
Accrued FICA & Income Tax WH	$	(99.15)		
FUTA Payable		505.34		
TEC Payable		881.36		
Taxes - Regulatory Assmt.		1,605.65		
Accounts Payable		15,009.75		
deposit on construction meter		500.00		
Total Current Liabilities			$	18,402.95
Long Term Liabilities				
Note Payable - Brady National		238,945.14		
Total Long Term Liabilities				238,945.14
Equity				
Unreserved Retained Earnings		784,194.02		
Reserved Retained Earnings		126,924.19		
Contributed Capital		927,416.64		
Current Income (Loss)		4,337.53		
Total Equity				1,842,872.38
Total Liabilities & Equity			$	2,100,220.47

Richland Special Utility District
Income Statement
For the Period Ended August 30, 2007

	1 Month Ended Aug. 30, 2007	Budget	Variance	Pct	8 Months Ended Aug. 30, 2007	Budget	Variance	Pct
Revenue								
Water Sales	$ 41,921.86	$ 44,166.67	$ (2,244.81)	(5)	$ 298,166.79	$ 353,333.32	$ (55,166.53)	(16)
Installation Fee	375.00	364.58	10.42	3	4,875.00	2,916.68	1,958.32	67
Meter & Parts	555.00	540.33	14.67	3	6,845.00	4,322.68	2,522.32	58
Finance Charge	132.00	108.33	23.67	22	1,017.00	866.68	150.32	17
Miscellaneous Revenue	0.00	0.00	0.00	0	506.17	0.00	506.17	0
Line Extension-supplie	0.00	208.37	(208.37)	(100)	830.00	1,666.68	(836.68)	(50)
LINE EXTENSION-DI	0.00	333.33	(333.33)	(100)	31,679.32	2,666.68	29,012.64	999
Road Bore	0.00	250.00	(250.00)	(100)	0.00	2,000.00	(2,000.00)	(100)
IMPACT FEE	750.00	729.17	20.83	3	9,376.00	5,833.32	3,542.68	61
Interest Income	20.19	597.94	(577.75)	(97)	2,630.52	4,483.49	(1,852.97)	(41)
Total Revenue	43,754.05	47,298.72	(3,544.67)	(7)	355,925.80	378,089.53	(22,163.73)	(6)
Taxes								
Payroll Taxes	1,107.00	1,079.03	27.97	3	9,774.84	8,632.24	1,142.60	13
Total Taxes	1,107.00	1,079.03	27.97	3	9,774.84	8,632.24	1,142.60	13
Maintenance Expense								
Pumps & Motors - Mai	8.50	1,041.67	(1,033.17)	(99)	9,408.23	8,333.32	1,074.91	13
Buildings & Grounds -	0.00	83.33	(83.33)	(100)	539.95	666.64	(126.69)	(19)
Tanks & Reservoirs - M	0.00	350.00	(350.00)	(100)	864.39	2,800.00	(1,935.61)	(69)
Mains & Valves - Maint	0.00	1,034.05	(1,034.05)	(100)	1,912.07	8,272.40	(6,360.33)	(77)
Meters - Maintenance	16.00	166.67	(150.67)	(90)	1,579.00	1,333.36	245.64	18
Pressure Regulators -	0.00	291.67	(291.67)	(100)	910.90	2,333.32	(1,422.42)	(61)
Backhoe Maintenance	0.00	166.67	(166.67)	(100)	1,804.13	1,333.32	470.81	35
VERMEER MAINTEN	0.00	41.67	(41.67)	(100)	116.45	333.36	(216.91)	(65)
CASE 660	0.00	83.33	(83.33)	(100)	0.00	666.64	(666.64)	(100)
760 CASE	35.85	83.33	(47.48)	(57)	622.16	666.64	(44.48)	(7)
860 case	1,326.81	166.67	1,160.14	696	2,086.80	1,333.32	753.48	57
PICK UP MAINT	237.19	208.33	28.86	14	3,289.01	1,666.68	1,622.33	97
Trailer Maintenance	0.00	83.33	(83.33)	(100)	340.46	666.64	(326.18)	(49)
Water Purchased	0.00	41.67	(41.67)	(100)	0.00	333.32	(333.32)	(100)
CASE DITCHER MAI	133.29	0.00	133.29	0	748.56	0.00	748.56	0
Miscellaneous Mainten	22.69	41.67	(18.98)	(46)	193.02	333.36	(140.34)	(42)
Chlorinator Maintenan	0.00	8.33	(8.33)	(100)	0.00	66.64	(66.64)	(100)
Total Maintenanc	1,780.33	3,892.39	(2,112.06)	(54)	24,415.13	31,138.96	(6,723.83)	(22)
Salaries and Wages								
Manager Salary	3,822.34	3,822.34	0.00	0	30,578.72	30,578.72	0.00	0
Secretary Salary	1,911.00	1,911.00	0.00	0	15,287.00	15,288.00	(1.00)	(0)
OFFICE SERVICE	1,770.64	80.00	1,690.64	999	2,978.99	640.00	2,338.99	365
Contract Labor	265.00	166.67	98.33	59	1,359.75	1,333.32	26.43	2
Field Service Salary	6,087.04	6,723.87	(636.83)	(9)	52,593.73	53,790.92	(1,197.19)	(2)
Employee Benefits	221.62	141.67	79.95	56	1,207.42	1,133.32	74.10	7
Total Salaries and	14,077.64	12,845.55	1,232.09	10	104,005.61	102,764.28	1,241.33	1
Training								
Food & Lodging	201.33	83.33	118.00	142	201.33	666.64	(465.31)	(70)
Dues & Subscriptions	0.00	16.67	(16.67)	(100)	0.00	133.32	(133.32)	(100)
Total Training	201.33	100.00	101.33	101	201.33	799.96	(598.63)	(75)
Insurance Expense								
Company Insurance	0.00	541.67	(541.67)	(100)	215.00	4,333.36	(4,118.36)	(95)
Total Insurance	0.00	541.67	(541.67)	(100)	215.00	4,333.36	(4,118.36)	(95)
Legal & Professional								
Audit	0.00	400.00	(400.00)	(100)	0.00	3,200.00	(3,200.00)	(100)
Legal Expense	0.00	83.33	(83.33)	(100)	218.20	666.68	(448.48)	(67)
Engineering Expense	0.00	83.33	(83.33)	(100)	3,000.00	666.64	2,333.36	350
PUBLICATIONS	249.98	0.00	249.98	0	249.98	0.00	249.98	0
Total Legal & Pr	249.98	566.66	(316.68)	(56)	3,468.18	4,533.32	(1,065.14)	(23)
Chemicals								
BACTERIAL ANALY	140.00	58.33	81.67	140	640.00	466.68	173.32	37

	1 Month Ended Aug. 30, 2007	Budget	Variance	Pct	8 Months Ended Aug. 30, 2007	Budget	Variance	Pct
Inspection	0.00	62.50	(62.50)	(100)	736.00	500.00	236.00	47
State Chemical Test	262.00	83.33	178.67	214	826.00	666.68	159.32	24
Chlorine	42.00	166.67	(124.67)	(75)	1,073.04	1,333.32	(260.28)	(20)
PO4	0.00	333.33	(333.33)	(100)	0.00	2,666.68	(2,666.68)	(100)
Total Chemicals	444.00	704.16	(260.16)	(37)	3,275.04	5,633.36	(2,358.32)	(42)
Supplies								
Office Supplies	19.99	291.67	(271.68)	(93)	2,443.58	2,333.32	110.26	5
Postage	233.73	316.67	(82.94)	(26)	2,285.61	2,533.36	(247.75)	(10)
FOOD	101.03	166.67	(65.64)	(39)	866.26	1,333.32	(467.06)	(35)
Micellaneous Expense	0.00	41.67	(41.67)	(100)	346.18	333.32	12.86	4
Tools	150.90	83.33	67.57	81	792.00	666.64	125.36	19
Expendables	28.80	83.33	(54.53)	(65)	341.04	666.64	(325.60)	(49)
vermeer expendables	2.70	8.33	(5.63)	(68)	2.70	66.64	(63.94)	(96)
PICK UP FUEL	643.44	583.33	60.11	10	4,956.31	4,666.68	289.63	6
Backhoe Fuel	512.50	208.33	304.17	146	1,565.37	1,666.68	(101.31)	(6)
Ditcher Fuel	0.00	0.00	0.00	0	274.42	0.00	274.42	0
Communication	0.00	8.33	(8.33)	(100)	0.00	66.64	(66.64)	(100)
Miscellaneous Supplie	50.55	83.33	(32.78)	(39)	546.61	666.64	(120.03)	(18)
Total Supplies	1,743.64	1,874.99	(131.35)	(7)	14,420.08	14,999.88	(579.80)	(4)
Auto Expense								
Manager - Auto Reimbu	1,280.00	1,280.00	0.00	0	10,240.00	10,240.00	0.00	0
Secretary - Auto Reimb	96.00	96.00	0.00	0	703.20	768.00	(64.80)	(8)
Sub - Secretary - Auto	12.00	8.33	3.67	44	37.20	66.64	(29.44)	(44)
Field Service - Auto Re	172.40	116.67	55.73	48	612.64	933.32	(320.68)	(34)
Total Auto Expen	1,560.40	1,501.00	59.40	4	11,593.04	12,007.96	(414.92)	(3)
Utilities								
Telephone	372.07	358.33	13.74	4	3,144.21	2,866.68	277.53	10
Electricity	3,234.00	5,333.33	(2,099.33)	(39)	30,854.33	42,666.68	(11,812.35)	(28)
Water	33.00	33.33	(0.33)	(1)	265.50	266.64	(1.14)	(0)
Propane	0.00	183.33	(183.33)	(100)	1,539.05	1,466.64	72.41	5
Mobile Phone & Radio	147.44	266.33	(118.89)	(45)	2,801.07	2,130.68	670.39	31
Total Utilities	3,786.51	6,174.65	(2,388.14)	(39)	38,604.16	49,397.32	(10,793.16)	(22)
Depreciation								
Depreciation Expense	7,378.06	7,397.87	(19.81)	(0)	59,024.48	59,182.96	(158.48)	(0)
Total Depreciatio	7,378.06	7,397.87	(19.81)	(0)	59,024.48	59,182.96	(158.48)	(0)
Interest Expense								
Interest - Brady Natl Ba	1,182.59	1,426.64	(244.05)	(17)	10,936.86	11,413.12	(476.26)	(4)
Total Interest Exp	1,182.59	1,426.64	(244.05)	(17)	10,936.86	11,413.12	(476.26)	(4)
Case Tractor Note								
System Expansion								
System Expansion	0.00	250.00	(250.00)	(100)	3,937.36	2,000.00	1,937.36	97
Line Extension	8,292.97	1,666.67	6,626.30	398	21,752.28	13,333.32	8,418.96	63
Total System Exp	8,292.97	1,916.67	6,376.30	333	25,689.64	15,333.32	10,356.32	68
Election Expense								
Election Expense	0.00	41.67	(41.67)	(100)	0.00	333.36	(333.36)	(100)
Election Supplies	0.00	66.67	(66.67)	(100)	0.00	533.36	(533.36)	(100)
Total Election Ex	0.00	108.34	(108.34)	(100)	0.00	866.72	(866.72)	(100)
Operating INc	1,949.60	7,169.10	(5,219.50)	(73)	50,302.41	57,052.77	(6,750.36)	(12)
Net Income (Loss)	$ 1,949.60	$ 7,169.10	$ (5,219.50)	(73)	$ 50,302.41	$ 57,052.77	$ (6,750.36)	(12)

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Rochelle WAter Supply Corp.
Contact Name: W. G. Johnny King
Phone: 325-243-5307 FAX: N/A Email N/A
Website: NA
Mailing address: P.O. Box 70
Rochelle, TexAS 76872

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.

2. Do you plan to develop new source(s) of water? If so, what sources? NO

   What is the time frame for development of new sources? N/A

   What percentage of your demand will this new source supply? _____

3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: _____ Commercial: _____

   Wholesale: NONE Other (please specify): Live Stock WAter

4. How many miles of pipeline are in your system? approx 20

5. What is your annual budget for:

   Water treatment? $4,500

   Water distribution? $7,200 Elec. only.

   System maintenance? $7,000 well & elect repair.

   Water purchase (if applicable)? N/A

   Other (salaries, other operation costs, etc.) $15,000

6. What is your average residential water bill (please specify monthly or annual)? $29.20 Mo.

7. What is your average residential wastewater bill (please specify monthly or annual)? N/A

8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.) Postage, Water quality Test, TCEQ assessment fees. Office supplys.

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Rochelle WSC
Contact: William G King
Phone: 325-243-5307 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
188		124	122		0.028	
Correct ☒	Correct ☐	Correct ☒	Correct ☒	Correct ☐	Correct ☒	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.061	0	0.216		Hickory aquifer	Self Supplied Groundwater
Correct ☒	Correct ☒	Correct ☒	Correct ☐	Correct ☒	Correct ☒
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Rowena WSC
Contact Name: Bill Lange
Phone: 325-442-2331 FAX: 325-442-3302 Email
Website:
Mailing address: P.O. Box 125
Rowena, TX 76875

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1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? No

   What is the time frame for development of new sources?

   What percentage of your demand will this new source supply?
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?

   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: Commercial:

   Wholesale: Other (please specify):
4. How many miles of pipeline are in your system? approx 18 mi
5. What is your annual budget for:

   Water treatment? We purchase treated Water from Ballinger (we add Cl_2)

   Water distribution?

   System maintenance? ~~[illegible]~~ 6,841 supplies

   Water purchase (if applicable)? \$61,317

   Other (salaries, other operation costs, etc.) \$750 Meter Reader all maintance (donated labor)
6. What is your average residential water bill (please specify monthly or annual)? \$35
7. What is your average residential wastewater bill (please specify monthly or annual)? None
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)

   Price of water purchased by our system (\$4.50 per thousand)
   Cost of replacing pipe lines & Water Towers
   All paper work for TCEQ

Thank you very much!

Please return completed surveys by November 5, 2007 to:

Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Rowena WSC
Contact: Bill Lange
Phone: 325-442-2331 Fax: Email:

Population Served [a]	Area Served (sq mi) [a]	Number of Connections [a]	Number of Meters [a]	Wholesale Customer(s) [b]	Avg Daily Consumption [a] (MGD)	Max Daily Consumption [a] (MGD)
386		196	196	0	0.043	.110
Correct ☑	Correct ☐	Correct ☑	Correct ☑	Correct ☐	Correct ☑	Correct ☐
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Total Storage [a] (MG)	Elevated Storage [a] (MG)	Production Capacity [a] (MGD)	Max Purchased Capacity [a] (MGD)	Source(s) of Water [b]	Type of Source [b]
0.15	0.05	0 0.2	0.2	Lake Ballinger, Lake Ivie	Purchased Treated Surface Water
Correct ☑	Correct ☑	Correct ☐	Correct ☑	Correct ☑	Correct ☑
Corrected	Corrected	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the infomation in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Data Questionnaire
Region F Rural Water Study
September 25, 2007

Entity Name: Zephyr Water Supply Corp
Contact Name: Mike Bell
Phone: 325-739-5264 FAX: 739-2032 Email
Website:
Mailing address: P.O. Box 122
Zephyr Texas 76890

1. Please refer to the attached table. Is the information in the table correct? If not, please correct in the space below and return with this questionnaire.
2. Do you plan to develop new source(s) of water? If so, what sources? Researching New sources
   What is the time frame for development of new sources? 2 years
   What percentage of your demand will this new source supply? 100 %
3. Do you classify connections by type of use (residential, commercial, wholesale, etc.)?
   Yes No

   If yes, could you please provide us with a breakdown of the number of connections by use category?

   Residential: 1,348 Commercial: 25
   Wholesale: 1 Other (please specify):
4. How many miles of pipeline are in your system? 197
5. What is your annual budget for:
   Water treatment? N/A
   Water distribution? 800,000
   System maintenance? 40,000
   Water purchase (if applicable)? 285,000
   Other (salaries, other operation costs, etc.) Salaries 160,000
6. What is your average residential water bill (please specify monthly or annual)? 47.30 Monthly
7. What is your average residential wastewater bill (please specify monthly or annual)? N/A
8. What are the primary factors that impact the cost of water for your system? Please include factors that directly impact water delivery, as well as regulatory or other factors that contribute to the cost of delivery. (Use additional sheets if needed.)
   Cost per thousand from treated water suppliers
   Cost of electricity

Thank you very much!

Please return completed surveys by November 5, 2007 to:
Freese and Nichols, Inc.
Attn. Jeremy Rice
4055 International Plaza
Fort Worth, Texas 76109
Phone (817) 735-7397 Fax (817) 735-7491

Survey Data

Utility: Zephyr WSC
Contact: Mike Beul
Phone: 325-739-5264 Fax: 325-739-2032 Email:

Population Served[a]	Area Served (sq mi)[a]	Number of Connections[a]	Number of Meters[a]	Wholesale Customer(s)[b]	Avg Daily Consumption[a] (MGD)	Max Daily Consumption[a] (MGD)
2,550	193	1,123	1,123	City of Blanket	0.305	
Correct ☐	Correct ☐	Correct ☐	Correct ☐	Correct ☑	Correct ☐	Correct ☐
Corrected 4,122	Corrected 236	Corrected 1,374	Corrected 1,374	Corrected	Corrected 0.350	Corrected .600MGD

Total Storage[a] (MG)	Elevated Storage[a] (MG)	Production Capacity[a] (MGD)	Max Purchased Capacity[a] (MGD)	Source(s) of Water[b]	Type of Source[b]
0.269	0	0.251	1.606	Lake Brownwood	Purchased Treated Surface Water
Correct ☐	Correct ☐	Correct ☑	Correct ☑	Correct ☑	Correct ☑
Corrected .496	Corrected .200	Corrected	Corrected	Corrected	Corrected

Data Sources

a Texas Commission on Enviornmental Quality
b Texas Water Development Board

Instructions: Please verify the information in the above table. If the information is correct check the box marked correct for that cell. If the information is not correct please provide the correct information in the corrected row.

Appendix C

Rural System Conceptual Model

Table C-1
Regression Equations for Conceptual Model

Dependent Variable	Independent Variable	x2 Coefficient	x Coefficient	Constant
Miles of Pipeline	Service Area (sq. mi.)	-0.00033	0.9716	71.559
Average Water Use (MGD)	Population	0	0.000093	-0.0109
Treatment Cost ($)	Population	0	24037	6558.8
Distribution Cost ($)	Population	0	1100000	-43759
Maintenance Cost ($)	Population	0	148081	18539
Other Cost ($)	Population	0	726560	10332
Total Cost ($)	Population	0	2400000	15048

Table C-2 Conceptual Model

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	3	150	0.010	$ 6,800	$ -	$ 20,000	$ 17,600	$ 39,000	50	$ 65.00
100	165	3	300	0.017	$ 7,000	$ -	$ 21,100	$ 22,700	$ 55,800	100	$ 46.50
250	294	3	750	0.059	$ 8,000	$ 21,100	$ 27,300	$ 53,200	$ 156,600	250	$ 52.20
500	475	3	1,500	0.129	$ 9,700	$ 98,100	$ 37,600	$ 104,100	$ 324,600	500	$ 54.10
750	615	3	2,250	0.198	$ 11,300	$ 174,000	$ 47,900	$ 154,200	$ 490,200	750	$ 54.47
1,000	713	3	3,000	0.268	$ 13,000	$ 251,000	$ 58,200	$ 205,100	$ 658,200	1,000	$ 54.85
1,250	770	3	3,750	0.338	$ 14,700	$ 328,000	$ 68,600	$ 255,900	$ 826,200	1,250	$ 55.08
1,500	786	3	4,500	0.408	$ 16,400	$ 405,000	$ 79,000	$ 306,800	$ 994,200	1,500	$ 55.23

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	4	200	0.010	$ 6,800	$ -	$ 20,000	$ 17,600	$ 39,000	67	$ 48.51
100	165	4	400	0.026	$ 7,200	$ -	$ 22,400	$ 29,200	$ 77,400	133	$ 48.50
250	294	4	1,000	0.082	$ 8,500	$ 46,400	$ 30,700	$ 69,900	$ 211,800	333	$ 53.00
500	475	4	2,000	0.175	$ 10,800	$ 148,700	$ 44,500	$ 137,500	$ 435,000	667	$ 54.35
750	615	4	3,000	0.268	$ 13,000	$ 251,000	$ 58,200	$ 205,100	$ 658,200	1,000	$ 54.85
1,000	713	4	4,000	0.361	$ 15,200	$ 353,300	$ 72,000	$ 272,600	$ 881,400	1,333	$ 55.10
1,250	770	4	5,000	0.454	$ 17,500	$ 455,600	$ 85,800	$ 340,200	$ 1,104,600	1,667	$ 55.22
1,500	786	4	6,000	0.547	$ 19,700	$ 557,900	$ 99,500	$ 407,800	$ 1,327,800	2,000	$ 55.33

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	10	500	0.036	$ 7,400	$ -	$ 23,900	$ 36,500	$ 101,400	167	$ 50.60
100	165	10	1,000	0.082	$ 8,500	$ 46,400	$ 30,700	$ 69,900	$ 211,800	333	$ 53.00
250	294	10	2,500	0.222	$ 11,900	$ 200,400	$ 51,400	$ 171,600	$ 547,800	833	$ 54.80
500	475	10	5,000	0.454	$ 17,500	$ 455,600	$ 85,800	$ 340,200	$ 1,104,600	1,667	$ 55.22
750	615	10	7,500	0.687	$ 23,100	$ 711,900	$ 120,300	$ 509,500	$ 1,663,800	2,500	$ 55.46
1,000	713	10	10,000	0.919	$ 28,600	$ 967,100	$ 154,600	$ 678,000	$ 2,220,600	3,333	$ 55.52
1,250	770	10	12,500	1.152	$ 34,200	$ 1,223,400	$ 189,100	$ 847,300	$ 2,779,800	4,167	$ 55.59
1,500	786	10	15,000	1.384	$ 39,800	$ 1,478,600	$ 223,500	$ 1,015,900	$ 3,336,600	5,000	$ 55.61

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	15	750	0.059	$ 8,000	$ 21,100	$ 27,300	$ 53,200	$ 156,600	250	$ 52.20
100	165	15	1,500	0.129	$ 9,700	$ 98,100	$ 37,600	$ 104,100	$ 324,600	500	$ 54.10
250	294	15	3,750	0.338	$ 14,700	$ 328,000	$ 68,600	$ 255,900	$ 826,200	1,250	$ 55.08
500	475	15	7,500	0.687	$ 23,100	$ 711,900	$ 120,300	$ 509,500	$ 1,663,800	2,500	$ 55.46
750	615	15	11,250	1.035	$ 31,400	$ 1,094,700	$ 171,800	$ 762,300	$ 2,499,000	3,750	$ 55.53
1,000	713	15	15,000	1.384	$ 39,800	$ 1,478,600	$ 223,500	$ 1,015,900	$ 3,336,600	5,000	$ 55.61
1,250	770	15	18,750	1.733	$ 48,200	$ 1,862,500	$ 275,200	$ 1,269,500	$ 4,174,200	6,250	$ 55.66
1,500	786	15	22,500	2.082	$ 56,600	$ 2,246,400	$ 326,800	$ 1,523,000	$ 5,011,800	7,500	$ 55.69

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	20	1,000	0.082	$ 8,500	$ 46,400	$ 30,700	$ 69,900	$ 211,800	333	$ 53.00
100	165	20	2,000	0.175	$ 10,800	$ 148,700	$ 44,500	$ 137,500	$ 435,000	667	$ 54.35
250	294	20	5,000	0.454	$ 17,500	$ 455,600	$ 85,800	$ 340,200	$ 1,104,600	1,667	$ 55.22
500	475	20	10,000	0.919	$ 28,600	$ 967,100	$ 154,600	$ 678,000	$ 2,220,600	3,333	$ 55.52
750	615	20	15,000	1.384	$ 39,800	$ 1,478,600	$ 223,500	$ 1,015,900	$ 3,336,600	5,000	$ 55.61
1,000	713	20	20,000	1.849	$ 51,000	$ 1,990,100	$ 292,300	$ 1,353,700	$ 4,452,600	6,667	$ 55.65
1,250	770	20	25,000	2.314	$ 62,200	$ 2,501,600	$ 361,200	$ 1,691,600	$ 5,568,600	8,333	$ 55.69
1,500	786	20	30,000	2.779	$ 73,400	$ 3,013,100	$ 430,100	$ 2,029,400	$ 6,684,600	10,000	$ 55.71

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	30	1,500	0.129	$ 9,700	$ 98,100	$ 37,600	$ 104,100	$ 324,600	500	$ 54.10
100	165	30	3,000	0.268	$ 13,000	$ 251,000	$ 58,200	$ 205,100	$ 658,200	1,000	$ 54.85
250	294	30	7,500	0.687	$ 23,100	$ 711,900	$ 120,300	$ 509,500	$ 1,663,800	2,500	$ 55.46
500	475	30	15,000	1.384	$ 39,800	$ 1,478,600	$ 223,500	$ 1,015,900	$ 3,336,600	5,000	$ 55.61
750	615	30	22,500	2.082	$ 56,600	$ 2,246,400	$ 326,800	$ 1,523,000	$ 5,011,800	7,500	$ 55.69
1,000	713	30	30,000	2.779	$ 73,400	$ 3,013,100	$ 430,100	$ 2,029,400	$ 6,684,600	10,000	$ 55.71
1,250	770	30	37,500	3.477	$ 90,100	$ 3,780,900	$ 533,400	$ 2,536,600	$ 8,359,800	12,500	$ 55.73
1,500	786	30	45,000	4.174	$ 106,900	$ 4,547,600	$ 636,600	$ 3,043,000	$ 10,032,600	15,000	$ 55.74

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
50	119	40	2,000	0.175	$ 10,800	$ 148,700	$ 44,500	$ 137,500	$ 435,000	667	$ 54.35
100	165	40	4,000	0.361	$ 15,200	$ 353,300	$ 72,000	$ 272,600	$ 881,400	1,333	$ 55.10
250	294	40	10,000	0.919	$ 28,600	$ 967,100	$ 154,600	$ 678,000	$ 2,220,600	3,333	$ 55.52
500	475	40	20,000	1.849	$ 51,000	$ 1,990,100	$ 292,300	$ 1,353,700	$ 4,452,600	6,667	$ 55.65
750	615	40	30,000	2.779	$ 73,400	$ 3,013,100	$ 430,100	$ 2,029,400	$ 6,684,600	10,000	$ 55.71
1,000	713	40	40,000	3.709	$ 95,700	$ 4,036,100	$ 567,800	$ 2,705,100	$ 8,916,600	13,333	$ 55.73
1,250	770	40	50,000	4.639	$ 118,100	$ 5,059,100	$ 705,500	$ 3,380,800	$ 11,148,600	16,667	$ 55.74
1,500	786	40	60,000	5.569	$ 140,400	$ 6,082,100	$ 843,200	$ 4,056,500	$ 13,380,600	20,000	$ 55.75

Actual Data

Service Area (sq. mi.)	Miles of Pipeline	Population Density (people/sq. mi.)	Population	Average Water Use (MGD)	Treatment Cost	Distribution Cost	Maintenance Cost	Other Cost	Total Cost	Number of Connections	Monthly Cost per Connection
12	11	50	600	0.043	$ 8,000	$ 15,000	$ 10,000	$ 13,500	$ 46,500	267	$ 14.51
53	590	96	5,082	0.464	$ 23,000	$ 175,000	$ 75,000	$ 195,000	$ 468,000	1,694	$ 23.02
190	330	4	764	0.160	$ 10,489	$ 68,573	$ 106,649	$ 280,345	$ 466,056	382	$ 101.67
236	197	17	4,122	0.350	$ -	$ 800,000	$ 40,000	$ 160,000	$ 1,000,000	1,374	$ 60.65
382	550	25	9,654	0.972	$ 10,000	$ 1,522,271	$ 126,685	$ 596,491	$ 2,255,447	3,218	$ 58.41
650	500	3	2,184	0.127	$ 30,000	$ 32,000	$ 48,000	$ 189,500	$ 299,500	728	$ 34.28
1,262	639	3	3,200	0.790	$ 22,500	$ 195,000	$ 188,000	$ 999,110	$ 1,404,610	1,488	$ 78.66
1,460	850	3	5,000	0.317	$ -	$ 600,000	$ -	$ 300,000	$ 900,000	2,200	$ 34.09
531	*458*	*25*	*3,826*	*0.403*	*$ 12,999*	*$ 425,981*	*$ 74,292*	*$ 341,743*	*$ 855,014*	*1,419*	*$ 50.66*

Appendix D

Applicability of Point of Use and Point of Entry Treatment Technologies

1. Applicability of Treatment Technologies

The tables in this Appendix are taken from the EPA report Point of Use or Point of Entry Treatment Option for Small Drinking Water Systems[1] Exhibits D.1 and D.2. The tables show the approved treatment types to remove contaminants for Point of Use or Point of Entry Treatment.

[1] The Cadmus Group. Point of Use or Point of Entry Treatment Option for Small Drinking Water Systems, Environmental Protection Agency, Arlington VA. April 2006.

Exhibit D.1: Applicability of Point of Use Treatment Technologies

Treatment Technology	Contaminant							
	Arsenic	Copper	Lead	Fluoride	Nitrate	Synthetic Organic Contaminants	Radium	Uranium
Activated Alumina	Small System Compliance Technology			Under Investigation				X
Distillation	X	X	X		Small System Compliance Technology		?	?
Granular Activated Carbon						Small System Compliance Technology		
Anion Exchange	X				Suggested Further Investigation			Small System Compliance Technology
Cation Exchange		Small System Compliance Technology	Small System Compliance Technology				Small System Compliance Technology	
Reverse Osmosis	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Suggested Further Investigation		Small System Compliance Technology	Small System Compliance Technology
Other Adsorption Media	X							

Note: a Small System Compliance Technology has been identified by EPA as a preferred technology for systems of less than 500

Exhibit D.1 (cont): Applicability of Point of Use Treatment Technologies

Treatment Technology	Contaminant						
	Antimony	**Barium**	**Beryllium**	**Cadmium**	**Chromium**	**Selenium**	**Thallium**
Anion Exchange	Small System Compliance Technology				Small System Compliance Technology	Small System Compliance Technology	
Cation Exchange		Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology			Small System Compliance Technology
Reverse Osmosis	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology	Small System Compliance Technology

Exhibit D.2: Applicability of Point of Entry Treatment Technologies

Treatment Technology	Contaminant										
	Arsenic	**Copper**	**Lead**	**Fluoride**	**Nitrate**	**Synthetic Organic Contaminants**	**VOC's**	**Radon**	**Radium**	**Uranium**	**Microbial**
Activated Alumina	X			X							
Aeration: Diffused Bubble or Packed Tower							Questionable	Questionable			
Granular Activated Carbon						Under Investigation		Small System Compliance Technology (less than 500)			
Anion Exchange	X				X					X	
Cation Exchange		X	X						X		
Ozonation											X
Reverse Osmosis	X	X	X	X	X	X			X	X	X
Other Adsorption Media	X										
Ultraviolet Light											X

Appendix E

POE/POU Regulations and Case Studies

1. Regulations

Point-of-use and point-of-entry treatment are regulated by section 1412(b)(4)(E)(ii) of the Safe Drinking Water Act. Significant requirements of this act include:

- POE and POU devices must be owned, controlled, and maintained by the water provider or by a contractor hired by the water provider
- POE and POU devices must have mechanical warnings to automatically inform customers of operational problems
- Only units that meet American National Standards Institute (ANSI) standards may be used

Additional rules for POE treatment only are included in the Code of Federal Regulations, Title 40 Section 141.100. Section 141.100[1] of the code is specific to POE devices and does not address POU devices. Noteworthy rules include:

- The utility must develop and obtain approval from the State for a monitoring plan for POE devices. Devices must provide an equivalent health protection to central water treatment.
- For POE treatment, every building connected to the water system must have a POE device. Every property owner connected to the system must meet this requirement.
- The state must require adequate certification of performance, field testing and, if not included in the certification process, a rigorous engineering design review of the POE devices.

The Texas Commission on Environmental Quality requires that each home needs to be tested at least once every three years[2].

2. Case Studies

The EPA cites 27 case studies in *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems.* Appendix E is a summary of these studies. Only one of the case studies focused on the removal of radium through POE/POU treatment. The Illinois EPA is planning a pilot study to test the effectiveness of POE Cation Exchange for radium removal. In the selection process for a community to receive the pilot test they must have 100% user participation, the water system must be totally responsible for all parts of the operation and only POE units will be installed. The program will begin by selecting one home and collecting samples for two months before installing additional softeners in other homes. In phase two of the study 11 additional homes will have softeners installed. Based on the pilot study a hardness indicator will be selected for each water supplier in the region. When the indicator is exceeded the softener must be serviced promptly. Results from the pilot study will be published following three years of monitoring.

Many of the case studies indicate that POE/POU can be an effective alternative to traditional water treatment. The variety of treatment options allows water systems to use POE/POU to effectively treat water for most contaminants. The case studies indicated that several issues must be addressed by any water supplier, 1) access to the units, 2) effective monitoring and maintenance and 3) waste disposal. Small communities should carefully evaluate the advantages and drawbacks of POE/POU treatment relying on these case studies as an example.

Table E-1: Summary of POE/POU Applications

Location	Community Size	Contaminants	Dates	Technology	Description
Fairbanks, AK. And Eugene, OR.	4 homes	Arsenic	1989	POU AA, AX and RO.	Two homes were selected in each city to receive treatment with all three treatment options. Local and state employees performed all sampling of the units on a biweekly basis. Issues occurred with the AA tanks which were not properly pre-treated. The study found that the RO system while effective at reducing arsenic produced small amounts (3-5 gallons per day) of drinking water.
San Ysidro, NM	200 people	Arsenic, fluoride & other inorganic chemicals	1985 to current	POU RO	Utility requires all customers to have a RO unit installed under the kitchen sink and requires access for maintenance. The utility has experienced difficulty in maintaining system and obtaining consistent access. Elderly members of the community, which have been drinking water their entire lives, are resistant to the application.
Hancock, NH.	1 School	Arsenic	2000 to current	POE AA	A single tank was installed which effectively removes arsenic from the drinking water. The school was able to obtain and install the unit for less than $1,000. The system has low maintenance costs of around $100 per year.
Lummi Island, WA	10 homes	Arsenic and Cyanide	1995 to 2000	POE AX	In order to gain permission from the state to operate POE systems the homeowners had to have a certified operator, check the system monthly, notify future homeowners of the system and demonstrate a simple method for checking the system. All residents participated and an O&M manual was developed for the homeowners. The homeowners are responsible for installation, operation and maintenance of the system.
Fallon Naval Air Station	360 homes	Arsenic	2001 to current	POU RO	POU units were installed throughout the base. The systems are able to produce 25 gallons per day. The units were installed and maintained by a vendor. The vendor is responsible for waste disposal. The Navy ensures access to all units. A central water treatment plant for the Navy and the City is being planned.

Location	Community Size	Contaminants	Dates	Technology	Description
Grimes, CA	300 people	Arsenic		POU AA and Iron Media	Each unit had an automatic shutoff device. Access to homes for maintenance and installation was not difficult to achieve, although coordination of appointments were sometimes difficult. Estimated household costs were between $17-$25 per month for maintenance. The overall attitude of the community after the study was positive.
Tucson, AZ	N/A	Arsenic		POU RO and AA, POE Fe-AA and GFH	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL.
Sun City West, AZ	N/A	Arsenic		POU RO and AA, POE Mn-AA, Fe-AA, GFH	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL.
Stagecoach, NV	N/A	Arsenic		POE Fe-AA and GFH	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL.
Unity, ME	N/A	Arsenic		POU RO and Mn-AA	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL except the RO device.
Carson City, NV	N/A	Arsenic		POU GFH and POE Mn-AA	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL.
Houston, TX	N/A	Arsenic		POE GFH and Fe-AA	These systems were evaluated at various sites. These devices were operated in both continuous and intermittent conditions. Weekly samples were taken of the raw water. All devices tested were capable of removing arsenic to levels below the new MCL.

Location	Community Size	Contaminants	Dates	Technology	Description
Florence, MT	N/A	Copper		POU CX	One unit was installed at a school and one unit was installed in a residence. The units were sampled on a weekly basis. Breakthrough of copper was observed after five months at the school and after two months at the residence. After breakthrough Copper levels were higher in the treated water than the influent water.
Location 2, MT	16 units	Copper and Lead	2000	POU RO	The cost of each system was $970 installed. Ongoing maintenance is conducted by the vendor. To date the units have worked well reducing Copper by 93% and lead levels by 40%.
Suffolk, VA	56 homes	Fluoride	1992 to 1998	POU RO	All homeowners were required to participate and sign a home access agreement. There were no significant problems in achieving 100% participation. Units were installed in homes under the kitchen sink and were also connected to refrigerators with ice makers. The units performed well and a post study survey indicated that 75% of the homeowners were satisfied with the service and quality of their water.
Emington, IL	47 homes	Fluoride and TDS		POU RO	Low pressure RO units were installed by equipment dealers and monitored for eight months. While the RO units operated well in removing fluoride, a significant drawback was their low water output of approximately 3 gallons per day. Many homeowners purchased up to 30 gallons per month of bottled water.
New Ipswich, NH	600 people	Fluoride	1997 to current	POE RO, AA and UV	A system was installed in a school to reduce fluoride levels. A central system which supplied six water fountains and two sinks was determined to be more cost effective than individual units. Multiple and redundant treatment components were used to ensure effective removal. The total system cost $17,230 installed.
Opal, WY	98 people	Fluoride and Sulfate	2002 to current	POU RO	The town passed an ordinance requiring 100% participation in the POU program. The town obtained state permission to use the lowest level of state certified water system operator to operate and maintain the systems. Access to the units was fairly simple to obtain and residents were willing and cooperative in the project.

Location	Community Size	Contaminants	Dates	Technology	Description
Suffolk County, NY		Nitrate	1983	POE/POU GAC, IX, RO and Distillation	All units demonstrated the ability to remove the contaminants, and consumers were satisfied with the performance of the units. Several problems were encountered during the study attributed to poor installation. Once these units were replaced all units functioned satisfactorily.
Hamburg, WI	200 people	Nitrate	1996 to current	POE AX	A unit was installed at an elementary school. The unit has been extremely successful at reducing nitrate levels well below the MCL since its installation.
Fort Lupton, CO	100 homes	Nitrate and TSS	2000 to current	POU RO	Every home in the city was equipped with an under sink unit. A town meeting was held to inform all homeowners and an owner's manual was developed for all residents. The city required a licensed plumber and a licensed electrician to oversee each installation. The maintenance was conducted by the city.
Various States	121 homes	Radon		POE GAC	121 POE GAC units were installed in 12 states and were monitored over seven years. Sixty percent of the installations were done by homeowners. Removal rates were above 90% and costs range from $775 -$1,225.
Derry, NH	2 units	Radon	1990	POE GAC and Aeration	Initially both POE GAC units removed 97.5% of the radon for the first four months of the study. For the remaining eight months the radon amount rose and did not comply with the MCL. The aeration system removed greater than 99% of the radon. However, when the air hose became clogged radon removal rates dropped significantly. An automatic alarm and shutoff system need to be installed to avoid this malfunction.
Byron, IL		Trichloroethylene	1986	POU/POE GAC	A salvage yard near the city had contaminated the drinking water. Homeowners were required to use bottled water while POU/POE devices were installed. Four options were presented for another nearby community. Connection to a treatment facility at $900,000 (1986 dollars), bottled water at $91,000 which would not prevent direct contact with contaminated water, equipping each home with a POU unit for $26,000 which would not prevent human contact and POE treatment at $115,000. The fourth alternative was selected.

Location	Community Size	Contaminants	Dates	Technology	Description
Elkhart, IN	66 homes	Trichloroethylene and Carbon Tetrachloride	1986	POE GAC, Aeration and	Significant contamination was detected and EPA immediately provided bottled water. POE units were installed throughout the community. Monitoring was conducted showing that he units effectively reduced the levels of contaminants. The lifetime of the filters was uncertain and the amount of water treated differed substantially.
Hudson, WI	155 homes	Trichloroethylene and 1,1,1- Trichloroethylene	1995 to current	POE GAC	An industrial plant was contaminating the local water supply. The plant was required to remediate the problem and chose to install POE units for each residence. In order to obtain a POE unit a residence must sign an access agreement. One resident chose not to sign the agreement and was provided with bottled water. Maintenance appointments were charged at two different rates, one lower during the day and a higher rate for nights and weekends. Some complaints were made about pressure drops in their taps
Illinois		Radium		POE CX	The Illinois EPA is conducting a study. The study requires 100% participation in the program. The water system must be totally responsible for all aspects of the operation. In addition only POE units will be allowed. This project is still in the planning stages.

[1]United States Government Printing Office. Code of Federal Regulations Title 40 Section 141.100. http://www.gpoaccess.gov/cfr/index.html, May 2008

[2]Texas Secretary of State. Texas Administrative Code 30 TAC 290 Subchapter F Section 290.117(h)(2)(c), http://info.sos.state.tx.us/pls/pub/readtac$ext.viewtac, May 2008

Appendix F
Cost Estimates

Cost Estimate F-1

WUGNAME: Runnels County Other (North Runnels WSC)
STRATEGY: Lake Coleman Water to Runnels County
STRATEGY NUMBER:
AMOUNT (ac-ft/yr): 224

CONSTRUCTION COSTS

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipe	8 in.	179,000	LF	$ 32	$ 5,728,000
Pressure reducing valve		1	LS	$ 12,400	$ 12,400
Engineering and Contingencies (30%)					$ 1,722,000
Subtotal Pipeline					$ 7,462,400

Pump Station	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pump Station	31 HP	2	LS	$ 562,000	$ 1,124,000
Storage Tank	0.5 MG	2	LS	$ 407,000	$ 814,000
Engineering and Contingencies (35%)					$ 678,000
Subtotal of Pump Station(s)					$ 2,616,000

CONSTRUCTION TOTAL		$ 10,078,400
Permitting and Mitigation		$ 92,000
Interest During Construction	(6 months)	$ 218,000
TOTAL COST		**$ 10,388,400**

ANNUAL COSTS	
Debt Service (6% for 20 years)	$ 906,000
Electricity ($0.09 kWh)	$ 15,000
Operation & Maintenance	$ 127,000
Treated Water Purchase	$ 416,000
Total Annual Costs	**$ 1,464,000**

UNIT COSTS (Until Amortized)	
Per Acre-Foot of treated water	$ 6,536
Per 1,000 Gallons	$ 20.04

UNIT COSTS (After Amortization)	
Per Acre-Foot	$ 2,491
Per 1,000 Gallons	$ 7.64

Notes: Cost for buying treated water is assumed to be $5.70 per 1,000 gallons

Cost Estimate F-2

WUGNAME:	Millersview-Doole WSC
STRATEGY:	Lake Coleman Water to Concho County
STRATEGY NUMBER:	
AMOUNT (ac-ft/yr):	443

CONSTRUCTION COSTS

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipe	10 in.	181,500	LF	$ 40	$ 7,260,000
Pressure reducing valve		1	LS	$ 12,400	$ 12,400
Right-of-way easements		83	AC	$ 1,000	$ 83,000
Engineering and Contingencies (30%)					$ 2,207,000
Subtotal Pipeline					$ 9,562,400

Pump Station	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pump Station	27 HP	1	LS	$ 643,200	$ 643,200
Storage Tank	0.5 MG	1	LS	$ 407,000	$ 407,000
Engineering and Contingencies (35%)					$ 368,000
Subtotal of Pump Station(s)					$ 1,418,200

CONSTRUCTION TOTAL		$ 10,980,600
Permitting and Mitigation		$ 100,000
Interest During Construction	(6 months)	$ 238,000
TOTAL COST		**$ 11,318,600**
ANNUAL COSTS		
Debt Service (6% for 20 years)		$ 987,000
Electricity ($0.09 kWh)		$ 12,000
Operation & Maintenance		$ 119,000
Treated Water Purchase		$ 823,000
Total Annual Costs		**$ 1,941,000**
UNIT COSTS (Until Amortized)		
Per Acre-Foot of treated water		$ 4,381
Per 1,000 Gallons		$ 13.44
UNIT COSTS (After Amortization)		
Per Acre-Foot		$ 2,153
Per 1,000 Gallons		$ 6.61

Notes: Cost for buying treated water is assumed to be $5.70 per 1,000 gallons

Appendix G

Volunteer Construction

1. Colonia Self-Help and Community Self-Help Programs

The State of Texas has two programs for providing water and wastewater infrastructure to economically disadvantaged communities. An Economically Disadvantaged Community is defined as an area where water supply or wastewater treatment are inadequate to meet minimal state standards, the financial resources are inadequate to provide services to meet those needs, and there was an established residential subdivision in either June 1, 2005 for the community program or November 1, 1989 for the Colonia program. A Colonia is a special category of Economically Disadvantaged Communities located in areas near the Texas-Mexico border.[1,2] In order to qualify for funding, a community must be in a county which has a median income that is less than 75 percent of the median state household income[3]. Although the county may be above the 75 percent median, the water supplier may prove the service area is less than 75 percent of the state median by conducting a survey developed by the TWDB. Table 1 compares the median income for the study area to median state household income. Coke, Coleman, McCulloch and Runnels Counties qualify under this criterion. Water Supply Corporations and Municipal Utility Districts which supply rural areas are eligible for funding. In order to qualify for colonia program funds, the county must be adjacent to an international border, which does not apply to any county in the study area.

One of the typical features of projects funded through these programs is the use of community volunteers to assist with implementation of these projects. As a result, implementing a project that uses community volunteers for construction is not an unusual concept for projects in rural areas. These types of projects have historically been eligible for both state and federal funds.

Table 1
2005 Median Household Income and Percent of State Median Household Income for Study Area

State or County	2005 Estimated Median Income	% of State
Texas	$42,165	
Brown County	$33,990	81%
Coke County	**$30,657**	**73%**
Coleman County	**$27,187**	**64%**
McCulloch County	**$28,944**	**69%**
Runnels County	**$30,070**	**71%**
Tom Green County	$37,203	88%
Concho County	$32,122	76%

Data are from the U.S. Census Bureau Small Area Income and Poverty estimates for the year 2005. Counties in bold text qualify for Economically Disadvantaged Community programs.

2. Regulatory Issues

Several regulatory issues are involved in the construction of any water supply pipeline, including a pipeline which is self-constructed. Construction is regulated by the Texas Commission on Environmental Quality (TCEQ) and rules governing pipeline construction may be found in Title 30 Chapter 290, subchapter D, Rule 290.44[4]. The rules specify that pipelines must meet American Water Works Association industry standards, provide information on the sizing of pipelines, and the location of pipelines in respect to other pipelines. Plans for pipelines must be designed and sealed by a licensed engineer. It is possible for the volunteer construction of any pipeline although substantial supervising of the construction may be required to meet all of the regulations.

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[1] Texas Water Development Board. Colonia Self Help Program http://www.twdb.state.tx.us/assistance/financial/fin_infrastructure/self-help.asp#AreaEligibility, May 2008

[2] Texas Water Development Board. Economically Distressed Areas Program http://www.twdb.state.tx.us/assistance/financial/fin_infrastructure/edapfund.asp, May 2008

[3] United States Census Bureau. http://www.census.gov/hhes/www/saipe/, May 2008

[4] Texas Secretary of State. Texas Administrative Code Title 30 Chapter 290, subchapter D, Rule 290.44 http://www.sos.state.tx.us/tac/, May 2008

Appendix H

Rainwater Harvesting

1. Feasibility in Region F

In Texas, two state agencies publish data on the topic of rainwater harvesting. The Texas Water Development Board (TWDB) primarily focuses on the supply aspect of rainwater harvesting in two documents: *Rainwater Harvesting Potential and Guidelines for Texas*[1] and the *Texas Manual on Rainwater Harvesting.*[2]. The TCEQ publishes data on the uses of rainwater harvesting for domestic indoor use and the feasibility of rainwater harvesting for public water systems in two reports: *Harvesting, Storing, and Treating Rainwater for Indoor Use,*[3] and *Rainwater Harvesting: Guidance for Public Water Systems*[4]. According to the TWDB publications, an average rainfall of 20 inches or greater is required for rainwater harvesting. Region F on average receives approximately 20 inches of rainfall or less so rainwater harvesting may not be feasible in some areas. Most of the literature recommends that rural users install a rainwater harvesting system where connecting to a public water system may not be possible. The TCEQ treats rainwater harvesting by individual homes in the same manner as well water. This water is not regulated or tested, although the TCEQ guidance does contain recommendations for potable use[3]. Whenever rainwater is being used for non-potable use within the home, TCEQ requires the use of separate plumbing to deliver water to points within a home. An air gap (greater than 1 inch) must exist between pipes for potable use and non-potable use. Lastly, the home must have a backflow preventer installed at the service meter. Rainwater systems used for irrigation will also require an air gap between pipes containing potable water. Non-potable uses require a minimal amount of disinfection within the storage tank using liquid bleach which can be purchased at pool supply stores and local convenience stores.

2. Public Utility Use

In addition to household use, TCEQ regulations allow rainwater harvesting as a source for public water systems[4]. Regulations for public water systems may be found in Texas Administrative Code (30 TAC) Chapter 290 subchapters D and F[5]. One requirement is that the roof and storage reservoir must be large enough to capture and store enough untreated water to provide an adequate reserve during periods when there is limited rainfall. The facilities must be capable of treating enough rainwater to meet the customer’s maximum day demand, which normally would occur during dry periods. Because of the large collection area and storage volume needed to reliably supply water, rainwater harvesting as a single source of supply for a public water system is most likely not feasible in Region F, although supplementing other sources with rainwater may be a feasible option. Depending on a Public Utility's other water sources, rainwater may require additional treatment or a different type of treatment. A licensed engineer must demonstrate that the treatment technologies meet the required level for public health and consumption.

Another option is to supplement water received from a public water system with on-site rainwater harvesting and non-potable use to reduce consumption. Any use of rainwater for non-potable use supplied from a public water supplier requires a separate system to prevent cross-contamination.

3. Cost of Installing an Individual Rainwater Harvesting System

The average home roof area of 2,000 square feet was assumed for a home in Region F. Google Earth was used to verify average square roof area for three cities in Region F. San Angelo, Brady, and Brownwood. The assumption of 2,000 sq ft is relatively close to the averages obtained using Google Earth. Roof type is the first thing that may impact the cost of rainwater harvesting. Only metal and clay or concrete tile roofs allow the harvesting of rainwater for potable use. Other roof types such as composite or asphalt shingles have many toxins which prevent potable use. Standard gutter systems may need to be modified to allow rainwater harvesting. All gutters must drain to a central location. In many cases some sort of screen or filter must be used to remove leaves and other debris. First flush diverters must be installed to divert the initial flows from a rainfall event to keep dust and sediment away from the storage tank. The storage tank is the largest component and has the greatest impact on the cost of the rainwater harvesting system. The size of the tank is dictated by the purpose of use and the frequency of rainfall. Using rainwater harvesting as the sole source of water for a residence requires a tank that can store water through the longest expected dry period. According to the *Texas Manual on Rainwater Harvesting*, this period is roughly between 75-100 days without rainfall in Region F. A smaller storage tank may be used when rainwater is used only for landscape irrigation.

Based on the needs to create the rainwater harvesting system described above and the assumption of a 5,000 gallon storage tank, the cost will be approximately $8,000. Increasing the size of the storage tank adds approximately $1.50 per gallon of storage, with a 10,000 gallon storage tank adding $7,500 to the cost of the system. As mentioned earlier a greater storage collection area and storage tank is needed for areas with longer periods without rainfall or with low amounts of rainfall.

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[1]Rainwater Harvesting Evaluation Committee, Rainwater Harvesting Potential and Guidelines for Texas, Texas Water Development Board, Austin TX, November 2006.

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