Water Rights Analysis and ASR Feasibility in Kerr County

Prepared for:

Plateau Region Water Planning Group
and
Texas Water Development Board

May 2009

LBG-Guyton Associates

Freese and Nichols, Inc.

Table of Contents

List of Tables

List of Figures

1.0 Executive Summary

As the population of Kerr County continues to increase, the availability of water to meet the growing demand and the infrastructure to deliver the water continues to be of local concern. Although the Guadalupe River traverses the County, local entities have limited permitted access to surface water supplies. While Kerrville is able to use both surface water and groundwater, other municipal water suppliers rely entirely on groundwater sources. The purpose of this study was to assess the feasibility of two water management strategies proposed in the 2006 Plateau Region Water Plan to address potential future water shortages for the City of Kerrville and the rural population of Kerr County as potentially serviced by the Upper Guadalupe River Authority (UGRA).

The Guadalupe River Basin has 358 water right permits, of which 191 are located above Canyon Lake. The best water rights to supplement Kerr County water supplies are those located above Canyon Lake. An analysis of potentially available water rights was performed in which reliability, location, and valuation were considered. Also evaluated were the impact of moving diversion points upstream and the potential use of wastewater effluent.

The feasibility of constructing an aquifer storage and recovery (ASR) facility to provide additional water supplies for the eastern part of Kerr County was evaluated. The evaluation assumed a facility site near the Community of Center Point, a water supply source based on UGRA water rights, additional water rights that could be leased or purchased, and injection and storage of treated water underground in the Lower Trinity Aquifer.

For this analysis a surface water diversion of 3,029 acre-feet per year is assumed. This diversion is composed of the existing UGRA water right (2,000 acre-feet per year) and additional rights leased or purchased (1,029 acre-feet per year). A direct distribution from the treatment facility of 1,124 acre-feet per year (1.5 MGD) would be made and a maximum consideration of 1,905 acre-feet per year (2.5 MGD) would be injected and recovered. The cost of purchasing additional water rights for 1,029 acre-feet per year is $974,100 (2008 dollars).

The facility for treating water from the Guadalupe River near Center Point is assumed to have an approximate capacity of 4 MGD. Cost estimates assume a low-pressure membrane treatment process for particle removal (microfiltration) and a second stage treatment with high-

pressure membranes (nanofiltration) for softening 50% of the flow. A 16 MG terminal reservoir is recommended to buffer high turbidity peaks from the Guadalupe River.

The estimated capital cost for this plant is $13,725,000 (2008 dollars), which includes the raw water pump station, terminal storage reservoir, residuals handling facilities, high service pump station, clearwell, engineering and contingencies. The annual cost of operation and maintenance is $194,000. The cost to construct and equip a single Lower Trinity well capable of both injection and withdrawals is approximately $403,000. Modeling results suggest that at least two wells will be needed. The overall capital cost is $15,505,100, which includes purchase of 11 water rights, a 4 MGD treatment plant and 2 wells. The unit cost of this strategy is $1,217 per acre-foot.

A Lower Trinity Aquifer groundwater simulation model constructed by LBG-Guyton Associates for the Bandera County River Authority and Groundwater District and supported by the Headwaters Groundwater Conservation District was used to assess the ASR potential in eastern Kerr County. Based on the conceptual understanding and assimilated data, a one-layer MODFLOW groundwater flow model was developed. The model was calibrated to pre-development conditions and the transient conditions from 1950 through 2005.

The model evaluation indicates that a total injection of 2.54 MGD in two wells is overly aggressive from a hydrogeologic perspective because the Lower Trinity water level (pressure) in the nearby wells would be above ground surface. Alternative simulation scenarios suggest that, under the given assumptions, around 0.6 MGD would be the most feasible injection rate at which pressurized water levels near the injection wells would not rise above the land surface. However, increased well spacing or additional wells could potentially allow for an increased injection rate.

2.0 Introduction

As the population of Kerr County continues to increase, the availability of water to meet the growing demand and the infrastructure to deliver the water continues to be of local concern. Although the Guadalupe River traverses the County, local entities have limited permitted access to surface water supplies. While Kerrville is able to use both surface water and groundwater, other municipal water suppliers rely entirely on groundwater sources.

The purpose of this study is to assess the feasibility of two water management strategies proposed in the 2006 Plateau Region Water Plan (LBG-Guyton and Freese and Nichols, 2006) to address potential future water shortages for the City of Kerrville and the rural population of Kerr County as potentially serviced by the UGRA. The first strategy (Strategy J-1) considers the purchase or lease of water rights from the UGRA to increase surface water availability and enhance Kerrville's ASR program. The current project expands this strategy to considering other water rights in the upper Guadalupe River Basin. The acquisition of additional water rights would also positively impact needed supplies for Strategy J-4, which considers the expansion of Kerrville's water treatment and ASR capacity. The second strategy (Strategy J-7) considers the development and delivery of water to rural users in Kerr County (County-Other) by UGRA. The current project also considers the feasibility of developing an ASR program by UGRA. The assessment of surface water availability, hydrogeological description of the Lower Trinity Aquifer, delivery scenarios and infrastructure costs are presented in this study.

Both strategies require securing additional surface water diversions through the purchase or lease of water rights in the Guadalupe River Basin or the use of existing wastewater effluents. This study identified a group of water rights that meet the minimum desirable reliability. Only water rights in the Guadalupe River Basin above Canyon Lake were considered in this analysis.

Table 2.1 is a summary of the City of Kerrville's supply and demand taken from the 2006 Plateau Region Water Plan. Kerrville's water supply is 3,040 acre-feet per year, which is the total of 2,890 acre-feet per year of current groundwater supply (based on a permit from the Headwaters Groundwater Conservation District) and 150 acre-feet per year of reliable surface water rights (as determined by the Texas Commission on Environmental Quality's (TCEQ) Water Availability Model of the Guadalupe River Basin, or Guadalupe WAM). Based on these supply and demand estimations, Kerrville will need to develop 2,222 acre-feet per year of

additional supplies to meet its future needs. Enhancement of the Kerrville ASR project as recommended in the Plateau Region Water Plan would increase Kerrville's supply by 2,240 acre-feet per year (average 2 MGD).

Table 2.1 Supply and Demand for City of Kerrville
(From the 2006 Plateau Region Water Plan)

	2010	2020	2030	2040	2050	2060
Supply (acre-feet/year)	3,040	3,040	3,040	3,040	3,040	3,040
Demand (acre-feet/year)	4,362	4,746	4,918	4,937	5,152	5,262
Additional Supplies Needed	1,322	1,706	1,878	1,897	2,112	2,222

The UGRA contemplates becoming a wholesale water provider in coming years with the intent to supply water in Kerr County to those users not served by the City of Kerrville. Table 2.2 shows the supply and demand for County-Other users in Kerr County as presented in the 2006 Plateau Region Water Plan. Although a supply deficit is not forecasted for the County-Other category, the Plateau Water Planning Group is concerned that future population growth in the unincorporated areas of the County could result in supply problems. UGRA's interest in becoming a conjunctive use wholesale water provider and the development of an ASR project were included in the 2006 Plateau Region Water Plan to meet this potential need. Declining groundwater levels are also a concern. Therefore, decreasing the use of existing groundwater is desirable.

Table 2.2 Supply and Demand for Kerr County, County - Other
(From the 2006 Plateau Region Water Plan)

	2010	2020	2030	2040	2050	2060
Supply (acre-feet/year)	12,558	12,558	12,558	12,558	12,558	12,558
Demand (acre-feet/year)	2,322	2,510	2,551	2,572	2,705	2,784
Surplus (acre-feet/year)	10,236	10,048	10,007	9,986	9,853	9,774

3.0 Water Rights Analysis for Upper Guadalupe Basin

3.1 Description of Water Rights

The Guadalupe River Basin has 358 water right permits. The information collected on the water rights in the entire Guadalupe River Basin shows that:

a. The total authorized diversions are 6.13 million acre-feet per year. Of this amount, 5.30 million acre-feet per year are entirely non-consumptive rights for hydroelectric power and 209,189 acre-feet per year are entirely non-consumptive diversion for steam electric generation. These non-consumptive rights account for 90% of the total authorized diversion in the Basin. These large water rights are listed in Table 3.1.

b. The non-consumptive use shown in Table 3.1 is authorized by eight water rights. These water rights are owned by the City of Gonzales, the Guadalupe Blanco River Authority (GBRA), Small Hydro of Texas Inc., Texas State University, New Braunfels Utilities, Victoria WLE, and Hydraco Power Inc. The water rights owned by the GBRA have a priority date of April 1, 1914 and September 16, 1926 and are among the most senior water rights in the basin.

c. The 10 largest water rights with consumptive use have an annual diversion between 120,000 and 9,676 acre-feet per year and a consumptive use between 106,000 and 500 acre-feet per year. For many of these water rights, the consumptive use is less than the authorized diversion. These top 10 water rights are listed in Table 3.2.

d. The change of cumulative consumptive use with priority date is shown in Figure 3.1. Consumptive use amount were obtained from hard copies of the Certificates of Adjudication or Permits issued by the TCEQ.

e. The City of Kerrville and UGRA own water rights for a diversion of 8,077 acre-feet per year under several permits as follows:

Permit	Annual Amount (acre-feet per year)
1996	225
3505	3,603
3635	80
5394	4,169
Total	**8,077**

There are 191 water rights located above and including Canyon Lake, including those associated with GBRA's administration of the reservoir (CA-18-2074) and those owned by the City of Kerrville and the UGRA. The locations of the diversion points of the water rights above and including Canyon Lake are shown in Figure 3.2. Detailed information about these water rights was obtained from the TCEQ and is shown in Attachment 1.

The best water rights to supplement Kerr County water supplies are those located above Canyon Lake. The UGRA and Kerrville own five water rights, which were excluded in the purchase analysis. Another water right (4167) owned by GBRA for hydropower use was also excluded because it has no consumptive use. According to the 2006 Plateau Regional Water Plan, the City of Kerrville has identified its need to develop agreements with the Guadalupe Blanco River Authority (GBRA) that will provide for subordination of GBRA's Canyon Reservoir authorization to the City's existing permits. Water available from Canyon Reservoir to the City of Kerrville and UGRA will likely be available through a water contract or subordination agreement, a strategy that is different from a purchase or lease. Therefore, water rights associated with Canyon Lake were not considered in the analysis.

The following statements summarize the basic information on the water rights considered for purchase or lease:

a. There are 184 water rights above Canyon Lake, excluding those owned by Kerrville, UGRA, and GBRA. The total authorized diversion by these rights is 16,345 acre-feet per year and the consumptive use is 10,821 acre-feet per year. Most of the authorized diversions above Canyon Lake are for irrigation.

b. The authorized use is divided as follows:

Use	Acre-Feet/Year	Percent	
Municipal	299	1.8%	
Industrial	5,797	35.5%	(5,380 non-consumptive)
Irrigation	10,064	61.6%	
Mining	143	0.9%	(123 non-consumptive)
Other	42	0.26%	(21 non-consumptive)
Total	16,345	100%	

c. The authorized diversion amount senior to the GBRA water right for Canyon Lake is 4,868 acre-feet per year with a consumptive use of 4,745 acre-feet.

d. The Texas Parks and Wildlife Department owns the largest water right for fish hatchery operations in Heart of the Hills Fisheries (Certificate of Adjudication 18-1975). This water right has an authorized diversion of 5,780 acre-feet per year with a consumptive use limited to 400 acre-feet per year. The priority date is July 1, 1925. The remaining 5,380 acre-feet per year are non-consumptive with a priority date of July 22, 1992.

Figure 3.1 Cumulative Consumptive Use vs. Priority Date

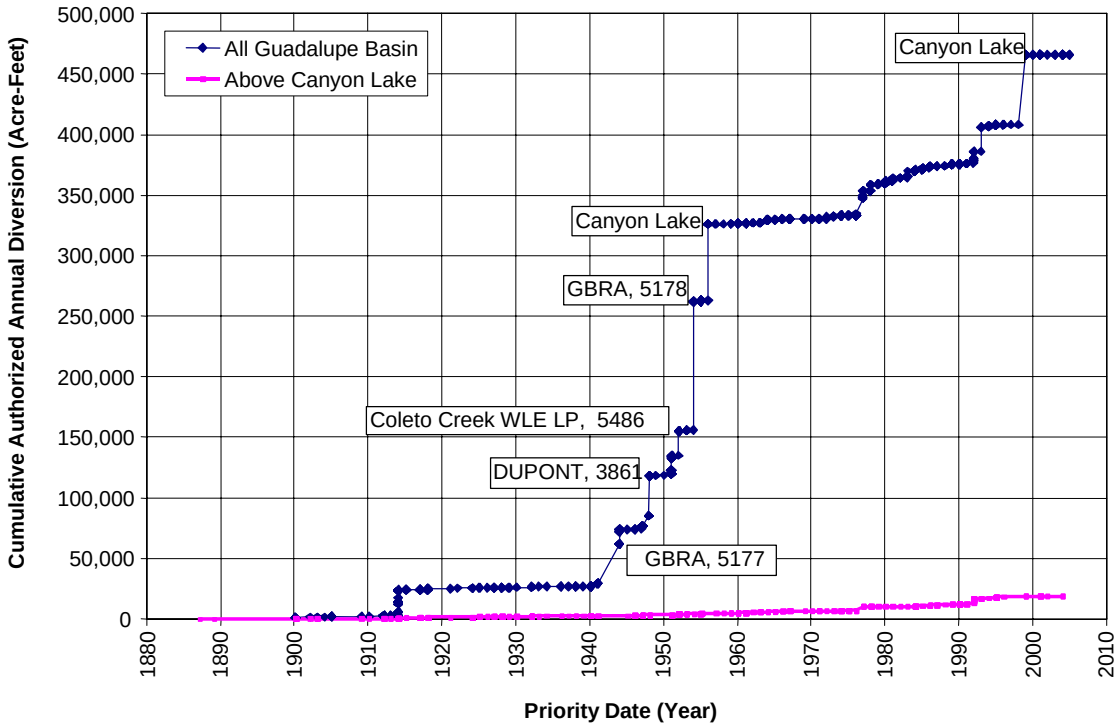


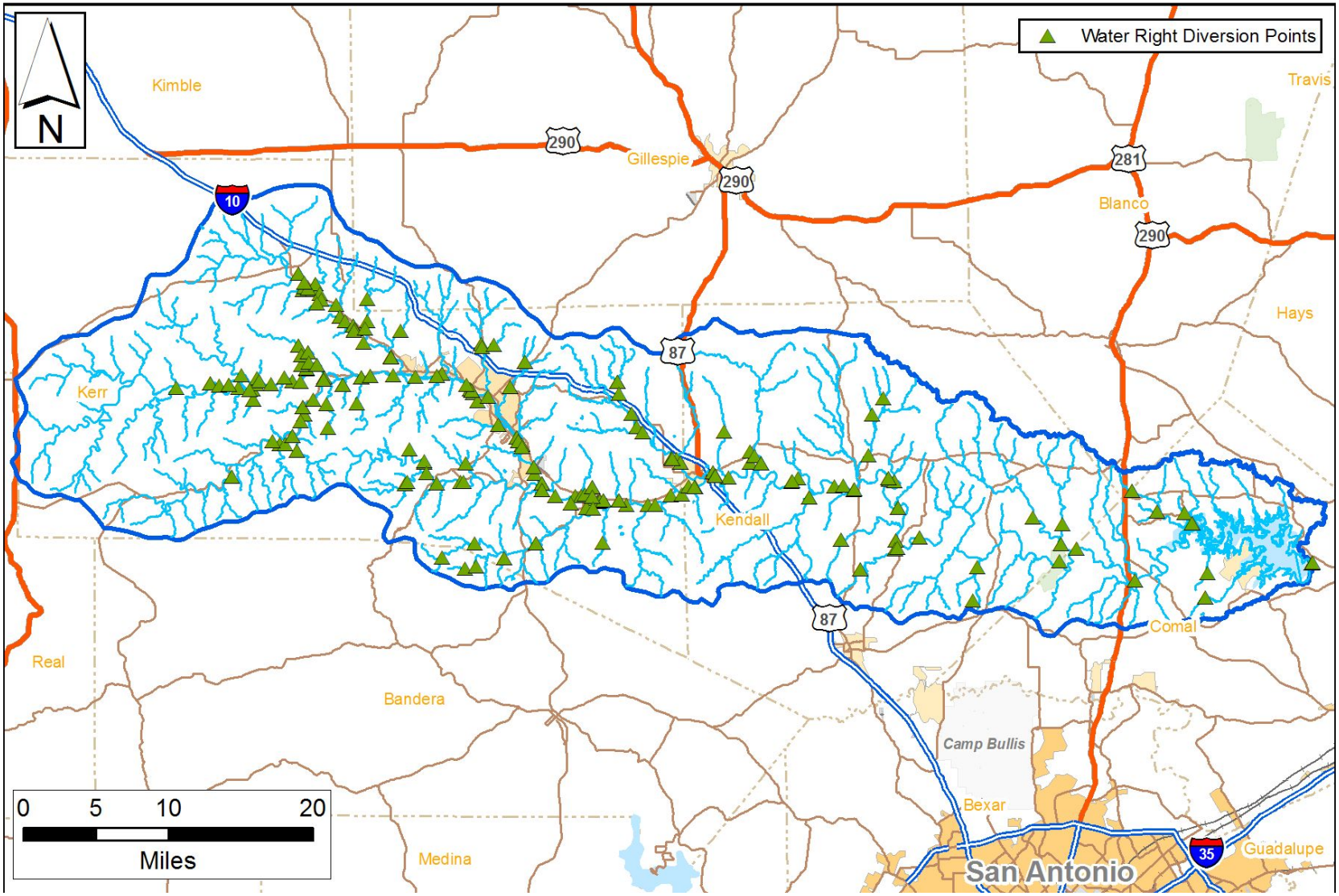
Table 3.1 Non-Consumptive Hydropower and Steam Electric Water Rights in the Guadalupe River Basin

Water Right Number	Priority Date	Owner	County	Use	Authorized Use (ac-ft/year)	Comments
CA 18-3824	June 29, 1914	New Braunfels Utilities	Comal	Hydropower	124,870	Diversion is from man-made channel tributary of the Comal River. Water rights also authorizes municipal, industrial, and irrigation use (additional 5,858 acre-feet per year)
CA 18-3846	February 25, 1980	City of Gonzales	Gonzales	Hydropower	796,363	
CA 18-3853	May 17, 1982	Small Hydro of Texas Inc	De Witt	Hydropower	538,560	Water right subordinated to all other rights in the Guadalupe River.
CA 18-3865	September 4, 1895	Texas State University - San Marcos	Hays	Hydropower	64,370	Spring Lake on San Marcos River.
Permit 18-4492	September 4, 1895	HYDRACO Power Inc	Caldwell	Hydropower	15,000	Subordinate to all rights in the San Marcos River
CA 18-5172	September 16, 1926	GBRA	Gonzales	Hydropower	585,599	Lake Gonzales H-4
				Hydropower	574,832	Lake Wood H-5
CA 18-5485	August 15, 1951	Victoria WLE LP	Victoria	Steam electric	209,189	
CA 18-5488	April 1, 1914	GBRA	Guadalupe	Hydropower	663,892	Lake Dunlap TP-1
				Hydropower	659,995	Lake McQueeney TP-3
				Hydropower	655,323	Lake Placid TP-4
				Hydropower	624,781	Lake Nolte TP-5
				TOTAL	5,512,774	

Table 3.2 Ten Largest Authorized Diversions with Consumptive Use

Water Right Number	Owner	County	Priority Date	Authorized Annual Diversion (ac-ft/year)	Consumptive Use (ac-ft/year)	Use	Comments
CA 18-3859	South Texas Electric Coop Inc	Victoria	February 18, 1964	110,000	1,900	Industrial	
CA 18-5178	GBRA	Calhoun	May 5, 1954	106,000	106,000	Industrial and Irrigation	
CA 18-2074	GBRA	Comal	March 19, 1956	62,900	450,000 acre-feet in 5 consecutive years	Municipal	Canyon Lake
			June 14,1999	57,100		Municipal	Canyon Lake overdraft.
			Total	***120,000***			
CA 18-3861	Dupont De Nemours & Co	Victoria	August 16, 1948	60,000	33,000	Industrial	
CA 18-5177	GBRA and Union Carbride	Calhoun	January 3, 1944	32,615	32,615	Municipal, industrial, and irrigation	
			January 26, 1948	10,000	10,000	Municipal, industrial, and irrigation	
			January 26, 1948	8,632	8,632	Industrial and irrigation	
			Total	***51,247***			
CA 18-5486	Coleto Creek WLE LP	Victoria	January 7, 1952	20,000	20,000	Industrial	Diversion from the Guadalupe River
			January 10, 1977	12,500	Up to 12,500	Industrial	Coleto Creek Reservoir
			Total	***32,500***			
Permit 5466	City of Victoria	Victoria	May 28, 1993	20,000	20,000	Municipal	
CA 18-3869	Texas Parks and Wildlife Department	Hays	June 25, 1947	500	500	Industrial	
			December 17, 1985	9,500	0	Industrial	
			Total	***10,000***			
CA 18-5176	GBRA	Calhoun	June 21, 1951	9,944	9,944	Industrial, Municipal, and Irrigation	
Permit 3606	Gulf Oil Chemicals	Victoria	July 10, 1978	9,676	4,676	Industrial	Divert to off channel reservoir

Figure 3.2 Location of the Diversion Points of the Water Rights above Canyon Lake



3.2 Selection of Water Right Based on Reliability

The reliability of the water rights above Canyon Lake was used to determine which water rights may be good candidates for lease or purchase by Kerrville and UGRA. This reliability was calculated using the Run 3 version of the Water Availability Model for the Guadalupe River Basin (Guadalupe WAM) dated March 2008 and provided by the TCEQ. Assumptions of the Run 3 include adherence to strict prior appropriation, maximum use and storage, no return flows, and a hydrologic simulation period of 1934-1989. The version as received from the TCEQ includes updates for Lake Medina/Diversion Lake and the addition of channel loss factors to all main stem water rights in the Guadalupe and San Antonio River Basins. At the time of this study, this version was being used by TCEQ for evaluating water right permit applications. This study used the following three reliability parameters to prioritize the water rights from most reliable to least reliable:

1) Volume reliability during drought of record. This is the average diversion during the hydrologic period 1950-1956 (which is the drought of record for the Guadalupe Basin) expressed as a percent of the authorized annual diversion. Water rights with volume reliability of at least 80% during the drought of record meet the selection criterion associated with this parameter (Criterion 1).

2) Minimum Annual Diversion. This is the annual diversion during the driest year expressed as a percentage of the authorized annual diversion. Water rights with a minimum annual diversion of at least 50% of the authorized amount meet the selection criterion associated with this parameter (Criterion 2).

3) 75/75 Criterion. A water right meets the criterion if 75% of the authorized annual diversion is met in at least 75% of the years (Criterion 3).

The water rights were prioritized in five groups based on the three selection criteria mentioned above. Group 1 is the most reliable and Group 5 is the least reliable. The description of each group is:

Group 1. This group is composed of those water rights that meet all three selection criteria. There are 27 water rights in this group for a total authorized diversion of 669 acre-feet per year.

Group 2. This group is composed of those water rights that meet the selection Criterion 1 but not Criterion 2 (i.e., the drought reliability was greater than 80%, but the minimum annual diversion was less than 50% of the permitted amount). There are 16 water rights in this group for a total authorized diversion of 295 acre-feet per year. Some of these water rights meet criterion 3 and some do not.

Group 3. This group is composed of those water rights that meet the selection Criterion 2 but not Criterion 1 (i.e., the minimum annual diversion is greater than 50% of the permitted amount, but the average drought reliability is less than 80%). There are 2 water rights in this group for a total authorized diversion of 211 acre-feet per year.

Group 4. This group is composed of those water rights that passed the Criterion 3 but are not included in Groups 1, 2, or 3. (i.e., all of the following conditions are true: At least 75 percent of the diversion is available for at least 75 percent of the time, the drought reliability is less than 80%, and the minimum annual diversion is less than 50% of the permitted amount.) There are 33 water rights in this group for a total authorized diversion of 1,760 acre-feet per year.

Group 5. This group includes all other water rights. Water rights in this group are very unreliable and were not considered for lease or purchase.

The additional surface water diversions by Kerrville or UGRA from additional water rights would be used in conjunction with ASR projects. During wet years when surface water diversions are possible, excess water could be treated and injected in the ASR. Water would be pumped from the ASR system during dry years when surface water availability is limited. Therefore, the desirable water rights to purchase do not have to be reliable at all times. Planning group members discussed the results of the reliability for each group and determined that water rights in Groups 3 and 4 have acceptable reliability for the purposes of developing a potential ASR project and should be given priority to determine its monetary value.[1]

[1] Meeting held September 2, 2008 at UGRA offices. Results were presented at the December 2008 meeting of the Plateau Regional Water Planning Group

3.3 Selection of Water Rights Based on Location

Water rights currently owned by Kerrville and UGRA authorize a diversion of 8,077 acre-feet per year from the Guadalupe River, inside Kerrville city limits (Certificate of Adjudication 1996 and Permits 3505, 3635 and 5394). This diversion point could be used to divert the additional water from the additional water rights.

The location of other water rights relative to the diversion point of Kerrville and UGRA must be considered in the selection process. Water rights upstream of Kerrville are more desirable because moving their diversion point downstream (to Kerrville's current diversion point) would probably only require minor permit changes. Water rights downstream of Kerrville are less desirable because the diversion point will have to be moved upstream. Moving a diversion point upstream could result in major permitting changes because the intervening water rights and the environment between the new and the old diversion points could be impacted. The new diversion upstream would likely be subject to additional flow bypass requirements, which could make the diversion less reliable. As an alternative to changing the diversion point, the water could be diverted at the most downstream diversion point and then conveyed to Kerrville by a pipeline. However, this alternative is more expensive as it requires additional infrastructure.

The location of the diversion point relative to Kerrville was considered in prioritizing the water rights feasible to purchase. Groups 1 to 4 were subdivided with respect to the relative location to Kerrville (upstream or downstream). Table 3.3 shows a summary of the water rights for each group subdivided by location. Table 3.4 shows the minimum annual diversion for each group. Figures 3.3 to 3.6 show the location of the water rights in each group.

Table 3.3 Summary of Water Rights by Reliability Group

	Upstream of Kerrville		Downstream of Kerrville		Total	
	Number of Water Rights	Authorized Diversion (ac-ft/yr)	Number of Water Rights	Authorized Diversion (ac-ft/yr)	Number of Water Rights	Authorized Diversion (ac-ft/yr)
Group 1	14	454	8	215	22	669
Group 2	13	282	3	13	16	295
Group 3	1	108	1	103	2	211
Group 4	12	308	21	1,452	33	1,760
Total	40	1,152	33	1,783	73	2,935

Table 3.4 Summary of Minimum Annual Diversion by Reliability Group

	Upstream of Kerrville		Downstream of Kerrville		Total	
	Minimum Annual Diversion (ac-ft/yr)	Percent of Authorized Diversion	Minimum Annual Diversion (ac-ft/yr)	Percent of Authorized Diversion	Minimum Annual Diversion (ac-ft/yr)	Percent of Authorized Diversion
Group 1	324	71%	175	81%	499	74.6%
Group 2	133	47%	6	46%	139	47.1%
Group 3	32	30%	51	50%	83	39.3%
Group 4	49	16%	273	19%	322	18.3%
Total	538	47%	505	28%	1,043	36%

Figure 3.3 Location of Water Rights in Group 1

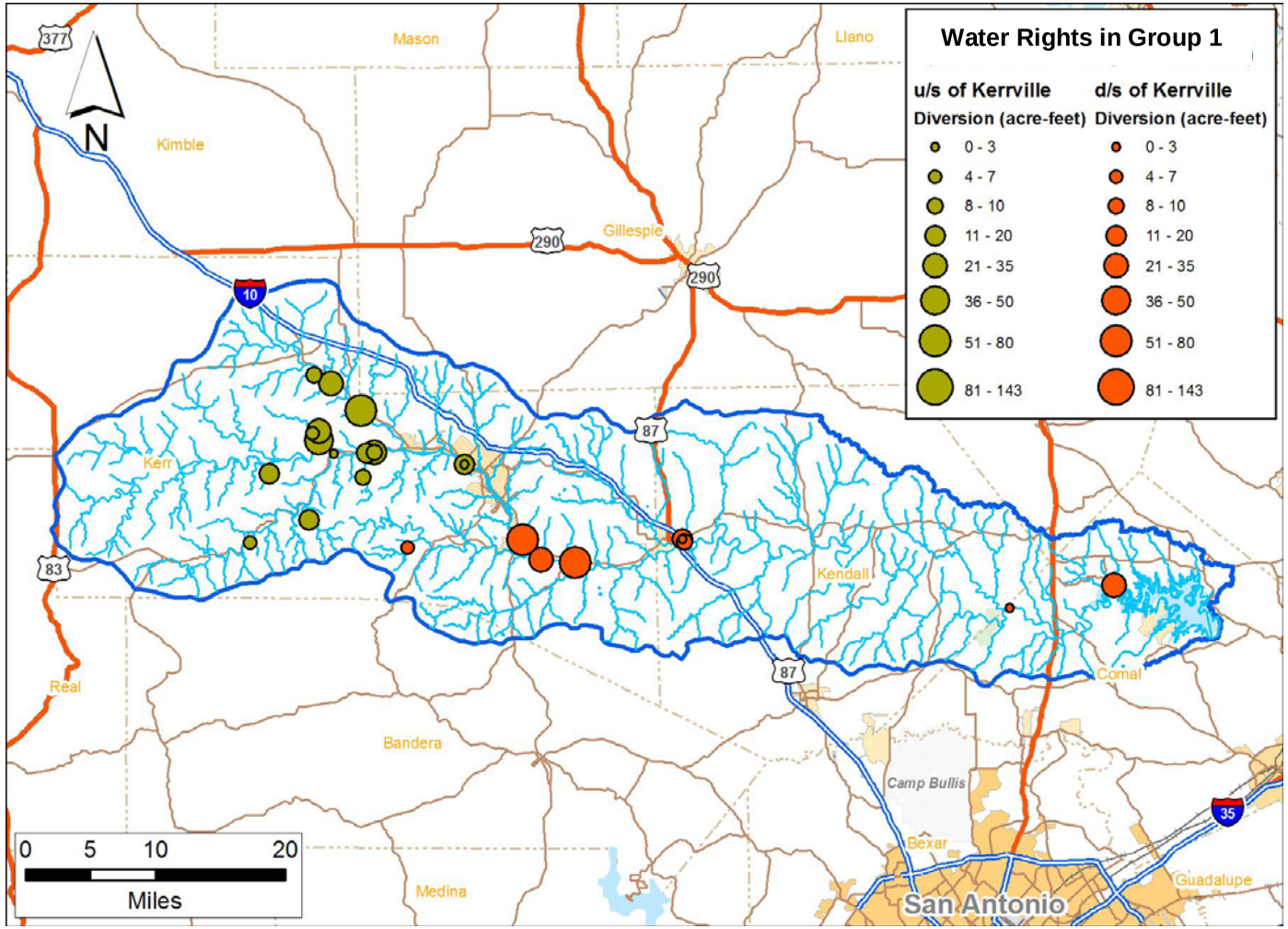


Figure 3.4 Location of Water Rights in Group 2

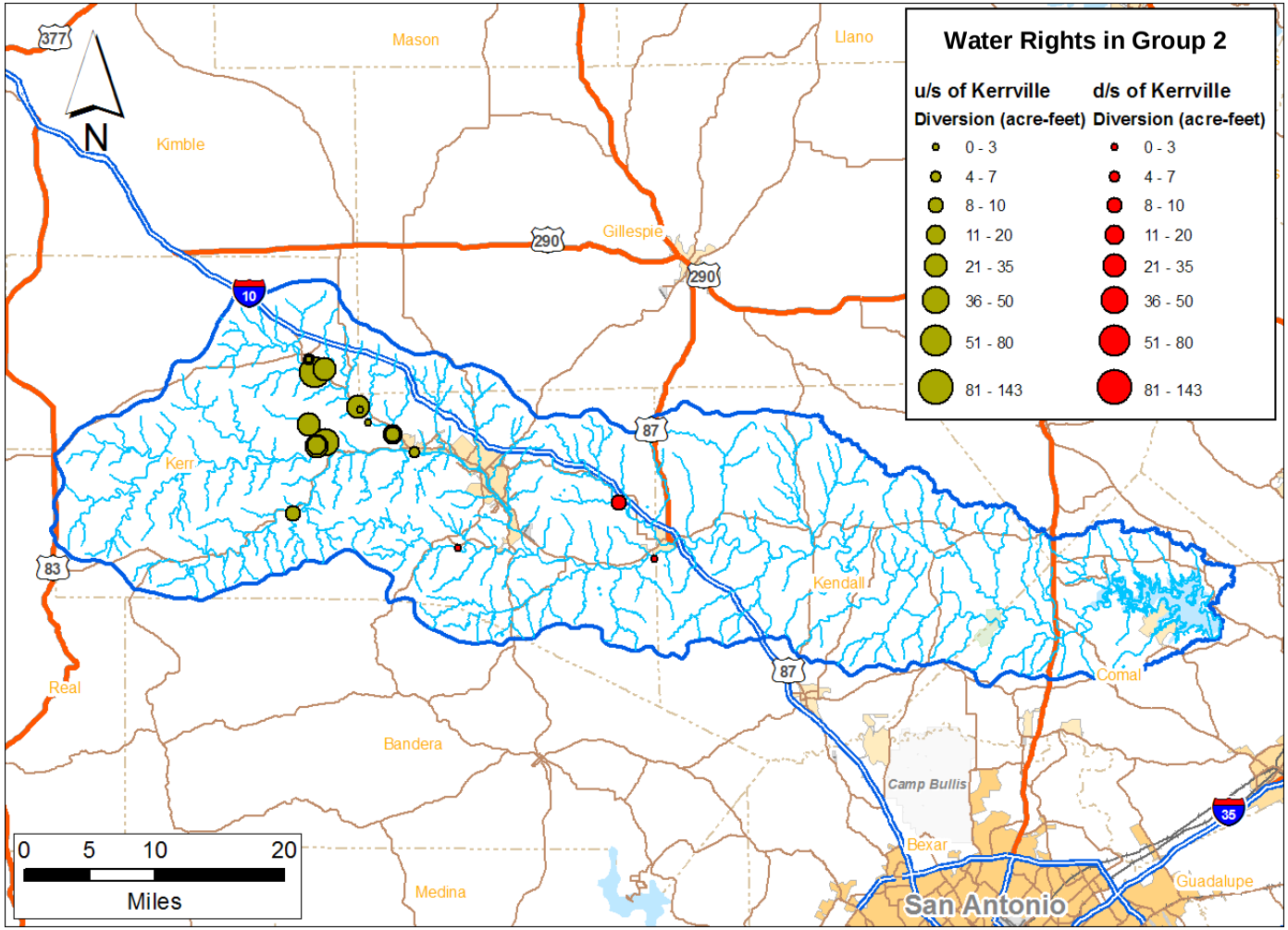


Figure 3.5 Location of Water Rights in Group 3

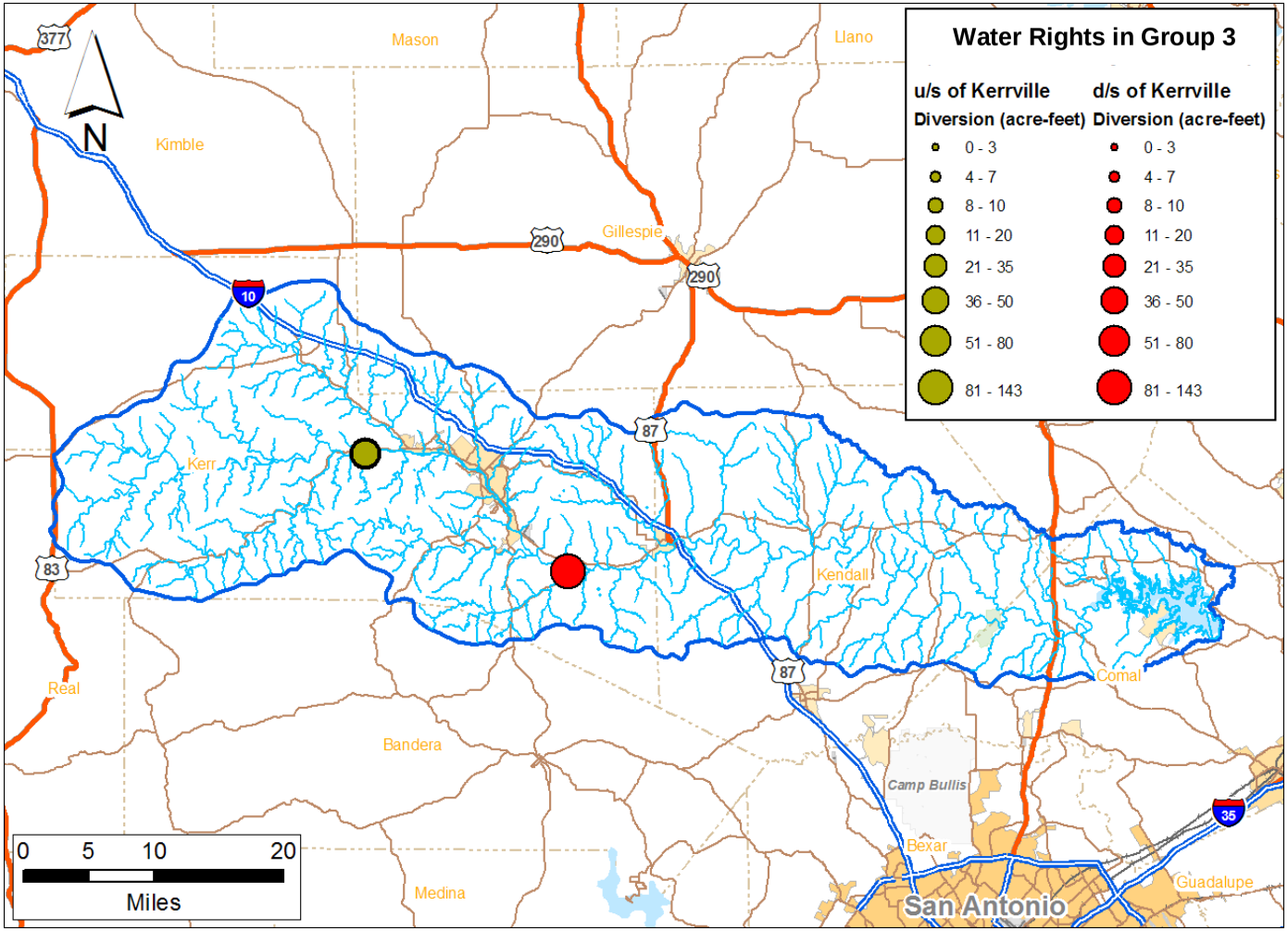
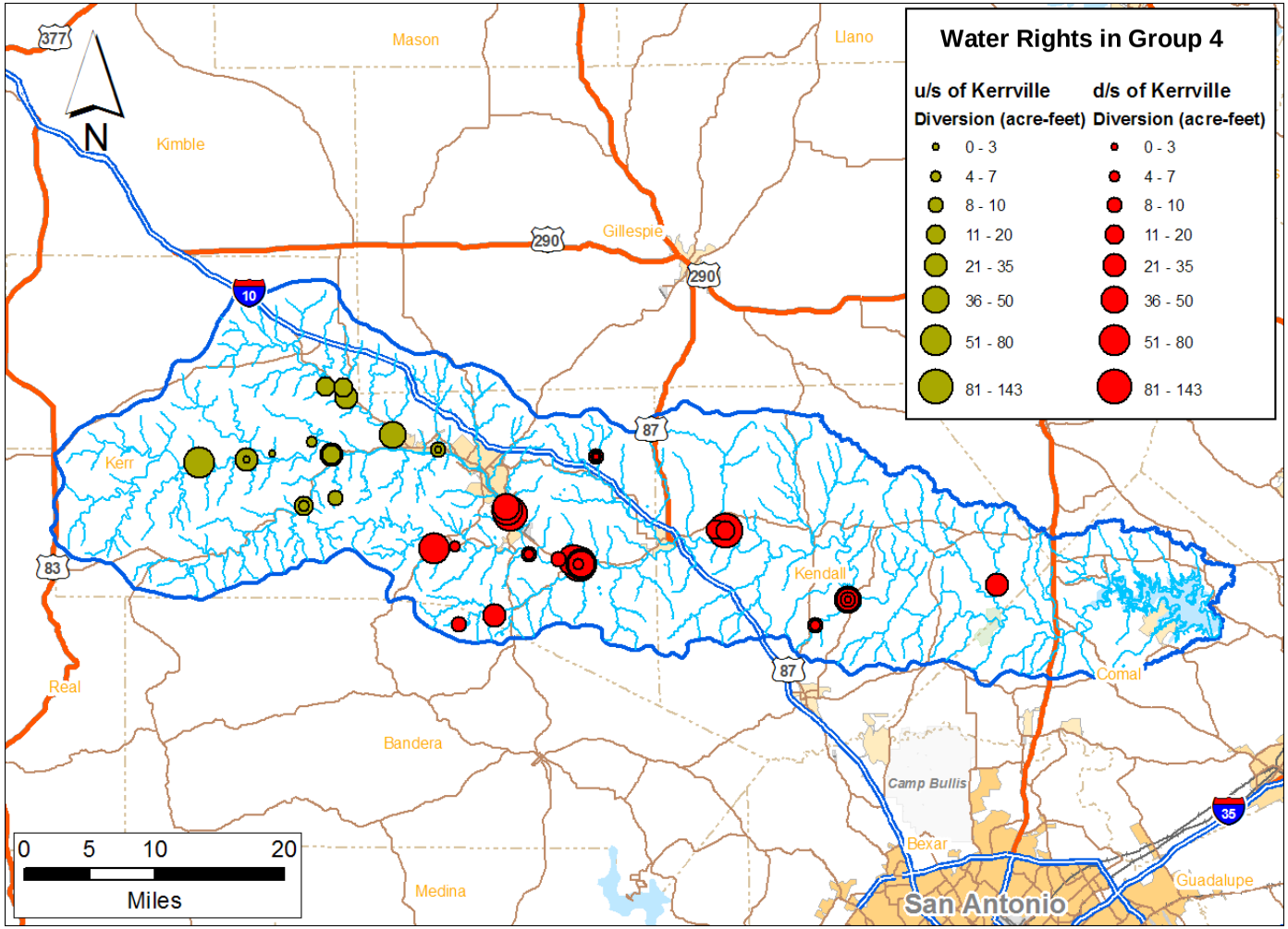


Figure 3.6 Location of Water Rights in Group 4



3.4 Water Rights Valuation

The scope of work for this study included an assessment of the monetary value of the water rights based on replacement cost. The sources of replacement water for the water right holders are groundwater and water purchased from Canyon Lake. Due to the potential for large water level decline, local groundwater is not a feasible option. The only other feasible option is water purchased from Canyon Lake. Currently the Guadalupe Blanco River Authority sells water from Canyon Lake at a rate of $69 per acre-foot. (This rate was obtained from recent GBRA upstream contracts.) This price will be used as a baseline for estimating costs for the lease of water for Kerrville.

For the purpose of a preliminary assessment of the monetary value, a rate of $69 per acre-foot was used for water 100% reliable and a rate of $35 per acre-foot was used for non-reliable water. These rates are preliminary for planning purposes and should not be construed as the final rate for the transaction. The actual value of the water right will be determined in future negotiations between Kerrville, UGRA, and water right holders. The transaction price will depend on factors including but not limited to supply, demand, potential revenue of crops, conflicts on water use, and estate equity issues.

Water rights can be purchased or leased. Purchase is a permanent transfer of ownership. For the purpose of this preliminary assessment, the price of purchasing a water right was estimated as the value of the authorized volume for diversion over a 20-year period. For example, the price of a water right authorized for 100 acre-feet per year and 100% reliable is $138,000 calculated as:

$$\$69/\text{acre-foot} \times 100 \text{ acre-feet/year} \times 20 \text{ years} = \$138,000$$

This price will be less if the water right is less reliable.

A lease is an agreement that would allow Kerrville/UGRA to use the water over a specified period of time. At the end of the lease term, the right to use the water returns to the water right holder unless both parties agree to renew or renegotiate the lease terms.

Values for individual water rights were calculated and are detailed in Attachment 2. Table 3.5 is a summary of the total purchase value and the total annual lease for each reliability group.

Table 3.5 Estimated Purchase Value and Annual Lease for Water Rights

Reliability Group	Location Relative to Kerrville	Value of Water	Annual Lease	Authorized Annual Diversion	Average Diversion	Average price per acre-foot per year
1	Upstream	$573,800	$28,690	454	441	$65.00
	Downstream	$246,700	$12,335	215	211	$58.52
Total Group 1		**$820,500**	**$41,025**	**669**	**652**	**$62.91**
2	Upstream	$281,300	$14,065	282	270	$52.05
	Downstream	$13,200	$660	13	13	$52.63
Total Group 2		**$294,500**	**$14,725**	**295**	**283**	**$52.08**
3	Upstream	$118,800	$5,940	108	97	$61.11
	Downstream	$106,900	$5,345	103	91	$58.71
Total Group 3		**$225,700**	**$11,285**	**221**	**188**	**$59.95**
4	Upstream	$245,500	$12275	308	280	$43.77
	Downstream	$1,204,600	$60,230	1452	1,308	$46.03
Total Group 4		**$1,611,100**	**$80,555**	**1,760**	**1,589**	**$50.70**

The Value of Water Right shown in Table 3.5 includes only the value of the water. It does not include other costs associated with transactions such as legal and court fees or permit amendments. Therefore, if Kerrville or UGRA pursues the purchase of water rights, the costs incurred may be higher than the value listed in Table 3.5.

The Annual Lease is the price paid every year to the water right holders to temporarily transfer use of the water. The Authorized Diversion is the amount from the current authorization. The Average Diversion is calculated based on 56 years of the hydrologic period 1934-1989. The Average Unit Price is calculated as the annual lease value divided by the average annual diversion. It represents the average cost of water in the long-term.

3.5 Final Selection of Water Rights

The following list of criteria was used to select the final water rights that might be purchased or leased:

- *Acceptable reliability.* As explained in Section 3.2, water rights in Groups 3 and 4 are more desirable when used in conjunction with an ASR project. Water rights with 100% reliability are not required for ASR. The ASR projects are reliable if surface water diversions are fully available during wet periods. Groups 3 and 4 have acceptable reliability for the ASR. Water rights in Groups 1 and 2 are more reliable but would be more expensive. Therefore, water rights in Groups 3 and 4 are preferred.
- *Location relative to Kerrville*. Water rights upstream from Kerrville are preferred over water rights downstream. If downstream water rights are needed, the diversion point should be within a reasonable pipeline distance.
- *Amount of authorized diversion.* Water rights authorized for at least 20 acre-feet per year are desirable. This criterion minimizes the number of water right holders Kerrville and UGRA would have to negotiate with.
- *Minimum Annual Diversion*. Water rights with a minimum annual diversion of zero were eliminated from consideration.
- *Historical use*. Water rights that have not been fully utilized in recent years could be easier to acquire than those utilized recently.

Table 3.6 lists the water rights that meet the five criteria listed above. Recent historical use records (2000 through 2008) for each right in Table 3.6 were obtained from TCEQ's South Texas Watermaster Office. This historical use information is shown in Table 3.7. This information shows that most of the rights have not been utilized at all or have been underutilized in recent years. The only rights that have been at or near full utilization are Water Rights 2001 and 2002. Due to this use, the owners are unlikely to be willing to sell or lease this water or may want to negotiate a higher value. These water rights are left in the final selection with a lower priority.

Water Rights 2021 and 2450, which total 260.66 acre-feet per year, are potentially owned by one family and could be combined in one lease agreement, making the process easier. Water Rights 2021, 2024, 2025, and 2450 are located within 10 miles downstream of Kerrville and would require either a change in diversion point from TCEQ or a pipeline to deliver the water to the City and UGRA service area. Based on the above analysis, the rights shown in Table 3.6

should be pursued for lease by the City of Kerrville and UGRA to increase the surface water supplies. The additional authorized amount is 1,029 acre-feet per year. Figure 3.7 is a map of the recommended water rights listed in Table 3.6.

The estimated total price for a purchase of all of these rights is $974,100. Alternatively, the estimated annual lease cost is $48,705 per year. The long-term average annual diversion from these rights is 953 acre-feet per year (778 acre-feet per year downstream from Kerrville and 175 acre-feet per year upstream from Kerrville). If the water rights are purchased with a loan paid over 30 years at 6% interest, the unit cost during a drought is $94 per acre-foot. If the water rights are leased, the unit cost is $65 per acre-foot.

Table 3.6 Water Rights Selected for Lease or Purchase

Water Right Number	Owner(s)	Annual Permitted Diversion Amount (AFY)	Volume Reliability during Drought (%)	% Years meeting 75% of Annual	Reliable Water at $69/AF[+] (Ac-ft)	Non Reliable water at $35/AF (Ac-ft)	Estimated Annual Lease ($/yr)	Estimated Value if purchased ($)
Upstream from Kerrville								
1969	Bobby Don Blackburn	108	63	89	63.4	44.6	$ 5,940	$ 118,800
1993	Wes H Wagner Et al	50	78	93	18.5	31.5	$ 2,380	$ 47,600
1981	Jack D Clark Jr Et al	32	72	88	10.0	22.0	$ 1,460	$ 29,200
Downstream from Kerrville								
2021	Raymond F Mosty Et al	102.66	79	91	51.5	51.2	$ 5,345	$ 106,900
2001	Rosemary Hunt Meek*	41	75	89	12.8	28.2	$ 1,870	$37,400
2003	Wheatcraft Inc	52	77	89	18.9	33.1	$ 2,465	$ 49,300
2024	Wheatcraft Inc	114	75	89	35.6	78.4	$ 5,200	$ 104,000
2002	Comanche Trace Ranch & Golf	136	75	89	42.4	93.6	$ 6,205	$ 124,100
2011	William Alan Gruy	80	64	88	22.0	58.0	$ 3,550	$ 71,000
2450	Robert L Mosty Jr	158	75	89	49.3	108.7	$ 7,210	$ 144,200
2025	Jocelyn Levi Straus Et al David B Wray Byno Salsman Et ux	155	77	89	48.6	106.4	$ 7,080	$ 141,600
	TOTAL	**1,029**					**$ 48,705**	**$ 974,100**

[+] Reliable water is the same as minimum annual diversion

* Water right 2001 is authorized for 295 acre-feet per year. Of that amount, 41 are authorized at priority December 31, 1924, 100 acre-feet per year at priority January 6, 1992, and 154 acre-feet per year at priority January 24, 1995. Purchase includes only the most senior portion of the water right (41 acre-feet per year).

Figure 3.7 Location of Selected Water Rights to Purchase

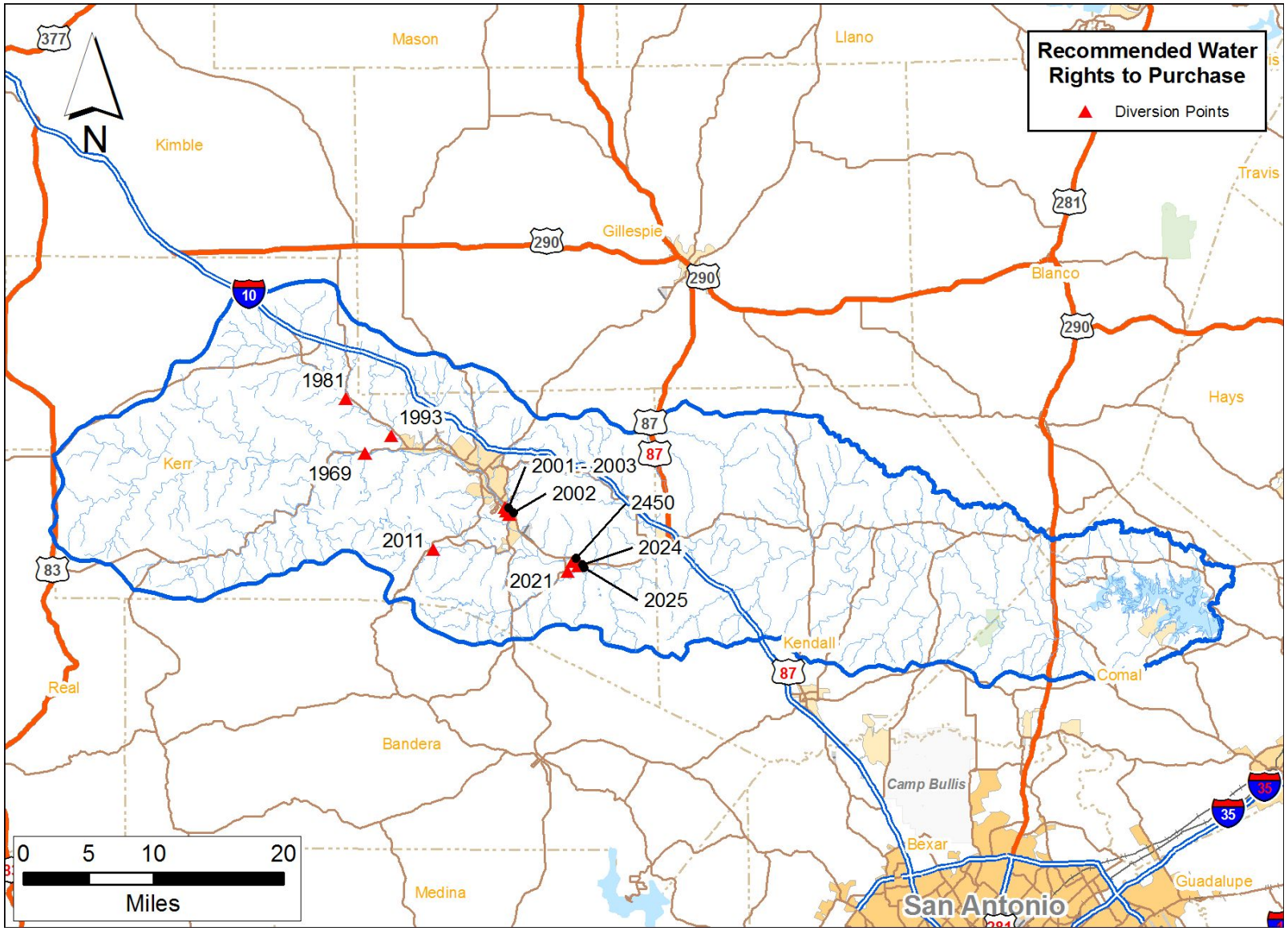


Table 3.7 Historical Water Use for Identified Water Rights

Water Right Number	Annual Permitted Diversion Amount (AFY)	Annual Diversions Reported to TCEQ (in Acre-Feet)								
		2000	2001	2002	2003	2004	2005	2006	2007	2008*
Upstream from Kerrville										
1969	108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	32	8.8	7.7	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Downstream from Kerrville										
2021	103	23.6	31.6	26.2	0.0	0.0	0.0	3.4	0.0	0.0
2001	295	159.7	256.0	103.2	102.6	0.6	50.1	111.5	8.1	148.0
2003	52	31.2	13.5	32.7	13.1	0.0	41.3	0.0	0.0	0.0
2024	114	64.3	37.9	18.0	0.0	0.0	0.0	88.8	108.0	61.9
2002	136	53.9	99.6	136.0	129.9	127.8	135.9	136.0	104.6	75.6
2011	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2450	158	0.0	122.9	52.3	48.3	9.3	129.0	139.4	9.0	35.4
2025	155	29.5	19.4	7.5	17.1	0.0	0.0	0.0	0.0	0.0
TOTALS	**1,029**	**371.0**	**588.6**	**377.3**	**311.0**	**137.7**	**346.3**	**479.1**	**229.7**	**320.9**

*Year 2008 is only a partial year reporting (Jan. – Sept.)

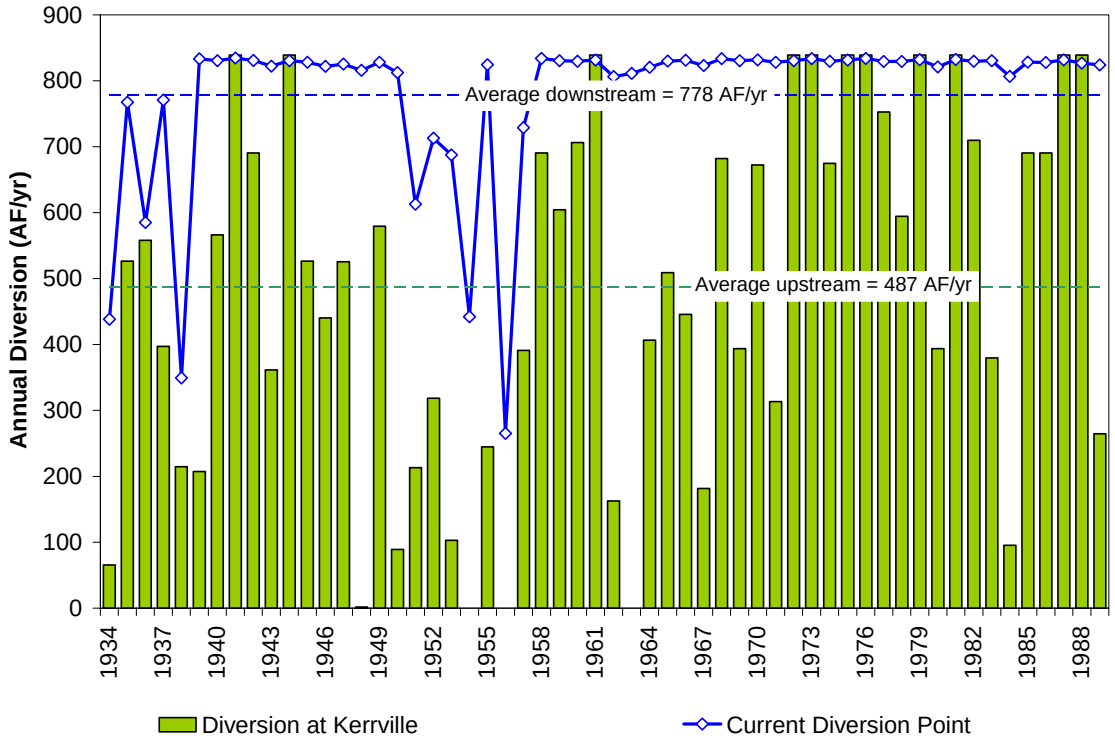
3.6 Impact of Moving the Diversion Upstream

Eight water rights considered for purchase are located downstream of Kerrville. If these water rights are acquired, Kerrville and UGRA may need to move the diversion point upstream. As explained in Section 3.3, moving the diversion point upstream may decrease the reliability. As an alternative, water could be diverted at the most downstream control point and delivered to a treatment plant by pipelines.

Figure 3.8 shows the impact on surface water availability if the diversion point is moved upstream assuming a bypass requirement equal to 44 cfs, which is the 7Q2 at the Guadalupe River at Kerrville. The 7Q2 is defined as the minimum average 7-day flow that has a return period of 2 years. This quantity is usually the minimum flow required for environmental protection. The actual bypass will be determined in the permitting process and could be higher than the 7Q2 during normal years.

Figure 3.8 also shows that the long-term average annual diversion would decrease from 778 to 487 acre-feet per year when moving the diversion point. During a drought of record, the average annual diversion would decrease from 622 to 138 acre-feet per year. This is a substantial impact on the reliability. Therefore, it is recommended to keep the diversion downstream and deliver the water through a pipeline.

Figure 3.8 Impact on Annual Diversions when Moving Diversion Point Upstream



3.7 Potential Use of Wastewater Effluents

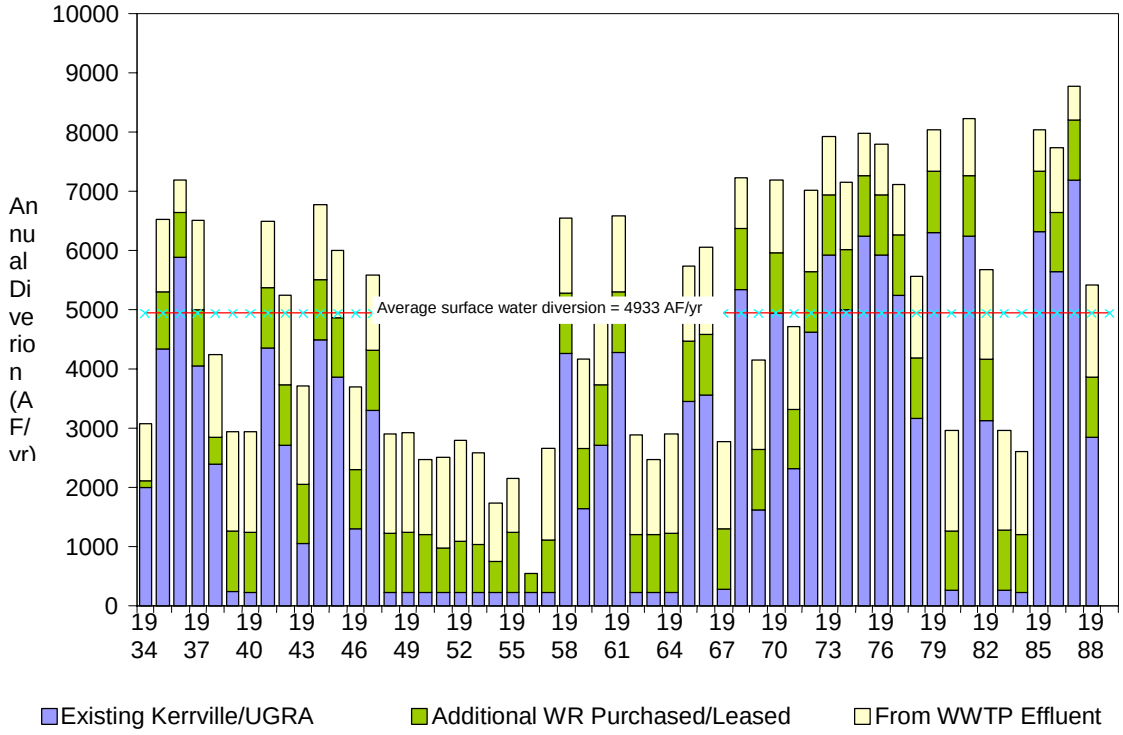
According to the 2008 City of Kerrville Capital Improvement Plan, the wastewater effluents from the City of Kerrville are expected to increase from 2.41 million gallons per day (MGD) in 2007 to 5.27 MGD in 2027. These return flows are not considered in the Water Availability Model of the Guadalupe River Basin and represent a potential additional source of water supply.

Kerrville and UGRA have a current agreement with GBRA by which GBRA agrees to subordinate its hydropower rights to make water available for Kerrville and UGRA. In return,

Kerrville agrees to pay $5.00 per acre-foot for any reduction in flow to the hydropower rights. The reduction in flow (and therefore the potential compensation to GBRA) is less if a portion of the diversion is returned as treated wastewater effluent.

The water availability analysis explained before does not account for additional diversions available as a result of wastewater effluents. These additional diversions were evaluated with the Guadalupe WAM assuming that GBRA does not make a priority call on a diversion of up to 1.5 MGD at Kerrville. The March 2008 Guadalupe WAM was modified to model a scenario in which Canyon Lake does not make a priority call on the permits owned by Kerrville and UGRA (3769 and 5394). This scenario assumes that the additional water available to Kerrville and UGRA is limited to the return flow amount. This scenario provides a gain of up to 1,685 acre-feet per year. During dry years, the existing water rights owned by Kerrville and UGRA still have no water available because of lack of natural flow. Figure 3.9 shows the total annual supply using the hydrology of the period 1934-1989 with the existing water rights, the new water purchased with no change in the diversion points and the additional water available as a result of wastewater effluents. Ideally, after the ASR reaches a steady storage, the system should be able to provide an average of 4,933 acre-feet per year. Of this amount, 2,222 acre-feet per year can be used by Kerrville to meet the projected needs and the remaining 2,711 acre-feet per year will be available for UGRA. This supply is available after the ASR storage is steady and does not consider water that cannot be recovered from storage.

Figure 3.9 Total Annual Diversion for Kerrville and UGRA with New Water Rights and 1.5 MGD of WWTP Effluents



3.8 Other Considerations

There are a number of other issues to be considered when seeking to lease or purchase water rights. These issues include but are not limited to the following:

a. *Previous Ownership:* Water rights specify the tracts of land in which the water will be used. If the land is sold, the water right is usually included in the transaction, unless the seller explicitly requests to keep the water right. A research on previous transactions of land and water rights is needed.

b. *Change of Use or Diversion Point*: If Kerrville is able to purchase or lease any of this irrigation water shown in Table 3.6, it will require an application for use change with the TCEQ. Changing the purpose or place of use of surface water will require an amendment of the water right. Surface water right permit amendments require approval of TCEQ and the approval process involves a

substantive review of the proposed change in order to protect existing water rights.

c. *Legal cost:* Monetary values included in this study represent only the estimated cost of the water. Other costs such as an appraisal, legal fees and cost of the water rights amendment are not included in the final cost of the purchase.

d. *Alternative water rights*: If enough water cannot be purchased or leased from Groups 3 and 4, Kerrville and UGRA should look at Groups 1 and 2 for additional rights.

4.0 ASR Feasibility Analysis in Eastern Kerr County

4.1 ASR Site Selection

Based on a compromise of subsurface hydrogeologic conditions and the need for a facility in the eastern part of Kerr County, an arbitrary site was selected in the vicinity of the proposed package treatment plant for the community of Center Point (Tetra Tech, 2007). This site is adjacent to the Guadalupe River (ASR source supply), is in the general area of potential distribution, and has adequate Lower Trinity Aquifer characteristics to warrant further consideration. The proposed well site is positioned on a raised river terrace at a surface elevation of 1,530 feet above mean sea level. Figure 4.1 shows the location of the proposed ASR well site along with locations of other wells in the general vicinity.

4.2 Lower Trinity Aquifer

The most used groundwater resource in Kerr County is the Trinity Aquifer, which can be subdivided into Upper, Middle and Lower hydrologic units. Within the County, most domestic wells tap into the shallower Upper (upper Glen Rose) and Middle Trinity (lower Glen Rose-Hensell-Cow Creek) and most public supply wells are completed in the Lower Trinity (Sligo-Hosston). For ASR purposes, the Lower Trinity is a better subsurface reservoir environment and offers more protection from unwanted withdrawals due to fewer wells that penetrate the deeper aquifer.

The Lower Trinity Aquifer is comprised of the Hosston Sand and where it exists in the Southeastern part of the County, the overlying Sligo Formation. Figures 4.2 and 4.3 depict the top and base of the Lower Trinity, while Figure 4.4 shows the net thickness of the unit.

The Hosston Sand is the lower portion of the Lower Trinity Aquifer and is often referred to by local water well drillers as the "Lower Trinity Sand." The Hosston consists of a basal conglomerate grading upward to sandstone, claystone, shale, dolomite, and limestone. The thickness of the Hosston is variable because of the uneven surface in the underlying Paleozoic rocks on which it was deposited, but generally thickens south and southeast throughout Kerr County to approximately 200 feet (LBG-Guyton and Jones Geological Consulting, 2001). The overlying Sligo Formation, a sandy to shaley, dolomitic limestone, only occurs in the southeastern corner of Kerr County.

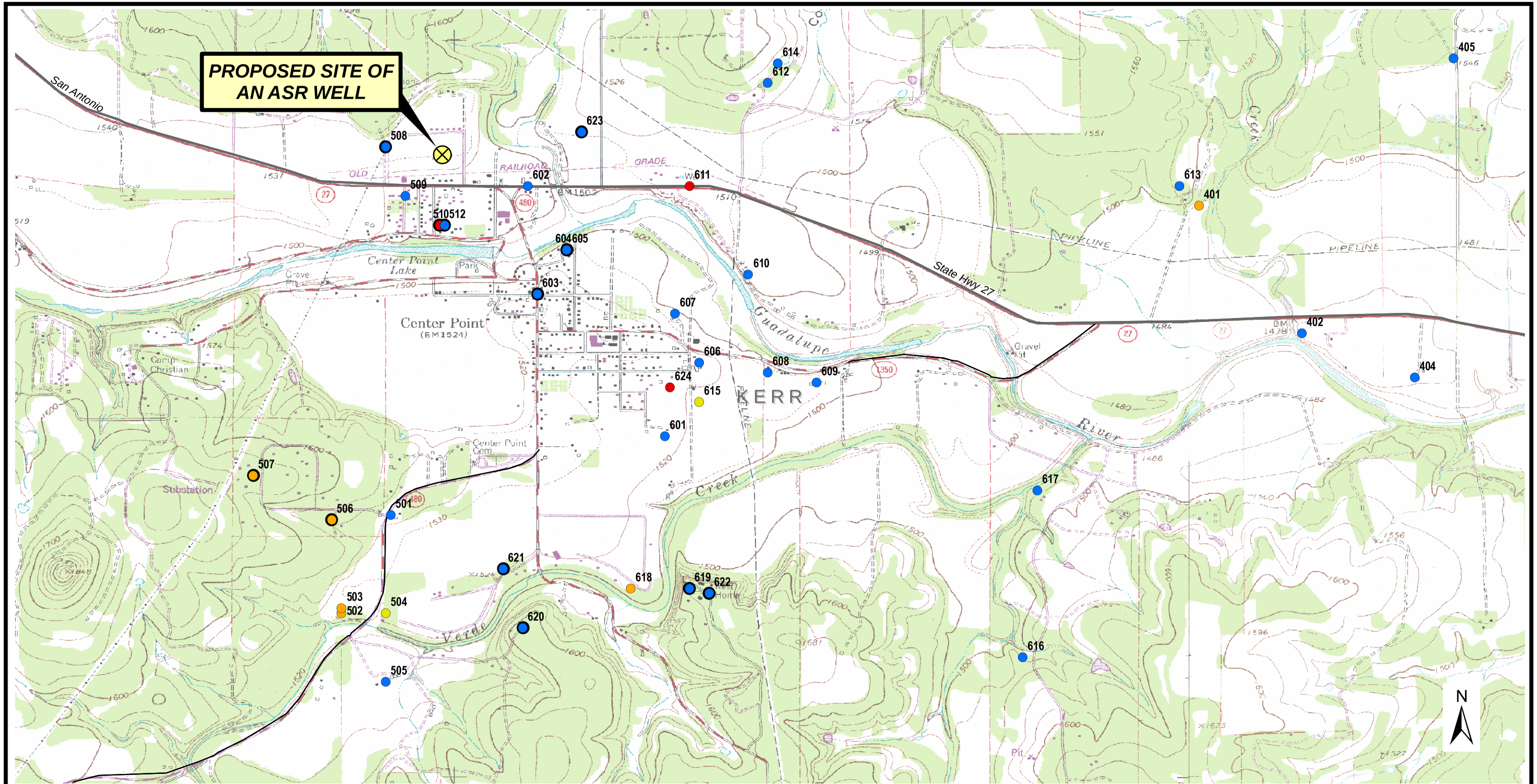
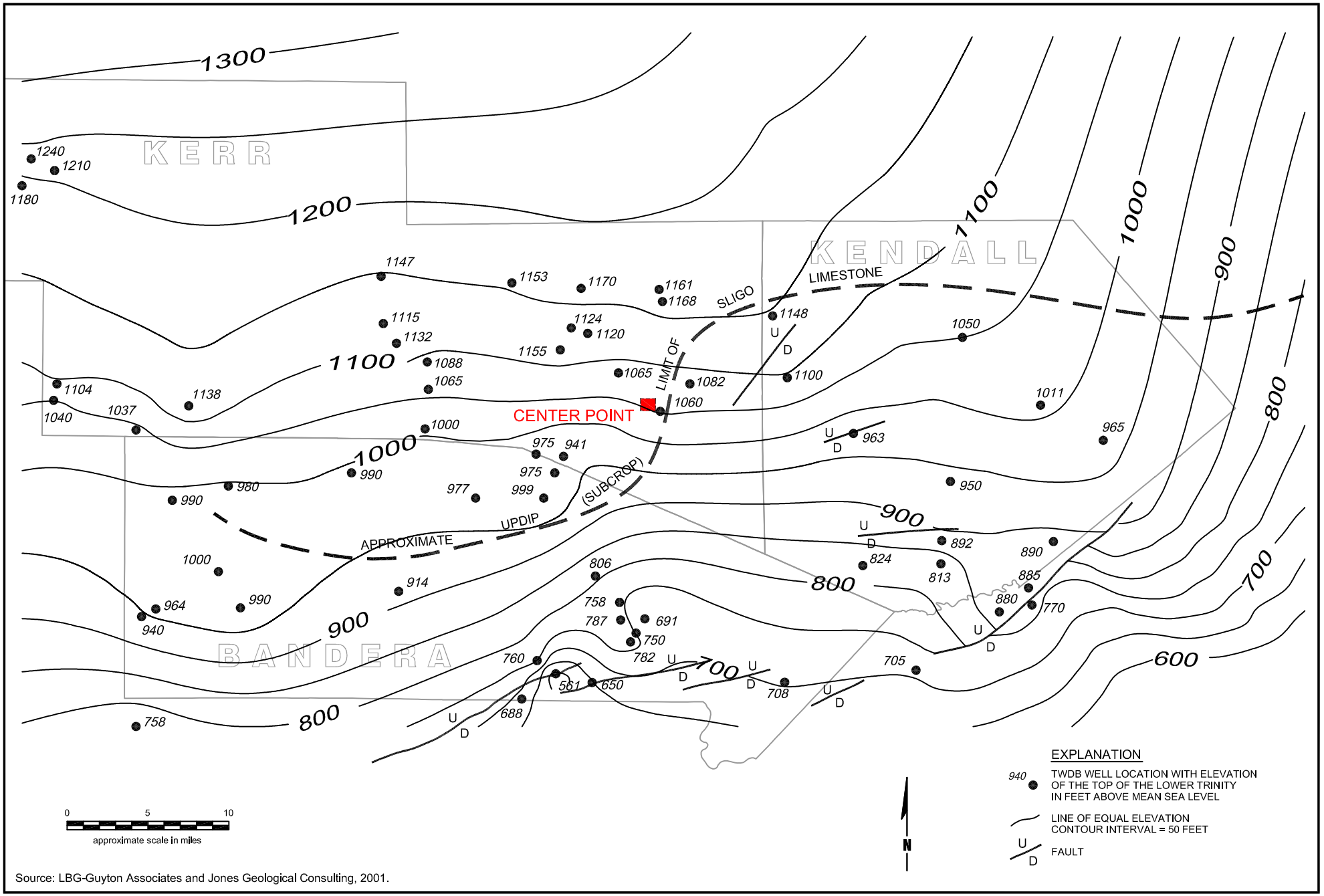
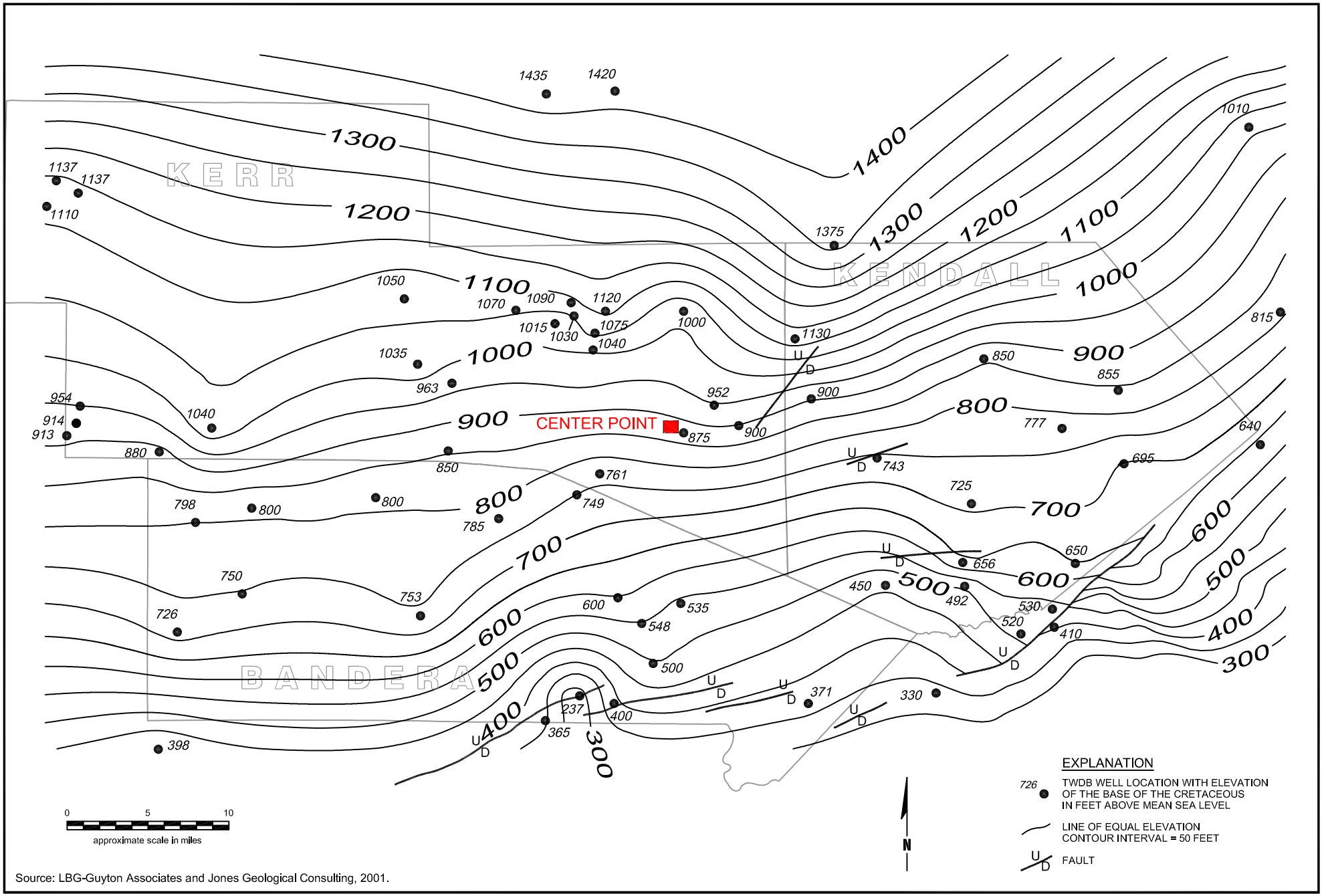


Figure 4.1 Wells in TWDB and TCEQ Groundwater Databases
Center Point Area
Kerr County, Texas



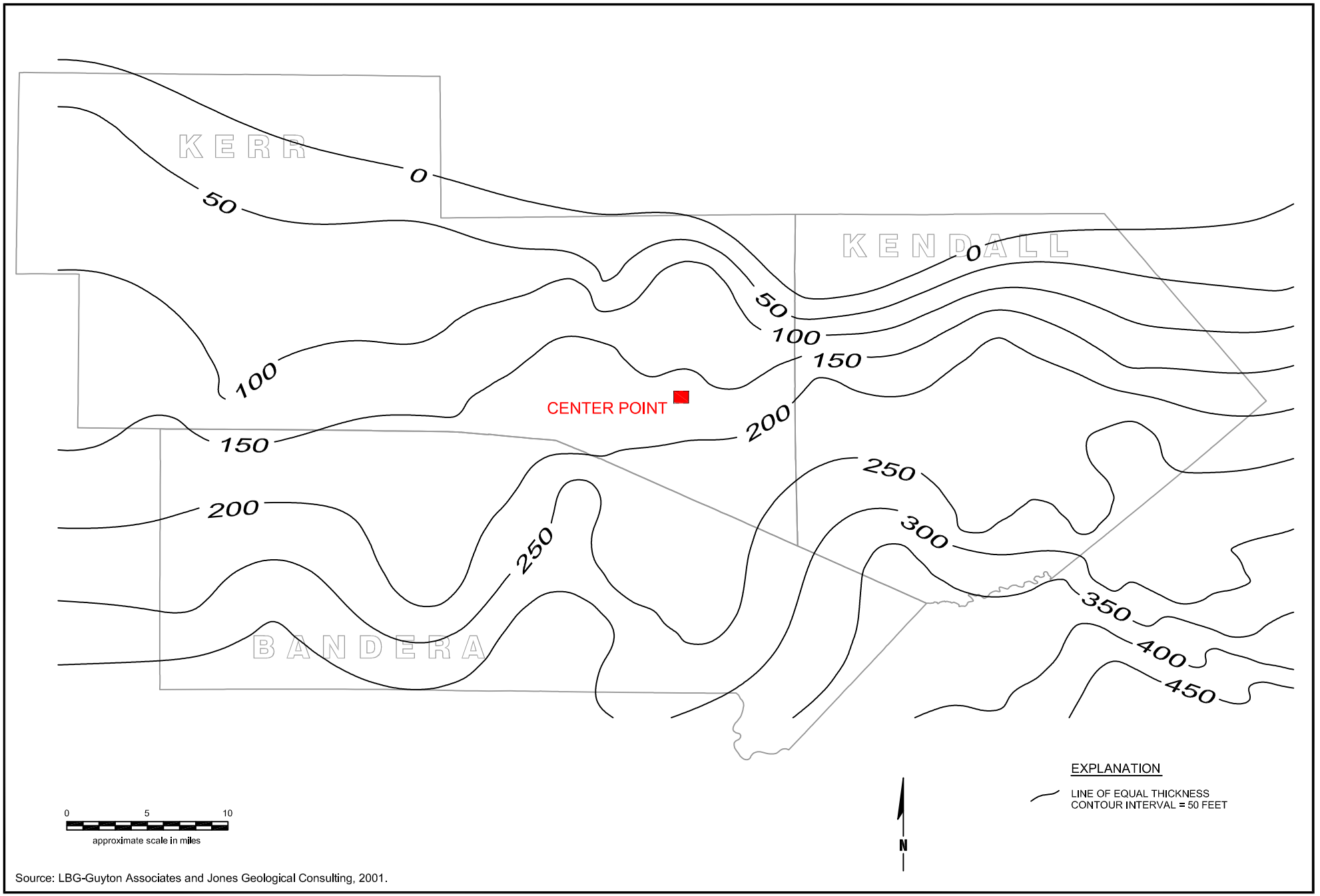
Source: LBG-Guyton Associates and Jones Geological Consulting, 2001.

FIGURE 4.2 TOP OF LOWER TRINITY AQUIFER IN KERR, BANDERA, AND KENDALL COUNTIES



Source: LBG-Guyton Associates and Jones Geological Consulting, 2001.

FIGURE 4.3 BASE OF LOWER TRINITY AQUIFER IN KERR, BANDERA, AND KENDALL COUNTIES



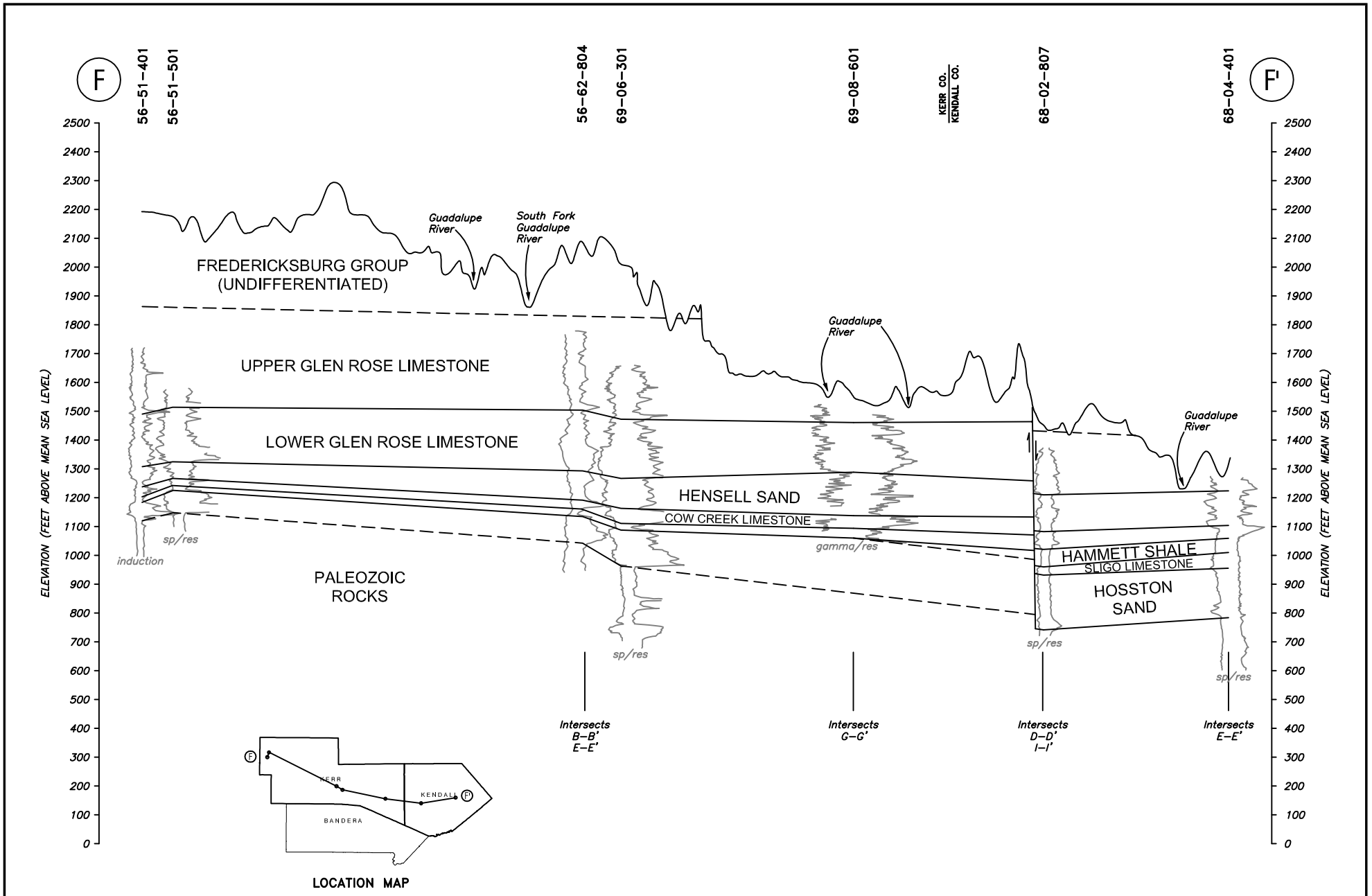
Source: LBG-Guyton Associates and Jones Geological Consulting, 2001.

FIGURE 4.4 NET THICKNESS OF LOWER TRINITY AQUIFER IN KERR, BANDERA, AND KENDALL COUNTIES

Figure 4.5 provides a regional cross-section view of the vertical extent of the Trinity formations from west to east through Kerr County, which serve to illustrate two significant features of the Lower Trinity. The first is the occurrence of the Hammett Shale that overlies the Lower Trinity. Because of its impermeable nature, the Hammett forms a hydrologic barrier between the Lower and Middle Trinity Aquifers and thus is a confining unit over the Lower Trinity.

The second feature is the observation that the Hosston Sand appears in GAMMA Ray geophysical logs to be more transmissive in its northern and west-central extent. Near the southern and eastern borders of the County, the Hosston may be thicker but appears to contain more non-water-bearing material such as silt and clay. This becomes an important factor when attempting to locate a well site with adequate transmissive thickness to support an ASR project.

A more localized cross-section view of the Trinity formations, extending through two Headwaters Groundwater Conservation District monitoring wells (Monitoring Wells 1 and 7) in the vicinity of Center Point, is provided in Figure 4.6. This view suggests that the Sligo Formation is either very thin or nonexistent at the Center Point location.



Source: LBG-Guyton Associates and Jones Geological Consulting (2001), and Jones (1998).

VERTICAL EXAGGERATION = 100x

FIGURE 4.5 LOWER TRINITY AQUIFER CROSS SECTION F - F'

A

A'

69-08-304
69-08-305
HGCD MW-7
EL. 1662'

69-01-703
69-01-704
HGCD MW-1
EL. 1525'

*Intersects D–D'**

*Intersects G–G'**

*Intersects F–F'**

APPROXIMATE LOCATION OF CENTER POINT ASR

gamma *resistivity*

LAND SURFACE

GLEN ROSE LIMESTONE

HENSELL SAND

COW CREEK LIMESTONE

HAMMETT SHALE

SLIGO LIMESTONE

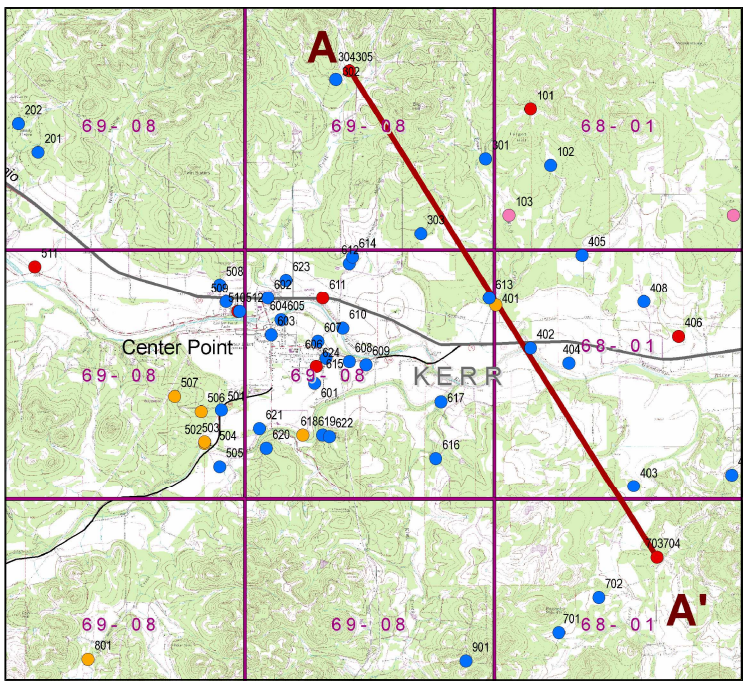
HOSSTON SAND

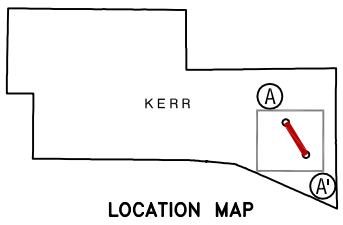
PALEOZOIC ROCKS

gamma *resistivity*

1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800

ELEVATION (FEET ABOVE MEAN SEA LEVEL)





LOCATION MAP

100
0
0
3000
6000
Scale (feet)

VERTICAL EXAGGERATION = 45X

* Cross sections D–D', F–F' and G–G' from LBG–Guyton Associates and Jones Geological Consulting, 2001.

FIGURE 4.6 TRINITY AQUIFER CROSS SECTION A - A'

4.3 ASR Water Supply Availability

This section examines the reliability of the surface water diversion by UGRA and the recommended size of the treatment facilities for an ASR project near Center Point. For this analysis a surface water diversion of 3,029 acre-feet per year is assumed. This diversion is composed of the existing UGRA water right (2,000 acre-feet per year) and the additional rights leased or purchased (1,029 acre-feet per year). The diversion point at Center Point is downstream from the authorized diversion points of all water rights. Therefore, the water availability of these water rights is not expected to change if the diversion is moved to Center Point.

Figure 4.7 shows the annual diversion calculated with the Guadalupe-San Antonio WAM. (Water rights are modeled at the currently authorized diversion points.) The average annual diversion is 1,323 acre-feet per year. After a long time, in theory, the average annual supply from the ASR project should be equal to the average annual diversion of surface water. For planning purposes, we recommend assuming a supply of 1,124 acre-feet per year (1.0 MGD) or 85% of the average annual diversion to be conservative.

Based on this water availability assessment and using a peaking factor of 1.5, the following capacities for the facilities of a potential ASR project near Center Point are recommended:

Element	Annual Supply	Capacity (Maximum Daily Value)
Diversion and Treatment	3,029 AFY	4.0 MGD
Direct Distribution	1,124 AFY	1.5 MGD
Injection and Recovery	Up to 1,905 AFY	Up to 2.5 MGD

Values assume that surface water diverted but not immediately used or distributed, will be treated and injected in the ASR. It is also assumed that the same wells are used for injection and recovery.

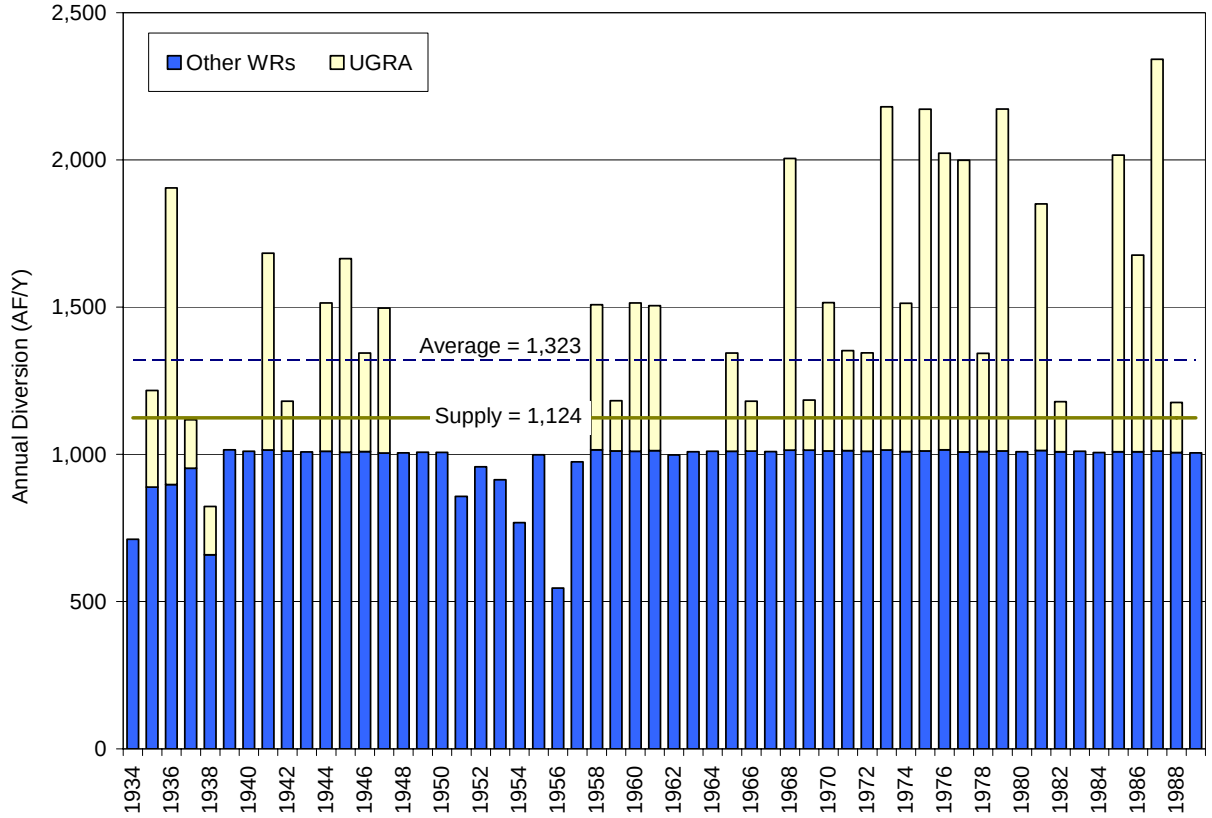


Figure 4.7 Annual Diversion of Surface Water at Center Point

4.4 Infrastructure Cost

Source-water Treatment Facility

This plant will be treating water from the Guadalupe River near Center Point and will have an approximate capacity of 4 MGD. Water quality data from a USGS station in the Guadalupe River near Center Point shows high variability of turbidity. The dissolved solids are low and softening is recommended. Cost estimates assume a low-pressure membrane treatment process for particle removal (microfiltration) and a second stage treatment with high-pressure membranes (nanofiltration) for softening 50% of the flow. A 16 MG terminal reservoir is recommended to buffer high turbidity peaks from the Guadalupe River.

The estimated capital cost for this plant is $13,725,000 (2008 dollars). This cost includes the raw water pump station, terminal storage reservoir, residuals handling facilities (solid storage lagoon), high service pump station, clearwell, engineering and contingencies. The annual cost of operation and maintenance is $194,000.

Volume of water treated:	3,029 acre-feet/year	Wet years
	0 acre-feet/year	Dry year
	1,323 acre-feet/year	Average
Capital Cost	$ 13,725,000	
Annual Cost		
Average Annual Volume Treated	1,323 acre-feet	2.7 MGD
Unit Cost O&M	$146.6/acre-foot	$0.45/1000 gal
Cost O&M	$ 194,000	
Debt Service (6%. 30 years)	$ 997,000	
Total Annual Cost	**$ 1,191,000**	

Unit Cost

Supply	1,124 acre-feet per year	(85% of average diversion)
Unit cost	**$ 1,060 per acre-foot**	($3.25 per 1,000 gallons)

Injection and Recovery Well

The following cost projection is for a single Lower Trinity ASR well and is based on average 2008 itemized drilling contractor bid estimates. Contractor prices can vary widely for individual items, but the aggregate prices are often similar. An ASR project at the Center Point location would likely require more than one well.

ASR Well Components

- Mobilization
- Pilot Hole
- Geophysical Logs
- Reaming 16”
- 12” Casing
- Cement Casing
- Reaming 12”
- 10” Casing
- 10” Screen
- Well Development
- Pumping Test
- Water Quality Samples
- Surface Slab
- Appurtenances
- Pumps, Piping and Installation
- Motor Controls

Total Well Cost: $403,000

Total Unit Cost

The total capital cost of the ASR strategy is $15,505,100 and the unit cost is $ 1,217 acre-feet per year. The breakdown of these costs is included in Table 4.1.

Table 4.1 Capital and Unit Costs of the ASR Strategy

Supply	1,124 AFY
Capital Cost	
Purchase of water rights	$ 974,100
Water Treatment Plant	$ 13,725,000
Wells (2)	$ 806,000
Total Capital Cost	***$ 15,505,100***
Annual Cost	
Debt Service	$ 1,126,000
Treatment	$ 194,000
Wells	$ 48,000
Total	***$ 1,368,000***
Unit Cost ASR	***$ 1,217***

4.5 Lower Trinity Aquifer Model

At the request of the Bandera County River Authority and Groundwater District and supported by the Headwaters Groundwater Conservation District, LBG-Guyton conducted a modeling study of the Lower Trinity Aquifer in Bandera, Kerr and surrounding counties (LBG-Guyton Associates, 2009). The main objective was to build a Lower Trinity model to evaluate aquifer response to projected water demands that could be used as a water supply management tool. The study consisted of: (1) conceptual model development of the Lower Trinity Aquifer, (2) assimilation of relevant data into a format that can be used in the numerical model, (3) calibration of a steady-state model, which represents pre-development conditions, (4) calibration of a transient model from 1950 to 2005, and (5) predictive simulations from 2006 to 2060.

Based on the conceptual understanding and assimilated data, a one-layer MODFLOW groundwater flow model was developed. The code used to develop the Lower Trinity Aquifer model is MODFLOW-2000 (Harbaugh et al., 2000). Pre- and post-processing of the model data uses Groundwater Vistas (Version 5). The model was calibrated to pre-development conditions and the transient conditions from 1950 through 2005. Calibration statistics indicate the model simulates the historical water level trends reasonably well.

4.6 Model Analysis Results

The model was used to assess the impact of various ASR injection rates on the Lower Trinity Aquifer in the Center Point area. All scenarios assumed that injection would occur equally in two wells, and that withdrawals from the aquifer are consistent with the 2006 Plateau Region Water Plan water demand projections for the prediction time period (2010 to 2060). Model simulations predicted that, due to the relatively low transmissivity of the Lower Trinity, water levels near the injection wells would increase (rise) significantly if injection rates were too high. Scenarios were deemed hydrologically infeasible if the simulated potentiometric water surface was above the land surface (1,530 feet amsl) at any time during the 50 years of ASR operation. Following is a range of simulated injection rates and their corresponding potentiometric surface elevations after 50 years of operation:

Injection Rate (MGD)	Spacing Between Two Wells (miles)	Water Level Elevation in 2060 (feet amsl)
2.54	0.75	1,772
2.54	1.50	1,756
0.60	0.75	1,515

Under the specified assumptions, the model indicates that an injection rate of 2.54 MGD results in potentiometric water levels that exceed the land surface elevation. A sensitivity evaluation indicated that the highest injection rate that does not cause the potentiometric surface to rise above land surface is about 0.6 MGD (Figure 4.8).

Although increasing well spacing would reduce the simulated maximum water level in general, it is important to note that local formation transmissivity is also a significant factor. The existing parameters in the Lower Trinity Aquifer model in the Center Point area need to be refined if more realistic representation is requested. Conclusions reached in this ASR assessment are based on assumptions that are conceptual. Additional site-specific aquifer characterization and testing as well as modeling scenarios should be completed in conjunction with facility planning and design.

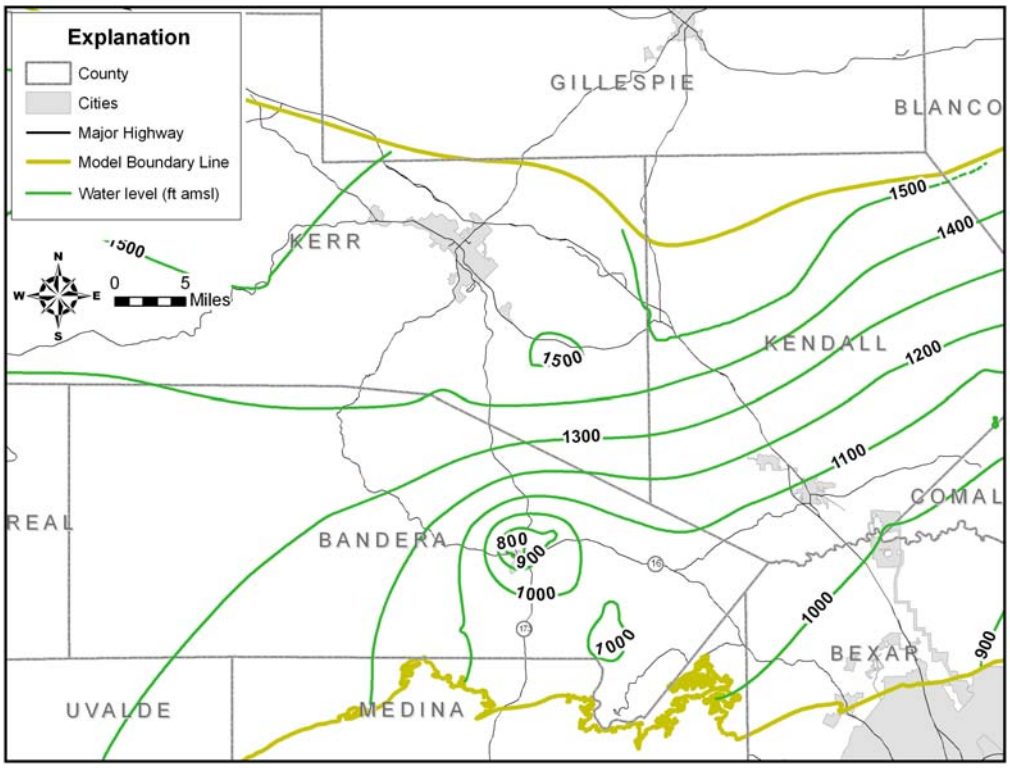


Figure 4.8 Water Level in the Lower Trinity after 50 years of Injection (2060) at a Rate of 0.6 MGD

5.0 Conclusions

The two primary goals of this study were:

- Identify surface water opportunities in the upper Guadalupe River Basin to address potential future municipal shortages for the City of Kerrville and the Upper Guadalupe River Authority (UGRA)
- Evaluate the feasibility of an ASR system in the Lower Trinity Aquifer in Kerr County capable of delivering water to rural (County-Other) users in Kerr and a portion of Bandera counties within the service area of the Upper Guadalupe River Authority.

The study compiled an inventory of 191 water rights above Canyon Lake (including those associated with the reservoir). These water rights were classified in five groups based on reliability. The inventory also contains estimated rough monetary values. For purposes of securing future supplies, the planning group determined that water rights in Groups 3 and 4 are more desirable to purchase because they are less expensive to buy and provide enough reliability during wet years, when water can be used in combination with the existing ASR system operated by Kerrville or the proposed ASR operated by UGRA.

This study identified 11 water right that can be used in combination with the existing UGRA surface water rights, and an ASR system in the Lower Trinity Aquifer to obtain a reliable supply of 1,124 acre-feet per year. The selected 11 water rights meet specified criteria of reliability, historical use and location. During wet years, as much as 3,029 acre-feet per year of surface water could be available. Excess water during wet years may be injected in the ASR and water from storage in the aquifer may be pumped during dry years. This strategy requires a treatment plant with a capacity of 4 MGD and at least 2 injection wells with a combined capacity of 2.54 MGD. The overall capital cost of this strategy is $ 15,505,100 and the unit cost is $1,217 per acre-foot.

The model evaluation indicates that a total injection of 2.54 MGD is overly aggressive from a hydrogeologic perspective because the Lower Trinity water level (pressure) in the wells nearby would be above ground surface. Alternative simulation scenarios suggest that, under the

given assumptions, around 0.6 MGD would be the most feasible injection rate at which pressurized water levels near the injection wells would not rise above the land surface.

Conclusions reached in this analysis are based on assumptions that are conceptual. A higher level of model confidence will require field verification of local aquifer hydraulic conditions (transmissivity, etc.). Additional scenarios should be explored as advanced facility planning and design progress.

Another strategy not considered in this study and included in the 2006 Plateau Regional Water Plan was the possibility of entering into an agreement with GBRA to subordinate Canyon Lake water rights to the junior right owned by Kerrville and UGRA. GBRA would be compensated for the reduction in the firm yield of Canyon Lake as a result of this subordination. It is recommended that Kerrville and UGRA explore this possibility before pursing any purchase of additional water rights.

6.0 References

Ashworth, J.B., 1983, Ground-water availability of the lower Cretaceous formations in the Hill Country of south-central Texas: Texas Department of Water Resources Report 273.

Harbaugh, A.W., Banta, E.R., Hill, M.C. and McDonald, M.G., 2000, MODFLOW-2000, the U.S. Geological Survey Modular Ground-Water Model-User guide to modularization concepts and the Ground-Water Flow Process, U.S. Geological Survey Open-File Report 00–92.

Jones, J.P., 1998, Unpublished geologic cross sections in Bandera, Kendall and Kerr Counties.

LBG-Guyton Associates, 2009, Groundwater model for the Lower Trinity aquifer in Bandera County, Texas and surrounding areas: prepared for Bandera County River Authority and Groundwater District.

LBG-Guyton Associates and Freese and Nichols, Inc., 2006. Plateau Region Water Plan. Prepared for the Plateau Region Water Planning Group and the Texas Water Development Board.

LBG-Guyton Associates and Jones Geological Consulting, 2001, The Lower Trinity Aquifer of Bandera and Kerr Counties, Texas: Prepared for the Plateau Region Water Planning Group and the Texas Water Development Board.

Tetra Tech, Inc., 2007, Feasibility analysis for regional water and wastewater services, Center Point and eastern Kerr County, Texas: Prepared for Kerr County and the Upper Guadalupe River Authority.

Wilson, W.F., 2008, Hydrogeology of Kerr County: Report prepared for the Headwaters Groundwater Conservation District, Kerrville Texas.

ATTACHMENT 1

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
1930	6	HERSHEL REID ET UX	69	3	12/31/1930	66	FLAT ROCK CRK	Kerr
1932	6	PRESBYTERIAN MO-RANCH ASSEMBLY	60	1	12/31/1948		N FRK GUADALUPE RIVER	Kerr
1932	6	PRESBYTERIAN MO-RANCH ASSEMBLY	14	3	12/31/1948	7	N FRK GUADALUPE RIVER	Kerr
1932	6	PRESBYTERIAN MO-RANCH ASSEMBLY	0	7	4/3/1929		N FRK GUADALUPE RIVER	Kerr
1932	6	PRESBYTERIAN MO-RANCH ASSEMBLY	5	7	3/30/1994		N FRK GUADALUPE RIVER	Kerr
1934	6	KATHY JAN FREEMAN	1.55	3	12/31/1967	2.32	DRY CRK	Kerr
1935	6	ROBERT P MICHEL ET UX	8.45	3	12/31/1967	8.68	N FRK GUADALUPE RIVER	Kerr
1935	6	ROBERT P MICHEL ET UX	0	3	12/31/1967		N FRK GUADALUPE RIVER	Kerr
1936	6	WILLIAM I HENDERSON ET AL	17	3	8/2/1909	6	N FRK GUADALUPE RIVER	Kerr
1936	6	WILLIAM I HENDERSON ET AL	134	3	12/31/1960	48	INDIAN CRK	Kerr
1937	6	BOY SCOUTS- ALAMO AREA	0	7	12/31/1938		BEAR CRK	Kerr
1938	6	LOUIS H STUMBERG	2	3	12/31/1948	4	N FRK GUADALUPE RIVER	Kerr
1938	6	LOUIS H STUMBERG	15	3	12/31/1933	22	N FRK GUADALUPE RIVER	Kerr
1939	6	LOUIS H STRUMBERG	3	3	12/31/1952	6	GRAPE CRK	Kerr
1940	6	B E QUINN III ET AL	28	3	12/31/1936	16	N FRK GUADALUPE RIVER	Kerr
1940	6	B E QUINN III ET AL	4	3	12/31/1936		GRAPE CRK	Kerr
1941	6	DELMAR SPIER AGENT	6	3	12/31/1953	9	TURTLE CRK	Kerr
1943	6	RIO NORTE LTD	14	1	12/31/1945		N FRK GUADALUPE RIVER	Kerr
1945	6	JOHN P HILL	25	3	12/31/1915	20	N FRK GUADALUPE RIVER	Kerr
1946	6	JOHN P HILL ADMINISTRATOR	11	3	12/31/1915	9	N FRK GUADALUPE RIVER	Kerr
1947	6	GUAD VALLEY LOT OWNERS ASSN	6	3	12/31/1960	10	N FRK GUADALUPE RIVER	Kerr
1947	6	GUAD VALLEY LOT OWNERS ASSN	3	1	12/31/1960		N FRK GUADALUPE RIVER	Kerr
1948	6	JOHN H DUNCAN	7	3	9/18/1914	7	BRUSHY CRK	Kerr
1949	6	WILLIAM O CARTER TRUSTEE	6	3	12/31/1948	2	HONEY CRK	Kerr
1949	6	WILLIAM O CARTER TRUSTEE	27	3	12/31/1900	9	HONEY CRK	Kerr
1950	6	JOHN H DUNCAN	6	3	12/31/1903	20	HONEY CRK	Kerr
1950	6	JOHN H DUNCAN	0	7	12/31/1903		HONEY CRK	Kerr
1952	6	CYPRESS COVE MAINTENANCE ASSN	0	7	12/31/1960		SCHULTZ CRK	Comal
1953	6	LAURA B LEWIS ET VIR	40	3	6/26/1914	24	N FRK GUADALUPE RIVER	Kerr
1954	6	LAWRENCE D KRAUSE	5	3	7/22/1974	5	JENTSCH CRK	Comal
1954	6	LAWRENCE D KRAUSE	15	3	7/22/1974	15	JENTSCH CRK	Comal
1955	6	KRAUSE FAMILY LTD PARTNERSHIP	10	3	7/22/1974	18	JENTSCH CRK	Comal
1956	6	RIVER INN ASSN OF UNIT OWNERS	0	7	12/31/1936		S FRK GUADALUPE RIVER	Kerr
1956	6	RIVER INN ASSN OF UNIT OWNERS	10	1	7/3/1984		S FRK GUADALUPE RIVER	Kerr
1957	6	RAYMOND M BOWEN JR ET AL	0	7	12/14/1928		S FRK GUADALUPE RIVER	Kerr
1958	6	COOL WATER LLC	20	3	12/5/1938	10	CYPRESS CRK	Kerr
1958	6	COOL WATER LLC	0	13	12/5/1938		CYPRESS CRK	Kerr
1961	6	LAVERNE CRIDER MOORE ET VIR	3	1	12/31/1947		S FRK GUADALUPE RIVER	Kerr
1961	6	LAVERNE CRIDER MOORE ET VIR	1	3	12/31/1947	3	S FRK GUADALUPE RIVER	Kerr
1963	6	LAWRENCE L GRAHAM ET AL	2	3	5/29/1917	12	S FRK GUADALUPE RIVER	Kerr
1963	6	LAWRENCE L GRAHAM ET AL	0	7	5/29/1917		S FRK GUADALUPE RIVER	Kerr
1964	6	VIRGINIA MOORE JOHNSTON	10	3	12/31/1948	10	TEGENER	Kerr
1967	6	FORD SMITH TRUSTEE	20	8	8/2/1971		GUADALUPE RIVER	Kerr
1967	6	FORD SMITH TRUSTEE	0	8	12/13/1990		GUADALUPE RIVER	Kerr
1967	6	FORD SMITH TRUSTEE	0	7	8/2/1971		GUADALUPE RIVER	Kerr
1967	6	FORD SMITH TRUSTEE	0	11	8/2/1971		GUADALUPE RIVER	Kerr
1968	6	LOUIS DOMINGUES	10	3	12/31/1889	20	GUADALUPE RIVER	Kerr
1969	6	BOBBY DON BLACKBURN	15	2	6/29/1914		GUADALUPE RIVER	Kerr
1969	6	BOBBY DON BLACKBURN	49	3	12/31/1946	80	KELLY CRK	Kerr
1969	6	BOBBY DON BLACKBURN	59	3	12/31/1946		GUADALUPE RIVER	Kerr
1969	6	BOBBY DON BLACKBURN	0	5	6/29/1914		GUADALUPE RIVER	Kerr
1970	6	CARL HAWKINS	10	1	7/1/1913		GUADALUPE RIVER	Kerr
1970	6	CARL HAWKINS	32	3	7/1/1913	25	GUADALUPE RIVER	Kerr
1971	6	COUNTY OF KERR	0	7	4/4/1955		GUADALUPE RIVER	Kerr
1972	6	WESLEY ELLEBRACHT	0.8	3	12/31/1900	0.8	WELSH BR	Kerr
1972	6	WELCH CREEK PARTNERS LTD	5.15	3	12/31/1900	5.15	WELSH BR	Kerr
1972	6	ARANSAS BAY COMPANY	0.05	3	12/31/1900	0.05	WELSH BR	Kerr
1973	6	SHELTON RANCHES INC	10	3	6/29/1914	10	SMITHS BR	Kerr
1974	6	SHELTON RANCHES INC	70	3	6/29/1914	35	SMITHS BR	Kerr
1975	6	TEXAS PARKS & WILDLIFE DEPT	400	2	7/1/1925		FESSENDEN BR	Kerr
1975	6	TEXAS PARKS & WILDLIFE DEPT	5380	2	7/2/1992		FESSENDEN BR	Kerr

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
1976	6	APACHE SPRINGS LP	29	3	6/10/1914	14.5	FESSENDEN BR	Kerr
1976	6	APACHE SPRINGS LP	0	7	7/25/1941		FESSENDEN BR	Kerr
1977	6	TEXAS CATHOLIC BOYS CAMP	23	3	12/1/1969	23	JOHNSON CRK	Kerr
1978	6	A J RUST	33	3	12/31/1902	65	JOHNSON CRK	Kerr
1979	6	KEITH S MEADOW	18	3	12/31/1914	6	BYAS CRK	Kerr
1980	6	A L MOORE	12	3	1/28/1918	6	JOHNSON CRK	Kerr
1981	6	JACK D CLARK JR ET AL	32	3	1/28/1918	16	JOHNSON CRK	Kerr
1981	6	JACK D CLARK JR ET AL	143	3	12/31/1961	76	JOHNSON CRK	Kerr
1982	6	SAVOY LTD	133	3	12/31/1955	50	JOHNSON CRK	Kerr
1983	6	N V MAMIMAR	32	3	4/29/1914	17	JOHNSON CRK	Kerr
1983	6	N V MAMIMAR	67	3	12/31/1953	35	JOHNSON CRK	Kerr
1983	6	DAVID J COPELAND ET UX	0	3	12/31/1953		JOHNSON CRK	Kerr
1983	6	DAVID J COPELAND ET UX	0	3	12/31/1953		JOHNSON CRK	Kerr
1984	6	MICHAEL E & GAIL SEARS	1	3	4/29/1914	2	JOHNSON CRK	Kerr
1985	6	T & L CAUTHEN LLC	80	3	12/31/1910	31	JOHNSON CRK	Kerr
1987	6	REGINALD E WARREN JR	90	3	12/31/1934	30	JOHNSON CRK	Kerr
1988	6	JIMMIE L QUERNER SR ESTATE	128	3	12/31/1960	64	FALL CRK	Kerr
1990	6	DOROTHY L JENKINS ET AL	3	3	6/30/1914	1	JOHNSON CRK	Kerr
1991	6	LAZY HILLS GUEST RANCH INC	21	3	12/31/1960	28	HENDERSON BR	Kerr
1992	6	RICHARD A SMITH ET UX	13.1	3	6/24/1914	8.55	JOHNSON CRK	Kerr
1992	6	ALLIE B BURTON	9.9	3	6/24/1914	6.45	JOHNSON CRK	Kerr
1993	6	WES H WAGNER ET AL	50	3	2/18/1918	50	JOHNSON CRK	Kerr
1994	6	M H & MARY FRANCES MONTGOMERY	5	3	9/23/1914	4	GUADALUPE RIVER	Kerr
1995	6	GEOFFREY WRIGHT	3.027	3	12/31/1951	3.027	GOAT CRK	Kerr
1995	6	DON E WOODWORTH ET AL	7.973	3	12/31/1951	7.973	GOAT CRK	Kerr
1996	6	KERRVILLE, CITY OF	150	1	4/4/1914		GUADALUPE RIVER	Kerr
1996	6	KERRVILLE, CITY OF	75	3	4/4/1914	44	GUADALUPE RIVER	Kerr
1997	6	DARRELL G LOCHTE ET AL	143	4	12/31/1946		GUADALUPE RIVER	Kerr
1997	6	DARRELL G LOCHTE ET AL	2	2	12/31/1946		GUADALUPE RIVER	Kerr
1998	6	JOE M PRUNEDA III ET AL	26.48	3	12/31/1959	70.66	TOWN CRK	Kerr
1998	6	JOE M PRUNEDA III ET AL	0	13	12/31/1959		TOWN CRK	Kerr
1999	6	KERRVILLE STATE HOSPITAL	0	7	6/4/1973		GUADALUPE RIVER	Kerr
2000	6	RIVERHILL COUNTRY CLUB INC	135	3	4/29/1974	160.71	CAMP MEETING CRK	Kerr
2000	6	RIVERHILL COUNTRY CLUB INC	215	3	6/1/1987		GUADALUPE RIVER	Kerr
2001	6	ROSEMARY HUNT MEEK	41	3	12/31/1924	194	GUADALUPE RIVER	Kerr
2001	6	ROSEMARY HUNT MEEK	100	3	1/6/1992		GUADALUPE RIVER	Kerr
2001	6	ROSEMARY HUNT MEEK	154	3	1/24/1995		GUADALUPE RIVER	Kerr
2002	6	COMANCHE TRACE RANCH & GOLF CL	136	3	12/31/1924	471.4	GUADALUPE RIVER	Kerr
2002	6	CITY OF KERRVILLE	0	3	12/31/1924		GUADALUPE RIVER	Kerr
2003	6	WHEATCRAFT INC	52	3	10/11/1917	125	GUADALUPE RIVER	Kerr
2003	6	WHEATCRAFT INC	0	4	10/11/1917		GUADALUPE RIVER	Kerr
2004	6	COUNTY OF KERR	0	7	4/4/1955		GUADALUPE RIVER	Kerr
2005	6	HARRIET BOCKHOFF ESTATE	59	3	12/31/1900	98	GUADALUPE RIVER	Kerr
2006	6	R B COLVIN	104.16	3	12/31/1952	298.18	GUADALUPE RIVER	Kerr
2006	6	R B COLVIN	0	1	12/31/1952		GUADALUPE RIVER	Kerr
2006	6	R B COLVIN	0	2	12/31/1952		GUADALUPE RIVER	Kerr
2006	6	R B COLVIN	48.84	3	9/29/1989		GUADALUPE RIVER	Kerr
2006	6	1967 SHELTON TRUSTS PART ET AL	106.9	3	12/31/1952	78.55	GUADALUPE RIVER	Kerr
2006	6	1967 SHELTON TRUSTS PART ET AL	50.1	3	9/29/1989		GUADALUPE RIVER	Kerr
2006	6	FRITZ FAMILY ENTERPRISES LP	34.04	3	12/31/1952		GUADALUPE RIVER	Kerr
2006	6	FRITZ FAMILY ENTERPRISES LP	15.96	3	9/29/1989		GUADALUPE RIVER	Kerr
2006	6	J W COLVIN III ET AL	74.9	3	12/31/1952	214.37	GUADALUPE RIVER	Kerr
2006	6	J W COLVIN III ET AL	35.1	3	9/29/1989		GUADALUPE RIVER	Kerr
2006	6	BEDROCK MATERIALS LTD	100	3	8/1/1996	76	GUADALUPE RIVER	Kerr
2007	6	JOHN G WRIGHT ET AL	31	3	12/31/1959	31	SPRING CRK	Kerr
2008	6	LUTHERAN CAMP CHRYSALIS	11	1	11/18/1974		TURTLE CRK	Kerr
2009	6	WILLIAM C NORTON ET UX	5	3	12/31/1970	5	BUSHWHACK CRK	Kerr
2010	6	G ROBERT SWANTNER JR ET UX	7	3	12/31/1938	5	BUSHWHACK CRK	Kerr
2011	6	WILLIAM ALAN GRUY	80	3	12/31/1940	50	TURTLE CRK	Kerr
2012	6	SANDRA BLAIR	1	3	12/31/1953	1	TURTLE CRK	Kerr
2013	6	FELIX R & LILLIAN STEILER REAL	11	3	12/31/1953	12	WEST CRK	Kerr

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
2014	6	CINDI SHARP	6.36	3	12/31/1932	5.63	TURTLE CRK	Kerr
2014	6	BENNO OOSTERMAN ET UX	6.36	3	12/31/1932	5.63	TURTLE CRK	Kerr
2014	6	JOHN M LEBOLT TRUSTEE	9.02	3	12/31/1932	7.98	TURTLE CRK	Kerr
2014	6		4.26	3	12/31/1932	7.98	TURTLE CRK	Kerr
2015	6	JAMES E NUGENT	27	3	12/31/1887	21	GUADALUPE RIVER	Kerr
2016	6	DORIS J HODGES	8	3	12/31/1946	8	GUADALUPE RIVER	Kerr
2017	6	COUNTY OF KERR	0	7	4/4/1955		GUADALUPE RIVER	Kerr
2017	6	COUNTY OF KERR	0	8	4/4/1955		GUADALUPE RIVER	Kerr
2018	6	LEE ANTHONY MOSTY	154	3	12/31/1951	94	GUADALUPE RIVER	Kerr
2020	6	FOUR SEASONS GROWERS LTD	60	3	6/22/1914	30	GUADALUPE RIVER	Kerr
2021	6	RAYMOND F MOSTY ET AL	102.66	3	11/24/1914	45	GUADALUPE RIVER	Kerr
2022	6	ROBERT LEE MOSTY JR ET AL	17	3	11/24/1914	119	GUADALUPE RIVER	Kerr
2022	6	BELINDA LEE MOSTY STANUSH ET AL	0	13	11/24/1914	174	GUADALUPE RIVER	Kerr
2022	6	ROBERT LEE MOSTY JR	0	13	11/24/1914	136.67	GUADALUPE RIVER	Kerr
2023	6	RICHARD A GREEN ET UX	7	3	12/31/1930	3	GUADALUPE RIVER	Kerr
2024	6	WHEATCRAFT INC	114	3	12/31/1932	125	GUADALUPE RIVER	Kerr
2024	6	WHEATCRAFT INC	0	4	12/31/1932		GUADALUPE RIVER	Kerr
2025	6	JOCELYN LEVI STRAUS ET AL	40.3	3	4/24/1917	20.8	GUADALUPE RIVER	Kerr
2025	6	DAVID B WRAY	57.35	3	4/24/1917	29.6	GUADALUPE RIVER	Kerr
2025	6	BYNO SALSMAN ET UX	57.35	3	4/24/1917	29.6	GUADALUPE RIVER	Kerr
2026	6	ZANE H ROBINSON ET UX	53.945	3	12/31/1961	34.52	GUADALUPE RIVER	Kerr
2026	6	RONNIE W SCHLOTTMAN ET UX	17.83	3	12/31/1961	11.41	GUADALUPE RIVER	Kerr
2026	6	KENNETH WHITEWOOD ET UX	1.225	3	12/31/1961		GUADALUPE RIVER	Kerr
2026	6	KENNETH WHITEWOOD ET UX	52	3	12/31/1961		GUADALUPE RIVER	Kerr
2026	6	KENNETH WHITEWOOD ET UX	100	3	8/1/1996		GUADALUPE RIVER	Kerr
2027	6	ROBERT L PARKER SR ET AL	8	3	12/31/1918	3.4	VERDE CRK	Bandera
2028	6	HOWARD E BUTT	0	7	7/19/1940		PALMER CRK	Bandera
2029	6	WALTERS INVESTMENTS LP	25	3	8/21/1972	200	PRISON CANYON CRK	Kerr
2029	6	WALTERS INVESTMENTS LP	0	3	12/31/1947		VERDE CRK	Kerr
2030	6	JERRY BROCK	180	3	12/31/1947	90	VERDE CRK	Kerr
2030	6	JERRY BROCK	16.29	13	12/31/1947		VERDE CRK	Kerr
2030	6	JAY H HEIZER ET UX	11.57	3	12/31/1947	5.785	VERDE CRK	Kerr
2030	6	OWNERSHIP VERIFIED BUT PENDING	58.14	3	12/31/1947	29.07	VERDE CRK	Kerr
2031	6	JOSEPH PAUL MILLER ET UX	115	3	12/31/1951	80	GUADALUPE RIVER	Kerr
2032	6	VERA L SALVATORE	10	3	12/31/1960	6	GUADALUPE RIVER	Kerr
2033	6	CHRISTOPHER L HAVENS ET UX	90	3	12/31/1961	90	GUADALUPE RIVER	Kerr
2034	6	CHESTER P HEINEN ET AL	2	3	12/31/1961	6	GUADALUPE RIVER	Kerr
2035	6	EARL PANKRATZ ET UX	2	3	12/31/1963	5	GUADALUPE RIVER	Kendall
2036	6	46 SKYLINE DRIVE LLC	50	3	12/31/1964	200	GUADALUPE RIVER	Kendall
2036	6	46 SKYLINE DRIVE LLC	75	3	12/31/1964		GUADALUPE RIVER	Kendall
2037	6	GENE ARTHUR ALLERKAMP	5	3	12/31/1940	6.33	CYPRESS CRK	Kerr
2037	6	JANICE CHARLOTTE BULLARD	4.46	3	12/31/1940	5.66	CYPRESS CRK	Kerr
2037	6	ROMAN Q LUNA ET UX	10	3	12/31/1940	12.67	CYPRESS CRK	Kerr
2037	6	OWNER VERIFIED BUT PENDING	5	3	12/31/1940	6.33	CYPRESS CRK	Kerr
2037	6	WERNER WAYNE ALLERKAMP	5	3	12/31/1940	6.33	CYPRESS CRK	Kerr
2037	6	WAYNE KLEIN ET UX	0.54	3	12/31/1940	0.68	CYPRESS CRK	Kerr
2038	6	HARRY E REEH	15	3	12/31/1965	15	CYPRESS CRK	Kerr
2039	6	FRED SAUR	7	3	12/31/1964	7	CYPRESS CRK	Kerr
2040	6	A C & DOROTHY PFEIFFER	10	3	9/25/1918	5	CYPRESS CRK	Kerr
2041	6	SUSSEX PARTNERS LTD	25	3	12/31/1955		CYPRESS CRK	Kerr
2041	6	SUSSEX PARTNERS LTD	45	3	8/28/1984		CYPRESS CRK	Kerr
2041	6	ALAN R SPARGER III ET UX	64	3	8/28/1984		CYPRESS CRK	Kerr
2042	6	KENDALL WATER SUPPLY	209	3	12/31/1964	375	CYPRESS CRK	Kerr
2043	6	MARY LEE EDWARDS	19.57	3	8/30/1976	14.68	CYPRESS CRK	Kerr
2043	6	EDGAR SEIDENSTICKER ET UX	16.85	3	8/30/1976	12.63	CYPRESS CRK	Kerr
2043	6	L J MANNERING ET UX	3.58	3	8/30/1976	2.69	CYPRESS CRK	Kerr
2044	6	LION'S LAIR LLC	16.38	3	12/31/1912	13.65	GUADALUPE RIVER	Kendall
2044	6	PATRICIA GALT STEVES	1.62	3	12/31/1912	1.35	GUADALUPE RIVER	Kendall
2045	6	MARSHALL STEVES	8	3	12/31/1912	3	GUADALUPE RIVER	Kendall
2046	6	WILLIAM G & MILDRED D SPROWLS	28	3	12/31/1957	37	GUADALUPE RIVER	Kendall
2047	6	H C SEIDENSTICKER	20	3	12/31/1954	30	GUADALUPE RIVER	Kendall

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
2048	6	SUSAN ROSE DURDEN	100	3	12/31/1965	50	BLOCK CRK	Kendall
2049	6	KENNETH M & CYNTHIA RUSCH	5	3	12/31/1966	30	GUADALUPE RIVER	Kendall
2050	6	ERWIN KLEMSTEIN	102.84	3	12/31/1955	51.42	GUADALUPE RIVER	Kendall
2050	6	ERWIN KLEMSTEIN	0	3	12/31/1955	297.23	GUADALUPE RIVER	Kendall
2050	6	ERWIN KLEMSTEIN	0	3	12/31/1955		GUADALUPE RIVER	Kendall
2050	6	JOHN C MCCALEB	16.58	3	12/31/1955	8.29	GUADALUPE RIVER	Kendall
2050	6	ROBERT & MARGARET STEVEN (UNVERIFIED)	16.58	3	12/31/1955	8.29	GUADALUPE RIVER	Kendall
2051	6	JOSHUA CREEK RANCH INC	2	3	12/31/1965	130	JOSHUA CRK	Kendall
2051	6	JOSHUA CREEK RANCH INC	260	3	7/31/1991		JOSHUA CRK	Kendall
2051	6	JOSHUA CREEK RANCH INC	0	7	1/3/2002		JOSHUA CRK	Kendall
2052	6	RANCHO KENDALL INC	232	3	12/31/1953	116	GUADALUPE RIVER	Kendall
2053	6	ERNO SPENRATH	32	3	12/31/1965	63	GUADALUPE RIVER	Kendall
2054	6	EDMUND BEHR ESTATE	80	3	12/31/1966	60	GUADALUPE RIVER	Kendall
2056	6	MARK E WATSON JR ET UX	20	3	8/1/1966	36	WILLIE CRK	Kendall
2057	6	MARK E WATSON JR ET UX	25	3	8/1/1966	147	ASKEY CRK	Kendall
2058	6	OTTO KASTEN	16.53	3	12/31/1966	13.22	GUADALUPE RIVER	Kendall
2058	6	A W WRIGHT FAMILY LIMITED PARTNERSHIP	23.47	3	12/31/1966	18.78	GUADALUPE RIVER	Kendall
2059	6	RANCH BRANCH LLC	39	3	12/31/1962	45	GUADALUPE RIVER	Kendall
2060	6	CHADEAUX INVESTMENTS LTD	90	3	6/30/1963	40	GUADALUPE RIVER	Kendall
2060	6	CHADEAUX INVESTMENTS LTD	0	3	6/30/1963	297.23	GUADALUPE RIVER	Kendall
2060	6	CHADEAUX INVESTMENTS LTD	0	3	6/30/1963		GUADALUPE RIVER	Comal
2061	6	PATRICK DAVID VANDERWILT ET UX	36.74	3	12/31/1966	36.74	GUADALUPE RIVER	Kendall
2061	6	MARJORIE RANZAU INGENHUETT	17.61	3	12/31/1966	17.61	GUADALUPE RIVER	Kendall
2061	6	LEANING R RANCH FAMILY LTD PARTNERSHIP	15.65	3	12/31/1966	15.65	GUADALUPE RIVER	Kendall
2062	6	LAYNE L PULS	30	3	12/31/1965	30	WASP CRK	Kendall
2062	6	SUSAN J PULS	30	3	12/31/1965	30	WASP CRK	Kendall
2063	6	FROST-LANCASTER PROPERTIES	33.23	3	1/17/1955	18.115	GUADALUPE RIVER	Kendall
2063	6	OWNERSHIP VERIFIED BUT PENDING	22.71	3	1/17/1955	12.39	GUADALUPE RIVER	Kendall
2063	6	CHRISTOPHER P HILL	8.09	3	1/17/1955	4.415	GUADALUPE RIVER	Kendall
2063	6	KENDALL WATER SUPPLY	3.06	3	1/17/1955	1.67	GUADALUPE RIVER	Kendall
2063	6	OWNERSHIP UNVERIFIED	37.91	3	1/17/1955	20.66	GUADALUPE RIVER	Kendall
2064	6	EARL S DODERER ET UX	4.38	3	12/31/1932	4.38	SABINAS CRK	Kendall
2064	6	SYBIL R JONES CO-TRUSTEE ET AL	7.62	3	12/31/1932	7.62	SABINAS CRK	Kendall
2065	6	GUY BODINE III ET UX	10	3	12/31/1962		SABINAS CRK	Kendall
2065	6	FRASHIER LAND PARTNERSHIP II LTD	10	3	12/31/1962		SABINAS CRK	Kendall
2066	6	DAVID M ERNSBERGER ET UX	5	3	12/31/1959	10	SABINAS CRK	Kendall
2067	6	TY RAMPY ET AL	20	3	12/31/1958	20	GUADALUPE RIVER	Kendall
2067	6	TY RAMPY ET AL	20	3	8/6/1973	20	GUADALUPE RIVER	Kendall
2068	6	KWW RANCHES LTD	72	3	2/24/1975	250	GUADALUPE RIVER	Kendall
2069	6	DOUBLE U-SPRING BRANCH	30	3	12/31/1951	11	SIMMONS CRK	Kendall
2070	6	FRANK A STANUSH	22	3	12/31/1963	11	GUADALUPE RIVER	Comal
2070	6	FRANK A STANUSH	98	3	12/31/1963	49	GUADALUPE RIVER	Comal
2071	6	GUADALUPE RIVER RANCH & CATTLE	1	3	6/16/1914	1	GUADALUPE RIVER	Comal
2072	6	ELOY GARCIA JR ET UX	35	3	12/31/1939	100	GUADALUPE RIVER	Comal
2073	6	LAKE OF THE HILLS PROP OWNERS	0	7	12/15/1975		REBECCA CRK	Comal
2073	6	LAKE OF THE HILLS PROP OWNERS	0	7	12/15/1975		REBECCA CRK	Comal
2073	6	LAKE OF THE HILLS PROP OWNERS	0	7	12/15/1975		REBECCA CRK	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	62900	1	3/19/1956		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	2	3/19/1956		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	3	3/19/1956		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	7	3/19/1956		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	11	3/13/1956		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	57100	1	6/14/1999		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	2	6/14/1999		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	3	6/14/1999		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	7	6/14/1999		GUADALUPE RIVER	Comal
2074	6	GUADALUPE-BLANCO RIVER AUTHORITY	0	11	6/14/1999		GUADALUPE RIVER	Comal
2437	6	DAN W BACON MD ET UX	0	7	12/31/1948		N FRK GUADALUPE RIVER	Kerr

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
2438	6	LUTZ ISSLIEB ET AL	26.55	3	12/31/1941	15.93	N FRK GUADALUPE RIVER	Kerr
2438	6	JAY DICKENS	3.45	3	12/31/1941		N FRK GUADALUPE RIVER	Kerr
2439	6	DALE B AND MARSHA G ELMORE	8	3	12/31/1937	8	N FRK GUADALUPE RIVER	Kerr
2440	6	JOANNE SCHERER SMITH TRUST	1	3	12/31/1961	1	N FRK GUADALUPE RIVER	Kerr
2441	6	SILAS B RAGSDALE	21	3	12/31/1941	105	N FRK GUADALUPE RIVER	Kerr
2442	6	SUMMER DREAMS	28	3	12/31/1900	14	HONEY CRK	Kerr
2442	6	SUMMER DREAMS	0	7	12/31/1900		HONEY CRK	Kerr
2443	6	JOHN H DUNCAN	40	3	12/31/1915	20	HONEY CRK	Kerr
2444	6	BRUCE F HARRISON	6	3	12/31/1921	3	S FRK GUADALUPE RIVER	Kerr
2444	6	BRUCE F HARRISON	0	7	7/29/1927		S FRK GUADALUPE RIVER	Kerr
2445	6	CAMP MYSTIC INC	5	3	12/31/1952	15	CYPRESS CRK	Kerr
2445	6	CAMP MYSTIC INC	7	3	12/31/1952		S FRK GUADALUPE RIVER	Kerr
2445	6	CAMP MYSTIC INC	14	1	3/15/1927		CYPRESS CRK	Kerr
2446	6	BOB/KAT INC	20	3	12/31/1927	10	S FRK GUADALUPE RIVER	Kerr
2447	6	CAMP LA JUNTA INC	26	3	12/31/1928	15	S FRK GUADALUPE RIVER	Kerr
2447	6	CAMP LA JUNTA INC	14	1	12/31/1928		S FRK GUADALUPE RIVER	Kerr
2447	6	CAMP LA JUNTA INC	0	7	12/31/1928		S FRK GUADALUPE RIVER	Kerr
2448	6	COOL CREEK LLC	6	3	12/31/1955	5	TEGENER CRK	Kerr
2449	6	BILLIE ZUBER ET AL	17	3	12/31/1926	25.5	GUADALUPE RIVER	Kerr
2450	6	ROBERT L MOSTY JR	80	3	12/31/1932	110	GUADALUPE RIVER	Kendall
2450	6	ROBERT L MOSTY JR	78	3	12/31/1932	117	GUADALUPE RIVER	Kerr
3505	1	CITY OF KERRVILLE	3603	1	5/23/1977		GUADALUPE RIVER	Kerr
3505	1	CITY OF KERRVILLE	0	3	5/23/1977	192	GUADALUPE RIVER	Kerr
3567	1	ROBERT L PARKER SR ET AL	0	7	10/17/1977		VERDE CRK	Bandera
3651	1	T & R PROPERTIES	0	7	10/30/1978		PALMER CRK	Kerr
3625	1	KENNETH W & MARCIA C MULFORD	0	11	1/3/1978		RATTLESNAKE CRK	Kerr
3625	1	KENNETH W & MARCIA C MULFORD	0	7	1/3/1978		RATTLESNAKE CRK	Kerr
3635	1	CITY OF KERRVILLE	80	3	8/14/1978	56	QUINLAN CRK	Kerr
3635	1	CITY OF KERRVILLE	0	7	8/14/1978		QUINLAN CRK	Kerr
3714	1	PECAN VALLEY RANCH OWNERS ASSN	0	7	11/5/1979		ELM CRK	Kerr
3743	1	SHELTON RANCHES INC	0	7	3/31/1980		JOHNSON CRK	Kerr
4125	1	TEXAS PARKS & WILDLIFE DEPT	25	1	3/23/1981		GUADALUPE RIVER	Kendall
4100	1	SHELTON RANCHES INC	20	3	6/14/1982	14	JOHNSON CRK	Kerr
4096	1	ALISON B MENCAROW LIVING TRUST	11.52	3	1/3/1983	18	TOWN CRK	Kerr
4167	1	GUADALUPE-BLANCO RIVER AUTHORITY	0	5	4/17/1984		GUADALUPE RIVER	Comal
4181	1	JAY L POTH JR	25.86	3	8/28/1984	12.93	CYPRESS CRK	Kerr
4181	1	THOMAS D POTH	25.38	3	8/28/1984	12.69	CYPRESS CRK	Kerr
4181	1	CHESTER C HURST ET UX	18.76	3	8/28/1984	9.38	CYPRESS CRK	Kerr
4163	1	COMAL CO FRESH WSD #1	0	7	9/4/1984		REBECCA CRK	Comal
4163	1	COMAL CO FRESH WSD #1	120	1	9/4/1984		REBECCA CRK	Comal
4255	1	GEORGE M WILLIAMS SR ET AL	50	3	7/9/1985	50	GUADALUPE RIVER	Kendall
4291	1	PURALLOY INC	50	3	8/28/1985	50	GUADALUPE RIVER	Comal
5060	1	AUSTEX PROPERTIES LTD	10	3	5/20/1986	12	FALL CRK	Kerr
5107	1	46 SKYLINE DRIVE LLC	518	3	10/23/1986	200	GUADALUPE RIVER	Kendall
5107	1	46 SKYLINE DRIVE LLC	0	3	10/23/1986		GUADALUPE RIVER	Kendall
5122	1	BUCKLEY LP	75	3	3/19/1987	50	GUADALUPE RIVER	Kerr
5125	1	ROBERT L SCHWARZ	40	3	4/3/1987	38	CURRY CRK	Kendall
5208	1	JAMES F HAYES & MARY K HAYES	40	3	12/9/1988	40	VERDE CRK	Kerr
5315	1	DANA G KIRK TRUSTEE	0	8	10/5/1990		E TOWN CRK	Kerr
5321	1	LARRY J LANGBEIN	150	3	12/2/1990	75	E SISTER CRK	Kendall
5322	1	E RAND SOUTHARD ET UX	0	7	11/2/1990		FALL CRK	Kerr
5331	1	ROBERT E BARTELL ET AL	15	1	11/8/1990		S FRK GUADALUPE RIVER	Kerr
5331	1	ROBERT E BARTELL ET AL	0	7	11/8/1990		S FRK GUADALUPE RIVER	Kerr
5331	1	ROBERT E BARTELL ET AL	86	3	11/8/1990	30	S FRK GUADALUPE RIVER	Kerr
5331	1	DR CURTIS S MCCUBBIN	10	3	11/8/1990	7.8	S FRK GUADALUPE RIVER	Kerr
5348	1	BRYON DONZIS	5	3	3/5/1991	4	N FRK GUADALUPE RIVER	Kerr
5352	1	BONITA OWNERS ASSN INC	2	3	3/28/1991	2	S FRK GUADALUPE RIVER	Kerr
5394	1	UPPER GUADALUPE RIVER AUTHORITY	1661	1	1/6/1992		GUADALUPE RIVER	Kerr
5394	1	UPPER GUADALUPE RIVER AUTHORITY	339	1	1/6/1992		GUADALUPE RIVER	Kerr
5394	1	UPPER GUADALUPE RIVER AUTHORITY	0	3	1/6/1992		GUADALUPE RIVER	Kerr
5394	1	UPPER GUADALUPE RIVER AUTHORITY	0	9	1/6/1992		GUADALUPE RIVER	Kerr

Attachment 1
Water Rights Above and Including Canyon Lake

Water Right Number	Water Right Type	Owner	Annual Diversion (AFY)	Use Code	Priority Date	Acres	Stream Name	County
5394	1	CITY OF KERRVILLE	761	1	1/6/1992		GUADALUPE RIVER	Kerr
5394	1	CITY OF KERRVILLE	339	1	1/6/1992		GUADALUPE RIVER	Kerr
5394	1	CITY OF KERRVILLE	1069	1	1/6/1992		GUADALUPE RIVER	Kerr
5401	1	H E BUTT GROCERY CO	0	7	2/20/1992		TURTLE CRK	Kerr
5402	1	TURTLE CREEK INDUSTRIES INC	0	7	2/24/1992		TURTLE CRK	Kerr
5444	1	EUGENE D ELLIS ET UX	10	3	1/5/1993	25.5	GUADALUPE RIVER	Kerr
5474	1	ELTON RUST	10	3	11/16/1993	24	GUADALUPE RIVER	Kendall
5479	1	J W COLVIN III ET AL	566	3	2/22/1994	283	GUADALUPE RIVER	Kerr
5490	1	BILLY J & KARAN R BOLES	10	3	5/31/1994	8	GUADALUPE RIVER	Kendall
5495	1	LOIS & JOSEPH WESSENDORF ET AL	0	7	7/27/1994		S FRK GUADALUPE RIVER	Kerr
5501	1	BARRY T & KATHRYN B NALL	5	3	8/24/1994	6	FLAT ROCK CRK	Kendall
5521	1	MEYERSTEIN FAMILY TRUST	30	3	2/2/1995	30	GUADALUPE RIVER	Kerr
5528	1	KEVIN SCOTT PETERMANN ET UX	49	3	5/19/1995		GUADALUPE RIVER	Kendall
5528	1	STEVES BROTHERS	49	3	5/19/1995	56.76	GUADALUPE RIVER	Kendall
5531	1	LEE ROY COSPER ET UX	29.1	3	6/21/1995	14.55	GUADALUPE RIVER	Kerr
5531	1	DIANE DEMPSEY	50.9	3	6/21/1995	25.45	GUADALUPE RIVER	Kerr
5534	1	WILLIAM G JOHNSON III ET AL	20	3	7/17/1995	50	GUADALUPE RIVER	Kendall
5536	1	J W COLVIN III	92	3	7/28/1995		GUADALUPE RIVER	Kerr
5536	1	J W COLVIN III TRUSTEE	18	3	7/28/1995		GUADALUPE RIVER	Kerr
5536	1	J W COLVIN III TRUSTEE ET AL	190	3	7/28/1995		GUADALUPE RIVER	Kerr
5536	1	CITY SOUTH MANAGEMENT CORP	84.3	3	7/28/1995		GUADALUPE RIVER	Kerr
5536	1	J W COLVIN III TRUSTEE FOR FM 1092 CTR	15.7	3	7/28/1995		GUADALUPE RIVER	Kerr
5541	1	LONGCOPE FAMILY LTD	14	3	8/31/1995	15	N FRK GUADALUPE RIVER	Kerr
5641	1	MARLIN R MARCUM	1	3	8/10/1999	2	CYPRESS CRK	Kerr
5647	1	SOUTHERLAND PROPERTIES INC	350	3	9/17/1999	297.23	GUADALUPE RIVER	Comal
5647	1	SOUTHERLAND PROPERTIES INC	0	3	9/17/1999		GUADALUPE RIVER	Comal
5737	1	ROBERT E SIEKER ET AL	1	3	4/16/2001		GUADALUPE RIVER	Kerr
5749	1	HILLTOP HOLDINGS INC	0	7	8/9/2001		WATER HOLE CRK	Comal
5749	1	HILLTOP HOLDINGS INC	0	7	8/9/2001		WATER HOLE CRK	Comal
5749	1	HILLTOP HOLDINGS INC	0	7	8/9/2001		WATER HOLE CRK	Comal
5846	1	CORDILLERA RANCH POA	0	7	8/31/2004		SWEDE CRK	Kendall
5846	1	CORDILLERA RANCH POA	0	7	8/31/2004		SWEDE CRK	Kendall

Source: Texas Commission on Environmental Quality, WRDETAIL, January 2008.

Type Codes: 1 = Permit
6 = Certificate of Adjudication

Use Codes:
1 = Municipal
2 = Industrial
3 = Irrigation
4 = Mining
5 = Hydropower
7 = Recreation
8 = Other
9 = Recharge
11 = Domestic
13 = Storage

ATTACHMENT 2

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
1930	HERSHEL REID ET UX	69	12/31/1930	53.5	0.0	83.9	4	$ 48,300	$ 2,415
1932	PRESBYTERIAN MO-RANCH ASSEMBLY	60	12/31/1948	37.4	0.0	69.6	5	$ 42,000	$ 2,100
1932	PRESBYTERIAN MO-RANCH ASSEMBLY	14	12/31/1948	35.9	0.0	66.1	5	$ 9,800	$ 490
1932	PRESBYTERIAN MO-RANCH ASSEMBLY		4/3/1929	NA	0.0	NA	5	$ -	$ -
1932	PRESBYTERIAN MO-RANCH ASSEMBLY	5	3/30/1994	31.0	0.0	64.3	5	$ 3,500	$ 175
1934	KATHY JAN FREEMAN	1.55	12/31/1967	0.0	0.0	3.6	5	$ 1,100	$ 55
1935	ROBERT P MICHEL ET UX	8.45	12/31/1967	0.0	0.0	3.6	5	$ 6,000	$ 300
1935	ROBERT P MICHEL ET UX	0	12/31/1967	NA	0.0	NA	5	$ -	$ -
1936	WILLIAM I HENDERSON ET AL	17	8/2/1909	100.0	8.8	96.4	1	$ 17,900	$ 895
1936	WILLIAM I HENDERSON ET AL	134	12/31/1960	0.0	0.0	3.6	5	$ 93,800	$ 4,690
1937	BOY SCOUTS- ALAMO AREA		12/31/1938	NA	0.0	NA	5	$ -	$ -
1938	LOUIS H STUMBERG	2	12/31/1948	17.5	0.0	48.2	5	$ 1,400	$ 70
1938	LOUIS H STUMBERG	15	12/31/1933	18.6	0.0	48.2	5	$ 10,500	$ 525
1939	LOUIS H STRUMBERG	3	12/31/1952	48.5	0.0	85.7	4	$ 2,100	$ 105
1940	B E QUINN III ET AL	28	12/31/1936	43.1	0.0	69.6	5	$ 19,600	$ 980
1940	B E QUINN III ET AL	4	12/31/1936	38.3	0.0	64.3	5	$ 2,800	$ 140
1941	DELMAR SPIER AGENT	6	12/31/1953	74.2	0.1	92.9	4	$ 4,300	$ 215
1943	RIO NORTE LTD	14	12/31/1945	14.9	0.0	53.6	5	$ 9,800	$ 490
1945	JOHN P HILL	25	12/31/1915	80.8	7.8	91.1	2	$ 22,900	$ 1,145
1946	JOHN P HILL ADMINISTRATOR	11	12/31/1915	80.8	3.4	91.1	2	$ 10,100	$ 505
1947	GUAD VALLEY LOT OWNERS ASSN	6	12/31/1960	0.0	0.0	3.6	5	$ 4,200	$ 210
1947	GUAD VALLEY LOT OWNERS ASSN	3	12/31/1960	0.0	0.0	3.6	5	$ 2,100	$ 105
1948	JOHN H DUNCAN	7	9/18/1914	64.8	2.1	87.5	4	$ 6,400	$ 320
1949	WILLIAM O CARTER TRUSTEE	6	12/31/1948	17.5	0.0	48.2	5	$ 4,200	$ 210
1949	WILLIAM O CARTER TRUSTEE	27	12/31/1900	88.0	12.3	91.1	2	$ 27,300	$ 1,365
1950	JOHN H DUNCAN	6	12/31/1903	97.6	5.0	100.0	1	$ 7,700	$ 385
1950	JOHN H DUNCAN		12/31/1903	NA	0.0	NA	5	$ -	$ -
1952	CYPRESS COVE MAINTENANCE ASSN		12/31/1960	NA	0.0	NA	5	$ -	$ -
1953	LAURA B LEWIS ET VIR	40	6/26/1914	83.3	12.5	91.1	2	$ 36,500	$ 1,825
1954	LAWRENCE D KRAUSE	5	7/22/1974	0.0	0.0	60.7	5	$ 3,500	$ 175
1954	LAWRENCE D KRAUSE	15	7/22/1974	0.5	0.0	39.3	5	$ 10,500	$ 525
1955	KRAUSE FAMILY LTD PARTNERSHIP	10	7/22/1974	0.0	0.0	35.7	5	$ 7,000	$ 350
1956	RIVER INN ASSN OF UNIT OWNERS		12/31/1936	NA	0.0	NA	5	$ -	$ -
1956	RIVER INN ASSN OF UNIT OWNERS	10	7/3/1984	87.8	4.6	94.6	2	$ 10,200	$ 510
1957	RAYMOND M BOWEN JR ET AL		12/14/1928	NA	0.0	NA	5	$ -	$ -
1958	COOL WATER LLC	20	12/5/1938	91.1	12.8	96.4	1	$ 22,700	$ 1,135
1958	COOL WATER LLC		12/5/1938	NA	0.0	NA	5	$ -	$ -
1961	LAVERNE CRIDER MOORE ET VIR	3	12/31/1947	15.6	0.0	50.0	5	$ 2,100	$ 105
1961	LAVERNE CRIDER MOORE ET VIR	1	12/31/1947	15.6	0.0	50.0	5	$ 700	$ 35
1963	LAWRENCE L GRAHAM ET AL	2	5/29/1917	100.0	2.0	100.0	1	$ 2,800	$ 140
1963	LAWRENCE L GRAHAM ET AL		5/29/1917	NA	0.0	NA	5	$ -	$ -
1964	VIRGINIA MOORE JOHNSTON	10	12/31/1948	62.3	0.0	83.9	4	$ 7,000	$ 350
1967	FORD SMITH TRUSTEE	20	8/2/1971	0.0	0.0	37.5	5	$ 14,000	$ 700
1967	FORD SMITH TRUSTEE		12/13/1990	NA	0.0	NA	5	$ -	$ -
1967	FORD SMITH TRUSTEE		8/2/1971	NA	0.0	NA	5	$ -	$ -
1967	FORD SMITH TRUSTEE		8/2/1971	NA	0.0	NA	5	$ -	$ -
1968	LOUIS DOMINGUES	10	12/31/1889	91.4	5.1	91.1	1	$ 10,500	$ 525

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
1969	BOBBY DON BLACKBURN	15	6/29/1914	88.0	8.0	96.4	1	$ 16,000	$ 800
1969	BOBBY DON BLACKBURN	49	12/31/1946	63.0	31.7	89.3	3	$ 55,900	$ 2,795
1969	BOBBY DON BLACKBURN	59	12/31/1946	63.0	31.7	89.3	3	$ 62,900	$ 3,145
1969	BOBBY DON BLACKBURN		6/29/1914	NA	0.0	NA	5	$ -	$ -
1970	CARL HAWKINS	10	7/1/1913	97.4	5.4	94.6	1	$ 10,700	$ 535
1970	CARL HAWKINS	32	7/1/1913	97.4	17.4	94.6	1	$ 34,300	$ 1,715
1971	COUNTY OF KERR		4/4/1955	NA	0.0	NA	5	$ -	$ -
1972	WESLEY ELLEBRACHT	0.8	12/31/1900	87.0	0.4	91.1	2	$ 900	$ 45
1972	WELCH CREEK PARTNERS LTD	5.15	12/31/1900	87.0	2.3	91.1	2	$ 5,200	$ 260
1972	ARANSAS BAY COMPANY	0.05	12/31/1900	87.0	0.0	91.1	2	$ 100	$ 5
1973	SHELTON RANCHES INC	10	6/29/1914	90.5	5.8	98.2	1	$ 11,000	$ 550
1974	SHELTON RANCHES INC	70	6/29/1914	88.0	33.1	94.6	2	$ 71,500	$ 3,575
1975	TEXAS PARKS & WILDLIFE DEPT	400	7/1/1925	0.1	0.0	0.0	5	$ 280,000	$ 14,000
1975	TEXAS PARKS & WILDLIFE DEPT	5380	7/2/1992	0.1	0.0	0.0	5	Non-consumptive	Non-consumptive
1976	APACHE SPRINGS LP	29	6/10/1914	83.7	10.8	91.1	2	$ 27,700	$ 1,385
1976	APACHE SPRINGS LP		7/25/1941	NA	0.0	NA	5	$ -	$ -
1977	TEXAS CATHOLIC BOYS CAMP	23	12/1/1969	0.0	0.0	42.9	5	$ 16,100	$ 805
1978	A J RUST	33	12/31/1902	99.8	17.0	96.4	1	$ 34,700	$ 1,735
1979	KEITH S MEADOW	18	12/31/1914	74.3	5.6	91.1	4	$ 16,500	$ 825
1980	A L MOORE	12	1/28/1918	74.5	3.7	89.3	4	$ 11,000	$ 550
1981	JACK D CLARK JR ET AL	32	1/28/1918	71.9	10.0	87.5	4	$ 29,200	$ 1,460
1981	JACK D CLARK JR ET AL	143	12/31/1961	0.0	0.0	3.6	5	$ 100,100	$ 5,005
1982	SAVOY LTD	133	12/31/1955	21.3	0.0	50.0	5	$ 93,100	$ 4,655
1983	N V MAMIMAR	32	4/29/1914	88.6	11.9	91.1	2	$ 30,600	$ 1,530
1983	N V MAMIMAR	67	12/31/1953	13.5	0.0	44.6	5	$ 46,900	$ 2,345
1983	DAVID J COPELAND ET UX		12/31/1953	NA	0.0	NA	5	$ -	$ -
1983	DAVID J COPELAND ET UX		12/31/1953	NA	0.0	NA	5	$ -	$ -
1984	MICHAEL E & GAIL SEARS	1	4/29/1914	85.1	0.4	91.1	2	$ 1,000	$ 50
1985	T & L CAUTHEN LLC	80	12/31/1910	92.4	41.3	92.9	1	$ 84,100	$ 4,205
1987	REGINALD E WARREN JR	90	12/31/1934	18.6	0.0	48.2	5	$ 63,000	$ 3,150
1988	JIMMIE L QUERNER SR ESTATE	128	12/31/1960	0.0	0.0	3.6	5	$ 89,600	$ 4,480
1990	DOROTHY L JENKINS ET AL	3	6/30/1914	86.2	1.1	91.1	2	$ 2,900	$ 145
1991	LAZY HILLS GUEST RANCH INC	21	12/31/1960	0.0	0.0	16.1	5	$ 14,700	$ 735
1992	RICHARD A SMITH ET UX	13.1	6/24/1914	83.3	4.1	91.1	2	$ 12,000	$ 600
1992	ALLIE B BURTON	9.9	6/24/1914	83.3	3.1	91.1	2	$ 9,100	$ 455
1993	WES H WAGNER ET AL	50	2/18/1918	78.3	18.5	92.9	4	$ 47,600	$ 2,380
1994	M H & MARY FRANCES MONTGOMERY	5	9/23/1914	83.6	1.9	91.1	2	$ 4,800	$ 240
1995	GEOFFREY WRIGHT	3.027	12/31/1951	78.8	1.0	96.4	4	$ 2,800	$ 140
1995	DON E WOODWORTH ET AL	7.973	12/31/1951	78.8	2.5	96.4	4	$ 7,300	$ 365
1997	DARRELL G LOCHTE ET AL	143	12/31/1946	85.6	82.6	92.9	1	$ 156,300	$ 7,815
1997	DARRELL G LOCHTE ET AL	2	12/31/1946	85.6	1.2	92.9	1	$ 2,200	$ 110
1998	JOE M PRUNEDA III ET AL	26.48	12/31/1959	0.0	0.0	17.9	5	$ 18,600	$ 930
1998	JOE M PRUNEDA III ET AL		12/31/1959	NA	0.0	NA	5	$ -	$ -
1999	KERRVILLE STATE HOSPITAL		6/4/1973	NA	0.0	NA	5	$ -	$ -
2000	RIVERHILL COUNTRY CLUB INC	135	4/29/1974	0.0	0.0	32.1	5	$ 94,500	$ 4,725
2000	RIVERHILL COUNTRY CLUB INC	215	6/1/1987	0.0	0.0	3.6	5	$ 150,500	$ 7,525
2001	ROSEMARY HUNT MEEK	41	12/31/1924	74.5	12.8	89.3	4	$ 37,400	$ 1,870
2001	ROSEMARY HUNT MEEK	100	1/6/1992	0.0	0.0	3.6	5	$ 70,000	$ 3,500
2001	ROSEMARY HUNT MEEK	154	1/24/1995	0.0	0.0	1.8	5	$ 107,800	$ 5,390
2002	COMANCHE TRACE RANCH & GOLF CL	136	12/31/1924	74.5	42.4	89.3	4	$ 124,100	$ 6,205
2002	CITY OF KERRVILLE		12/31/1924	NA	0.0	NA	5	$ -	$ -
2003	WHEATCRAFT INC	52	10/11/1917	76.6	18.9	89.3	4	$ 49,300	$ 2,465
2003	WHEATCRAFT INC		10/11/1917	NA	0.0	NA	5	$ -	$ -
2004	COUNTY OF KERR		4/4/1955	NA	0.0	NA	5	$ -	$ -

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
2005	HARRIET BOCKHOFF ESTATE	59	12/31/1900	100.0	30.4	96.4	1	$ 62,100	$ 3,105
2006	R B COLVIN	104.16	12/31/1952	38.5	2.1	17.9	5	$ 74,400	$ 3,720
2006	R B COLVIN		12/31/1952	NA	0.0	NA	5	$ -	$ -
2006	R B COLVIN		12/31/1952	NA	0.0	NA	5	$ -	$ -
2006	R B COLVIN	48.84	9/29/1989	36.9	1.0	23.2	5	$ 34,900	$ 1,745
2006	1967 SHELTON TRUSTS PART ET AL	106.9	12/31/1952	46.1	2.1	17.9	5	$ 76,300	$ 3,815
2006	1967 SHELTON TRUSTS PART ET AL	50.1	9/29/1989	42.5	1.0	41.1	5	$ 35,800	$ 1,790
2006	FRITZ FAMILY ENTERPRISES LP	34.04	12/31/1952	43.7	0.7	67.9	5	$ 24,300	$ 1,215
2006	FRITZ FAMILY ENTERPRISES LP	15.96	9/29/1989	36.3	0.3	17.9	5	$ 11,400	$ 570
2006	J W COLVIN III ET AL	74.9	12/31/1952	42.1	1.5	28.6	5	$ 53,500	$ 2,675
2006	J W COLVIN III ET AL	35.1	9/29/1989	36.4	0.7	17.9	5	$ 25,100	$ 1,255
2006	BEDROCK MATERIALS LTD	100	8/1/1996	35.3	2.0	12.5	5	$ 71,400	$ 3,570
2007	JOHN G WRIGHT ET AL	31	12/31/1959	0.0	0.0	50.0	5	$ 21,700	$ 1,085
2008	LUTHERAN CAMP CHRYSALIS	11	11/18/1974	0.0	0.0	37.5	5	$ 7,700	$ 385
2009	WILLIAM C NORTON ET UX	5	12/31/1970	0.0	0.0	35.7	5	$ 3,500	$ 175
2010	G ROBERT SWANTNER JR ET UX	7	12/31/1938	92.8	4.4	98.2	1	$ 7,900	$ 395
2011	WILLIAM ALAN GRUY	80	12/31/1940	64.1	22.0	87.5	4	$ 71,000	$ 3,550
2012	SANDRA BLAIR	1	12/31/1953	85.9	0.1	98.2	2	$ 800	$ 40
2013	FELIX R & LILLIAN STEILER REAL	11	12/31/1953	36.1	0.2	62.5	5	$ 7,900	$ 395
2014	CINDI SHARP	6.36	12/31/1932	74.5	2.0	89.3	4	$ 5,900	$ 295
2014	BENNO OOSTERMAN ET UX	6.36	12/31/1932	74.5	2.0	89.3	4	$ 5,900	$ 295
2014	JOHN M LEBOLT TRUSTEE	9.02	12/31/1932	74.5	2.8	89.3	4	$ 8,300	$ 415
2014		4.26	12/31/1932	74.5	1.3	89.3	4	$ 3,900	$ 195
2015	JAMES E NUGENT	27	12/31/1887	100.0	13.9	96.4	1	$ 28,400	$ 1,420
2016	DORIS J HODGES	8	12/31/1946	74.5	2.5	89.3	4	$ 7,300	$ 365
2017	COUNTY OF KERR		4/4/1955	NA	0.0	NA	5	$ -	$ -
2017	COUNTY OF KERR		4/4/1955	NA	0.0	NA	5	$ -	$ -
2018	LEE ANTHONY MOSTY	154	12/31/1951	42.9	9.9	69.6	5	$ 114,600	$ 5,730
2020	FOUR SEASONS GROWERS LTD	60	6/22/1914	90.5	31.0	91.1	1	$ 63,100	$ 3,155
2021	RAYMOND F MOSTY ET AL	102.66	11/24/1914	78.7	51.4	91.1	3	$ 106,900	$ 5,345
2022	ROBERT LEE MOSTY JR ET AL	17	11/24/1914	48.7	6.9	7.1	5	$ 16,600	$ 830
2022	BELINDA LEE MOSTY STANUSH ET AL		11/24/1914	NA	0.0	NA	5	$ -	$ -
2022	ROBERT LEE MOSTY JR		11/24/1914	NA	0.0	NA	5	$ -	$ -
2023	RICHARD A GREEN ET UX	7	12/31/1930	74.5	2.2	89.3	4	$ 6,400	$ 320
2024	WHEATCRAFT INC	114	12/31/1932	74.5	35.6	89.3	4	$ 104,000	$ 5,200
2024	WHEATCRAFT INC		12/31/1932	NA	0.0	NA	5	$ -	$ -
2025	JOCELYN LEVI STRAUS ET AL	40.3	4/24/1917	77.1	12.6	89.3	4	$ 36,800	$ 1,840
2025	DAVID B WRAY	57.35	4/24/1917	77.1	17.9	89.3	4	$ 52,400	$ 2,620
2025	BYNO SALSMAN ET UX	57.35	4/24/1917	77.1	17.9	89.3	4	$ 52,400	$ 2,620
2026	ZANE H ROBINSON ET UX	53.945	12/31/1961	0.0	0.0	3.6	5	$ 37,800	$ 1,890
2026	RONNIE W SCHLOTTMAN ET UX	17.83	12/31/1961	0.0	0.0	3.6	5	$ 12,500	$ 625
2026	KENNETH WHITEWOOD ET UX	1.225	12/31/1961	0.0	0.0	3.6	5	$ 900	$ 45
2026	KENNETH WHITEWOOD ET UX	52	12/31/1961	0.0	0.0	3.6	5	$ 36,400	$ 1,820
2026	KENNETH WHITEWOOD ET UX	100	8/1/1996	0.0	0.0	1.8	5	$ 70,000	$ 3,500
2027	ROBERT L PARKER SR ET AL	8	12/31/1918	76.2	2.6	89.3	4	$ 7,400	$ 370
2028	HOWARD E BUTT		7/19/1940	NA	0.0	NA	5	$ -	$ -
2029	WALTERS INVESTMENTS LP	25	8/21/1972	0.0	0.0	82.1	4	$ 17,500	$ 875
2029	WALTERS INVESTMENTS LP		12/31/1947	NA	0.0	NA	5	$ -	$ -
2030	JERRY BROCK	180	12/31/1947	41.0	17.6	71.4	5	$ 138,000	$ 6,900
2030	JERRY BROCK	16.29	12/31/1947	41.0	1.6	71.4	5	$ 12,500	$ 625
2030	JAY H HEIZER ET UX	11.57	12/31/1947	41.0	1.1	71.4	5	$ 8,900	$ 445

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
2030	OWNERSHIP VERIFIED BUT PENDING	58.14	12/31/1947	41.0	5.7	71.4	5	$ 44,600	$ 2,230
2031	JOSEPH PAUL MILLER ET UX	115	12/31/1951	11.4	4.9	3.6	5	$ 83,800	$ 4,190
2032	VERA L SALVATORE	10	12/31/1960	0.0	0.0	3.6	5	$ 7,000	$ 350
2033	CHRISTOPHER L HAVENS ET UX	90	12/31/1961	0.0	0.0	3.6	5	$ 63,000	$ 3,150
2034	CHESTER P HEINEN ET AL	2	12/31/1961	85.6	0.9	92.9	2	$ 2,100	$ 105
2035	EARL PANKRATZ ET UX	2	12/31/1963	0.0	0.0	3.6	5	$ 1,400	$ 70
2036	46 SKYLINE DRIVE LLC	50	12/31/1964	0.0	0.0	33.9	5	$ 35,000	$ 1,750
2036	46 SKYLINE DRIVE LLC	75	12/31/1964	0.0	0.0	33.9	5	$ 52,500	$ 2,625
2037	GENE ARTHUR ALLERKAMP	5	12/31/1940	78.2	1.7	89.3	4	$ 4,700	$ 235
2037	JANICE CHARLOTTE BULLARD	4.46	12/31/1940	78.2	1.5	89.3	4	$ 4,200	$ 210
2037	ROMAN Q LUNA ET UX	10	12/31/1940	78.2	3.4	89.3	4	$ 9,300	$ 465
2037	OWNER VERIFIED BUT PENDING	5	12/31/1940	78.2	1.7	89.3	4	$ 4,700	$ 235
2037	WERNER WAYNE ALLERKAMP	5	12/31/1940	78.2	1.7	89.3	4	$ 4,700	$ 235
2037	WAYNE KLEIN ET UX	0.54	12/31/1940	78.2	0.2	89.3	4	$ 600	$ 30
2038	HARRY E REEH	15	12/31/1965	0.6	0.0	3.6	5	$ 10,500	$ 525
2039	FRED SAUR	7	12/31/1964	0.0	0.0	3.6	5	$ 4,900	$ 245
2040	A C & DOROTHY PFEIFFER	10	9/25/1918	85.6	4.7	92.9	2	$ 10,300	$ 515
2041	SUSSEX PARTNERS LTD	25	12/31/1955	42.0	0.0	73.2	5	$ 17,500	$ 875
2041	SUSSEX PARTNERS LTD	45	8/28/1984	0.0	0.0	3.6	5	$ 31,500	$ 1,575
2041	ALAN R SPARGER III ET UX	64	8/28/1984	0.0	0.0	3.6	5	$ 44,800	$ 2,240
2042	KENDALL WATER SUPPLY	209	12/31/1964	0.0	0.0	16.1	5	$ 146,300	$ 7,315
2043	MARY LEE EDWARDS	19.57	8/30/1976	0.0	0.0	3.6	5	$ 13,700	$ 685
2043	EDGAR SEIDENSTICKER ET UX	16.85	8/30/1976	0.0	0.0	3.6	5	$ 11,800	$ 590
2043	L J MANNERING ET UX	3.58	8/30/1976	0.0	0.0	3.6	5	$ 2,600	$ 130
2044	LION'S LAIR LLC	16.38	12/31/1912	100.0	16.4	100.0	1	$ 22,700	$ 1,135
2044	PATRICIA GALT STEVES	1.62	12/31/1912	100.0	1.6	100.0	1	$ 2,300	$ 115
2045	MARSHALL STEVES	8	12/31/1912	97.2	6.4	100.0	1	$ 10,000	$ 500
2046	WILLIAM G & MILDRED D SPROWLS	28	12/31/1957	0.0	0.0	3.6	5	$ 19,600	$ 980
2047	H C SEIDENSTICKER	20	12/31/1954	43.0	0.4	78.6	4	$ 14,300	$ 715
2048	SUSAN ROSE DURDEN	100	12/31/1965	0.0	0.0	3.6	5	$ 70,000	$ 3,500
2049	KENNETH M & CYNTHIA RUSCH	5	12/31/1966	0.0	0.0	3.6	5	$ 3,500	$ 175
2050	ERWIN KLEMSTEIN	102.84	12/31/1955	42.0	0.0	78.6	4	$ 72,000	$ 3,600
2050	ERWIN KLEMSTEIN		12/31/1955	NA	0.0	NA	5	$ -	$ -
2050	ERWIN KLEMSTEIN		12/31/1955	NA	0.0	NA	5	$ -	$ -
2050	JOHN C MCCALEB	16.58	12/31/1955	42.0	0.0	78.6	4	$ 11,700	$ 585
2050	ROBERT & MARGARET STEVEN (UNVERIFIED)	16.58	12/31/1955	42.0	0.0	78.6	4	$ 11,700	$ 585
2051	JOSHUA CREEK RANCH INC	2	12/31/1965	0.0	0.0	39.3	5	$ 1,400	$ 70
2051	JOSHUA CREEK RANCH INC	260	7/31/1991	0.0	0.0	3.6	5	$ 182,000	$ 9,100
2051	JOSHUA CREEK RANCH INC		1/3/2002	NA	0.0	NA	5	$ -	$ -
2052	RANCHO KENDALL INC	232	12/31/1953	43.0	4.6	78.6	4	$ 165,600	$ 8,280
2053	ERNO SPENRATH	32	12/31/1965	0.0	0.0	3.6	5	$ 22,400	$ 1,120
2054	EDMUND BEHR ESTATE	80	12/31/1966	0.0	0.0	3.6	5	$ 56,000	$ 2,800
2056	MARK E WATSON JR ET UX	20	8/1/1966	0.0	0.0	48.2	5	$ 14,000	$ 700
2057	MARK E WATSON JR ET UX	25	8/1/1966	0.0	0.0	50.0	5	$ 17,500	$ 875
2058	OTTO KASTEN	16.53	12/31/1966	0.0	0.0	3.6	5	$ 11,600	$ 580
2058	A W WRIGHT FAMILY LIMITED PARTNERSHIP	23.47	12/31/1966	0.0	0.0	3.6	5	$ 16,500	$ 825
2059	RANCH BRANCH LLC	39	12/31/1962	0.0	0.0	3.6	5	$ 27,300	$ 1,365
2060	CHADEAUX INVESTMENTS LTD	90	6/30/1963	24.6	0.0	44.6	5	$ 63,000	$ 3,150
2060	CHADEAUX INVESTMENTS LTD		6/30/1963	NA	0.0	NA	5	$ -	$ -
2060	CHADEAUX INVESTMENTS LTD		6/30/1963	NA	0.0	NA	5	$ -	$ -
2061	PATRICK DAVID VANDERWILT ET UX	36.74	12/31/1966	0.0	0.0	3.6	5	$ 25,800	$ 1,290

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
2061	MARJORIE RANZAU INGENHUETT	17.61	12/31/1966	0.0	0.0	3.6	5	$ 12,400	$ 620
2061	LEANING R RANCH FAMILY LTD PARTNERSHIP	15.65	12/31/1966	0.0	0.0	3.6	5	$ 11,000	$ 550
2062	LAYNE L PULS	30	12/31/1965	0.0	0.0	33.9	5	$ 21,000	$ 1,050
2062	SUSAN J PULS	30	12/31/1965	0.0	0.0	33.9	5	$ 21,000	$ 1,050
2063	FROST-LANCASTER PROPERTIES	33.23	1/17/1955	43.0	0.7	78.6	4	$ 23,800	$ 1,190
2063	OWNERSHIP VERIFIED BUT PENDING	22.71	1/17/1955	43.0	0.5	78.6	4	$ 16,300	$ 815
2063	CHRISTOPHER P HILL	8.09	1/17/1955	43.0	0.2	78.6	4	$ 5,800	$ 290
2063	KENDALL WATER SUPPLY	3.06	1/17/1955	43.0	0.1	78.6	4	$ 2,200	$ 110
2063	OWNERSHIP UNVERIFIED	37.91	1/17/1955	43.0	0.8	78.6	4	$ 27,100	$ 1,355
2064	EARL S DODERER ET UX	4.38	12/31/1932	76.5	1.5	94.6	4	$ 4,200	$ 210
2064	SYBIL R JONES CO-TRUSTEE ET AL	7.62	12/31/1932	76.5	2.7	94.6	4	$ 7,200	$ 360
2065	GUY BODINE III ET UX	10	12/31/1962	0.0	0.0	3.6	5	$ 7,000	$ 350
2065	FRASHIER LAND PARTNERSHIP II LTD	10	12/31/1962	0.0	0.0	3.6	5	$ 7,000	$ 350
2066	DAVID M ERNSBERGER ET UX	5	12/31/1959	0.0	0.0	3.6	5	$ 3,500	$ 175
2067	TY RAMPY ET AL	20	12/31/1958	0.0	0.0	3.6	5	$ 14,000	$ 700
2067	TY RAMPY ET AL	20	8/6/1973	0.0	0.0	23.2	5	$ 14,000	$ 700
2068	KWW RANCHES LTD	72	2/24/1975	0.6	0.0	78.6	4	$ 50,400	$ 2,520
2069	DOUBLE U-SPRING BRANCH	30	12/31/1951	68.2	6.7	87.5	4	$ 25,600	$ 1,280
2070	FRANK A STANUSH	22	12/31/1963	0.0	0.0	3.6	5	$ 15,400	$ 770
2070	FRANK A STANUSH	98	12/31/1963	0.0	0.0	3.6	5	$ 68,600	$ 3,430
2071	GUADALUPE RIVER RANCH & CATTLE	1	6/16/1914	97.7	0.8	100.0	1	$ 1,300	$ 65
2072	ELOY GARCIA JR ET UX	35	12/31/1939	93.0	17.8	98.2	1	$ 36,700	$ 1,835
2073	LAKE OF THE HILLS PROP OWNERS		12/15/1975	NA	0.0	NA	5	$ -	$ -
2073	LAKE OF THE HILLS PROP OWNERS		12/15/1975	NA	0.0	NA	5	$ -	$ -
2073	LAKE OF THE HILLS PROP OWNERS		12/15/1975	NA	0.0	NA	5	$ -	$ -
2437	DAN W BACON MD ET UX		12/31/1948	NA	0.0	NA	5	$ -	$ -
2438	LUTZ ISSLIEB ET AL	26.55	12/31/1941	64.7	0.0	83.9	4	$ 18,600	$ 930
2438	JAY DICKENS	3.45	12/31/1941	64.7	0.0	83.9	4	$ 2,500	$ 125
2439	DALE B AND MARSHA G ELMORE	8	12/31/1937	18.6	0.0	48.2	5	$ 5,600	$ 280
2440	JOANNE SCHERER SMITH TRUST	1	12/31/1961	0.0	0.0	3.6	5	$ 700	$ 35
2441	SILAS B RAGSDALE	21	12/31/1941	17.5	0.0	48.2	5	$ 14,700	$ 735
2442	SUMMER DREAMS	28	12/31/1900	97.8	23.7	100.0	1	$ 35,800	$ 1,790
2442	SUMMER DREAMS		12/31/1900	NA	0.0	NA	5	$ -	$ -
2443	JOHN H DUNCAN	40	12/31/1915	93.7	26.8	98.2	1	$ 46,300	$ 2,315
2444	BRUCE F HARRISON	6	12/31/1921	99.5	5.8	100.0	1	$ 8,200	$ 410
2444	BRUCE F HARRISON		7/29/1927	NA	0.0	NA	5	$ -	$ -
2445	CAMP MYSTIC INC	5	12/31/1952	58.0	0.0	85.7	4	$ 3,500	$ 175
2445	CAMP MYSTIC INC	7	12/31/1952	58.0	0.0	85.7	4	$ 4,900	$ 245
2445	CAMP MYSTIC INC	14	3/15/1927	56.2	0.0	83.9	4	$ 9,800	$ 490
2446	BOB/KAT INC	20	12/31/1927	18.6	0.0	48.2	5	$ 14,000	$ 700
2447	CAMP LA JUNTA INC	26	12/31/1928	59.0	0.0	87.5	4	$ 18,200	$ 910
2447	CAMP LA JUNTA INC	14	12/31/1928	59.0	0.0	87.5	4	$ 9,800	$ 490
2447	CAMP LA JUNTA INC		12/31/1928	NA	0.0	NA	5	$ -	$ -
2448	COOL CREEK LLC	6	12/31/1955	13.5	0.0	41.1	5	$ 4,200	$ 210
2449	BILLIE ZUBER ET AL	17	12/31/1926	18.6	0.0	48.2	5	$ 11,900	$ 595
2450	ROBERT L MOSTY JR	80	12/31/1932	74.5	25.0	89.3	4	$ 73,000	$ 3,650
2450	ROBERT L MOSTY JR	78	12/31/1932	74.5	24.3	89.3	4	$ 71,200	$ 3,560

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
3567	ROBERT L PARKER SR ET AL		10/17/1977	NA	0.0	NA	5	$ -	$ -
3651	T & R PROPERTIES		10/30/1978	NA	0.0	NA	5	$ -	$ -
3625	KENNETH W & MARCIA C MULFORD		1/3/1978	NA	0.0	NA	5	$ -	$ -
3625	KENNETH W & MARCIA C MULFORD		1/3/1978	NA	0.0	NA	5	$ -	$ -
3714	PECAN VALLEY RANCH OWNERS ASSN		11/5/1979	NA	0.0	NA	5	$ -	$ -
3743	SHELTON RANCHES INC		3/31/1980	NA	0.0	NA	5	$ -	$ -
4125	TEXAS PARKS & WILDLIFE DEPT	25	3/23/1981	0.0	0.0	0.0	5	$ 17,500	$ 875
4100	SHELTON RANCHES INC	20	6/14/1982	0.0	0.0	50.0	5	$ 14,000	$ 700
4096	ALISON B MENCAROW LIVING TRUST	11.52	1/3/1983	0.0	0.0	44.6	5	$ 8,100	$ 405
4181	JAY L POTH JR	25.86	8/28/1984	0.0	0.0	3.6	5	$ 18,200	$ 910
4181	THOMAS D POTH	25.38	8/28/1984	0.0	0.0	3.6	5	$ 17,800	$ 890
4181	CHESTER C HURST ET UX	18.76	8/28/1984	0.0	0.0	3.6	5	$ 13,200	$ 660
4163	COMAL CO FRESH WSD #1		9/4/1984	NA	0.0	NA	5	$ -	$ -
4163	COMAL CO FRESH WSD #1	120	9/4/1984	0.0	0.0	3.6	5	$ 84,000	$ 4,200
4255	GEORGE M WILLIAMS SR ET AL	50	7/9/1985	0.0	0.0	3.6	5	$ 35,000	$ 1,750
4291	PURALLOY INC	50	8/28/1985	0.0	0.0	3.6	5	$ 35,000	$ 1,750
5060	AUSTEX PROPERTIES LTD	10	5/20/1986	0.0	0.0	3.6	5	$ 7,000	$ 350
5107	46 SKYLINE DRIVE LLC	518	10/23/1986	0.0	0.0	1.8	5	$ 362,600	$ 18,130
5107	46 SKYLINE DRIVE LLC		10/23/1986	NA	0.0	NA	5	$ -	$ -
5122	BUCKLEY LP	75	3/19/1987	0.0	0.0	5.4	5	$ 52,500	$ 2,625
5208	JAMES F HAYES & MARY K HAYES	40	12/9/1988	0.0	0.0	3.6	5	$ 28,000	$ 1,400
5315	DANA G KIRK TRUSTEE		10/5/1990	NA	0.0	NA	5	$ -	$ -
5321	LARRY J LANGBEIN	150	12/2/1990	0.0	0.0	3.6	5	$ 105,000	$ 5,250
5322	E RAND SOUTHARD ET UX		11/2/1990	NA	0.0	NA	5	$ -	$ -
5331	ROBERT E BARTELL ET AL	15	11/8/1990	0.0	0.0	14.3	5	$ 10,500	$ 525

Attachment 2
Estimated Value of Water Rights Above Canyon Lake

Water Right Number	Owner	Annual Diversion (AF)	Priority Date	Volume Reliability	Min Annual Diversion (AF)	Percent of Years Meeting 75/75	Rel Group	Estimated Purchase Value (*)	Estimated Annual Lease (*)
5331	ROBERT E BARTELL ET AL		11/8/1990	NA	0.0	NA	5	$ -	$ -
5331	ROBERT E BARTELL ET AL	86	11/8/1990	0.0	0.0	14.3	5	$ 60,200	$ 3,010
5331	DR CURTIS S MCCUBBIN	10	11/8/1990	0.0	0.0	30.4	5	$ 7,000	$ 350
5348	BRYON DONZIS	5	3/5/1991	0.0	0.0	3.6	5	$ 3,500	$ 175
5352	BONITA OWNERS ASSN INC	2	3/28/1991	0.0	0.0	3.6	5	$ 1,400	$ 70
5401	H E BUTT GROCERY CO		2/20/1992	NA	0.0	NA	5	$ -	$ -
5402	TURTLE CREEK INDUSTRIES INC		2/24/1992	NA	0.0	NA	5	$ -	$ -
5444	EUGENE D ELLIS ET UX	10	1/5/1993	0.0	0.0	1.8	5	$ 7,000	$ 350
5474	ELTON RUST	10	11/16/1993	0.0	0.0	1.8	5	$ 7,000	$ 350
5479	J W COLVIN III ET AL	566	2/22/1994	0.0	0.0	1.8	5	$ 396,200	$ 19,810
5490	BILLY J & KARAN R BOLES	10	5/31/1994	0.0	0.0	3.6	5	$ 7,000	$ 350
5495	LOIS & JOSEPH WESSENDORF ET AL		7/27/1994	NA	0.0	NA	5	$ -	$ -
5501	BARRY T & KATHRYN B NALL	5	8/24/1994	0.0	0.0	1.8	5	$ 3,500	$ 175
5521	MEYERSTEIN FAMILY TRUST	30	2/2/1995	0.0	0.0	1.8	5	$ 21,000	$ 1,050
5528	KEVIN SCOTT PETERMANN ET UX	49	5/19/1995	0.0	0.0	1.8	5	$ 34,300	$ 1,715
5528	STEVES BROTHERS	49	5/19/1995	0.0	0.0	1.8	5	$ 34,300	$ 1,715
5531	LEE ROY COSPER ET UX	29.1	6/21/1995	0.0	0.0	1.8	5	$ 20,400	$ 1,020
5531	DIANE DEMPSEY	50.9	6/21/1995	0.0	0.0	1.8	5	$ 35,700	$ 1,785
5534	WILLIAM G JOHNSON III ET AL	20	7/17/1995	0.0	0.0	1.8	5	$ 14,000	$ 700
5536	J W COLVIN III	92	7/28/1995	0.0	0.0	1.8	5	$ 64,400	$ 3,220
5536	J W COLVIN III TRUSTEE	18	7/28/1995	0.0	0.0	1.8	5	$ 12,600	$ 630
5536	J W COLVIN III TRUSTEE ET AL	190	7/28/1995	0.0	0.0	1.8	5	$ 133,000	$ 6,650
5536	CITY SOUTH MANAGEMENT CORP	84.3	7/28/1995	0.0	0.0	1.8	5	$ 59,100	$ 2,955
5536	J W COLVIN III TRUSTEE FOR FM 1092 CTR	15.7	7/28/1995	0.0	0.0	1.8	5	$ 11,000	$ 550
5541	LONGCOPE FAMILY LTD	14	8/31/1995	0.0	0.0	1.8	5	$ 9,800	$ 490
5641	MARLIN R MARCUM	1	8/10/1999	39.0	0.0	73.2	5	$ 700	$ 35
5647	SOUTHERLAND PROPERTIES INC	350	9/17/1999	31.7	0.0	58.9	5	$ 245,000	$ 12,250
5647	SOUTHERLAND PROPERTIES INC		9/17/1999	NA	0.0	NA	5	$ -	$ -
5737	ROBERT E SIEKER ET AL	1	4/16/2001	28.5	0.0	66.1	5	$ 700	$ 35
5749	HILLTOP HOLDINGS INC		8/9/2001	NA	0.0	NA	5	$ -	$ -
5749	HILLTOP HOLDINGS INC		8/9/2001	NA	0.0	NA	5	$ -	$ -
5749	HILLTOP HOLDINGS INC		8/9/2001	NA	0.0	NA	5	$ -	$ -
5846	CORDILLERA RANCH POA		8/31/2004	NA	0.0	NA	5	$ -	$ -
5846	CORDILLERA RANCH POA		8/31/2004	NA	0.0	NA	5	$ -	$ -

(*) NOTE: Monetary rates are preliminary for planning purposes. They should not be construed as the final value of the transaction. This value will depend on factors including but not limited to supply, demand, potential revenue of crops, conflicts on water use, and estate equity issues. The purchase value of the water right will be determined in future negotiations between Kerrville, UGRA, and water right holders.

Lease value is estimated based on a rate of $69/AF of firm water and $35/AF of interruptible water. Value may change with reliability.
Purchase value is calculated based on 20 years of supply.

RESPONSES TO TWDB COMMENTS

Response to TWDB Comments on Draft Final Region-Specific Study Reports

TWDB Contract No. 0704830695

Region J, Region-Specific Contract Study #2
Water Rights Analysis and ASR Feasibility in Kerr County;
ASR Feasibility in Bandera County

General Comments (for both reports):

1. This document includes two distinct/separate Reports that are bound together. Each report contains a separate Table of Contents (TOC), etc. Please consider either physically separating these to be two stand alone reports; or including a joint Title ("Alternative Water Supply Analyses for Kerr and Bandera Counties") and a joint TOC at the beginning of the document for clarity.

   Response: Two distinct/separate reports are created.

2. Please submit all data, maps, and functioning analytic models in an electronic format along with the final reports as stated in the contract between TWDB and Region J.

   Response: All requested material is provided.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

[Report 1: Alternative Water Supply Analysis for Kerr County]

1. Report 1, Page 1-2, Executive Summary: Please consider providing the infrastructure unit cost in the final report as was done for Report 2 (Bandera County report).

   Response: Unit cost is added on page 1-2.

2. Report 1, Page 1-2, Executive Summary, line 11: Please reconcile the number of injection wells used in the analysis in the final report. The Executive Summary states 1 well was used and Section 4.5 (page 4-13) states 2 wells were used.

   Response: Statement now reads "two wells" on page 1-2.

3. Report 1: Report repeatedly refers to water rights "above" Canyon Lake (eg: page 2-1, paragraph 3; page 3-1, paragraph 1). The contract scope of work, Task 1.A., specifies that water rights information will be provided including those explicitly associated with Canyon Lake. Please clarify in Section 3.1 which water rights listed in Attachment 1 are associated with Canyon Lake (eg: CA18-2074); and revise the title of Attachment 1 to reflect that TCEQ information for Canyon Lake water rights is included. Also, please explain the reason for not including the Canyon Lake water rights in the analysis, as was specified in the SOW, Task 1.C.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Response: Section 3.1 was changed to clarify that the water rights listed in Attachment 1 include those associated with Canyon Lake. Title of Attachment 1 was changed accordingly. A paragraph in Section 3.1 was added to explain that water available from Canyon Lake would be available through a subordination agreements or other type of contract, which is different from the purchase or lease of other water rights.

4. Report 1, Page 3-2, Section 3.1: Refers to summary information on total water right volumes for the City of Kerrville, UGRA, and GBRA. These totals could not be reproduced using Attachment 1 information. Please clarify on how these were derived and how these numbers are incorporated into the analysis.

   Response: A total breakdown of the water rights owned by Kerrville and UGRA was included in Section 3.1. Attachment 1 was formatted to highlight the water rights excluded in any purchase or lease analysis.

5. Report 1, Page 3-5, Table 3.2: It appears that different methodologies were used to determine the consumptive use values in this table. Please clarify what methodologies were used and justify differences, if any.

   Response: Consumptive use amount were obtained from hard copies of the Certificates of Adjudication or Permits issued by the TCEQ. No change needed.

6. Report 1, Page 3-6, Section 3.2: The contract scope of work, Task 1.C. specifies the use of the "state-approved" WAM during drought of record conditions and that the TCEQ's WAM Run 3 should be used and encompass the upper Guadalupe Basin down to and including Canyon Lake. Please further clarify what the "March 2008 WAM" refers to.

   Response: A sentence was added to clarify that the March 2008 WAM was a version received from TCEQ staff. This version includes approved changes to channel loss factors and updates to the modeling of Lake Medina and Diversion. At the time of the study, the Commission was making further revisions. These changes were not released until October 2008.

7. Report 1, Page 3-16, Section 3.5, last paragraph: Contract scope of work, Task 1.D. states that the planning group members and stakeholders will be provided the list of prioritized water rights and they "will then determine water rights of high interest for further analysis". Please document this process in the final report.

   Response: The decision to give more priority to water rights in groups 3 and 4 was made by members of the planning group. A sentence and a footnote were added in section 3.2 to document this decision.

8. Report 1, Page 3-17, paragraph 2 & Table 3.6: The contract scope of work, Task 1.E. requires the assessment of monetary value for the high priority water rights. Values in Table 3.6 do not appear to follow the methodology presented on page 3-14 (3-14, paragraph 2, 1st sentence). Please clarify.

   Response: Heading of Table 3-6 was changed to read reliable water and non-reliable water, indicating the unit cost. Numbers have one decimal so that reader can reproduce the calculation.

9. Report 1, Page 3-19, Table 3.7: Please consider indicating the specific time-frame referenced by "partial year reporting in 2008" in the final report.

   Response: "January through September" added to Table 3.7 footnote.

10. Report 1, Page 3-20 – 3-21, section 3.7: Report states wastewater return flows from the City of Kerrville are not considered in the WAM of the Guadalupe River Basin and represent a potential additional source of water supply. Please consider clarifying which WAM Run was used and what specific modifications were made to this WAM for the wastewater flow analysis.

    Response: A sentence was added to describe the version of the Guadalupe WAM used and the changes made for the analysis of return flow availability.

11. Report 1, Page 4-9, section 4.3: Although addressed in section 3.7, page 3-20, wastewater return flows were not considered as a potential source of water supply for ASR as specified in the contract scope of work Task 2.A. Please explain why return flows were not considered as an ASR supply source or include the analysis in the final report.

    Response: The ASR strategy in the Lower Trinity Aquifer uses sources available to UGRA. The assumed sources available to UGRA total 3,029 acre-feet per year. This amount is composed of the existing water right (2,000 acre-feet per year) and the additional water rights that can be leased or purchased (1,029 acre-feet per year). It is assumed that return flows are not available to the proposed ASR by UGRA. Return flows in the area come primarily from the City of Kerrville and are currently used to increase the diversion of the existing water right of Kerrville. No change was made to the report.

12. Report 1, Page 4-11: In the final report, please clarify whether the infrastructure cost listed on this page includes estimates for the management of concentrates generated during the treatment process and clarify what kind of process was assumed (desalination, etc). Please clarify what the anticipated quality of water will be from the Guadalupe River, and what the potential disposal method will be if concentrates are generated.

    Response: Report was changed to indicate that solid storage lagoon would be used as residual handling. (It was included in the cost). The report says that treatment will be a first stage of low-pressure membranes and a second stage of high-pressure membranes. No desalination will be required and no concentrate will be produced.

    Water quality description was added to the report.

13. Report 1, Pages 4-13 and 4-14, Figures 4.8 & 4.9: Please identify the year for which water levels and water level changes are shown in these figures in the final report.

    Response: The model analysis is revised in Section 4.6 and Figure 4.8 now illustrates the most feasible injection scenario for the year 2060. Figure 4.9 is eliminated from the report.

14. Report 1, Pages 4-13 (ASR analysis) & 4-14 (Conclusions): Since the only injection scenario (2.54 MGD) investigated is not feasible, please include clarification in the final report for use of the injection rate assumption and why other assumptions were not analyzed to determine a minimal acceptable injection rate or a minimal number of injection wells.

    Response: The model analysis is revised and additional injection rate scenarios are addressed in Section 4.6 that identify the most feasible injection rate.

15. Report 1, Page 4-14, Section 4.6: Please consider including the infrastructure unit cost (as was done for Report 2, Bandera County report) in the summary for the Conclusions section (reference Report 1 comment # 1 for page 1-2, Executive Summary, above).

Response: Unit cost is added to the Conclusions section.

16. Report 1, Page 4-14, section 4.6: In the final report, please consider expanding the Conclusions section to bring together the reasons for performing this study, the study's goals, and how the goals were achieved or not achieved, and summary discussion of recommendations for the next step(s) the RWPG should pursue in this process, including revisions to existing Region J water management strategies.

    Response: Conclusion section is expanded as suggested.

17. Report 1, page 5-1, Section 5 - References: Missing reference for Figure 4.5, page 4-7 – Jones, 1998. Please include this in the final report.

    Response: Jones 1998 is added to References.

[Comments for Consideration (for both reports)]

1. Please consider numbering all pages in these reports (eg: Report 1, Figures 4.1-4.6). and please use the correct single reference for Canyon Lake (eg: Lake Canyon - Report 1, page 2-1).

    Response: Page numbers and Canyon Lake designation are corrected.

2. Report 1, Page 3-2, Section 3.1: Please reconcile the difference between the City of Kerrville's water supply volume from the 2006 Plateau Regional Water Plan of 3,040 AFY and the City of Kerrville's water right diversion volume of 6,077 AFY.

    Response: Kerrville's water supply is 3,040 acre-feet per year, which is the total of 2,890 acre-feet per year of current groundwater supply (based on a permit from the Headwaters Groundwater Conservation District) and 150 acre-feet per year of reliable surface water rights. The amount 6,077 acre-feet per year is the authorized annual diversion from surface water. No change needed.