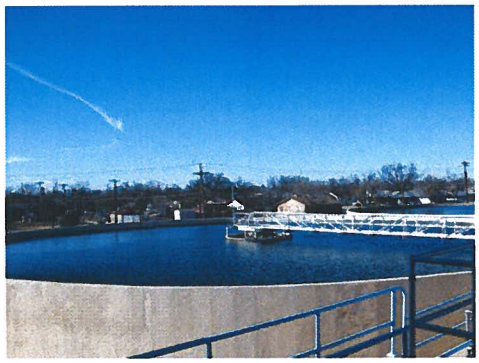
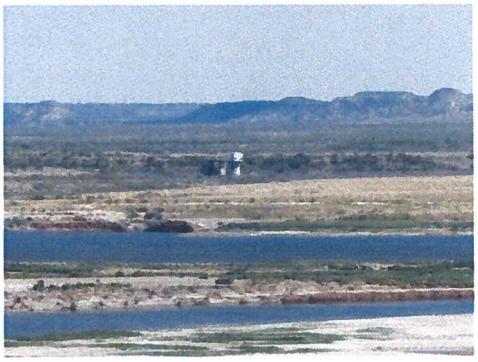
FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

REGIONAL WATER FACILITY CONCEPTUAL PLAN

Prepared for:

Upper Colorado River Authority

In Conjunction with:

Texas Water Development Board

Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

URA11379

1148311257_Final Report

Innovative approaches
Practical results
Outstanding service



REGIONAL WATER FACILITY CONCEPTUAL PLAN

Prepared for:

Upper Colorado River Authority

In Conjunction with:

Texas Water Development Board

Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

URA11379

REGIONAL WATER FACILITY CONCEPTUAL PLAN

Prepared for:

Upper Colorado River Authority

In Conjunction with:

Texas Water Development Board

10/25/12

Richard Weatherly

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Table of Contents

Table of Tables

Table of Figures

Appendices

Appendix A	Documentation of Public Meetings
Appendix B	Raw Water Supply Improvements Hydraulic Grade Lines (HGLs) & Cost Estimates Option 1: Sliplining
Appendix C	Raw Water Supply Improvements Hydraulic Grade Lines (HGLs) & Cost Estimates Option 2: Open Cut
Appendix D	Raw Water Supply Improvements Pump Station Cost Estimates Option 1: Sliplining
Appendix E	Raw Water Supply Improvements Pump Station Cost Estimates Option 2: Open Cut
Appendix F	Water Treatment Plant Improvements Cost Estimates
Appendix G	Treated Water Delivery Improvements Cost Estimates & HGLs
Appendix H	UCRA Water Conservation Plan & Drought Management Plan

EXECUTIVE SUMMARY

INTRODUCTION

In July of 2011, Freese and Nichols (FNI) was retained by the Upper Colorado River Authority (UCRA) in cooperation with the Texas Water Development Board (TWDB) to develop regional water facility plan for potential customers in Tom Green county. This study investigates the feasibility of tying together the various systems around the City of San Angelo, leveraging existing surface water sources which could reduce the area's dependence on groundwater. The purpose of this study is to determine which of the participating entities could be cost-effectively served through a regional water supply. The value of a sustainable water supply to the rural customers of Tom Green county is overall economic health enhancement. The entities participating in this study include the following:

- City of San Angelo
- Red Creek Municipal Utility District
- Tom Green Fresh Water District No. 1
- Tom Green Fresh Water District No. 2
- Tom Green Fresh Water District No. 3
- Concho Rural Water Corporation
    - Deer Valley
    - North Concho Lake Estates
    - Pecan Creek
    - The Oaks
    - Water Valley
    - Grape Creek
- City of Miles
- San Angelo State Supported Living Center (DADS facility)

POPULATION & WATER DEMANDS

Historical and existing populations were developed using completed surveys from each participating entity along with the most current TWDB population estimates wherever there were gaps in the survey data. **Table ES.1** shows the population for each entity for existing and 2030 conditions.

Table ES.1 Historical & Projected Population by City for Existing and 2030 Conditions

Entity	Existing	2030	Population Change
DADS*	1,200	1,200	0
Miles	870	1,063	193
Deer Valley	270	270	0
North Concho Lake Estates	1,400	1,400	0
Pecan Creek	750	1,110	360
The Oaks	678	768	90
Water Valley	84	84	0
Grape Creek	2,900	3,200	300
Tom Green WSD #1	630	630	0
Tom Green WSD #2	422	422	0
Tom Green WSD #3	800	800	0
Red Creek MUD	834	834	0
TOTAL	**10,838**	**11,781**	**943**

*DADS facility: San Angelo State Supported Living Center

The existing water usage was developed using completed surveys from each participating city. From the data provided, the annual average day water consumption was calculated. The average annual water usage in gallons per capita per day (gpcd) was determined using existing population. The existing average day and maximum day demand are presented in **Table ES.2**.

Table ES.2 Existing Average Day & Maximum Day Water Usage

Entity	Population	Average Day Demand (gpd)	Average Day Demand (gpcd)	Maximum Day Demand (gpd)	Maximum Day/ Avg Day Ratio
DADS	1,200	92,000	77	184,000	2.0
Miles	870	82,835	95	180,000	2.2
Deer Valley	270	26,027	96	52,000	2.0
North Concho Lake Estates	1,400	126,575	90	195,000	1.5
Pecan Creek	750	65,475	87	180,000	2.7
The Oaks	678	82,219	121	180,000	2.2
Water Valley	84	68,493*	815*	90,000	1.3
Grape Creek	2,900	265,205	91	490,000	1.8
Tom Green WSD #1	630	45,890	73	70,000	1.5
Tom Green WSD #2	422	40,090	95	80,180	2.0
Tom Green WSD #3	800	104,575	131	250,000	2.4
Red Creek MUD	834	47,452	57	72,000	1.5
TOTAL	**10,838**	**1,046,836**		**2,023,180**	

* Demand includes school district

The projected population was used, along with water usage factors, to project future average day and maximum day demands for 2030. The 2030 average and maximum day demands were developed using completed surveys from each participating entity. Using the criteria above, the resulting projected average day and maximum day wholesale water system demands used for the water system analysis are summarized in **Table ES.3**. The projected treated water maximum day demand for all potential wholesale customers is 2.17 MGD.

Table ES.3 Projected 2030 Average Day & Maximum Day Wholesale Water Demands

Entity	Population	Average Day Demand (gpd)	Average Day Demand (gpcd)	Maximum Day Demand (gpd)	Maximum Day/ Avg Day Ratio
DADS	1,200	92,000	77	184,000	2.0
Miles	1,063	100,985	95	201,970	2.0
Deer Valley	270	26,027	96	52,000	2.0
North Concho Lake Estates	1,400	126,575	90	195,000	1.5
Pecan Creek	1,110	96,903	87	180,000	1.9
The Oaks	768	93,133	121	203,895	2.2
Water Valley	84	68,493*	815*	90,000	1.3
Grape Creek	3,200	292,640	91	540,690	1.8
Tom Green WSD #1	630	45,890	73	70,000	1.5
Tom Green WSD #2	422	40,090	95	80,180	2.0
Tom Green WSD #3	945	123,795	131	295,313	2.4
Red Creek MUD	834	47,452	57	72,000	1.5
TOTAL	**11,781**	**1,153,983**		**2,165,048**	
AVERAGE			**96**		**1.9**

* Demand includes school district

According to the water purchase agreement between the UCRA and the City of San Angelo, the UCRA must supply 15% more raw water than the amount of treated water the UCRA intends to purchase. Since the treated water demand is 2.17 MGD, the UCRA must provide 2.50 MGD of raw water to meet the maximum day demand of all potential wholesale customers.

The City of San Angelo is a potential user of the E.V. Spence Reservoir raw water supply. The City and the UCRA requested that FNI evaluate the following four water supply alternatives from the E.V. Spence Reservoir. **Table ES.4** summarizes the raw water supply to the UCRA and the City of San Angelo in each alternative.

Table ES.4 Summary of Raw Water Supply Alternatives (MGD)

Raw Water Supply	Alternative 1	Alternative 2	Alternative 3	Alternative 4
UCRA	2.50	2.50	2.50	2.50
City of San Angelo	-	2.10	4.40	6.70
TOTAL	**2.50**	**4.60**	**6.90**	**9.20**

RAW WATER TRANSMISSION EVALUATION

To determine the required raw water system improvements, FNI first examined the existing E.V. Spence Reservoir raw water supply infrastructure, which is owned by the City of San Angelo. The system was originally designed in 1968 for 20 MGD of flow from the E.V. Spence Reservoir to the City of San Angelo. The existing E.V. Spence Reservoir raw water supply infrastructure has been out of service since the early 1990s due to multiple failures on the 36" pipeline.

The following infrastructure is currently in place but is not currently in service:

- Raw Water Intake Pump Station at E.V. Spence Reservoir
- Two (2) Booster Pump Stations
- Mountaintop GST
- 1.2 MG Mount Nebo GST
- Approximately 6.5 miles 36" Concrete Pipeline
- Approximately 22 miles 33" Concrete Pipeline
- Approximately 5 miles 39" Concrete Pipeline

All of the above infrastructure can be used for future supply after necessary investigations and necessary improvements have been made.

In order to use the existing raw water system from the E.V. Spence Reservoir, the following investigations and improvements are recommended:

- Rehab/replace existing 36" pipeline
- Perform condition assessment of existing 33" pipeline and ground storage tanks
- Dredge a new channel or place a barge and pump to the pump station intake structure
- Replace pumps at the existing pump stations

Two options were evaluated for the rehabilitation of the existing 36" concrete cylinder pipeline from the E.V. Spence Reservoir intake pump station to the Mountain Top ground storage tank:

- Option 1: Sliplining the existing 36" with a smaller diameter HDPE pipeline
- Option 2: Open-cut replacement with RCCP

The pipe size required for each option depends on the raw water supply alternative. The total length of the project is approximately 6.5 miles.

FNI analyzed whether either of the two existing booster pump stations could be eliminated along the 36" pipeline segment. FNI evaluated the required pump motor size for the supply alternatives of the sliplining and open cut line rehabilitation options. FNI confirmed with the electric provider that the existing power supply to the pump stations could be utilized in the future.

The total cost of the raw water transmission system improvements for Alternatives 1-4 are shown in **Table ES.5**. Based on this analysis, FNI recommends that open-cut replacement is utilized for the rehabilitation of the existing 36" portion of the E.V. Spence Reservoir raw water transmission line.

Table ES.5 Raw Water Transmission System Improvements Total Cost

Alt	Supply Rate (MGD)	Option	Required Pipe Cost (million)	Condition Assessment		Barge & Pump (million)	Required Pump Rehabilitation			Total Capital Cost (million)
				Existing 33" RCCP (million)	Existing GSTs (million)		Intake PS (million)	Booster PS #1 (million)	Booster PS #2 (million)	
1	2.5	1	$9.03	$0.70	$0.30	$2.10	$0.91	$1.27	$1.27	$16.58
		2	$7.78	$0.70	$0.30	$2.10	$1.15	-	$1.27	$15.30
2	4.6	1	$10.89	$0.70	$0.30	$2.10	$1.07	$1.43	$1.40	$18.89
		2	$8.53	$0.70	$0.30	$2.10	$1.20	-	$1.40	$16.23
3	6.9	1	$13.20	$0.70	$0.30	$2.10	$1.15	$1.52	$1.48	$21.45
		2	$9.64	$0.70	$0.30	$2.10	$1.32	-	$1.48	$17.54
4	9.2	1	$14.36	$0.70	$0.30	$2.10	$1.24	$1.62	$1.58	$22.90
		2	$10.75	$0.70	$0.30	$2.10	$1.71	-	$1.58	$19.14

WATER TREATMENT PLANT EVALUATION

Lake O.H. Ivie is the current dominant surface water supply source for the City of San Angelo. Historically, the E.V. Spence Reservoir water quality has been more saline than that of Lake O.H. Ivie. In order to maintain the current water quality of water treated by the City of San Angelo, desalination will be required to offset the E.V. Spence Reservoir salinity.

For the San Angelo WTP, a wide array of constituent data is available from the existing routine raw and finished water sampling. The data available from Lake O.H. Ivie and the E.V. Spence Reservoir is more limited in nature and primarily focuses on total dissolved solids (TDS), Chloride, and Sulfate. TDS is of interest because it is not removed by conventional water treatment processes and provides a general measure of the effectiveness of the desalination process. Chloride and Sulfate are of interest because they are constituents monitored for secondary standards by TCEQ. Secondary standards are related to aesthetic issues such as taste and odor, as opposed to primary standards which are related to public health. Furthermore, there are no known primary standard constituent issues as these reservoirs have been previously utilized for water supply. Accordingly, total dissolved solids, chloride and sulfate were used as a benchmark for evaluation of desalination technology in this application. Historical water quality data was analyzed for the period between 2007 and 2011.

The rated treatment capacity of the San Angelo WTP is 42 MGD; however, the current maximum day demand is only about 26.6 MGD. Therefore, the conceptual plan proposes to take advantage of the existing reserve capacity available from the San Angelo WTP infrastructure. Because the E.V. Spence Reservoir quality is more saline than the existing water supply for the San Angelo WTP, the addition of the E.V. Spence Reservoir flow to the San Angelo WTP process will result in a raw water quality with higher mineral content.

There are two water quality goals that have been established as benchmarks for this evaluation:

- **Goal 1:** The primary objective of the water treatment plant evaluation is to identify the flow capacity of desalination required to maintain the current water quality produced by the City of San Angelo.
- **Goal 2:** As a secondary objective, the water treatment plant evaluation explores the additional sidestream treatment capacity required to improve the San Angelo WTP finished water to a level where it meets the TCEQ Chapter 290 secondary standards, which focus on taste and odor.

This could potentially be an attractive alternative for consideration, benefitting both existing and potential customers.

Because conventional treatment does not have a removal mechanism for dissolved minerals, the treatment process would need to be modified in order to satisfy the specified water quality goals. Accordingly, desalination would need to be added to the process train.

Desalination is the removal of salts and other dissolved solids from saline water (brackish or seawater). Desalination technologies accomplish almost complete removal of salts; therefore, it is a common practice to bypass a portion of the source water and blend it with the desalination product water to achieve the desired level of water quality.

Conceptual budget level costs were developed for each of the two water quality goals evaluated. Results are presented in **Table ES.6** below.

Table ES.6 Conceptual Budget Level Capital Costs

Goal	Treated Water Quality	Alternative	E.V. Spence Reservoir Flow (MGD)	Net Increase in Production (MGD)	Conceptual Budget Level Construction Cost ($ million)
1	Match Existing	1	3.22	2.12	$13.67
		2	4.60	3.19	$16.79
		3	6.90	5.05	$21.06
		4	9.20	6.94	$24.98
2	Secondary	1	3.76	2.12	$19.14
		2	4.60	2.77	$20.81
		3	6.90	4.64	$25.02
		4	9.20	6.53	$28.97

The budgetary level capital costs presented above include yard piping, valves, meters and appurtenances; a membrane building including RO membrane equipment, chemical feed facilities, and a building; a 0.5 million gallon product water storage tank; reject facilities; and electrical and instrumentation. Deep well injection was assumed to be an appropriate disposal method for the concentrate. A separate disposal study will be needed to determine the feasibility of this option.

WATER DISTRIBUTION SYSTEM EVALUATION

FNI developed a hydraulic model and evaluated the hydraulic capacity of the existing water supply system to Miles. FNI determined that the existing water supply system is able to serve projected 2030 max day demands.

Table ES.7 summarizes the costs for each treated water supply line. The Northwest Supply Line requires two pump stations, a 400,000 gallon ground storage tank and 107,700 ft of water supply line to be installed from the Lakeview GST to Water Valley for a total cost of $11,927,900. The South Supply Line requires three pump stations, a 300,000 gallon and two 200,000 gallon ground storage tanks and 74,500 ft of 6" water line to be installed from Pecan Creek to The Oaks and from the existing Pecan Creek GST to Dove Creek for a total cost of $9,963,800.

Table ES.7 Summary of Treated Water Supply Line Costs ($ million)

Description	Unit Cost	Unit	Quantity	Total Cost
Northwest Supply Line				
Water Line & Appurtenances	Variable	LF	107,700	$9.23
Lakeview GST Pump Station	$1.20	EA	1	$1.20
Booster Pump Station	$1.20	EA	1	$1.20
400,000 gallon GST	$0.30	EA	1	$0.30
			Subtotal	**$11.93**
South Supply Line				
Water Line & Appurtenances	Variable	LF	74,500	$5.84
Booster Pump Station	$1.20	EA	3	$3.60
300,000 gallon GST	$0.23	EA	1	$0.23
200,000 gallon GST	$0.15	EA	2	$0.30
			Subtotal	**$9.97**
			Total	**$21.90**

COST SUMMARY

The cost of Alternatives 1, 2, 3 and 4 for each treatment goal is summarized in **Table ES.8**. This total cost includes the raw water transmission system, treatment plant and distribution system costs.

Table ES.8 Summary of Total Capital Costs ($ million)

	Goal 1: Maintain Current Water Quality				Goal 2: Achieve TCEQ Secondary Standards			
	Alternative				Alternative			
	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate
Raw Water Transmission								
Annualized Debt Service	$1.32	$1.40	$1.51	$1.65	$1.32	$1.40	$1.51	$1.65
Operations & Maintenance	$0.10	$0.11	$0.12	$0.14	$0.10	$0.11	$0.12	$0.14
Subtotal	***$1.42***	***$1.51***	***$1.63***	***$1.79***	***$1.42***	***$1.51***	***$1.63***	***$1.79***
Water Treatment								
Annualized Debt Service	$1.18	$1.44	$1.81	$2.15	$1.65	$1.79	$2.15	$2.49
Operations & Maintenance	$1.47	$1.98	$2.67	$3.36	$2.06	$2.34	$3.05	$3.75
Subtotal	***$2.65***	***$3.42***	***$4.48***	***$5.51***	***$3.71***	***$4.13***	***$5.20***	***$6.24***
Treated Water Distribution								
Annualized Debt Service	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88
Operations & Maintenance	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16
Subtotal	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***
Total Annualized Cost ($ million)	**$6.10**	**$6.97**	**$8.15**	**$9.34**	**$7.16**	**$7.68**	**$8.87**	**$10.07**
Total Annualized Cost ($/acre-ft)	$4,781	$2,804	$2,160	$1,844	$5,611	$3,088	$2,351	$1,989
Total Annualized Cost ($/1000 gal)	$15	$9	$7	$6	$17	$9	$7	$6

ADDITIONAL PLANNING CONSIDERATIONS

Due to the on-going drought in the region, the UCRA has established the current consumption of 100 gpcd for the City of Miles as the target consumption. The UCRA Water Conservation plan addresses the requirements of the Texas Commission on Environmental Quality for conservation plans, which are given in Section 288.2 of the Texas Administrative Code.

The City of San Angelo, which will be providing the treated water to the UCRA via the City distribution system, has also adopted water conservation measures in its own operations. The City of San Angelo Water Conservation and Drought Contingency Plan contains extremely stringent conditions for normal water consumption periods including public education, an enforced comprehensive plumbing code, a retrofit program, universal metering, prohibitive watering hours and a water waste enforcement program.

The UCRA Drought Management Plan addresses the requirements of the Texas Commission on Environmental Quality for drought contingency plans, which are given in Section 288.20 of the Texas Administrative Code.

Because the UCRA and the City of San Angelo have common water sources, the drought stage trigger criteria described in the UCRA plan are based on the triggers in the City of San Angelo Drought Contingency Plan. The City of San Angelo and the UCRA recognize three stages of drought and have developed an implementation plan to reduce water usage by 30% over these two stages.

E.V. Spence Reservoir is one of three reservoirs owned and operated by the Colorado River Municipal Water District (CRMWD) for water supply. The City of San Angelo has a contract with CRMWD for 6 percent of the safe yield of E.V. Spence, which was previously delivered by the E.V. Spence Reservoir raw water supply infrastructure. As part of the regional water planning efforts, estimates of reliable supply for E.V. Spence were conducted using updated hydrology through 2011. Based on this analysis, the reliable safe yield of E.V. Spence Reservoir is about 19,000 acre-feet per year.

The City of San Angelo and UCRA have an agreement that when the E.V. Spence line is repaired by UCRA and operational, then the City will repay UCRA with other sources of water from varied supplies for utilization by UCRA to regional rural customers. The City of San Angelo currently receives water from CRMWD, Lake Nasworthy, Twin Buttes Reservoir, and the Concho River, and will receive water from the Hickory Aquifer in the near future.

The City of San Angelo and UCRA also have an agreement in place specifying that UCRA will be the service provider for all rural entities. The City will treat the water for UCRA with the understanding that UCRA will take the water from various distribution points within the City and make it available to entities outside the city limits.

With these agreements in place, the use of the E.V. Spence Reservoir raw water supply infrastructure and delivery of water to rural customers will not impact the supplies to existing users of Spence Reservoir.

IMPLEMENTATION PLAN

Due to the high cost of the improvements, it is recommended that the UCRA phase in the projects over time. The water supply, treatment and distribution improvements are recommended to be implemented in the following phasing:

- Phase 1 – Extend Service to Southern Communities & Utilize UCRA Existing Water Rights

UCRA and the City of San Angelo determined that the communities of Christoval and Dove Creek are the highest priorities due to their existing water supply source quality and impact to the South Concho River water supplies. As part of Phase 1, service will also be extended to The Oaks subdivision due to its close proximity to Christoval. Phase 1 will only involve the construction of treated water distribution system improvements with the intent of deferring the raw water transmission and treatment capital costs.

Phase 1 will require the following treated water distribution system improvements:

  - 6” water line along US 277 to Christoval and the Oaks from the existing 6” water line
  - 6” water line from the existing Pecan Creek GST to the Dove Creek GST
  - Three (3) booster pump stations
  - Three (3) ground storage tanks

The total Phase 1 is estimated to be $9,960,000.

- Phase 2 – Construct Raw Water Transmission and Treatment Plant Improvements

The second phase would involve the construction of the raw water transmission system and treatment plant improvements. This cost would depend on the raw water supply alternative and treatment plant goal chosen and would be shared by all participating entities. The total Phase 2 cost is estimated to be $44,120,000.

- Phase 3 – Extend Service to Northwest Communities

The third phase would extend water to the communities on the Northwest Water Supply Line. This would require the UCRA and the City of San Angelo to have completed the defined raw water transmission system and treatment plant improvements.

Phase 3 will require the following treated water distribution system improvements:

- One (1) pump station at the Lakeview GST
- 107,700 ft of water line from the Lakeview GST to the Water Valley GST
- One (1) booster pump station at the Grape Creek split
- One (1) 400,000 gallon ground storage tank at the Grape Creek split

The total Phase 3 cost is estimated to be $11,930,000.

1.0 INTRODUCTION

In July of 2011, Freese and Nichols (FNI) was retained by the Upper Colorado River Authority (UCRA) in cooperation with the Texas Water Development Board (TWDB) to develop regional water facility plan for potential customers in Tom Green county. This study investigates the feasibility of tying together the various systems around the City of San Angelo, leveraging existing surface water sources which could reduce the area's dependence on groundwater. The purpose of this study is to determine which of the participating entities could be cost-effectively served through a regional water supply. The value of a sustainable water supply to the rural customers of Tom Green county is overall economic health enhancement. The entities participating in this study include the following:

- City of San Angelo
- Red Creek Municipal Utility District
- Tom Green Fresh Water District No. 1
- Tom Green Fresh Water District No. 2
- Tom Green Fresh Water District No. 3
- Concho Rural Water Corporation
    - Deer Valley
    - North Concho Lake Estates
    - Pecan Creek
    - The Oaks
    - Water Valley
    - Grape Creek
- City of Miles
- San Angelo State Supported Living Center (DADS facility)

A map of the UCRA study area is shown in **Figure 1.1**.

As part of this study, FNI and the UCRA held three public meetings. Documentation of these meetings and the attendees at the meetings are shown in **Appendix A**.

Created By Freese and Nichols, Inc.
Job No.: URA11379
Location: H:\W_WW_PLANNING\DELIVERABLES\04_Updated_Draft_Report_(8-09-12)\[Figure-1.1]-UCRA_Study_Area.mxd
Updated: Monday, October 22, 2012 10:44:23 AM

FIGURE 1.1
UPPER COLORADO RIVER AUTHORITY
STUDY AREA

LEGEND

- WTP
- GST
- PS
- Unincorporated Place
- Private Water Supplier
- Road
- Stream
- Lake
- Study Participant
- City Limit
- County Boundary

UCRA

FREESE AND NICHOLS

Lake E.V. Spence
Robert Lee
Bronte
158
COKE
208
Water Valley
Water Valley
Concho Rural
Water Corporation
San Angelo State
Supported Living Center
Carlsbad
Tom Green County
FWSD 1
Deer Valley
Concho Rural
Water Corporation
Grape Creek
Grape Creek
Concho Rural
Water Corporation
Red Creek MUD
City of
Miles
67
North Concho Lake
Estates
Concho Rural
Water Corporation
O.C. Fisher
Lake
277
City of San Angelo
Water Treatment Plant
WTP
87
67
TOM GREEN
San Angelo
Mereta
Lake
Nasworthy
Twin Buttes
Reservoir
IRION
67
Wall
87
Vancourt
Eola
Tom Green
FWSD #3
Pecan Creek
Concho Rural
Water Corporation
277
Knickerbocker
Pecan Creek
Concho Rural
Water Corporation
Tom Green County
FWSD 2
The Oaks
Concho Rural
Water Corporation
Christoval

N

0 2.5 5

SCALE IN MILES

1.1 BACKGROUND

The UCRA has entered into an agreement with the City of San Angelo to treat raw water for the UCRA such that the UCRA can make treated water available to rural communities and other entities outside the corporate limits of the City of San Angelo with a shared purpose of reducing reliance on groundwater and to facilitate the conservation of underground water resources, especially in Tom Green County, Texas. The UCRA is authorized to acquire up to 1,000 acre-ft/yr from the O.C. Fisher Reservoir. The UCRA currently provides wholesale treated water via the City of San Angelo's distribution system to the City of Miles, Red Creek MUD and the Pecan Creek subdivision.

Potential sources of water include the existing City of San Angelo water treatment plant and the E.V. Spence Reservoir. The City currently obtains raw water from O.C. Fisher Lake, Lake O.H. lvie, Lake Nasworthy and Twin Buttes Reservoir. Future sources include groundwater from McCulloch County and, potentially, desalination of local groundwater. The City currently treats its water at a 40 MGD water treatment plant located on the east side of the city.

1.2 STUDY ALTERNATIVES

For each of the identified potential wholesale customers, FNI determined the existing and 2030 population and resulting average and maximum day water demands. In order to supply these future demands, the UCRA directed FNI to develop a phased water supply system to fully utilize the existing UCRA water rights. In addition to using their own water rights, UCRA evaluated the feasibility of cost-participating in the rehabilitation of the existing City of San Angelo's E.V. Spence Reservoir water supply system to allow these water rights to also be made available to the UCRA regional wholesale customers. The water supply system would consist of the rehabilitation of the existing E. V. Spence Reservoir raw water transmission system, additional treatment at the existing City of San Angelo Water Treatment Plant and construction of treated water transmission pipelines to each of the wholesale customers.

In order to determine the most cost-effective water supply solution, the UCRA requested that FNI evaluate the following four water supply alternatives:

- Alternative 1: 2.50 MGD
- Alternative 2: 4.60 MGD
- Alternative 3: 6.90 MGD
- Alternative 4: 9.20 MGD

Once the most cost-effective solution was determined, FNI developed an implementation plan to phase in the recommended improvements. The results of this evaluation and the recommendations are detailed in the following sections of this report.

1.3 LIST OF ABBREVIATIONS

Table 1.1 provides a list of abbreviations used in this report.

Table 1.1 List of Abbreviations

Abbreviation	Full Nomenclature
DADS	Department of Aging and Disability Services
FNI	Freese and Nichols, Inc.
GPCD	Gallons per Capita per Day
GPD	Gallons per Day
GPM	Gallons per Minute
GST	Ground Storage Tank
HDPE	High Density Polyethylene
MGD	Million Gallons per Day
MUD	Municipal Utility District
PS	Pump Station
RCCP	Reinforced Concrete Cylinder Pipe
RO	Reverse Osmosis
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TWDB	Texas Water Development Board
UCRA	Upper Colorado River Authority
WTP	Water Treatment Plant

2.0 POPULATION & WATER DEMANDS

2.1 HISTORICAL POPULATION

Historical and existing populations were developed using completed surveys from each participating entity along with the most current TWDB population estimates wherever there were gaps in the survey data. **Table 2.1** shows the population for each entity for existing and 2030 conditions.

Table 2.1 Historical & Projected Population by City for Existing and 2030 Conditions

Entity	Existing	2030	Population Change
DADS*	1,200	1,200	0
Miles	870	1,063	193
Deer Valley	270	270	0
North Concho Lake Estates	1,400	1,400	0
Pecan Creek	750	1,110	360
The Oaks	678	768	90
Water Valley	84	84	0
Grape Creek	2,900	3,200	300
Tom Green WSD #1	630	630	0
Tom Green WSD #2	422	422	0
Tom Green WSD #3	800	800	0
Red Creek MUD	834	834	0
TOTAL	**10,838**	**11,781**	**943**

*DADS facility: San Angelo State Supported Living Center

2.2 WATER DEMANDS

2.2.1 UCRA Wholesale Customer Demands

The existing water usage was developed using completed surveys from each participating city. It was determined that more recent and local feedback would supersede data from the regional planning effort. For the entities that provided completed surveys, those population and water demands were utilized for this study. For the entities that did not return completed surveys, the TWDB populations and water demand projections were used.

From the data provided, the annual average day water consumption was calculated. The average annual water usage in gallons per capita per day (gpcd) was determined using existing population. The existing average day and maximum day demand are presented in **Table 2.2**. The annual average day per capita demand ranged from 73 gpcd to 131 gpcd with an average of 97 gpcd. Over the same time period, the maximum day/average day peaking factors had an average of 1.9, varying from 1.5 to 2.7.

Table 2.2 Existing Average Day & Maximum Day Water Usage

Entity	Population	Average Day Demand (gpd)	Average Day Demand (gpcd)	Maximum Day Demand (gpd)	Maximum Day/ Avg Day Ratio
DADS	1,200	92,000	77	184,000	2.0
Miles	870	82,835	95	180,000	2.2
Deer Valley	270	26,027	96	52,000	2.0
North Concho Lake Estates	1,400	126,575	90	195,000	1.5
Pecan Creek	750	65,475	87	180,000	2.7
The Oaks	678	82,219	121	180,000	2.2
Water Valley	84	68,493*	815*	90,000	1.3
Grape Creek	2,900	265,205	91	490,000	1.8
Tom Green WSD #1	630	45,890	73	70,000	1.5
Tom Green WSD #2	422	40,090	95	80,180	2.0
Tom Green WSD #3	800	104,575	131	250,000	2.4
Red Creek MUD	834	47,452	57	72,000	1.5
TOTAL	**10,838**	**1,046,836**		**2,023,180**	

* Demand includes school district

The UCRA currently provides wholesale water to the City of Miles, Red Creek Municipal Utility District and the Pecan Creek subdivision. The City of Miles has a current water purchase contract rate of 200 acre-ft/yr (181,818 gpd). The Red Creek MUD has a current water purchase contract rate of 100 acre-ft/yr (90,909 gpd). Pecan Creek has a current water purchase contract rate of 100 acre-ft/yr (90,909 gpd).

2.2.2 Projected Water Demands

The projected population was used, along with water usage factors, to project future average day and maximum day demands for 2030. The 2030 average and maximum day demands were developed using completed surveys from each participating entity. Using the criteria above, the resulting projected average day and maximum day wholesale water system demands used for the water system analysis are summarized in **Table 2.3**. The projected treated water maximum day demand for all potential wholesale customers is 2.17 MGD.

Table 2.3 Projected 2030 Average Day & Maximum Day Wholesale Water Demands

Entity	Population	Average Day Demand (gpd)	Average Day Demand (gpcd)	Maximum Day Demand (gpd)	Maximum Day/ Avg Day Ratio
DADS	1,200	92,000	77	184,000	2.0
Miles	1,063	100,985	95	201,970	2.0
Deer Valley	270	26,027	96	52,000	2.0
North Concho Lake Estates	1,400	126,575	90	195,000	1.5
Pecan Creek	1,110	96,903	87	180,000	1.9
The Oaks	768	93,133	121	203,895	2.2
Water Valley	84	68,493*	815*	90,000	1.3
Grape Creek	3,200	292,640	91	540,690	1.8
Tom Green WSD #1	630	45,890	73	70,000	1.5
Tom Green WSD #2	422	40,090	95	80,180	2.0
Tom Green WSD #3	945	123,795	131	295,313	2.4
Red Creek MUD	834	47,452	57	72,000	1.5
TOTAL	**11,781**	**1,153,983**		**2,165,048**	
AVERAGE			**96**		**1.9**

* Demand includes school district

2.2.3 Raw Water Supply Needs

According to the water purchase agreement between the UCRA and the City of San Angelo, the UCRA must supply 15% more raw water than the amount of treated water the UCRA intends to purchase. Since the treated water demand is 2.17 MGD, the UCRA must provide 2.50 MGD of raw water to meet the maximum day demand of all potential wholesale customers.

The City of San Angelo is a potential user of the E.V. Spence Reservoir raw water supply. The City and the UCRA requested that FNI evaluate the following four water supply alternatives from the E.V. Spence Reservoir, which were used in the raw water transmission and water treatment evaluations:

Alternative 1: 2.50 MGD Raw Water Supply

The UCRA requires 2.50 MGD of raw water supply to provide treated water to all their potential customer entities. This scenario assumes no City of San Angelo participation and, therefore, would require the UCRA to fund the entire raw water transmission system improvement, treatment plant upgrades and water transmission system improvements.

Alternative 2: 4.60 MGD Raw Water Supply

In order to provide 4.00 MGD of treated water, there must be a 4.60 MGD raw water supply. This scenario assumes that the UCRA receives 2.50 MGD and the City of San Angelo receives 2.10 MGD.

Alternative 3: 6.90 MGD Raw Water Supply

In order to provide 6.00 MGD of treated water, there must be a 6.90 MGD raw water supply. This scenario assumes that the UCRA receives 2.50 MGD and the City of San Angelo receives 4.40 MGD.

Alternative 4: 9.20 MGD Raw Water Supply

In order to provide 8.00 MGD of treated water, there must be a 9.20 MGD raw water supply. This scenario assumes that the UCRA receives 2.50 MGD and the City of San Angelo receives 6.70 MGD.

Table 2.4 summarizes the raw water supply to the UCRA and the City of San Angelo in each alternative.

Table 2.4 Summary of Raw Water Supply Alternatives (MGD)

Raw Water Supply	Alternative 1	Alternative 2	Alternative 3	Alternative 4
UCRA	2.50	2.50	2.50	2.50
City of San Angelo	-	2.10	4.40	6.70
TOTAL	**2.50**	**4.60**	**6.90**	**9.20**

3.0 RAW WATER TRANSMISSION EVALUATION

In order to supply the raw water demands described in Section 2.2.3 from the E.V. Spence Reservoir, it would be necessary to rehabilitate the existing E.V. Spence Reservoir raw water transmission system. This section details the improvements needed for all four water supply alternatives.

3.1 EXISTING E.V. SPENCE RESERVOIR RAW WATER TRANSMISSION SYSTEM

To determine the required raw water system improvements, FNI first examined the existing E.V. Spence Reservoir raw water supply infrastructure, which is owned by the City of San Angelo. The system was originally designed in 1968 for 20 MGD of flow from the E.V. Spence Reservoir to the City of San Angelo. The existing E.V. Spence Reservoir raw water supply infrastructure, as seen on **Figure 3.1**, has been out of service since the early 1990s due to multiple failures on the 36" pipeline.

The following infrastructure is currently in place but is not currently in service:

- Raw Water Intake Pump Station at E.V. Spence Reservoir
- Two (2) Booster Pump Stations
- Mountaintop GST
- 1.2 MG Mount Nebo GST
- Approximately 6.5 miles 36" Concrete Pipeline
- Approximately 22 miles 33" Concrete Pipeline
- Approximately 5 miles 39" Concrete Pipeline

All of the above infrastructure can be used for future supply after necessary investigations and necessary improvements have been made.

3.2 RAW WATER SYSTEM IMPROVEMENTS

In order to use the existing raw water system from the E.V. Spence Reservoir, the following investigations and improvements are recommended:

- Rehab/replace existing 36" pipeline
- Perform condition assessment of existing 33" pipeline and ground storage tanks
- Dredge a new channel or place a barge and pump to the pump station intake structure
- Replace pumps at the existing pump stations

Created By Freese and Nichols, Inc.
Job No.: URA11379
Location: H:\W_WW_PLANNING\DELIVERABLES\04_Updated_Draft_Report_(8-09-12)\(Figure-3.1)-Existing_Raw_Water_Transmission_System.mxd
Updated: Monday, October 22, 2012 10:46:12 AM

FIGURE 3.1
UPPER COLORADO RIVER AUTHORITY
EXISTING RAW WATER TRANSMISSION SYSTEM

LEGEND

- Valve
- GST
- PS
- WTP
- City of San Angelo Water Supply Line
- O.H. Ivie Water Supply Line
- Unincorporated Place
- Study Participant
- City Limit
- ETJ Boundary
- County Boundary

UCRA

FREESE AND NICHOLS

Lake E.V. Spence
Robert Lee
E.V. Spence Lake Pump Station
Booster PS #1 and 0.4 MG GST
Booster PS #2 and 0.4 MG GST
Mountain Top Ground Storage Tank
Valve
1.2 MG Mount Nebo Ground Storage Tank
O.H. Ivie 8 MG GST
O.C. Fisher Valve
City of San Angelo Water Treatment Plant
WTP
36"
33"
53"
60"
39"
COKE
RUNNELS
TOM GREEN
158
208
67
277
87
Water Valley
San Angelo State Supported Living Center
Carlsbad
Grape Creek
Red Creek MUD
City of Miles
O.C. Fisher Lake
San Angelo
Lake Nasworthy
Twin Buttes Reservoir
Wall
Tom Green FWSD #3

0 1.5 3
SCALE IN MILES

3.2.1 Existing 36" Pipeline Rehabilitation/Replacement

Two options were evaluated for the rehabilitation of the existing 36" concrete cylinder pipeline from the E.V. Spence Reservoir intake pump station to the Mountain Top ground storage tank:

- Option 1: Sliplining the existing 36" with a smaller diameter HDPE pipeline
- Option 2: Open-cut replacement with RCCP

The pipe size required for each option depends on the raw water supply alternative. The total length of the project is approximately 6.5 miles.

A. **Option 1: Sliplining**

FNI evaluated sliplining the existing 36" pipeline with DR9 HDPE pipe. HDPE pipe size is based on the outer diameter; thus a 24" HDPE pipe has an approximate inner diameter of 18". The DR9 HDPE pipe has a maximum allowable operating pressure (MAOP) of 250 psi. To account for surge, FNI assumed an allowable operating pressure of 66% of the MAOP, or 160 psi. The costs below assume that an entry pit will be used in 2,000' intervals and that the line is grouted in place. FNI assumed the grout cost to be $175/LY. Before construction would begin, the line will need TV entry and minor cleaning to determine the feasibility of sliplining the existing line.

1. Alternative 1: 2.50 MGD Raw Water Supply

   FNI developed HGLs and determined that the HDPE pipe size required to supply 2.50 MGD is 20" DR9 HDPE pipe. FNI assumed the grout cost to be $35/LF for 20" DR9 HDPE pipe sliplined into the existing 36" pipeline.

2. Alternative 2: 4.60 MGD Raw Water Supply

   FNI developed HGLs and determined that the HDPE pipe size required to supply 4.60 MGD is 24" DR9 HDPE pipe. FNI assumed the grout cost to be $25/LF for 24" DR9 HDPE pipe sliplined into the existing 36" pipeline.

3. Alternative 3: 6.90 MGD Raw Water Supply

   FNI developed HGLs and determined that the HDPE pipe size required to supply 6.90 MGD is 28" DR9 HDPE pipe. FNI assumed the grout cost to be $15/LF for 28" DR9 HDPE pipe sliplined into the existing 36" pipeline.

4. Alternative 4: 9.20 MGD Raw Water Supply

   FNI developed HGLs and determined that the HDPE pipe size required to supply 9.20 MGD is 30" DR9 HDPE pipe. FNI assumed the grout cost to be $10/LF for 30" DR9 HDPE pipe sliplined into the existing 36" pipeline.

A summary of the estimated cost for each supply alternative can be seen in **Table 3.1** below. The HGL profiles and cost estimates for each supply option are attached in **Appendix B**.

Table 3.1 Summary of Option 1: HDPE Sliplining Costs

Alternative	Maximum Supply Rate (MGD)	Required Pipe Size (DR9 HDPE)	Total Project Cost ($ million)
1	2.50	20"	$9.03
2	4.60	24"	$10.89
3	6.90	28"	$13.20
4	9.20	30"	$14.36

B. **Option 2: Open Cut Replacement**

FNI also evaluated an open-cut replacement of the existing 36" pipeline with RCCP. FNI assumed a cost of $8 per diameter inch for RCCP and assumed that no additional easements are needed for this option. RCCP has a maximum allowable operating pressure (MAOP) of 300 psi. To account for surge, FNI assumed an allowable operating pressure of 225 psi. Because RCCP is a higher pressure class pipe material, Booster Station #1 could be eliminated if RCCP was used.

1. Alternative 1: 2.50 MGD Raw Water Supply

   FNI determined that the pipe size required to supply 2.50 MGD is 16" RCCP pipe.

2. Alternative 2: 4.60 MGD Raw Water Supply

   FNI determined that the pipe size required to supply 4.60 MGD is 18" RCCP pipe.

3. Alternative 3: 6.90 MGD Raw Water Supply

   FNI determined that the pipe size required to supply 6.90 MGD is 21" RCCP pipe.

4. Alternative 4: 9.20 MGD Raw Water Supply

   FNI determined that the pipe size required to supply 9.20 MGD is 24" RCCP pipe.

The cost for each supply alternative is shown in **Table 3.2** below. The HGL profiles and cost estimates for each supply alternative are attached in **Appendix C.** The proposed E.V. Spence Reservoir raw water supply infrastructure can be seen on **Figure 3.2**.

Table 3.2 Summary of Option 2: Open-Cut Replacement Costs

Alternative	Maximum Supply Rate (MGD)	Required Pipe Size (RCCP)	Total Project Cost ($ million)
1	2.50	16”	$7.78
2	4.60	18”	$8.53
3	6.90	21”	$9.64
4	9.20	24”	$10.75

3.2.2 Existing 33” Pipeline Condition Assessment

FNI advises the UCRA to perform a condition assessment of the entire length of 33” pipeline as indicated in **Figure 3.2**. FNI estimates that there will be $700,000 in point repairs based on this condition assessment.

3.2.3 Existing Ground Storage Tank Condition Assessment

FNI advises the UCRA to perform a condition assessment of the Mountain Top and Mount Nebo ground storage tanks. FNI estimates that there will be $300,000 in point repairs and welding work required based on this condition assessment.

3.2.4 Evaluation of Dredging vs. Barge & Pump

FNI investigated whether it would be possible to dredge a channel from the current lake level to the E.V. Spence Reservoir pump station intake structure. FNI determined that the lake bottom elevations in the E.V. Spence Reservoir would make it impossible to dredge the lake to allow water to flow naturally to the intake structure. Instead, a barge-mounted pump would be required whenever the lake level is below the raw water intake level of 1850’ mean sea level (MSL). The barge and pumping scenario for the E.V. Spence Reservoir would cost approximately $1.1 million for a diesel pump station and $2.1 million for an electrical pump station.

Rehabilitate E.V. Spence Reservoir Intake Pump Station

Open-Cut RCCP Installation

Rehabilitate Booster PS #2 and Ground Storage Tank

Mountain Top Ground Storage Tank

Condition Assessment and Point Repairs

Valve

1.2 MG Mount Nebo Ground Storage Tank

O.H. Ivie 8 MG GST

O.C. Fisher Valve

City of San Angelo Water Treatment Plant

City of Robert Lee

City of Bronte

City of Miles

City of San Angelo

Water Valley
Concho Rural Water Corporation

Water Valley

Tom Green County FWSD 1

San Angelo State Supported Living Center

Carlsbad

Deer Valley
Concho Rural Water Corporation

Grape Creek
Concho Rural Water Corporation

Grape Creek

Red Creek MUD

North Concho Lake Estates
Concho Rural Water Corporation

Tom Green FWSD #3

Wall

Lake E.V. Spence

Twin Buttes Reservoir

O.C. Fisher Lake

COKE
TOM GREEN

RUNNELS
TOM GREEN

IRION
TOM GREEN

53"
60"
36"
33"
39"

UCRA - Miles Meter # 6030

GAFB Meter # 6110

GAFB Meter # 8280

GAFB Meter # 6108

Millersview/ Doole Meter # 102R

GAFB Meter # 6109

GAFB Meter # 70241059

UCRA Meter # 72771346

UCRA Meter # 72771346

0 8,000 16,000
SCALE IN FEET

FIGURE 3.2
UPPER COLORADO RIVER AUTHORITY
PROPOSED RAW WATER TRANSMISSION SYSTEM
LEGEND

- Water Meter
- Valve
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Spence Water Supply Line (Open-Cut RCCP Installation)
- City of San Angelo Water Supply Line
- O.H. Ivie Water Supply Line
- Private Water Supplier
- Unincorporated Place
- Road
- Stream
- Lake
- Study Participants
- City Limit
- ETJ Boundary
- County Boundary

FREESE AND NICHOLS

UCRA

Created By Freese and Nichols, Inc.
Job No. : URA11379
Location: H:\W_WW_PLANNING\DELIVERABLES\04_Updated_Draft_Report_(8-09-12)\Figure-3-2)-Proposed_Raw_Water_Transmission_System.mxd
Updated: Monday, October 22, 2012 10:47:33 AM

3.2.5 Pump Station Rehabilitation

FNI analyzed whether either of the two existing booster pump stations could be eliminated along the 36" pipeline segment. FNI evaluated the required pump motor size for the supply alternatives of the sliplining and open cut line rehabilitation options. FNI confirmed with the electric provider that the existing power supply to the pump stations could be utilized in the future.

A. Alternative 1: 2.50 MGD Raw Water Supply

For the Option 1, FNI determined that the pump motor sizes required when pumping through 20" DR9 HDPE pipe are the following:

- Intake Pump Station: 150 hp
- Booster Pump Station #1: 200 hp
- Booster Pump Station #2: 200 hp

For the Option 2, Booster Station #1 was eliminated by using RCCP and FNI determined that the pump motor sizes required when pumping through 16" RCCP are the following:

- Intake Pump Station: 400 hp
- Booster Pump Station #2: 200 hp

B. Alternative 2: 4.60 MGD Raw Water Supply

For the Option 1, FNI determined that the pump motor sizes required when pumping through 24" DR9 HDPE pipe are the following:

- Intake Pump Station: 250 hp
- Booster Pump Station #1: 400 hp
- Booster Pump Station #2: 300 hp

For the Option 2, Booster Station #1 was eliminated by using RCCP and FNI determined that the pump motor sizes required when pumping through 18" RCCP are the following:

- Intake Pump Station: 600 hp
- Booster Pump Station #2: 300 hp

C. Alternative 3: 6.90 MGD Raw Water Supply

For the Option 1, FNI determined that the pump motor sizes required when pumping through 28" DR9 HDPE pipe are the following:

- Intake Pump Station: 400 hp
- Booster Pump Station #1: 600 hp
- Booster Pump Station #2: 500 hp

For the Option 2, Booster Station #1 was eliminated by using RCCP and FNI determined that the pump motor sizes required when pumping through 21" RCCP are the following:

- Intake Pump Station: 900 hp
- Booster Pump Station #2: 500 hp

D. Alternative 4: 9.20 MGD Raw Water Supply

For the Option 1, FNI determined that the pump motor sizes required when pumping through 30" DR9 HDPE pipe are the following:

- Intake Pump Station: 600 hp
- Booster Pump Station #1: 800 hp
- Booster Pump Station #2: 700 hp

For the Option 2, Booster Station #1 was eliminated by using RCCP and FNI determined that the pump motor sizes required when pumping through 24" RCCP are the following:

- Intake Pump Station: 1350 hp
- Booster Pump Station #2: 700 hp

The required pump size for each supply alternative is summarized in **Table 3.3** below and the required cost for each pump station is shown in **Table 3.4**. The cost estimate tables for each supply rate are attached in **Appendix D** for Option 1 and **Appendix E** for Option 2.

Table 3.3 Summary of Required Pump Sizes

Alternative	Supply Rate (MGD)	Option	Required Motor Size		
			Intake PS (hp)	Booster PS #1 (hp)	Booster PS #2 (hp)
1	2.5	1	150	200	200
		2	400	-	200
2	4.6	1	250	400	300
		2	600	-	300
3	6.9	1	400	600	500
		2	900	-	500
4	9.2	1	600	800	700
		2	1350	-	700

Table 3.4 Summary of Pump Rehabilitation Costs for each Option

Alternative	Supply Rate (MGD)	Option	Required Pump Rehabilitation		
			Intake PS ($ million)	Booster PS #1 ($ million)	Booster PS #2 ($ million)
1	2.5	1	$0.91	$1.27	$1.27
		2	$1.15	-	$1.27
2	4.6	1	$1.07	$1.43	$1.40
		2	$1.20	-	$1.40
3	6.9	1	$1.15	$1.52	$1.48
		2	$1.32	-	$1.48
4	9.2	1	$1.24	$1.62	$1.58
		2	$1.71	-	$1.58

3.2.6 Summary of Raw Water Transmission Cost

The total cost of the raw water transmission system improvements for alternatives 1-4 are shown in **Table 3.5**. Based on this analysis, we recommend that open-cut replacement is utilized for the rehabilitation of the existing 36" portion of the E.V. Spence Reservoir raw water transmission line.

Table 3.5 Raw Water Transmission System Improvements Total Cost

Alt	Supply Rate (MGD)	Option	Required Pipe Cost (million)	Condition Assessment		Barge & Pump (million)	Required Pump Rehabilitation			Total Capital Cost (million)
				Existing 33" RCCP (million)	Existing GSTs (million)		Intake PS (million)	Booster PS #1 (million)	Booster PS #2 (million)	
1	2.5	1	$9.03	$0.70	$0.30	$2.10	$0.91	$1.27	$1.27	$16.58
		2	$7.78	$0.70	$0.30	$2.10	$1.15	-	$1.27	$15.30
2	4.6	1	$10.89	$0.70	$0.30	$2.10	$1.07	$1.43	$1.40	$18.89
		2	$8.53	$0.70	$0.30	$2.10	$1.20	-	$1.40	$16.23
3	6.9	1	$13.20	$0.70	$0.30	$2.10	$1.15	$1.52	$1.48	$21.45
		2	$9.64	$0.70	$0.30	$2.10	$1.32	-	$1.48	$17.54
4	9.2	1	$14.36	$0.70	$0.30	$2.10	$1.24	$1.62	$1.58	$22.90
		2	$10.75	$0.70	$0.30	$2.10	$1.71	-	$1.58	$19.14

4.0 WATER TREATMENT PLANT EVALUATION

4.1 WATER QUALITY REVIEW

Lake O.H. Ivie is the current dominant surface water supply source for the City of San Angelo. Historically, the E.V. Spence Reservoir water quality has been more saline than that of Lake O.H. Ivie. In order to maintain the current water quality of water treated by the City of San Angelo, desalination will be required to offset the E.V. Spence Reservoir salinity.

4.1.1 Historical Constituent Data

For the San Angelo WTP, a wide array of constituent data is available from the existing routine raw and finished water sampling. The data available from Lake O.H. Ivie and the E.V. Spence Reservoir is more limited in nature and primarily focuses on total dissolved solids (TDS), Chloride, and Sulfate. TDS is of interest because it is not removed by conventional water treatment processes and provides a general measure of the effectiveness of the desalination process. Chloride and Sulfate are of interest because they are constituents monitored for secondary standards by TCEQ. Secondary standards are related to aesthetic issues such as taste and odor, as opposed to primary standards which are related to public health. Furthermore, there are no known primary standard constituent issues as these reservoirs have been previously utilized for water supply. Accordingly, total dissolved solids, chloride and sulfate were used as a benchmark for evaluation of desalination technology in this application. Historical water quality data was analyzed for the period between 2007 and 2011. The total dissolved solids, chloride and sulfate data is plotted on **Figure 4.1**, **Figure 4.2**, and **Figure 4.3** below.

Average water quality for each of the three constituents is provided in **Table 4.1**.

Table 4.1 Average Water Quality (2007 – 2011)

	TDS (mg/l)	Chloride (mg/l)	Sulfate (mg/l)
Lake O.H. Ivie	1153	348	281
E.V. Spence Reservoir	2085	789	436
San Angelo WTP Finished Water	1206	343	318
TCEQ Secondary Standard	1000	300	300

Figure 4.1
Historical TDS Concentration
2007 - 2011

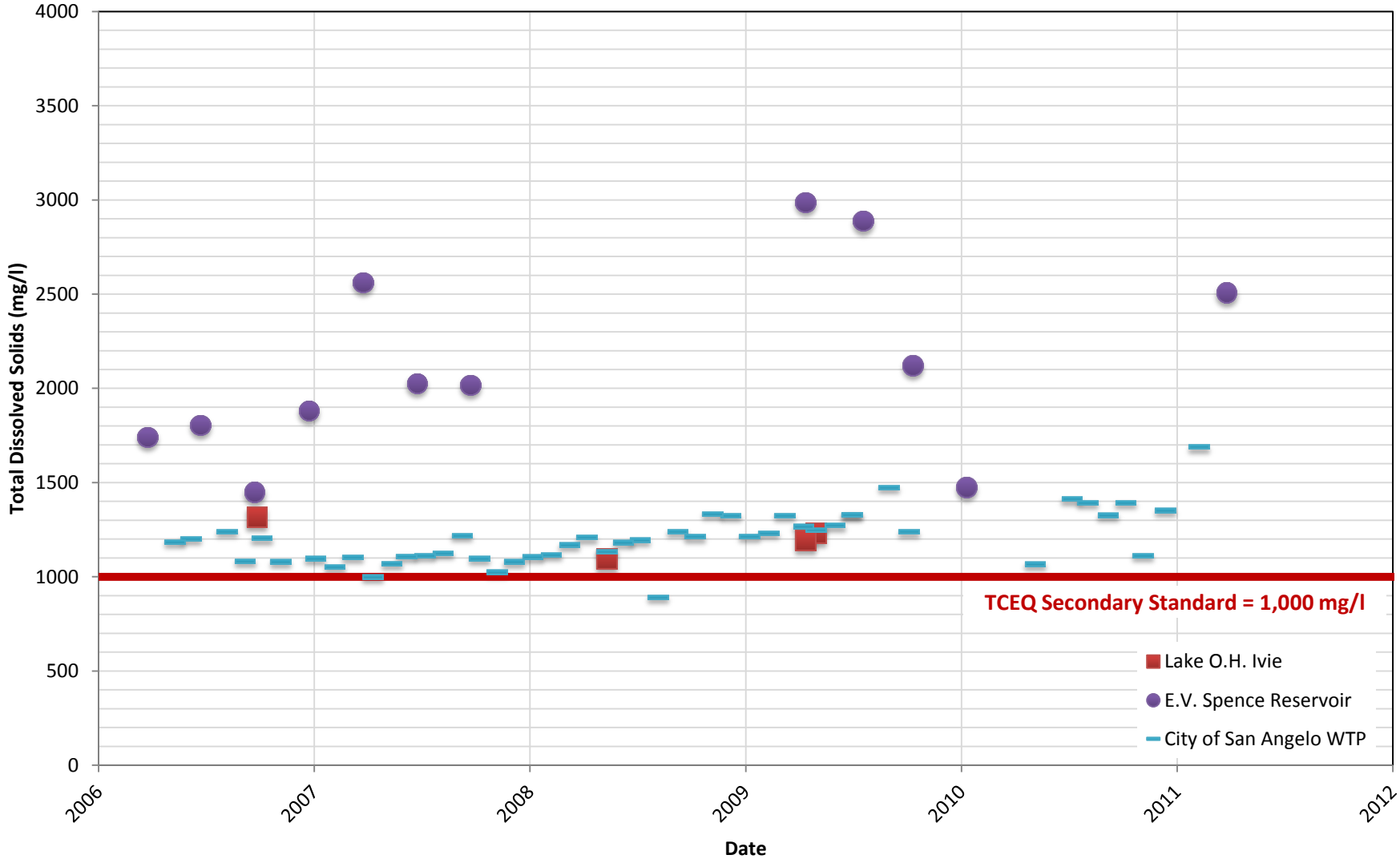


Figure 4.2
Historical Chloride Concentration
2007 - 2011

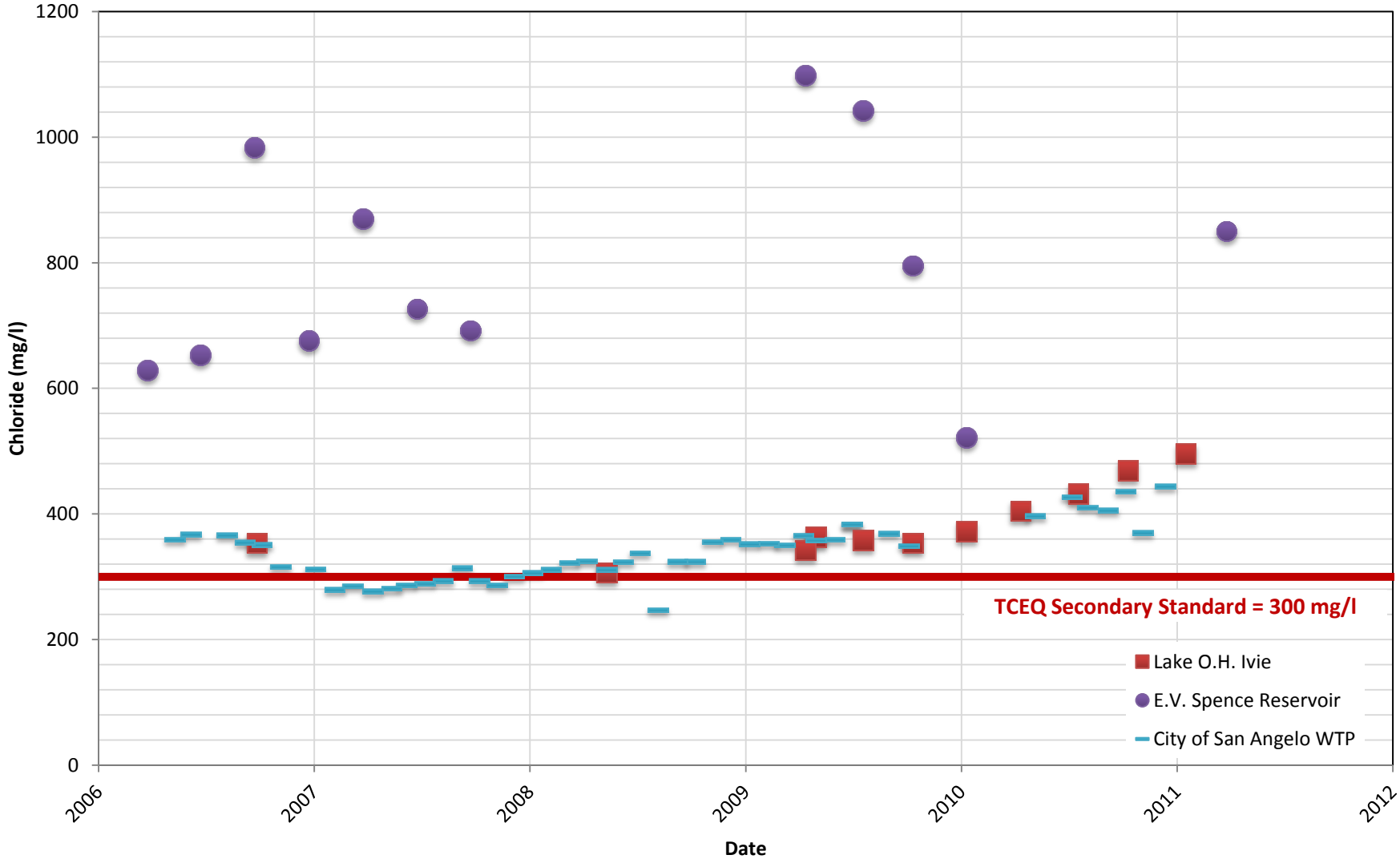
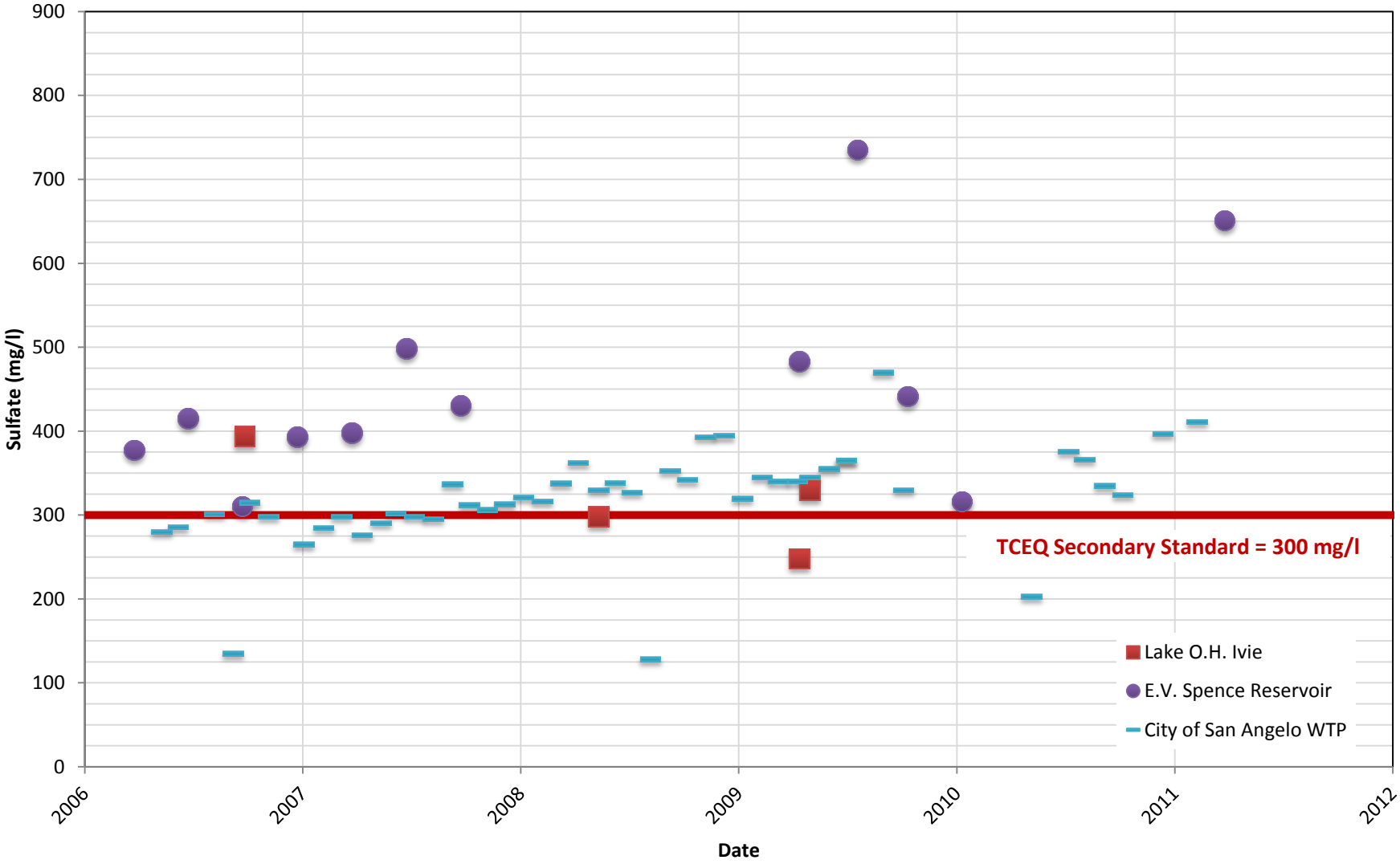


Figure 4.3
Historical Sulfate Concentration
2007 - 2011



4.1.2 Treatment Level Goals

The rated treatment capacity of the San Angelo WTP is 42 MGD; however, the current maximum day demand is only about 26.6 MGD. Therefore, the conceptual plan proposes to take advantage of the existing reserve capacity available from the San Angelo WTP infrastructure. Because the E.V. Spence Reservoir quality is more saline than the existing water supply for the San Angelo WTP, the addition of the E.V. Spence Reservoir flow to the San Angelo WTP process will result in a raw water quality with higher mineral content.

There are two water quality goals that have been established as benchmarks for this evaluation:

- **Goal 1:** The primary objective of the water treatment plant evaluation is to identify the flow capacity of desalination required to maintain the current water quality produced by the City of San Angelo.
- **Goal 2:** As a secondary objective, the water treatment plant evaluation explores the additional sidestream treatment capacity required to improve the San Angelo WTP finished water to a level where it meets the TCEQ Chapter 290 secondary standards, which focus on taste and odor. This could potentially be an attractive alternative for consideration, benefitting both existing and potential customers.

4.1.3 Desalination

Because conventional treatment does not have a removal mechanism for dissolved minerals, the treatment process would need to be modified in order to satisfy the specified water quality goals. Accordingly, desalination would need to be added to the process train.

Desalination is the removal of salts and other dissolved solids from saline water (brackish or seawater). Desalination technologies accomplish almost complete removal of salts; therefore, it is a common practice to bypass a portion of the source water and blend it with the desalination product water to achieve the desired level of water quality. **Figure 4.4** depicts the typical desalination process configuration.

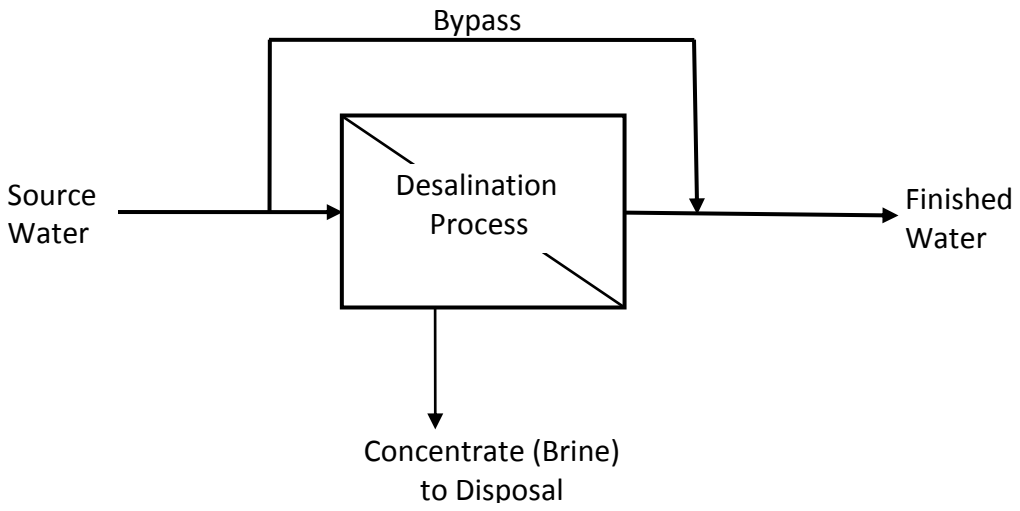


Figure 4.4 Typical Desalination Process Configuration

4.2 DESALINATION EVALUATION

4.2.1 Reverse Osmosis (RO)

Reverse osmosis (RO) consists of separating water from a saline solution by the use of a semi-permeable membrane and hydrostatic pressure. Reverse osmosis is a useful separation method since it permits the passage of water and rejects the passage of most ions and molecules other than water. Reverse osmosis is used to purify water and remove salts and other impurities in order to improve the color, taste or properties of the fluid.

Most reverse osmosis technology uses a process known as crossflow to allow the membrane to continually clean itself. As some of the fluid passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane. (See **Figure 4.5**) The process of reverse osmosis requires a driving force to push the fluid through the membrane, and the most common force is pressure from a pump. Higher pressures result in a larger driving force. As the concentration of the fluid being rejected increases, the driving force required to continue concentrating the fluid increases. Typical operating pressures for brackish water are 200-300 psi.

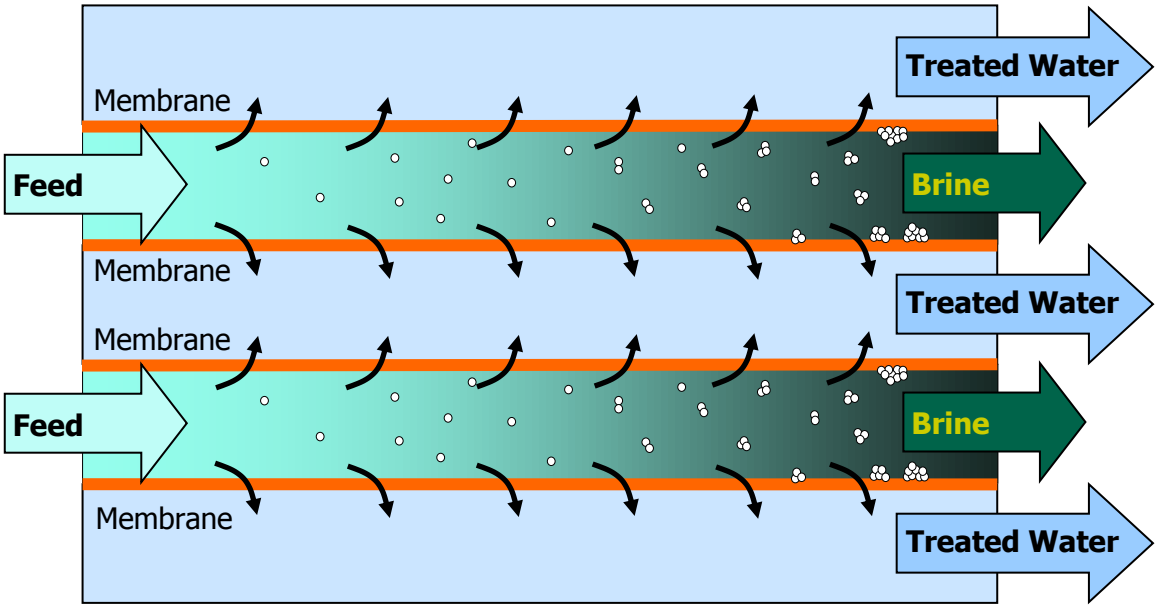


Figure 4.5 Reverse Osmosis Process Schematic

Reverse osmosis is capable of rejecting bacteria, salts, sugars, proteins, particles, dyes, and other constituents that have a molecular weight of greater than 150-250 daltons. The reverse osmosis separation is aided by electrical charges. This means that dissolved ions that carry a charge, such as salts, are more likely to be rejected by the membrane than those that are not charged, such as organics. The larger the charge and the larger the molecule, the more likely it will be removed from the water.

Water undergoing reverse osmosis may need to be pre-treated to remove larger particles to prevent clogging of the membranes and reduce membrane maintenance. Surface water sources will almost always require some kind of significant pre-treatment to remove suspended particles.

4.2.2 Electrodialysis

Electrodialysis is a membrane process in which ions are transported through a semi-permeable membrane under the influence of an electric potential. The membranes are cation or anion-selective, which means that either positive ions or negative ions will flow through. Cation-selective membranes are negatively charged, rejecting negatively charged ions and allowing positively charged ions to flow through. Anion-selective membranes have a positive charge, and allow only negatively charged ions to pass. By placing multiple membranes in a stack, which alternately allow positively or negatively charged ions to flow through, the ions can be removed from water.

In some columns, concentration of ions will take place and in other columns, ions will be removed. The concentrated saltwater flow is circulated until it has reached saturation. At this point the flow is discharged.

This technique can only remove ions from water. Particles that do not carry an electrical charge are not removed. Sometimes pre-treatment is necessary before the electrodialysis can take place. Suspended solids with a diameter that exceeds 10 mm need to be removed, or else they will plug the membrane pores. There are also substances that are able to neutralize a membrane, such as large organic anions, colloids, iron oxides and manganese oxide. These disturb the selective effect of the membrane. Pre-treatment methods, which aid the prevention of these effects are activated carbon filtration (for organic matter), flocculation (for colloids) and filtration techniques.

4.2.3 Other Desalination Technologies

Technologies that have been used for removing salts and minerals from the water also include ion exchange and thermal distillation. These technologies have been used widely in industrial applications and in removing specific contaminants such as nitrate or perchlorate.

Ion Exchange

Ion exchange is a reversible chemical reaction wherein an ion from a water stream is exchanged for a similarly charged ion attached to an immobile solid particle. These ion exchange particles are either naturally occurring inorganic zeolites or synthetically produced organic resins. The synthetic organic resins are the predominant type used today because their characteristics can be tailored to specific applications.

In a water ion exchange process, the resins exchange hydrogen ions (H+) for the positively charged ions (such as nickel. copper, calcium and sodium) and hydroxyl ions (OH-) for negatively charged sulfates, chromates and chlorides. Because the quantity of H+ and OH- ions is balanced, the result of the ion exchange treatment is relatively pure, neutral water. Ion exchange resins are classified as cation exchangers, which have positively charged mobile ions available for exchange, and anion exchangers, whose exchangeable ions are negatively charged. Both anion and cation resins are produced from the same basic organic polymers. Resins can be broadly classified as strong or weak acid cation exchangers or strong or weak base anion exchangers.

Thermal Distillation

Thermal distillation is the oldest method of desalination but is not typically used for public water supply in the United States. Distillation is a phase separation method where saline water is heated to produce water vapor, which is then condensed to produce fresh water. This distillation process operates on the principle of reducing the vapor pressure of water within the unit to permit boiling to occur at lower temperatures, without the use of additional heat. Distillation units routinely use designs that conserve as much thermal energy as possible by interchanging the heat of condensation and heat of vaporization within the units. The major energy requirement in the distillation process is the heat for vaporization of the feed water.

4.2.4 Reverse Osmosis Desalination Consideration

For the purposes of the evaluation, it was assumed that although other reservoirs contribute to the process flow at the San Angelo WTP, Lake O.H. Ivie dominates. Therefore, it was assumed that the Lake O.H. Ivie constituent data is representative of influent flow to the San Angelo WTP.

In both cases, the evaluation assumes 75% recovery through the reverse osmosis process. This value is typical for the source water salinity and hardness that is being considered in this application. Recovery is defined as the fraction of flow that is desalinized by the membrane process. The remaining fraction is the concentrated brine reject.

4.2.5 Conceptual Process Train

The conceptual process train, seen on **Figure 4.6**, proposes the addition of a RO desalination process to follow the existing conventional San Angelo WTP process. As noted in Section 4.2.1, surface water supplies almost always require removal of suspended particles to avoid rapidly fouling the RO membrane. The conventional treatment offered by the existing San Angelo WTP would provide the pretreatment required as it would remove the majority of suspended and colloidal particles upstream of the RO process. The RO process requires the addition of a brine waste stream that will require disposal.

For Goal 1 (match existing San Angelo WTP effluent water quality), the four water supply alternatives were evaluated. The first alternative evaluated the case where the net addition in water production was increased by 2.12 MGD. The flow contribution required from the E.V. Spence Reservoir was then back calculated using a mass balance. The second, third, and fourth alternatives evaluated the net increase in production based on the contribution in raw water from the E.V. Spence Reservoir in the amount of 4.6, 6.9, and 9.2 MGD, respectively.

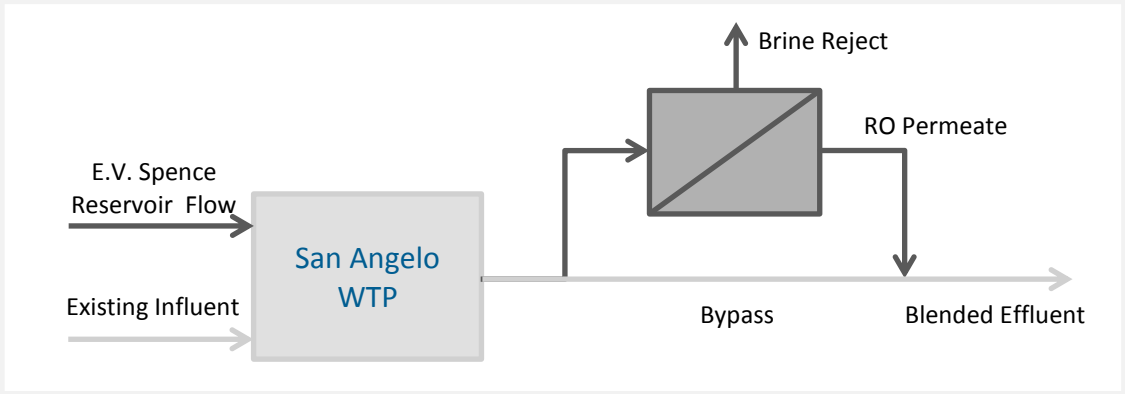


Figure 4.6 Conceptual Process Train

The analysis was performed with each of the three constituents, TDS, chloride, and sulfate. Of the three constituents evaluated, chloride was found to be the constituent controlling net production. A summary of the analysis is presented in **Table 4.2** below.

Table 4.2 Net Increase in Production for Case 1

	Flow (MGD)			
E.V. Spence Reservoir	3.22	4.60	6.90	9.20
Net Increase in Production	2.12	3.19	5.05	6.94
RO Concentrate	1.11	1.41	1.85	2.26

For Goal 2 (meet secondary water quality) the same four scenarios were evaluated for each of the three constituents. Again, chloride was found to be the controlling constituent of the three that were evaluated. A summary of the analysis is presented in **Table 4.3** below.

Table 4.3 Net Increase in Production for Case 2

	Flow (MGD)			
E.V. Spence Reservoir	3.76	4.60	6.90	9.20
Net Increase in Production	2.12	2.77	4.64	6.53
RO Concentrate	1.65	1.83	2.26	2.67

4.2.6 Concentrate Disposal

All desalination processes produce two liquid streams: the desalinated product water and a second stream containing the salts and other contaminants separated from the product water, referred to as reject, brine or concentrate. Concentrate disposal represents a significant challenge to most desalination operations. The concentrate is still mostly water (98-99.5% by weight) but is unfit for most

uses and many potential discharge locations. It represents a significant fraction of the original water source (10-35%) and so its disposition is far from trivial, especially for large projects. Typical disposal alternatives are described in the following paragraphs.

Reverse Osmosis treatment will produce 1.1 to 2.7 MGD of waste concentrate with a TDS of about 6000 mg/l. This water could not be sent to the wastewater treatment plant because it is over the crop threshold. Dedicated disposal is therefore required for the brine concentrate.

A. Evaporation

In a dry area such as West Texas, it is natural to consider evaporation for disposal of unwanted water, and it is a viable alternative for small quantities. Some devices such as mechanical "misters" and mirrors for concentrating solar energy have also been used to enhance natural evaporation; however, for large quantities of concentrate such as those contemplated in this project, the area required for evaporation would be very large, probably hundreds of acres. Evaporation reservoirs would require a synthetic liner to prevent contamination of shallow groundwater, and periodic dredging would likely be required to remove accumulated solids. Because of these factors, it does not appear that evaporation would be feasible as the primary disposal method for this project, although storage reservoirs may be beneficial in managing concentrate disposal, and some beneficial evaporation will occur during storage.

B. Discharge

Historically, most desalination concentrate has been discharged to the ocean, a sanitary sewer system, or to a stream. This is the simplest and most economical form of disposal, and is preferable when a suitable discharge location is available. However, potential receiving streams in the San Angelo vicinity flow into water supply reservoirs, and would not be compatible with brine discharges.

C. Dedicated Disposal Wells

Deep saline aquifers have been used in many locations for disposal of various waste streams, including oil field brines, cooling water blowdown, and desalination concentrate. Where favorable conditions exist, this method is attractive due to its minimal impact on the environment and potentially large capacity to receive liquid wastes. Deep well injection has

been the disposal method of choice for oil and gas extraction operations due to the industry's familiarity with underground operations and a favorable regulatory framework. Unfortunately, this regulatory framework does not extend to the water industry, where permitting of injection wells is a lengthy and expensive process. The flows from large-scale desalination projects are also significantly larger than typical waste flows from oil operations, complicating the transfer of injection experience. A "general" permit available for certain municipal wells has brought some relief, but permitting remains a significant effort.

D. Zero Liquid Discharge

Technology is also available which can recover additional water from desalination concentrate, increasing the yield from the original source and greatly reducing the volume of waste for disposal. For larger systems, such technology typically consists of a brine concentrator, which distills water from the concentrate stream through a combination of thermal energy and pressure manipulation. If a solid waste output is required, the resulting brine can be further reduced using a crystallizer, which requires additional energy to evaporate sufficient water to form solid salt crystals. These processes have primarily been used for disposal of cooling tower blowdown, but have also been used for desalination concentrate. The equipment is quite expensive and has high energy requirements, so is typically used only where other options do not prove feasible. This option has the advantage of yielding additional high-purity water. It is unlikely that zero discharge technology will be attractive for this project, but it does establish an upper limit on disposal costs, since it can be placed almost anywhere if sufficient energy is available.

4.2.7 Conceptual Costs

A. Capital

Conceptual budget level costs were developed for each of the two water quality goals evaluated. Results are presented in **Table 4.4** below.

Table 4.4 Conceptual Budget Level Capital Costs

Goal	Treated Water Quality	Alternative	E.V. Spence Reservoir Flow (MGD)	Net Increase in Production (MGD)	Conceptual Budget Level Construction Cost ($ million)
1	Match Existing	1	3.22	2.12	$13.67
		2	4.60	3.19	$16.79
		3	6.90	5.05	$21.06
		4	9.20	6.94	$24.98
2	Secondary	1	3.76	2.12	$19.14
		2	4.60	2.77	$20.81
		3	6.90	4.64	$25.02
		4	9.20	6.53	$28.97

The budgetary level capital costs presented above include yard piping, valves, meters and appurtenances; a membrane building including RO membrane equipment, chemical feed facilities, and a building; a 0.5 million gallon product water storage tank; reject facilities; and electrical and instrumentation. Deep well injection was assumed to be an appropriate disposal method for the concentrate. A separate disposal study will be needed to determine the feasibility of this option.

B. Operating Costs

For annual operation, one should consider the costs associated with expanded conventional treatment, membrane replacement, RO power costs, RO chemical costs, and RO concentrate disposal costs. **Table 4.5** and **Table 4.6** provide a summary of these costs for Goal 1 and Goal 2. Additional discussion of these considerations is provided in more detail below. The detailed cost estimates for each goal is located in **Appendix F**.

1. Conventional Treatment

   Reserve capacity of the existing San Angelo WTP is being considered for pretreatment of the reverse osmosis system, and additional capital investment will not be required; however, the impact to the O&M is not trivial and should be considered accordingly. It

is expected that utilizing the excess capacity would impact the chemical and energy operating costs. An average budgetary level estimate of annual O&M cost is $0.38 per thousand gallons of San Angelo WTP finished water.

2. RO Annual Membrane Replacement

   Although RO membrane systems are generally provided with a cross-flow arrangement, fouling leads to a decreased capacity over time. Chemical cleaning may help recover a fraction of the lost capacity; however, there comes a point where chemical cleaning is no longer beneficial and replacement of the membrane is required. Accordingly, membrane replacement needs to be considered for annual O&M budgetary purposes. An average normalized cost for membrane replacement is $0.08 per thousand gallons of RO permeate.

3. RO Annual Power

   In order to overcome the osmotic pressure, the membranes are subjected to an increase in pressure across the face of the membrane. This pressure increase is most commonly developed by pumping. Accordingly, the energy costs associated with membrane systems are a major factor contributing to overall O&M costs. An average normalized cost for RO membrane power is $0.38 per thousand gallons of RO permeate.

4. RO Annual Chemical

   As previously noted, membranes require periodic chemical cleaning to recover the flux. Some of the common chemicals used for this operation include sodium hypochlorite, sodium hydroxide, citric acid, hydrochloric acid and anti-scalants. An average normalized cost for RO membrane chemical costs is $0.06 per thousand gallons of RO permeate.

5. Concentrate Disposal

   Although a number of alternatives exist for concentrate disposal, deep well injection was considered for the purposes of developing budgetary O&M costs. A subsequent detailed study is recommended to more closely evaluate concentrate disposal. Although pipeline and appurtenance maintenance contributes to the concentrate disposal cost, energy is the primary contributing factor. An average normalized cost for RO concentrate disposal is $0.99 per thousand gallons of RO concentrate.

Table 4.5 Summary of O&M Costs for Case 1

Alt.	Net Increase in Production (MGD)	Additional Conventional Treatment (MGD)	Daily RO Production (MGD)	Daily RO Concentrate Disposal (MGD)	Annual Conventional Treatment O&M Increase ($ million)	Annual Membrane Replacement ($ million)	Annual RO Power ($ million)	Annual RO Chemical ($ million)	Annual Concentrate Disposal ($ million)	Total Annual O&M Increase ($ million)	O&M Unit Cost Increase ($/1000 gal)
1	2.11	3.22	3.32	1.11	$0.44	$0.10	$0.46	$0.07	$0.40	$1.47	$1.91
2	3.19	4.6	4.43	1.41	$0.63	$0.14	$0.61	$0.09	$0.51	$1.98	$1.70
3	5.05	6.9	5.56	1.85	$0.94	$0.17	$0.76	$0.12	$0.67	$2.67	$1.45
4	6.94	9.2	6.78	2.26	$1.26	$0.21	$0.93	$0.14	$0.82	$3.36	$1.33

Table 4.6 Summary of O&M Costs for Case 2

Alt.	Net Increase in Production (MGD)	Additional Conventional Treatment (MGD)	Daily RO Production (MGD)	Daily RO Concentrate Disposal (MGD)	Annual Conventional Treatment O&M Increase ($ million)	Annual Membrane Replacement ($ million)	Annual RO Power ($ million)	Annual RO Chemical ($ million)	Annual Concentrate Disposal ($ million)	Total Annual O&M Increase ($ million)	O&M Unit Cost Increase ($/1000 gal)
1	2.11	3.76	4.96	1.65	$0.52	$0.15	$0.68	$0.11	$0.60	$2.06	$2.67
2	2.77	4.6	5.48	1.83	$0.63	$0.17	$0.75	$0.12	$0.66	$2.34	$2.31
3	4.64	6.9	6.79	2.26	$0.94	$0.21	$0.93	$0.14	$0.82	$3.05	$1.80
4	6.53	9.2	8.02	2.67	$1.26	$0.25	$1.10	$0.17	$0.97	$3.75	$1.57

5.0 WATER DISTRIBUTION SYSTEM EVALUATION

5.1 EXISTING DISTRIBUTION SYSTEM

As seen on **Figure 5.1**, the UCRA currently provides wholesale water through the City of San Angelo distribution system to the City of Miles and Concho Rural Water Corporation. There is currently a 6" water line, a 100,000 gallon ground storage tank and a booster pump station along FM 2105 and Hwy 67 that supplies the City of Miles. There is currently a 6" and 8" water line along Hwy 277 to the Concho Rural Water Corporation (Pecan Creek subdivision).

5.2 PROPOSED DISTRIBUTION SYSTEM

Discussions with the City of San Angelo indicate that the City will continue to allow the UCRA to use its distribution system to convey treated water to the UCRA's customers. The UCRA requires three treated water supply lines to serve their potential wholesale customers. **Table 5.1** presents the maximum day demand that each line must supply.

Table 5.1 Water Supply Line Demand Allocation

Entity	Population	Maximum Day Demand (gpd)
Northeast Water Supply Line		
Miles	1,063	201,970
TOTAL	1,063	201,970
Northwest Water Supply Line		
North Concho Lake Estates	1,400	195,000
Red Creek MUD	834	72,000
Grape Creek	3,200	540,690
DADS	1,200	184,000
Deer Valley	270	52,000
Tom Green WSD #1	630	70,000
Water Valley*	783	90,000
TOTAL	7,483	1,203,690
South Water Supply Line		
Pecan Creek	1,110	180,000
Tom Green WSD #3	945	295,313
Tom Green WSD #2	422	80,180
The Oaks	768	203,895
TOTAL	3,100	759,388

Created By Freese and Nichols, Inc.
Job No.: URA11379
Location: H:\W_WW_PLANNING\DELIVERABLES\04_Updated_Draft_Report_(8-09-12)\(Figure-5.1)-Existing_Treated_Water_System.mxd
Updated: Monday, October 22, 2012 10:48:33 AM

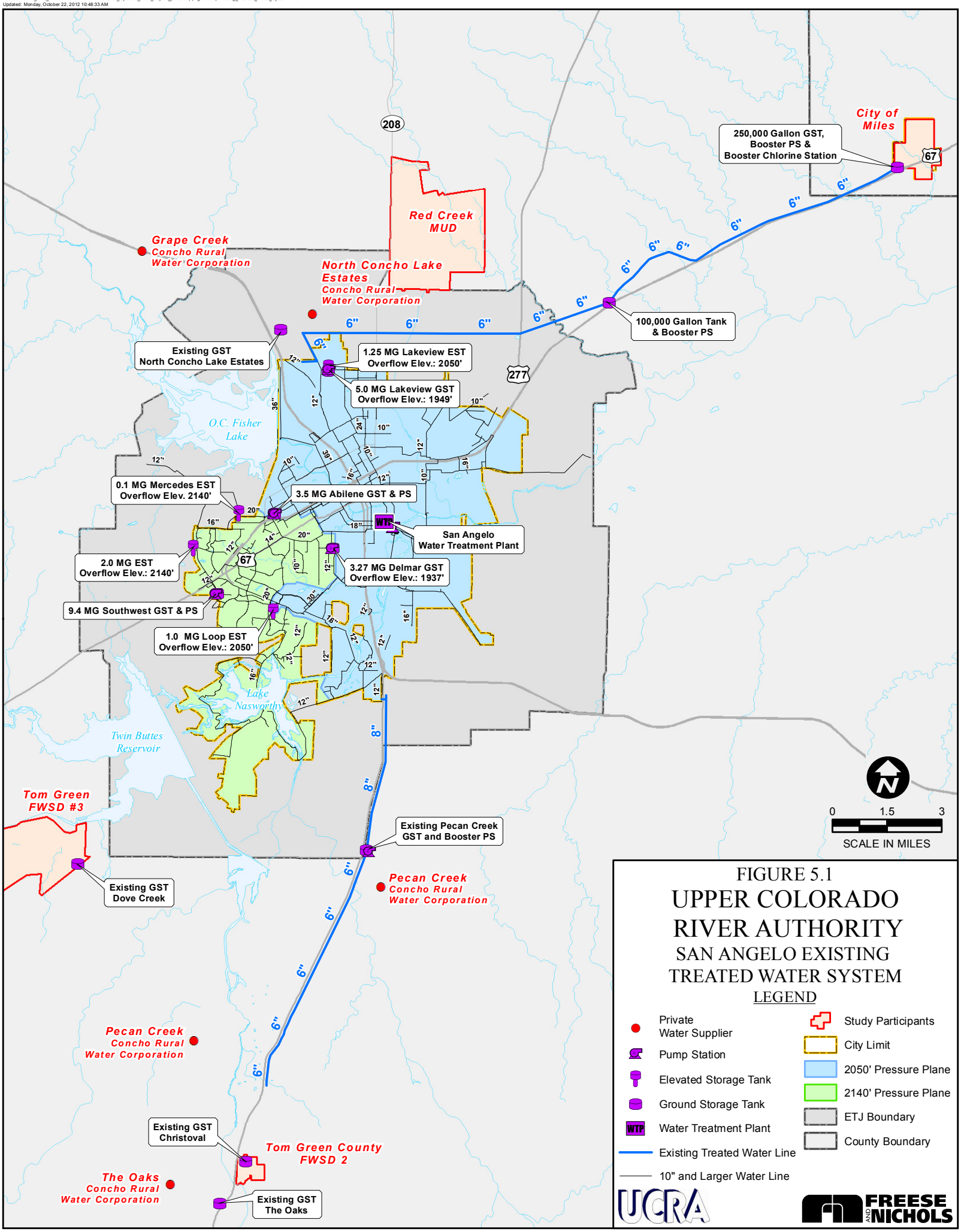


FIGURE 5.1
UPPER COLORADO RIVER AUTHORITY
SAN ANGELO EXISTING TREATED WATER SYSTEM

LEGEND

- Private Water Supplier
- Pump Station
- Elevated Storage Tank
- Ground Storage Tank
- WTP Water Treatment Plant
- Existing Treated Water Line
- 10" and Larger Water Line
- Study Participants
- City Limit
- 2050' Pressure Plane
- 2140' Pressure Plane
- ETJ Boundary
- County Boundary

UCRA

FREESE AND NICHOLS

5.2.1 Existing City of Miles Supply Line (Northeast Water Supply Line)

FNI developed a hydraulic model and evaluated the hydraulic capacity of the existing water supply system to Miles. FNI determined that the existing water supply system is able to serve projected 2030 max day demands. **Appendix G** provides the HGLs which detail the system performance of the Northeast Water Supply Line.

5.2.2 South Water Supply Line

There is an existing 6”/8” water line that extends from the City of San Angelo distribution system down south along Hwy 277 to the Concho Rural Water Corporation (Pecan Creek subdivision). The existing South water supply system consists of a ground storage tank and booster pump station at FM 584 near Hwy 87. Pecan Creek’s projected 2030 max day demand is 180,000 gpd (approximately 200 acre-ft/yr).

Using the hydraulic model, FNI determined the necessary improvements to serve Tom Green WSD #3 (Dove Creek), Tom Green County FWSD #2 (Christoval) and the Oaks in addition to Pecan Creek. In order to serve Tom Green County FWSD #2 (Christoval) and the Oaks in addition to Pecan Creek, the UCRA must construct the following:

- 6” water line along US Hwy 277 from the existing 6” to the existing GSTs
- Two (2) pump stations
- Two (2) ground storage tanks

In order to serve Tom Green WSD #3 (Dove Creek), the UCRA must construct an 6” dedicated line from the existing Pecan Creek GST to Dove Creek and install additional pumps at the existing Pecan Creek pump station.

The locations of the booster pump stations, ground storage tanks and proposed water supply line routes are shown in

Figure 5.2. **Appendix G** provides the HGLs which detail the system performance of the South Water Supply Line.

5.2.3 Northwest Water Supply Line

Using the hydraulic model, FNI determined the necessary improvements to serve Red Creek Municipal Utility District, Tom Green FWSD #1 (Carlsbad), Concho Rural Water Corporation (North Concho Lake Estates, Grape Creek, Deer Valley, Water Valley) and the San Angelo State Supported Living Center. The demands of these communities require 1,203,690 gpd (approximately 1325 acre-ft/yr).

Red Creek MUD will be served through North Concho Lake Estates. Both the Red Creek MUD and North Concho Lake Estates demands must be delivered and stored at the existing North Concho Lake Estates GST. FNI determined that it is necessary to construct a pump station at the existing Lakeview GST and a 10" water line from the Lakeview pump station to the existing North Concho Lake Estates GST to deliver treated water to North Concho Lake Estates and the Red Creek MUD.

To serve entities along Hwy 87 northwest of North Concho Lake Estates, the UCRA must construct a 10" water line from the North Concho Lake Estates GST northwest along US Hwy 87 North. At the split to Grape Creek, a 400,000 gallon ground storage tank and booster pump station is required to serve all entities on the northwest line. An 8" water line is required from the Grape Creek split to the Deer Valley split. From the Deer Valley split, an 6" water line is required to the existing Water Valley GST and 8" branch lines are required to the Deer Valley and Carlsbad GSTs. The San Angelo State Supported Living Center will be served by tying into the existing water line in the ROW.

The location of the required booster pump station and tank and the proposed water supply line sizes are shown on

Figure 5.2. **Appendix G** provides the HGLs which detail the system performance of the Northwest Water Supply Line.

Table 5.2 summarizes the costs for each treated water supply line. The Northwest Supply Line requires two pump stations, a 400,000 gallon ground storage tank and 107,700 ft of water supply line to be installed from the Lakeview GST to Water Valley for a total cost of $11,927,900. The South Supply Line requires three pump stations, a 300,000 gallon and two 200,000 gallon ground storage tanks and 74,500 ft of 6" water line to be installed from Pecan Creek to The Oaks and from the existing Pecan Creek GST to Dove Creek for a total cost of $9,963,800.

Table 5.2 Summary of Treated Water Supply Line Costs ($ million)

Description	Unit Cost	Unit	Quantity	Total Cost
Northwest Supply Line				
Water Line & Appurtenances	Variable	LF	107,700	$9.23
Lakeview GST Pump Station	$1.20	EA	1	$1.20
Booster Pump Station	$1.20	EA	1	$1.20
400,000 gallon GST	$0.30	EA	1	$0.30
			Subtotal	**$11.93**
South Supply Line				
Water Line & Appurtenances	Variable	LF	74,500	$5.84
Booster Pump Station	$1.20	EA	3	$3.60
300,000 gallon GST	$0.23	EA	1	$0.23
200,000 gallon GST	$0.15	EA	2	$0.30
			Subtotal	**$9.97**
			Total	**$21.90**

FIGURE 5.2
UPPER COLORADO RIVER AUTHORITY
SAN ANGELO WHOLESALE TREATED WATER SYSTEM

LEGEND

- Water Meter
- Existing Ground Storage Tank
- Existing Booster Pump Station
- Future Ground Storage Tank
- Future Pump Station
- Water Treatment Plant
- Existing Treated Water Line
- Proposed Treated Water Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Private Water Supplier
- Road
- Stream
- Study Participants
- Lake
- City Limit
- 2050' Pressure Plane
- 2140' Pressure Plane
- ETJ Boundary
- County Boundary

FREESE AND NICHOLS

UCRA

0 6,000 12,000
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: URA11379
Location: H:\W_RW_PLANNING\DELIVERABLES\04_Updated_Draft_Report_(8-09-12)\Figure-5.2)-Proposed_Treated_Water_System.mxd
Updated: Monday, October 22, 2012 10:50:16 AM

6.0 COST SUMMARY

The cost of Alternatives 1, 2, 3 and 4 for each treatment goal is summarized in **Table 6.1**. This total cost includes the raw water transmission system, treatment plant and distribution system costs.

Table 6.1 Summary of Total Capital Costs ($ million)

	Goal 1: Maintain Current Water Quality				Goal 2: Achieve TCEQ Secondary Standards			
	Alternative				Alternative			
	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate
Raw Water Transmission								
Annualized Debt Service	$1.32	$1.40	$1.51	$1.65	$1.32	$1.40	$1.51	$1.65
Operations & Maintenance	$0.10	$0.11	$0.12	$0.14	$0.10	$0.11	$0.12	$0.14
Subtotal	***$1.42***	***$1.51***	***$1.63***	***$1.79***	***$1.42***	***$1.51***	***$1.63***	***$1.79***
Water Treatment								
Annualized Debt Service	$1.18	$1.44	$1.81	$2.15	$1.65	$1.79	$2.15	$2.49
Operations & Maintenance	$1.47	$1.98	$2.67	$3.36	$2.06	$2.34	$3.05	$3.75
Subtotal	***$2.65***	***$3.42***	***$4.48***	***$5.51***	***$3.71***	***$4.13***	***$5.20***	***$6.24***
Treated Water Distribution								
Annualized Debt Service	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88	$1.88
Operations & Maintenance	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16
Subtotal	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***	***$2.04***
Total Annualized Cost ($ million)	**$6.10**	**$6.97**	**$8.15**	**$9.34**	**$7.16**	**$7.68**	**$8.87**	**$10.07**
Total Annualized Cost ($/acre-ft)	$4,781	$2,804	$2,160	$1,844	$5,611	$3,088	$2,351	$1,989
Total Annualized Cost ($/1000 gal)	$15	$9	$7	$6	$17	$9	$7	$6

6.1 PARTICIPANT COST ALLOCATION

In order to allocate the cost of the proposed water supply system, each participant was assigned a cost share based on their projected maximum day treated water demand. **Table 6.2** summarizes the projected maximum day treated water demands as a percentage of total projected maximum day demand.

Table 6.2 Summary of Maximum Day Demand as % of Total Demand

Entity	Maximum Day Demand (gpd)	Maximum Day Demand as % of Total Demand
DADS	184,000	8.50%
Miles	201,970	9.33%
Deer Valley	52,000	2.40%
North Concho Lake Estates	195,000	9.00%
Pecan Creek	180,000	8.31%
The Oaks	203,895	9.41%
Water Valley	90,000	4.16%
Grape Creek	540,690	24.97%
Tom Green WSD #1	70,000	3.23%
Tom Green WSD #2	80,180	3.70%
Tom Green WSD #3	295,948	13.67%
Red Creek MUD	72,000	3.32%
TOTAL	**2,165,683**	**100%**

Based off the demand percentages in Table 6.2, the cost allocation for each participant was determined. **Table 6.3** shows the total project capital cost allocation summary for each participant for the entire water supply system infrastructure improvements. This cost allocation could be used as basis for contract negotiations between each entity and the UCRA.

Table 6.3 UCRA Participant Capital Cost Summary ($ million)

		Goal 1: Maintain Current Water Quality				Goal 2: Achieve TCEQ Secondary Standards			
		Alternative				Alternative			
		1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate
City of Miles		$2.70	$1.67	$1.30	$1.11	$3.21	$1.87	$1.43	$1.21
South Line	Pecan Creek	$2.41	$1.49	$1.16	$0.99	$2.86	$1.67	$1.28	$1.08
	Tom Green FWSD #2	$2.36	$1.95	$1.80	$1.73	$2.56	$2.03	$1.86	$1.77
	The Oaks	$5.71	$4.66	$4.29	$4.11	$6.22	$4.87	$4.43	$4.21
	Tom Green FWSD #3	$8.21	$6.70	$6.16	$5.89	$8.96	$6.99	$6.35	$6.03
Northwest Line	North Concho Lake Estates	$2.97	$1.98	$1.62	$1.44	$3.47	$2.17	$1.75	$1.54
	Red Creek MUD	$1.10	$0.73	$0.60	$0.53	$1.28	$0.80	$0.65	$0.57
	Grape Creek	$10.54	$7.77	$6.79	$6.29	$11.91	$8.32	$7.14	$6.56
	Deer Valley	$2.17	$1.91	$1.81	$1.76	$2.30	$1.96	$1.84	$1.79
	Tom Green FWSD #1	$2.12	$1.76	$1.63	$1.57	$2.29	$1.83	$1.68	$1.60
	San Angelo State Supported Living Center	$4.99	$4.05	$3.71	$3.55	$5.46	$4.23	$3.84	$3.64
	Water Valley	$4.13	$3.67	$3.51	$3.43	$4.36	$3.76	$3.57	$3.47
UCRA Subtotal		**$49.42**	**$38.33**	**$34.39**	**$32.40**	**$54.89**	**$40.51**	**$35.81**	**$33.47**
City of San Angelo		$0.00	$15.14	$24.67	$32.18	$0.00	$16.99	$27.19	$35.08
Total Capital Cost ($ million)		**$49.42**	**$53.47**	**$59.05**	**$64.57**	**$54.89**	**$57.49**	**$63.01**	**$68.56**
Total Capital Cost ($/MGD)		**$19.77**	**$11.62**	**$8.56**	**$7.02**	**$21.96**	**$12.50**	**$9.13**	**$7.45**

7.0 ADDITIONAL PLANNING CONSIDERATIONS

In every water supply contract, the UCRA requires all successive wholesale water customers to develop and implement a water conservation plan pursuant to Texas Commission on Environmental Quality rules.

7.1 UCRA WATER CONSERVATION PLAN

Due to the on-going drought in the region, the UCRA has established the current consumption of 100 gpcd for the City of Miles as the target consumption. The UCRA plan addresses the requirements of the Texas Commission on Environmental Quality for conservation plans, which are given in Section 288.2 of the Texas Administrative Code and include:

- Utility Profile
- Specific, Quantified Goals
- Accurate and Universal Metering
- Determination and Control of Unaccounted Water
- Public Education and Information Program
- Non-Promotional Water Rate Structure
- Reservoir System Operation Plan
- Means of Implementation and Enforcement
- Coordination with Regional Water Planning Group
- Review and Update of Plan
- Leak Detection, Repair, and Water Loss Accounting
- Record Management System
- Requirement for Water Conservation Plans by Wholesale Customers

The City of San Angelo, which will be providing the treated water to the UCRA via the City distribution system, has also adopted water conservation measures in its own operations. The City of San Angelo Water Conservation and Drought Contingency Plan contains extremely stringent conditions for normal water consumption periods including public education, an enforced comprehensive plumbing code, a

retrofit program, universal metering, prohibitive watering hours and a water waste enforcement program. The UCRA Water Conservation Plan is provided in **Appendix H**.

7.2 UCRA DROUGHT MANAGEMENT PLAN

The UCRA plan addresses the requirements of the Texas Commission on Environmental Quality for drought contingency plans, which are given in Section 288.20 of the Texas Administrative Code and include:

- Provisions to Inform the Public and Provide Opportunity for Public Input
- Provisions for Continuing Public Education and Information
- Coordination with the Regional Water Planning Group
- Criteria for Initiation and Termination of Drought Stages
- Drought and Emergency Response Stages
- Specific, Quantified Targets for Water Use Reductions
- Water Supply and Demand Management Measures for Each Stage
- Procedures for Initiation and Termination of Drought Stages
- Procedures for Granting Variances
- Procedures for Enforcement of Mandatory Restrictions
- Consultation with Wholesale Supplier
- Notification of Implementation of Mandatory Measures
- Review and Update of Plan

Because the UCRA and the City of San Angelo have common water sources, the drought stage trigger criteria described in the UCRA plan are based on the triggers in the City of San Angelo Drought Contingency Plan. The City of San Angelo and the UCRA recognize three stages of drought and have developed an implementation plan to reduce water usage by 30% over these two stages. The UCRA Drought Management Plan is provided in **Appendix H**.

7.3 RELIABILITY OF E.V. SPENCE RESERVOIR SUPPLY

E.V. Spence Reservoir is one of three reservoirs owned and operated by the Colorado River Municipal Water District (CRMWD) for water supply. The CRMWD operates Spence reservoir as a system with O.H. Ivie and J.B Thomas reservoirs and groundwater from several well fields. Water from the CRMWD

system is used to supply three member cities and other customers in the Colorado River Basin. Only the City of Robert Lee currently receives water from CRMWD exclusively from E.V. Spence Reservoir. The City of San Angelo has a contract with CRMWD for 6 percent of the safe yield of E.V. Spence, which was previously delivered by the E.V. Spence Reservoir raw water supply infrastructure. San Angelo also receives water from CRMWD from the O.H. Ivie Reservoir. Both the Cities of Robert Lee and San Angelo have sources of water other than CRMWD supplies.

The Upper Colorado River Basin is in drought of record conditions with record low capacities reported for many area lakes. As part of the regional water planning efforts, estimates of reliable supply for E.V. Spence were conducted using updated hydrology through 2011. Based on this analysis, the reliable safe yield of E.V. Spence Reservoir is about 19,000 acre-feet per year.

This water could be used to fully meet the City of Robert Lee's demand on CRMWD and the contract with the City of San Angelo, as well as provide system water to CRMWD's customers. The City of San Angelo and UCRA have an agreement that when the E.V. Spence line is repaired by UCRA and operational, then the City will repay UCRA with other sources of water from varied supplies for utilization by UCRA to regional rural customers. The City of San Angelo currently receives water from CRMWD, Lake Nasworthy, Twin Buttes Reservoir, and the Concho River, and will receive water from the Hickory Aquifer in the near future.

The City of San Angelo and UCRA also have an agreement in place specifying that UCRA will be the service provider for all rural entities. The City will treat the water for UCRA with the understanding that UCRA will take the water from various distribution points within the City and make it available to entities outside the city limits.

With these agreements in place, the use of the E.V. Spence Reservoir raw water supply infrastructure and delivery of water to rural customers will not impact the supplies to existing users of Spence Reservoir.

7.4 POTENTIAL ADDITIONAL WATER SUPPLIES

7.4.1 Red Arroyo

The Red Arroyo project is a 4,000 acre-ft impoundment on the Red Arroyo that has been identified as a potential future water source. The UCRA and the City of San Angelo are investigating the feasibility of the Red Arroyo as a future water supply. FNI has reviewed this concept and it appears this

impoundment for water supply purposes would require a water right permit. If the Red Arroyo can be utilized as a water supply source, then the recommended raw water transmission and treatment plant improvements would need to be re-evaluated.

8.0 IMPLEMENTATION PLAN

8.1 PHASED CAPITAL IMPROVEMENT PLAN

Due to the high cost of the improvements, it is recommended that the UCRA phase in the projects over time. The water supply, treatment and distribution improvements are recommended to be implemented in the following phasing:

- Phase 1 – Extend Service to Southern Communities & Utilize UCRA Existing Water Rights

UCRA and the City of San Angelo determined that the communities of Christoval and Dove Creek are the highest priorities due to their existing water supply source quality and impact to the South Concho River water supplies. As part of Phase 1, service will also be extended to The Oaks subdivision due to its close proximity to Christoval. Phase 1 will only involve the construction of treated water distribution system improvements with the intent of deferring the raw water transmission and treatment capital costs.

Phase 1 will require the following treated water distribution system improvements:

  - 6" water line along US 277 to Christoval and the Oaks from the existing 6" water line
  - 6" water line from the existing Pecan Creek GST to the Dove Creek GST
  - Three (3) booster pump stations
  - Three (3) ground storage tanks

The total Phase 1 is estimated to be $9,960,000.

- Phase 2 – Construct Raw Water Transmission and Treatment Plant Improvements

The second phase would involve the construction of the raw water transmission system and treatment plant improvements. This cost would depend on the raw water supply alternative and treatment plant goal chosen and would be shared by all participating entities.

- Phase 3 – Extend Service to Northwest Communities

The third phase would extend water to the communities on the Northwest Water Supply Line. This would require the UCRA and the City of San Angelo to have completed the defined raw water transmission system and treatment plant improvements.

Phase 3 will require the following treated water distribution system improvements:

  - One (1) pump station at the Lakeview GST

- 107,700 ft of water line from the Lakeview GST to the Water Valley GST
- One (1) booster pump station at the Grape Creek split
- One (1) 400,000 gallon ground storage tank at the Grape Creek split

The total Phase 3 is estimated to be $11,930,000.

Table 8.1 summarizes the capital costs of the phased capital improvement plan. The costs of the treated water distribution system do not change based on the water supply alternative or treatment goal.

Table 8.1 Summary of Capital Costs per Phase

	Goal 1: Maintain Current Water Quality				Goal 2: Achieve TCEQ Secondary Standards			
	Alternative				Alternative			
	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate	1: 2.5 MGD Supply Rate	2: 4.6 MGD Supply Rate	3: 6.9 MGD Supply Rate	4: 9.2 MGD Supply Rate
Phase 1 - Extend Service to Southern Communities & Utilize UCRA Existing Water Rights								
Treated Water Distribution Costs	**$9.96**	**$9.96**	**$9.96**	**$9.96**	**$9.96**	**$9.96**	**$9.96**	**$9.96**
Phase 2 - Construct Raw Water Transmission and Treatment Plant Improvements								
Raw Water Transmission Costs	$15.30	$16.23	$17.54	$19.14	$15.30	$16.23	$17.54	$19.14
Water Treatment Costs	$13.67	$16.79	$21.06	$24.98	$19.14	$20.81	$25.02	$28.97
Total	**$28.97**	**$33.02**	**$38.60**	**$44.12**	**$34.44**	**$37.04**	**$42.56**	**$48.11**
Phase 3 - Extend Service to Northwest Communities								
Treated Water Distribution Costs	**$11.93**	**$11.93**	**$11.93**	**$11.93**	**$11.93**	**$11.93**	**$11.93**	**$11.93**

8.2 FUNDING

Funding for improvements to the UCRA regional water system can potentially come from several sources. Private financing is one option that can be pursued, but this typically entails higher financing costs. However, private financing on the open market can be completed on a shorter time line with fewer application requirements. Several state sponsored programs also exist, and a summary of the programs that the UCRA would likely qualify for are shown below.

8.2.1 Texas Water Development Board

Drinking Water State Revolving Fund (DWSRF)

The Texas Water Development Board manages the Drinking Water State Revolving Fund (DWSRF). The DWSRF provides loans at below market interest rates for planning, designing, and constructing public drinking water systems. The maximum repayment period is 20 years for most communities and 30 years for disadvantaged communities. UCRA is eligible to apply for this loan program.

The program includes funding provided by the Federal government. The fund requires that the project include the following elements: NEPA review, Davis-Bacon Act wage rates, water conservation and drought contingency plan, and TWDB disadvantaged business requirements.

In order for a project to be eligible for DWSRF funding, the project must be included in the TWDB's Intended Use Plan (IUP). The applicant must submit an IUP application by March 1. The IUP includes a cost estimate that must be sealed by a registered professional engineer. The TWDB reviews the applications and prioritizes them. Those with the highest priority are invited to submit formal DWSRF loan applications in late summer/early fall. The TWDB works its way down the prioritization list until all available funding has been used.

Texas Water Development Fund (DFund)

The Texas Water Development Board manages the Texas Water Development Fund. The DFund is the TWDB's traditional loan program that offers a low interest rate. The DFund can be used to pay for planning, design, and/or construction of water facilities. The maximum repayment of the loan is 30 years. UCRA is an eligible applicant for this program. The DFund requires that the applicant have a water conservation and drought contingency plan, which UCRA already has in place. An Environmental

Assessment is also required for this loan program. The TWDB considers applications on the first day of each month.

State Participation Program (SPP)

The State Participation Program (SPP) is a low-interest loan program managed by the Texas Water Development Board. This loan program allows the TWDB to assume temporary ownership in a regional water project that is sized for future growth. This arrangement provides the entity the opportunity to build the necessary facilities at the optimal size or "right size". As the entity begins using the additional capacity of the facility, the entity begins buying back the TWDB's ownership of the project. UCRA is eligible for this loan program. SPP provides a repayment period of 34 years.

The SPP requires a master agreement between the applicant and the Texas Water Development Board to define funding and the repayment of the loan. The program also requires a feasibility study and an Environmental Assessment.

Applications are typically due at the beginning of August each year. The funding for the SPP has been allocated for 2012. At this time, the TWDB says that no additional funding is available for this program. Future funding is dependent on the Texas Legislature appropriating funds or developing a revenue stream for the program in the 2013 Legislative Session.

Water Infrastructure Fund (WIF)

The Water Infrastructure Fund (WIF) is another low-interest loan program managed by the Texas Water Development Board. This program provides loans to plan, design, and/or construct recommended strategies included in the State Water Plan. In order for UCRA to obtain these funds they may have to amend the Regional Water Plan and State Water Plan to include the proposed project if it is not already included.

Applications are typically due at the beginning of August each year. The funding for the WIF has been allocated for 2012. At this time, the TWDB says that no additional funding is available for this program. Future funding is dependent on the Texas Legislature appropriating funds or developing a revenue stream for the program in the 2013 Legislative Session.

8.2.2 Texas Department of Agriculture

Community Development Block Grant (CDBG)

The Texas Department of Agriculture manages the Community Development Block Grant (CDBG). CDBG can be used to design or construct basic public facilities, including water facilities. Eligible applicants include cities with populations less than 50,000 and counties with populations less than 200,000. According to the U.S. Census, the population of San Angelo is greater than 50,000 and does not meet the TDA definition of non-entitlement. However, Tom Green County is considered to be a non-entitlement county based on its population being less than 200,000. UCRA could speak with TDA to find out if the agency would allow UCRA to apply on behalf of the smaller communities that would be served. Being a non-entitlement community simply means that a city or county applies to the TDA. Otherwise, the entity must apply directly to HUD. Projects benefitting low to moderate income areas receive higher scores than others.

The program accepts applications every other year. The upcoming deadline for applications for this program is October 26, 2012. UCRA concluded that they needed more time than is currently available to meet the application requirements. This fund should be available again in Fall 2014.

Infrastructure Development

The Texas Department of Agriculture also manages the Infrastructure Development Program. Water and sewer projects can be funded with this grant. This is a grant program for non-entitlement cities and counties for projects that create or maintain permanent jobs. Again, UCRA could consult with TDA to see if they would be allowed to submit an application on behalf of the small cities that would be served by the proposed project. The grant provides 50% matching costs. Applications are accepted on the 20th of each month.

8.2.3 Summary of Potential Opportunities

Table 8.2 summarizes the potential funding opportunities and schedules to implement the proposed water line and pump station project.

Table 8.2 Funding Opportunities and Schedules

Fund	Type of Fund	Potential Schedule	Notes
Drinking Water State Revolving Fund (DWSRF)	Annual loan program	March 1, 2013 – Submit application to fund design of pipeline and pump station for inclusion in the IUP. August 2013 – TWDB announces projects included in the IUP and invites high ranking projects to apply. September / October 2013 – Submit formal application, if invited by TWDB. December 2013 – TWDB announces recipients and work begins shortly thereafter.	Federal requirements must be met. Application process takes about a year to complete. Can submit request for construction funding after design has begun.
Texas Water Development Fund (DFund)	Monthly loan program	First day of Any Month – Submit loan application for design. End of Month or Following Month – TWDB Board announces decision.	Environmental Assessment is required. Can be used for design and construction as separate applications.
Community Development Block Grant	Grant available every other year	Next application cycle is Fall 2014, which may be later than when UCRA wants to begin.	UCRA should verify non-entitlement status with TDA. UCRA might consider pursuing fund for construction.
Infrastructure Development Program	Monthly grant program	20th Day of Any Month – Submit application. Following Month – TDA announces award recipients.	UCRA should verify non-entitlement status with TDA. Project must show benefit to creating/saving jobs. Can be used for design and construction.

8.2.4 Funding Plan

The funding program for implementation of water system improvements for the UCRA and the surrounding entities will be highly dependent on the alternative pursued. The UCRA has decided to pursue the implementation of the 24" RRCP raw water transmission line which would provide up to a 9.2 MGD raw water supply from E. V. Spence Reservoir. The UCRA has decided to pursue the four funds highlighted in **Table 8.2** above.

APPENDIX A

DOCUMENTATION OF PUBLIC MEETINGS
PUBLIC NOTICES & MEETING ATTENDEES

MEETING AGENDA

FREESE AND NICHOLS
Innovative approaches
Practical results
Outstanding service

4055 International Plaza, Suite 200 • Fort Worth, Texas 76109 • 817-735-7300 • fax 817-735-7491 www.freese.com

MEETING: Mid Point Public Meeting on Regional Water Planning Study
DATE: 2/16/12
LOCATION: Henry's Diner, San Angelo, TX
TIME: 7:00 PM
MEETING ORGANIZER: UCRA

UCRA

TOPIC

1. Welcome and Introductions
2. Project Status Update
3. Water Demand Development
4. Raw Water Transmission Evaluation
5. Treatment Feasibility Evaluation
6. Schedule
    i. Draft Report (May 2012)
    ii. Final Public Meeting (June 2012)
    iii. TWDB Contract Expires on 10/31/12
7. Next Public Meeting - June 2012

FREESE AND NICHOLS

Upper Colorado River Authority
Initial Public Meeting
September 6, 2011

UCRA

	Name	Organization	Position	Phone Number	E-mail Address
1	Angela Kemedy	TWDB	Project Manager	512-463-1437	angela.kemedy@twdb.state.tx.us
2	Graylan Hancock	Lake Coloraty Water Supply	operation manager	325-473-1238	
3	Bill Holland	UCRA	board	655-3135	bill@hollandjewelry.com
4	Kirk Boatright	City of Miles	Water Supt.	234-3194	Kjsboatright@yahoo.com
5	John R Jacobs	City of Robert Lee	Mayor	453-2831	
6	Kevin Kneezer	City of San Angelo	ENG.	657-4260	Kevin.Kneezer@sanangelotx.us
7	Ben Wiese	Concho Rural Water	Manager	325-277-4830	BFWiese4@aol.com
8	CHUCK BROWN	UCRA	DIR OF OP.	325 655 0565	Chuckb@ucratx.org
9	Christy Youker	UCRA	DIR OF Educ.	325 617-4350	christy@ucratx.org
10	Scott McWilliams	UCRA	Tech Services Coordinator	655-0525	Scottm@ucratx.org
11					
12					
13					
14					
15					

FREESE AND NICHOLS

Upper Colorado River Authority
Initial Public Meeting
September 6, 2011

UCRA

	Name	Organization	Position	Phone Number	E-mail Address
16	Gerald Saandusky	Bronte	Mayor	473 3391	gdsand@gmail.com
17	Fred Teagarden	UCRA	Hydrologist	325-655-0265	fteag@UCRATX.org
18	Ricky Royall	BRONTE	MANAGER	325-473-3501	RickR@wcc.net
19	Bill Wilde	San Angelo	Water Utilities	325-657-4209	Bill.Wilde@SanAngeloTexas.us
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

MEETING AGENDA

FREESE AND NICHOLS
Innovative approaches
Practical results
Outstanding service

4055 International Plaza, Suite 200 • Fort Worth, Texas 76109 • 817-735-7300 • fax 817-735-7491 www.freese.com

MEETING: Initial Public Meeting on Regional Water Planning Study
DATE: 9/8/11
LOCATION: UCRA Water Education Center
TIME: 10:00 AM
MEETING ORGANIZER: UCRA

TOPIC

1. Welcome and Introductions

2. Project Overview

    i. Texas Water Development Board Project
    ii. In Kind Services

3. Scope of Work

4. Schedule

    i. Mid Point Public Meeting to discuss Progress (December 2011)
    ii. Final Report and Final Public Meeting (May/June 2012)
    iii. TWDB Contract Expires on 10/31/12

5. Next Public Meeting - December

FREESE AND NICHOLS

Upper Colorado River Authority
Mid Point Public Meeting
February 16, 2012

UCRA

	Name	Organization	Position	Phone Number	E-mail Address
1	Angela Kennedy	TWDB			
2	Richard Seals	Sterling City	PWD	325-277-7916	Waterman 391965@yahoo.com
3	Jody Daiwehl	Daiwehl & Dickey	Manager	325-652-1920	
4	Ben Wiese	Concho Rural Water	President	325-658-2961	BfWiese4@aol.com
5	Randy Havlak	City of San Angelo	Water Operator	325-655-6019	—
6	mike Kerr	SAN ANGELO	WATER OPERATOR	325-655-9409	rimfireshooting@yahoo.com
7	Jerry Bryant	City of San Angelo	Water Operator	325-234-7381	jerrybryant@suddenlink.net
8	T. Adam Bailey	San Angelo	Water Operator	205-331-8476	tabailey1031b@yahoo.com
9	D Williams	San Angelo	supervisor	325-659-4297	
10	Richard Easingwood	TGC	Civilian	3252341573	comm4@verizon.net
11	E & Brimstool	TGC FWS Dist 3	V-P of BL	325 944-9801	
12	Don Spear	TGC#3	[redacted]	325 947.2575	dspear@[illegible].net
13	[illegible]	UCRA	DIRECTOR	325 944-0491	INKSTOWE@SUDDENLINKMAIL.COM
14	J Carlos Ruiz	City of Ballinger	Crew Chief	325-365-3511	—
15	Elwood Clark	City of Ballinger	Electrician	325-365-3511	
	Michael Nedley	San Angelo	Supervisor	325-657-4295	Mike.Nedley@SanAngelotexas.us

FREESE AND NICHOLS

Upper Colorado River Authority
Mid Point Public Meeting
February 16, 2012

UCRA

	Name	Organization	Position	Phone Number	E-mail Address
16	Anthony Nombrano	City of Ballinger	Water Tech.	325-365-3511	anthony.ray42@sbcglobal.net
17	Robert Ruiz	City of Ballinger	water Tech	325-456-5160	Rob121787@yahoo.com
18	Thor Nixon	City of Ballinger	water tech	325-365-3571	Lodz.ballinger@verizon.net
19	Clyde Kreste	" " "	Water Supper	" " "	" " "
20	Richard Lancaster	City of San Angelo	Maintance Supervisor	325-234-8975	
21	Ben Sargent	Carlsbad FW	Board Pres.		
22	David Turner	city of Sterling	operator	325 650-1722	
23	James Horn	Carlsbad Fresh W.	Board Mem	425 4359	
24	Charles Kuhn	Concho Rural Water	operator	465-8067	
25	W Lewis	Concho Rural Water	Foreman		
26	John Trimble	Brownspark Pool	Owner	325-653-5594	Jtrimble2006@peoplepc.com
27	Will Wilde	COSA	Director W.U.	325-657-4209	Will.Wilde@SanAngeloTexas.us
28	Luis R. VARELA	COSA	PLANT OPS.	325-657-4298	
29	Charles MEGard	" "	" "	" "	
30	Simon Cuellar Jr	" "	Inspector	325-657-4426	

FREESE AND NICHOLS

Upper Colorado River Authority
Mid Point Public Meeting
February 16, 2012

UCRA

	Name	Organization	Position	Phone Number	E-mail Address
31	Nathan Timm	City of San Angelo	Laborer	234-3107	
32	Tymn Comlett	COSA	Asst. W.Q. Superint.	4812722	tymn.comlett@sanangelotx.us
33	Elena Velez-Reyes	COSA	Sr. Water Analyst	374-2845	elena.velez-reyes@sanangelotexas.us
34	Courtney Lemons	COSA	Jr Water Analyst	450-2514	Courtney.lemons@SanAngelotexas.us
35	[illegible]	COSA	Labor	212 7391	
36	[illegible]	COSA	Section Chief	657-4295	
37	[illegible]	COSA	CEO	657-4295	
38	[illegible]	COSA	HEO	—	
39	Steven A. Olascoaga	COSA	HEO	212-5388	JOlascoaga@sanangelotexas.com
40	[illegible]	COSA	Motorshop	512-650-4154	
41	Joe Ramirez	COSA	Section Chief	450-5614	
42	[illegible]	COSA	Crew TECH	325-617-3392	
43	[illegible]	COSA	Field Service	325.450.3808	
44	Christian Dickison	COSA	Field Service	325-245-7016	
45	Reinaldo Salgado	City of San Angelo	Heavy Operator	(325) 450-3462	

Ricky Royall — City of Bronte - Director of Utilities — 325-473-3501
Bruce H. Tyree — City of San Angelo — Heavy Op — 325 657 4296
Kevin Krueger — City of San Angelo — Eng. — 325-657-4260
Thomas Kerr — " — Water Util. — 325-657-4208

UCRA

Upper Colorado River Authority . 512 Orient . San Angelo, Texas 76903

August 16, 2012

To Whom It May Concern:

The Upper Colorado River Authority (UCRA) is hosting a public meeting regarding the completion of the FY2012 Regional Water Supply Plan which includes public water supply entities in Tom Green, Coke and portions of Runnels Counties. The purpose of the meeting is to discuss the findings of the study, review the final report and receive public input regarding the project.

The meeting will be held at the UCRA Water Education Center at 417 South Oakes Street in San Angelo, Texas at 6:30 P.M. on Tuesday, August 28, 2012.

We look forward to seeing you there, sharing what has been discovered during the course of the study and hearing your ideas.

Sincerely,

Fred Teagarden

UCRA Project Officer

phone: 325.655.0565 . fax: 325.655.1371 . web: www.ucratx.org

gosanangelo.com

Standard-Times

****ATTENTION - PLEASE READ CAREFULLY****
- Mistakes not corrected on this proof become your liability.
- We cannot be responsible for any changes NOT indicated, by phone, fax, or by email, to this proof.
- If we do not hear from you, by phone or by email, by the deadline indicated, we will publish your ad AS SCHEDULED.

Client:	606037	UPPER COLORADO RIVER		Phone:	(325) 657-4203
Class.:	512 ORIENT				SAN ANGELO, TX 76903
Ad #	145409	Requested By:	FRED/DROP OFF	Fax:	
Sales Rep.:		Maria Velasquez		Phone:	(325) 659-8325
		mvelasquez@gosanangelo.com		Fax:	(325) 659-8172
Class.:	8200	Public Notices			
Start Date:	08/12/2012	End Date:	08/12/2012	Nb. of Inserts:	1
Publications:	STANDARD TIMES				
Paid Amount:	$0.00		Balance:	$38.59	
Total Price:	$38.59				

Runs 8/12/12

NOTICE: THE Upper Colorado River Authority (UCRA) will host a public meeting regarding a regional water supply plan that includes public water supply entites in Tom Green, Coke and portions of Runnels Counties. The purpose of the meeting is to discuss the finding of the study, review the final report and to receive public input regarding the project. The meeting will be held at the UCRA Water Education Center, 417 South Oaks Street in San Angelo, Texas at 6:30 P.M. on Tuesday, August 28, 21012. All interested parsons are urged to attend. Any questions can be directed to UCRA staff at 325-655-0565.

Attendees of the Final Public Meeting, held Tuesday, August 28th:

1. Richard Weatherly, FNI
2. Thomas Haster, FNI
3. Doug Shaw, TWDB
4. Fred Teagarden, UCRA
5. Stephen Brown, UCRA
6. Ben Wiese, Concho Rural Water Supply Corporation
7. Gerald Sandusky, Bronte Mayor
8. Ricky Royal, Bronte Utility Director
9. Kirk Boatright, City of Miles
10. Ed Brinnenstool, Dove Creek
11. Don Spear, Dove Creek

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

October 5, 2012

Chuck Brown
Director of Operations
Upper Colorado River Authority
512 Orient
San Angelo, Texas 76903

RE: Regional Water Facility Planning Grant Contract between the Texas Water Development Board (TWDB) and the Upper Colorado River Authority (UCRA); TWDB Contract No. 1148311257, Draft Report Comments

Dear Mr. Brown:

Staff members of the TWDB have completed a review of the draft report prepared under the above-referenced contract. ATTACHMENT 1 provides the comments resulting from this review. As stated in the TWDB contract, UCRA will consider incorporating draft report comments from the Executive Administrator as well as other reviewers into the final report. In addition, UCRA will include a copy of the Executive Administrator's draft report comments in the Final Report.

The TWDB looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (PDF) and six (6) bound double-sided copies. **Please further note, that in compliance with Texas Administrative Code Chapters 206 and 213 (related to Accessibility and Usability of State Web Sites), the digital copy of the final report must comply with the requirements and standards specified in statute. For more information, visit http://www.sos.state.tx.us/tac/index.shtml.** If you have any questions on accessibility, please contact David Carter with the Contract Administration Division at (512) 936-6079 or David.Carter@twdb.texas.gov

UCRA shall also submit one (1) electronic copy of any computer programs or models, and, if applicable, an operations manual developed under the terms of this Contract.

If you have any questions concerning the contract, please contact Angela Kennedy, the TWDB's designated Contract Manager for this project at (512) 463-1437.

Sincerely,

for Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Enclosures
c: Angela Kennedy, TWDB

Attachment 1
Upper Colorado River Authority - Regional Water Planning Study
TWDB Contract No. 1148311257
Draft Report Review Comments

1. As required by the contract, please include an executive summary as a stand-alone section of the report.

2. Please discuss the reliability of the supply from Lake Spence and the impact it would have on the communities that would use the water from this source through the proposed project.

3. Section 2.0, Page 2-1: The contract requires that the study consider TWDB water use data and projections. Please indicate whether the surveys used to determine existing water usage were from the TWDB. If not, please provide an explanation.

4. Section 2, Page 2-3 and Section 3, Page 3-1: It is unclear in the report which potential source(s) of raw water will ultimately be used for the four alternatives. Please identify the source(s) of raw water that will be treated and distributed to the entities listed in Tables 2.2 and 2.3.

5. Please include documentation of the required public meetings in an appendix of the report.

APPENDIX B

RAW WATER SUPPLY IMPROVEMENTS
HYDRAULIC GRADE LINES (HGLS) & COST ESTIMATES
OPTION 1: SLIPLINING

FREESE AND NICHOLS

SLIPLINING REHAB
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

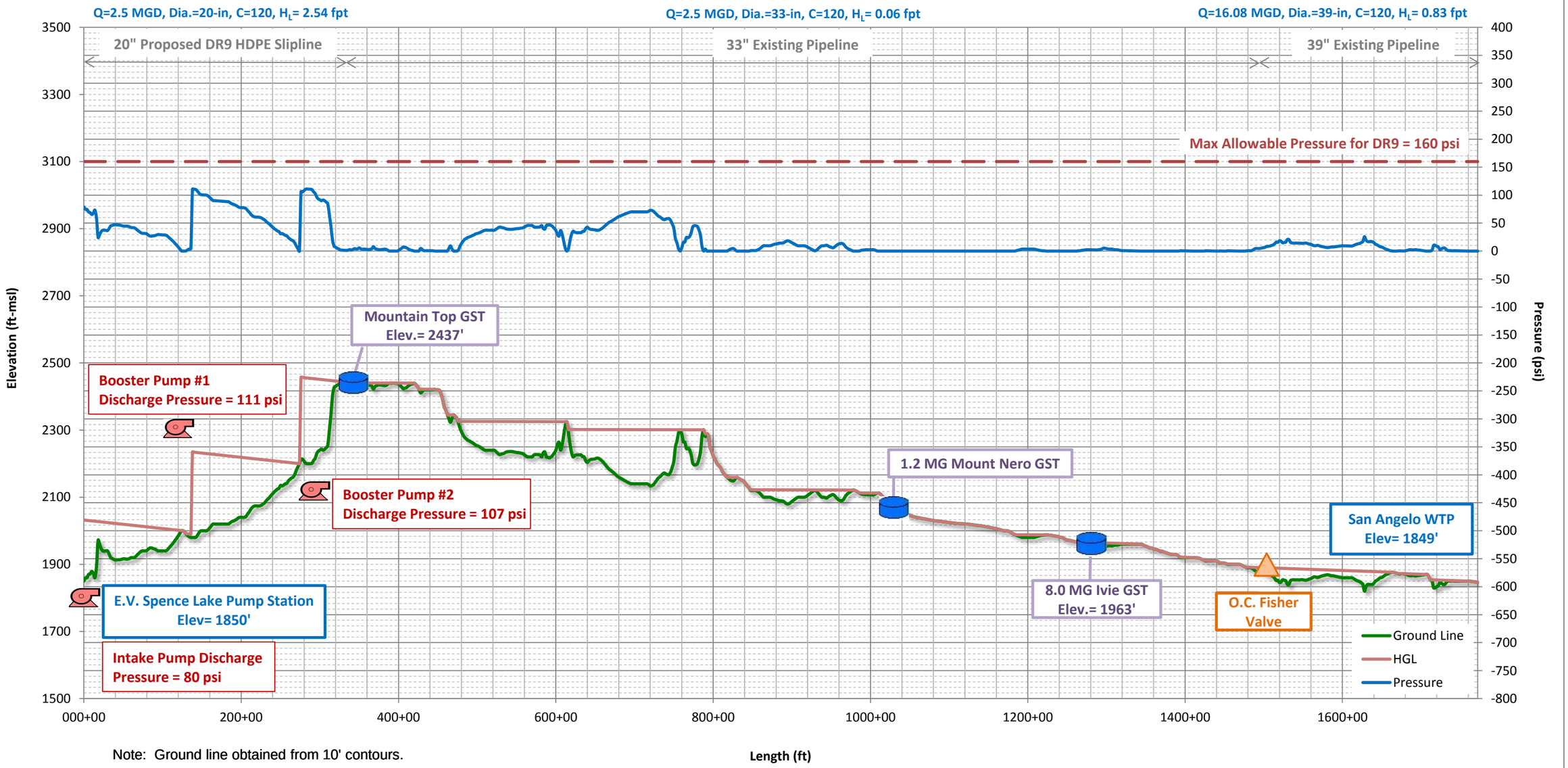
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Slipline Existing 36" Pipe w/ 20" OD DR-9 HDPE	34,320	LF	$130.00	$4,461,600.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	Grout Pipeline Between Annular Space	34,320	LF	$35.00	$1,201,200.00
	SUBTOTAL:				$6,692,400
	ENGINEERING/CONTINGENCY			35%	$2,342,340
	SUBTOTAL:				$9,034,740

PROJECT TOTAL **$9,034,800**

NOTES:

2.5 MGD Option w/ 2 Booster Stations

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Sliplined to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

SLIPLINING REHAB
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

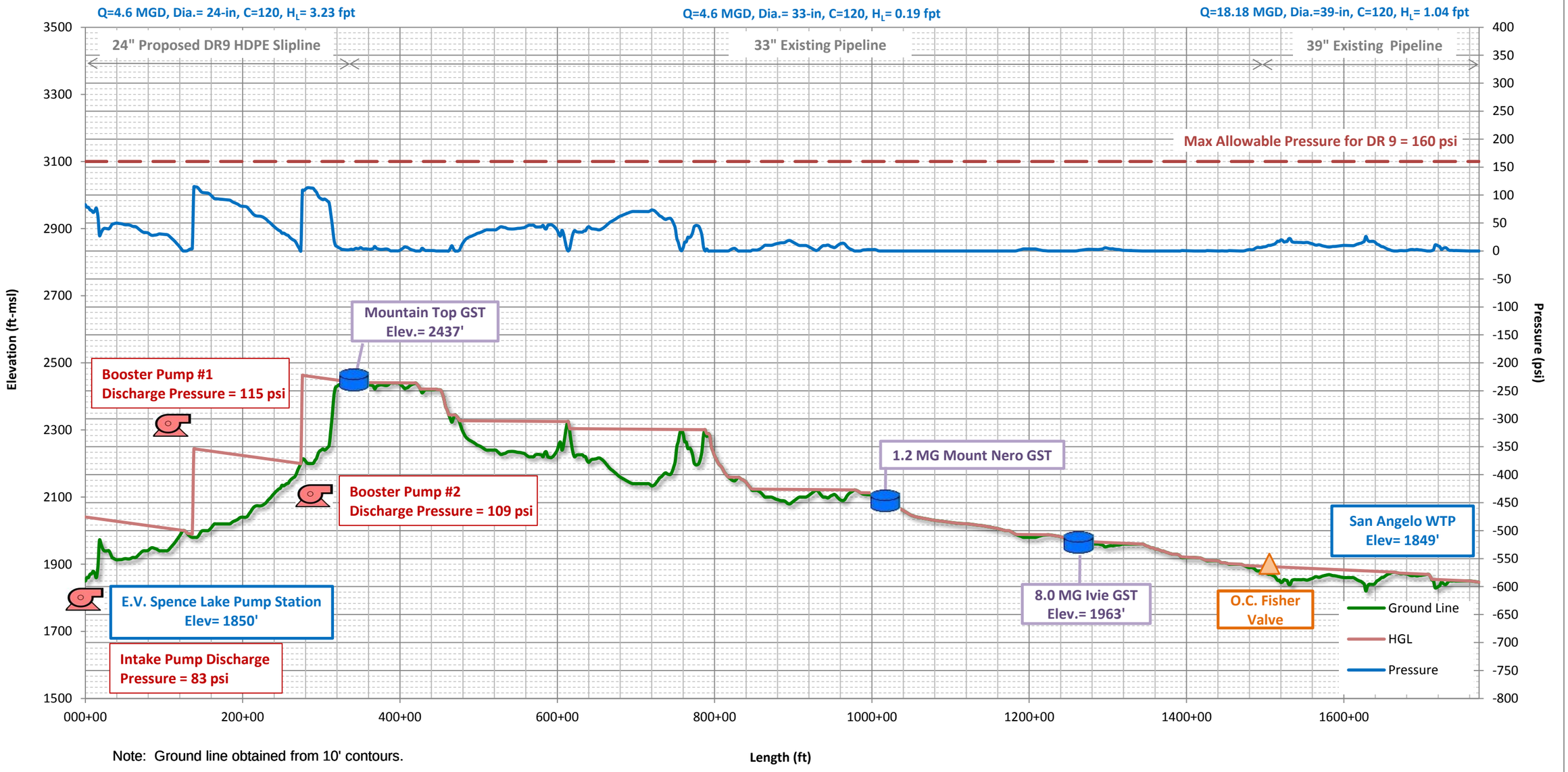
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Slipline Existing 36" Pipe w/ 24" OD DR-9 HDPE	34,320	LF	$180.00	$6,177,600.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	Grout Pipeline Between Annular Space	34,320	LF	$25.00	$858,000.00
	SUBTOTAL:				$8,065,200
	ENGINEERING/CONTINGENCY			35%	$2,822,820
	SUBTOTAL:				$10,888,020

PROJECT TOTAL **$10,888,100**

NOTES:

4.6 MGD Option w/ 2 Booster Stations

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Sliplined to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

SLIPLINING REHAB
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

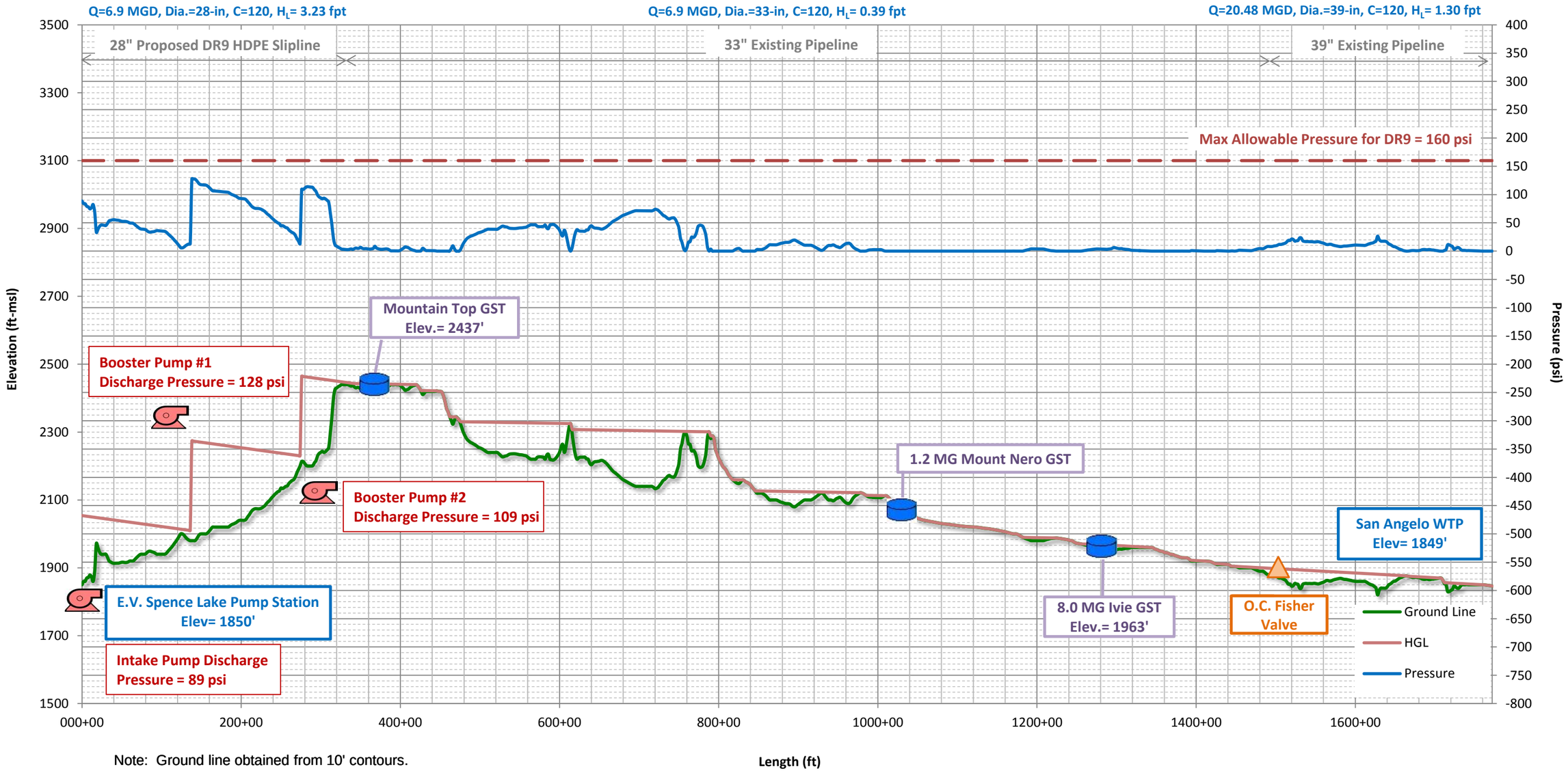
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Slipline Existing 36" Pipe w/ 28" OD DR-9 HDPE	34,320	LF	$240.00	$8,236,800.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	Grout Pipeline Between Annular Space	34,320	LF	$15.00	$514,800.00
	SUBTOTAL:				$9,781,200
	ENGINEERING/CONTINGENCY			35%	$3,423,420
	SUBTOTAL:				$13,204,620

PROJECT TOTAL **$13,204,700**

NOTES:

6.9 MGD Option w/ 2 Booster Stations

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Sliplined to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

SLIPLINING REHAB
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

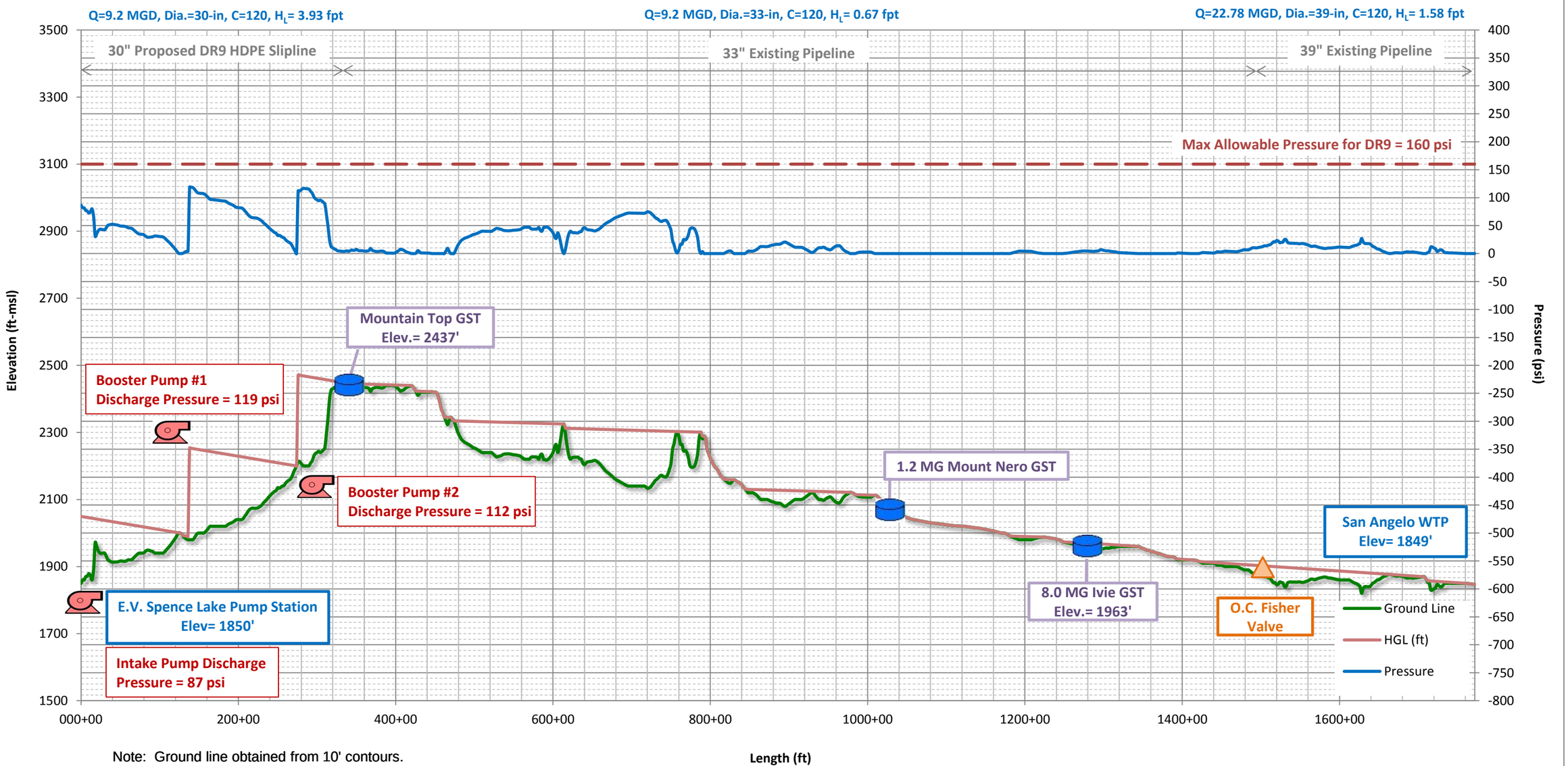
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Slipline Existing 36" Pipe w/ 30" OD DR-9 HDPE	34,320	LF	$270.00	$9,266,400.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	Grout Pipeline Between Annular Space	34,320	LF	$10.00	$343,200.00
	SUBTOTAL:				$10,639,200
	ENGINEERING/CONTINGENCY			35%	$3,723,720
	SUBTOTAL:				$14,362,920

PROJECT TOTAL **$14,363,000**

NOTES:

9.2 MGD Option w/ 2 Booster Stations

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Sliplined to Mountain Top GST



Note: Ground line obtained from 10' contours.

APPENDIX C

RAW WATER SUPPLY IMPROVEMENTS
HYDRAULIC GRADE LINES (HGLS) & COST ESTIMATES
OPTION 2: OPEN CUT

FREESE AND NICHOLS

OPEN CUT INSTALLATION
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

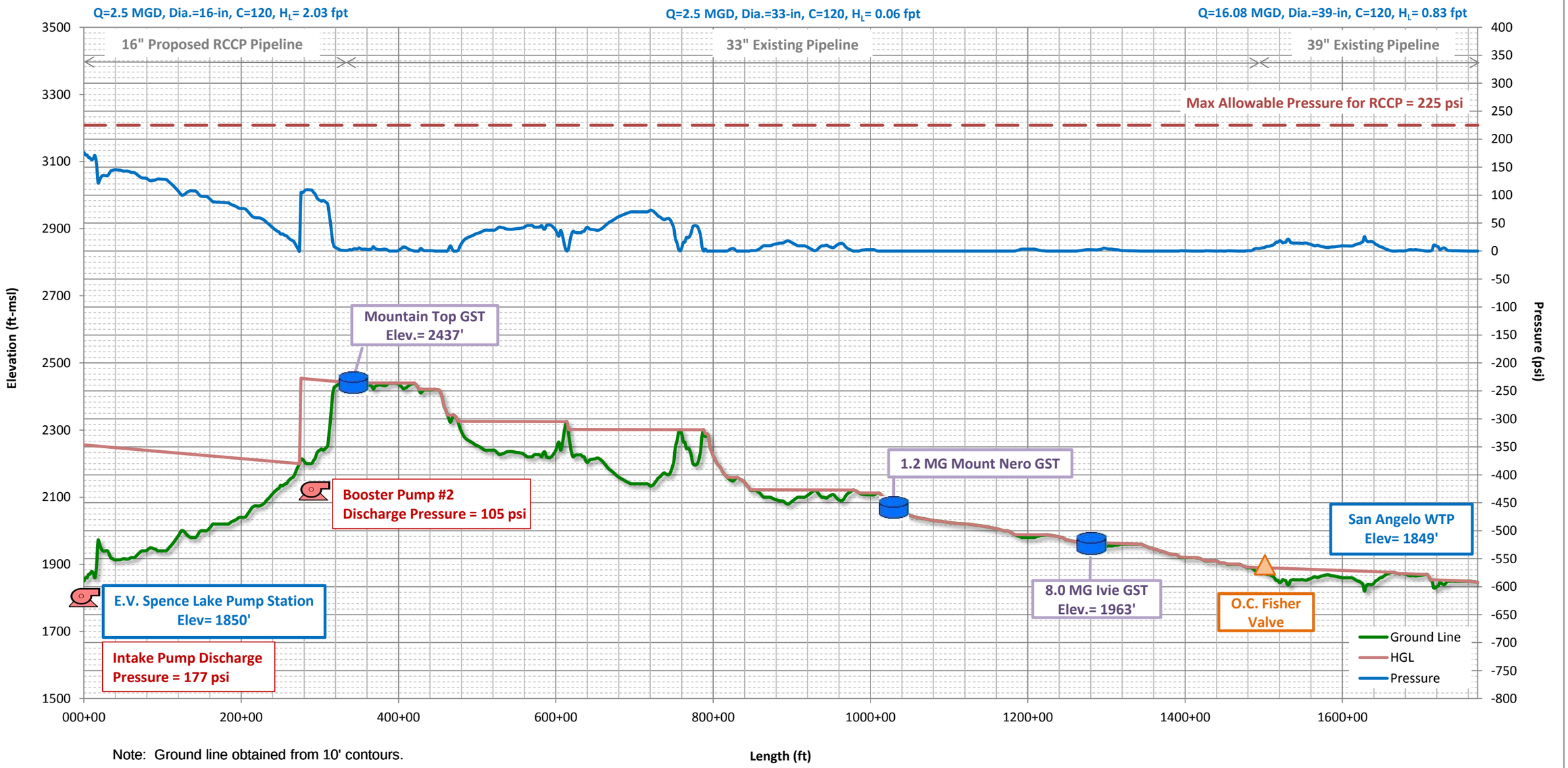
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" Water Line	34,320	LF	$128.00	$4,392,960.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	ROW Clearing and Reseeding	34,320	LF	$10.00	$343,200.00
	SUBTOTAL:				$5,765,760
	ENGINEERING/CONTINGENCY			35%	$2,018,020
	SUBTOTAL:				$7,783,780

PROJECT TOTAL **$7,783,800**

NOTES:

2.5 MGD Option w/ 1 Booster Station

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Open Cut to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

OPEN CUT INSTALLATION
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

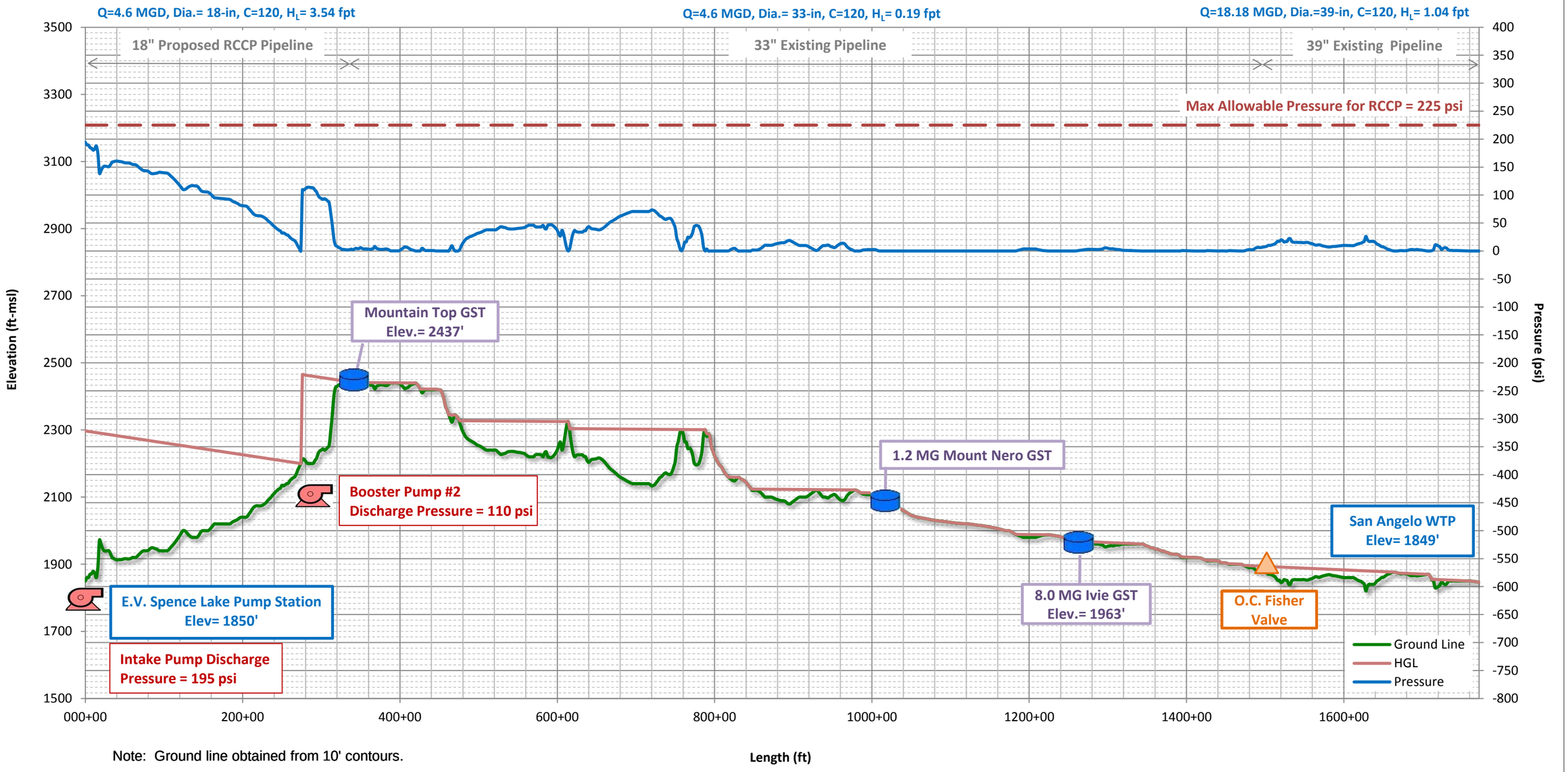
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	18" Water Line	34,320	LF	$144.00	$4,942,080.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	ROW Clearing and Reseeding	34,320	LF	$10.00	$343,200.00
	SUBTOTAL:				$6,314,880
	ENGINEERING/CONTINGENCY			35%	$2,210,210
	SUBTOTAL:				$8,525,090

PROJECT TOTAL **$8,525,100**

NOTES:

4.6 MGD Option w/ 1 Booster Station

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Open Cut to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

OPEN CUT INSTALLATION
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

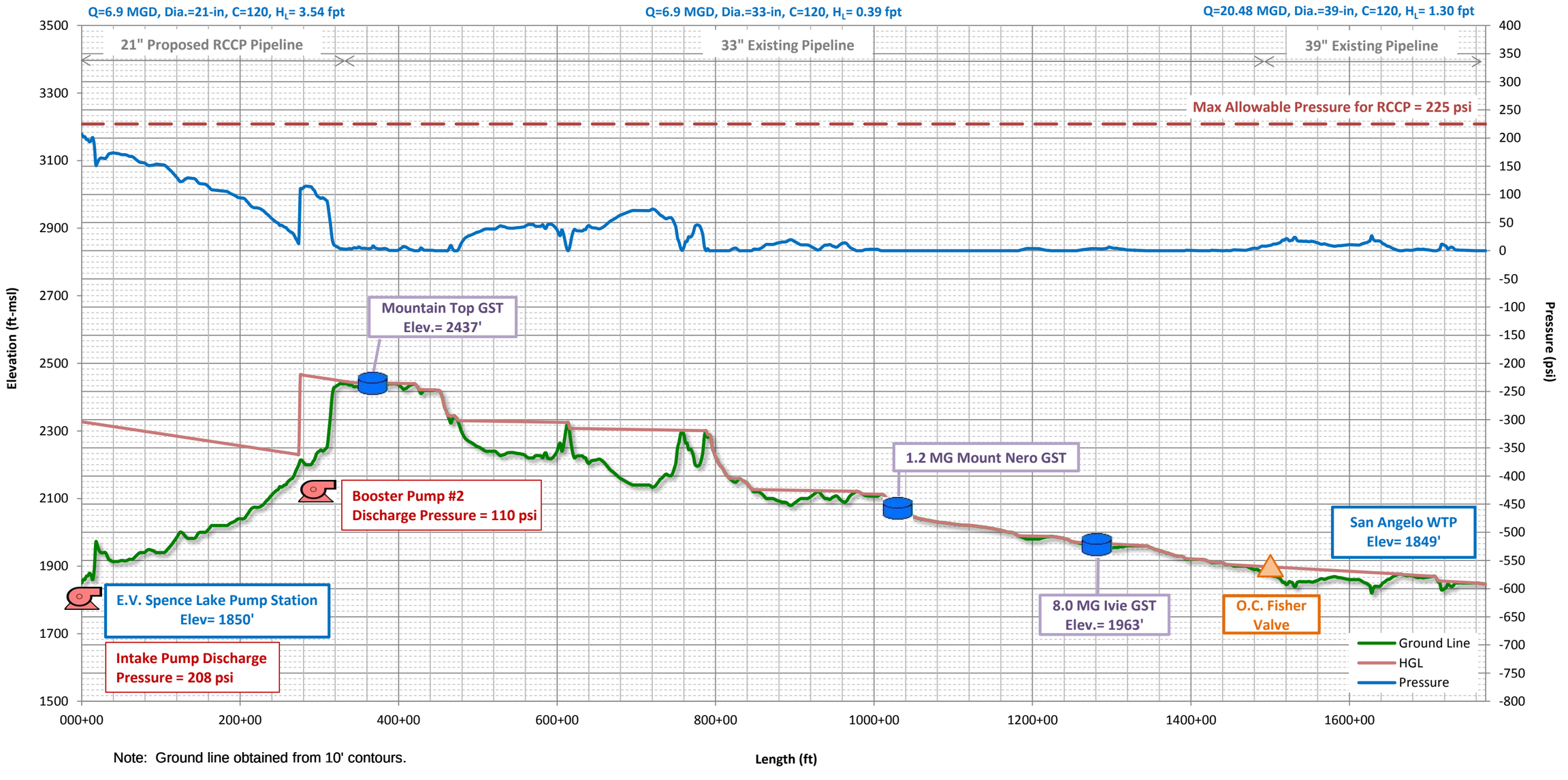
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Water Line	34,320	LF	$168.00	$5,765,760.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	ROW Clearing and Reseeding	34,320	LF	$10.00	$343,200.00
	SUBTOTAL:				$7,138,560
	ENGINEERING/CONTINGENCY			35%	$2,498,500
	SUBTOTAL:				$9,637,060

PROJECT TOTAL **$9,637,100**

NOTES:

6.9 MGD Option w/ 1 Booster Station

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Open Cut to Mountain Top GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

OPEN CUT INSTALLATION
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

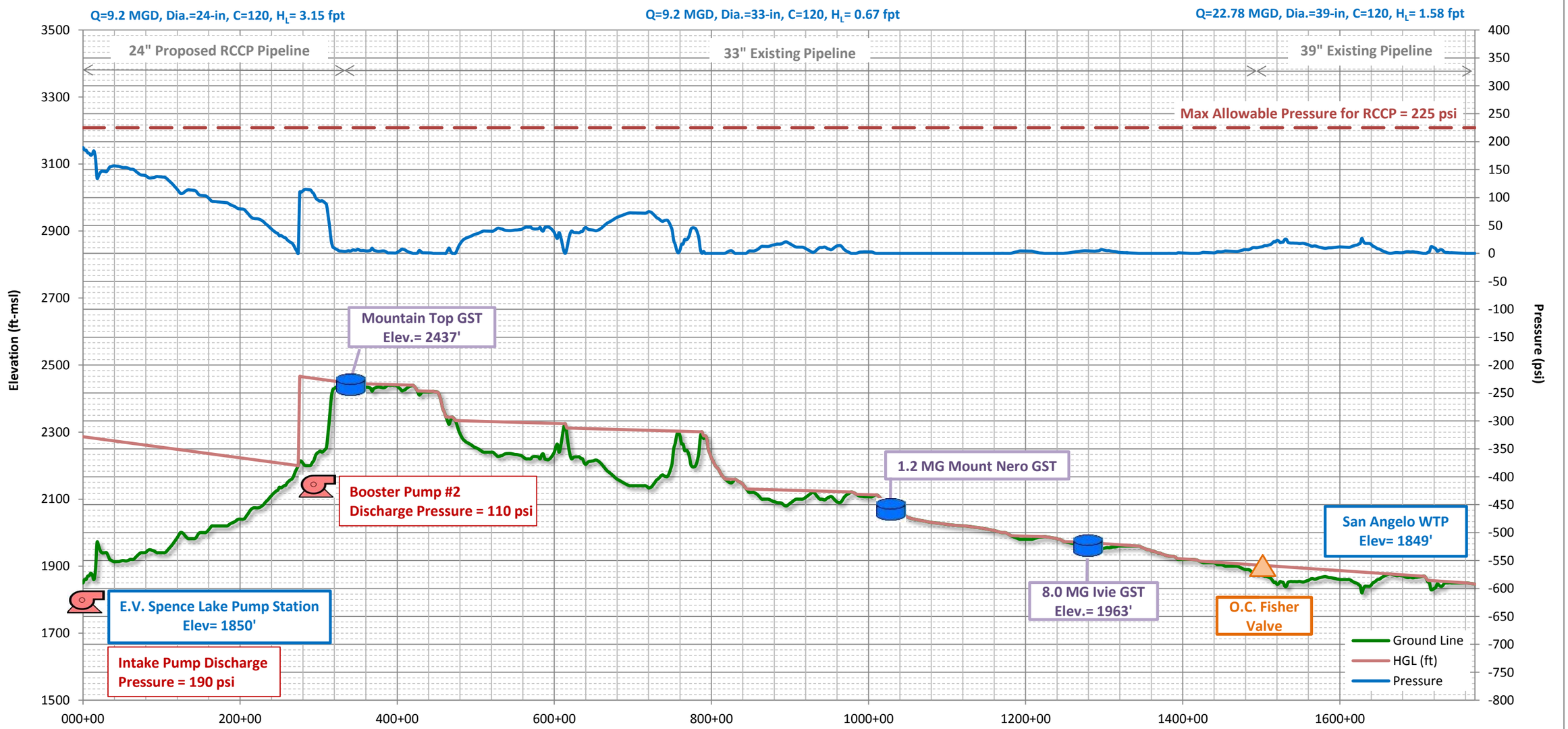
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Water Line	34,320	LF	$192.00	$6,589,440.00
2	Pipeline Appurtenances	34,320	LF	$30.00	$1,029,600.00
3	ROW Clearing and Reseeding	34,320	LF	$10.00	$343,200.00
	SUBTOTAL:				$7,962,240
	ENGINEERING/CONTINGENCY			35%	$2,786,790
	SUBTOTAL:				$10,749,030

PROJECT TOTAL **$10,749,100**

NOTES:

9.2 MGD Option w/ 1 Booster Station

Upper Colorado River Authority
Lake Spence Raw Water Supply Line Pressure Profile
Open Cut to Mountain Top GST



Note: Ground line obtained from 10' contours.

APPENDIX D

RAW WATER SUPPLY IMPROVEMENTS
PUMP STATION COST ESTIMATES
OPTION 1: SLIPLINING

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	August 6, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
2.5 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$31,965.00	$31,965.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	75 HP Pump and Motor	2	EA	$75,000.00	$150,000.00
7	8-inch Pump Discharge Piping	40	LF	$80.00	$3,200.00
8	8-Inch Surge Check Valve (PCV)	2	EA	$3,200.00	$6,400.00
9	8-inch Gate Valve	2	EA	$1,600.00	$3,200.00
10	8-inch Ball Valve with Motor Operator	2	EA	$8,000.00	$16,000.00
11	12-inch Piping	200	LF	$120.00	$24,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$18,000.00	$36,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$671,265
ENGINEERING/CONTINGENCY	35%	$234,950
TOTAL:		$906,200

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority
Booster Pump Station No. 1
Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	August 6, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
2.5 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$44,965.00	$44,965.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	100 HP Pump and Motor	2	EA	$100,000.00	$200,000.00
19	10-inch Pump Suction	40	LF	$100.00	$4,000.00
20	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
21	8-inch Pump Discharge	40	LF	$80.00	$3,200.00
22	8-Inch Surge Check Valve (PCV)	2	EA	$3,200.00	$6,400.00
23	8-inch Gate Valve	2	EA	$1,600.00	$3,200.00
24	8-inch Ball Valve with Motor Operator	2	EA	$8,000.00	$16,000.00
25	12-inch Piping	200	LF	$120.00	$24,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$19,000.00	$38,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$944,265
ENGINEERING/CONTINGENCY	35%	$330,500
TOTAL:		$1,274,800

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority
Booster Pump Station No. 2
Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	August 6, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
2.5 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$44,965.00	$44,965.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	100 HP Pump and Motor	2	EA	$100,000.00	$200,000.00
19	10-inch Pump Suction	40	LF	$100.00	$4,000.00
20	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
21	8-inch Pump Discharge	40	LF	$80.00	$3,200.00
22	8-Inch Surge Check Valve (PCV)	2	EA	$3,200.00	$6,400.00
23	8-inch Gate Valve	2	EA	$1,600.00	$3,200.00
24	8-inch Ball Valve with Motor Operator	2	EA	$8,000.00	$16,000.00
25	12-inch Piping	200	LF	$120.00	$24,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$19,000.00	$38,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$944,265
ENGINEERING/CONTINGENCY	35%	$330,500
TOTAL:		$1,274,800

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
4.6 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$37,875.00	$37,875.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	125 HP Pump and Motor	2	EA	$125,000.00	$250,000.00
7	10-inch Pump Discharge Piping	40	LF	$100.00	$4,000.00
8	10-Inch Surge Check Valve (PCV)	2	EA	$3,500.00	$7,000.00
9	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
10	10-inch Ball Valve with Motor Operator	2	EA	$10,000.00	$20,000.00
11	16-inch Piping	200	LF	$160.00	$32,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$20,000.00	$40,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$795,375
ENGINEERING/CONTINGENCY	35%	$278,390
TOTAL:		$1,073,800

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 1

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
4.6 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$50,555.00	$50,555.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	200 HP Pump and Motor	2	EA	$145,000.00	$290,000.00
19	12-inch Pump Suction	40	LF	$120.00	$4,800.00
20	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
21	10-inch Pump Discharge	40	LF	$100.00	$4,000.00
22	10-Inch Surge Check Valve (PCV)	2	EA	$3,500.00	$7,000.00
23	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
24	10-inch Ball Valve with Motor Operator	2	EA	$10,000.00	$20,000.00
25	16-inch Piping	200	LF	$160.00	$32,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$22,000.00	$44,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,061,655
ENGINEERING/CONTINGENCY	35%	$371,580
TOTAL:		$1,433,200

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
4.6 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$49,455.00	$49,455.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	150 HP Pump and Motor	2	EA	$135,000.00	$270,000.00
19	12-inch Pump Suction	40	LF	$120.00	$4,800.00
20	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
21	10-inch Pump Discharge	40	LF	$100.00	$4,000.00
22	10-Inch Surge Check Valve (PCV)	2	EA	$3,500.00	$7,000.00
23	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
24	10-inch Ball Valve with Motor Operator	2	EA	$10,000.00	$20,000.00
25	16-inch Piping	200	LF	$160.00	$32,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$21,000.00	$42,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,038,555
ENGINEERING/CONTINGENCY	35%	$363,500
TOTAL:		$1,402,100

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
6.9 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$40,575.00	$40,575.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	200 HP Pump and Motor	2	EA	$145,000.00	$290,000.00
7	12-inch Pump Discharge Piping	40	LF	$120.00	$4,800.00
8	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
9	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
10	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
11	18-inch Piping	200	LF	$180.00	$36,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$22,000.00	$44,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$852,075
ENGINEERING/CONTINGENCY	35%	$298,230
TOTAL:		$1,150,300

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 1

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

6.9 MGD Option w/ 2 Booster Pump Stations

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	SITE WORK				
1	Mobilization	1	LS	$53,535.00	$53,535.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	300 HP Pump and Motor	2	EA	$166,000.00	$332,000.00
19	14-inch Pump Suction	40	LF	$140.00	$5,600.00
20	14-inch Gate Valve	2	EA	$2,800.00	$5,600.00
21	12-inch Pump Discharge	40	LF	$120.00	$4,800.00
22	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
23	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
24	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
25	18-inch Piping	200	LF	$180.00	$36,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$25,000.00	$50,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,124,235
ENGINEERING/CONTINGENCY	30%	$393,490
TOTAL:		$1,517,700

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

6.9 MGD Option w/ 2 Booster Pump Stations

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	SITE WORK				
1	Mobilization	1	LS	$52,285.00	$52,285.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	250 HP Pump and Motor	2	EA	$155,000.00	$310,000.00
19	14-inch Pump Suction	40	LF	$140.00	$5,600.00
20	14-inch Gate Valve	2	EA	$2,800.00	$5,600.00
21	12-inch Pump Discharge	40	LF	$120.00	$4,800.00
22	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
23	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
24	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
25	18-inch Piping	200	LF	$180.00	$36,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$23,500.00	$47,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,097,985
ENGINEERING/CONTINGENCY	30%	$384,300
TOTAL:		$1,482,300

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
9.2 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$43,755.00	$43,755.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	300 HP Pump and Motor	2	EA	$166,000.00	$332,000.00
7	16-inch Pump Discharge Piping	40	LF	$160.00	$6,400.00
8	16-Inch Surge Check Valve (PCV)	2	EA	$3,900.00	$7,800.00
9	16-inch Gate Valve	2	EA	$3,200.00	$6,400.00
10	16-inch Ball Valve with Motor Operator	2	EA	$16,000.00	$32,000.00
11	20-inch Piping	200	LF	$200.00	$40,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$25,000.00	$50,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$918,855
ENGINEERING/CONTINGENCY	35%	$321,600
TOTAL:		$1,240,500

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 1

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
9.2 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$56,975.00	$56,975.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	400 HP Pump and Motor	2	EA	$188,000.00	$376,000.00
19	18-inch Pump Suction	40	LF	$180.00	$7,200.00
20	18-inch Gate Valve	2	EA	$3,600.00	$7,200.00
21	16-inch Pump Discharge	40	LF	$160.00	$6,400.00
22	16-Inch Surge Check Valve (PCV)	2	EA	$3,900.00	$7,800.00
23	16-inch Gate Valve	2	EA	$3,200.00	$6,400.00
24	16-inch Ball Valve with Motor Operator	2	EA	$16,000.00	$32,000.00
25	20-inch Piping	200	LF	$200.00	$40,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$28,000.00	$56,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,196,475
ENGINEERING/CONTINGENCY	35%	$418,770
TOTAL:		$1,615,200

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
9.2 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$55,725.00	$55,725.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	350 HP Pump and Motor	2	EA	$177,000.00	$354,000.00
19	18-inch Pump Suction	40	LF	$180.00	$7,200.00
20	18-inch Gate Valve	2	EA	$3,600.00	$7,200.00
21	16-inch Pump Discharge	40	LF	$160.00	$6,400.00
22	16-Inch Surge Check Valve (PCV)	2	EA	$3,900.00	$7,800.00
23	16-inch Gate Valve	2	EA	$3,200.00	$6,400.00
24	16-inch Ball Valve with Motor Operator	2	EA	$16,000.00	$32,000.00
25	20-inch Piping	200	LF	$200.00	$40,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$26,500.00	$53,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,170,225
ENGINEERING/CONTINGENCY	35%	$409,580
TOTAL:		$1,579,800

APPENDIX E

RAW WATER SUPPLY IMPROVEMENTS
PUMP STATION COST ESTIMATES
OPTION 2: OPEN CUT

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	August 6, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
2.5 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$40,575.00	$40,575.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	200 HP Pump and Motor	2	EA	$145,000.00	$290,000.00
7	12-inch Pump Discharge Piping	40	LF	$120.00	$4,800.00
8	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
9	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
10	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
11	18-inch Piping	200	LF	$180.00	$36,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$22,000.00	$44,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$852,075
ENGINEERING/CONTINGENCY	35%	$298,230
TOTAL:		$1,150,300

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority
Booster Pump Station No. 2
Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	August 6, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
2.5 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$44,965.00	$44,965.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	100 HP Pump and Motor	2	EA	$100,000.00	$200,000.00
19	10-inch Pump Suction	40	LF	$100.00	$4,000.00
20	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
21	8-inch Pump Discharge	40	LF	$80.00	$3,200.00
22	8-Inch Surge Check Valve (PCV)	2	EA	$3,200.00	$6,400.00
23	8-inch Gate Valve	2	EA	$1,600.00	$3,200.00
24	8-inch Ball Valve with Motor Operator	2	EA	$8,000.00	$16,000.00
25	12-inch Piping	200	LF	$120.00	$24,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$19,000.00	$38,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$944,265
ENGINEERING/CONTINGENCY	35%	$330,500
TOTAL:		$1,274,800

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
4.6 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$42,475.00	$42,475.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	300 HP Pump and Motor	2	EA	$166,000.00	$332,000.00
7	10-inch Pump Discharge Piping	40	LF	$100.00	$4,000.00
8	10-Inch Surge Check Valve (PCV)	2	EA	$3,500.00	$7,000.00
9	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
10	10-inch Ball Valve with Motor Operator	2	EA	$10,000.00	$20,000.00
11	16-inch Piping	200	LF	$160.00	$32,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$25,000.00	$50,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:			$891,975
CONTINGENCY	35%		$312,200
TOTAL:			$1,204,200

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
4.6 MGD Option w/ 2 Booster Pump Stations					
	SITE WORK				
1	Mobilization	1	LS	$49,455.00	$49,455.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	150 HP Pump and Motor	2	EA	$135,000.00	$270,000.00
19	12-inch Pump Suction	40	LF	$120.00	$4,800.00
20	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
21	10-inch Pump Discharge	40	LF	$100.00	$4,000.00
22	10-Inch Surge Check Valve (PCV)	2	EA	$3,500.00	$7,000.00
23	10-inch Gate Valve	2	EA	$2,000.00	$4,000.00
24	10-inch Ball Valve with Motor Operator	2	EA	$10,000.00	$20,000.00
25	16-inch Piping	200	LF	$160.00	$32,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500.00
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500.00
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$21,000.00	$42,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,038,555
ENGINEERING/CONTINGENCY	35%	$363,500
TOTAL:		$1,402,100

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
6.9 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$46,725.00	$46,725.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	450 HP Pump and Motor	2	EA	$199,000.00	$398,000.00
7	12-inch Pump Discharge Piping	40	LF	$120.00	$4,800.00
8	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
9	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
10	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
11	18-inch Piping	200	LF	$180.00	$36,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	2	EA	$29,500.00	$59,000.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$981,225
ENGINEERING/CONTINGENCY	30%	$343,430
TOTAL:		$1,324,700

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
6.9 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$52,285.00	$52,285.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	250 HP Pump and Motor	2	EA	$155,000.00	$310,000.00
19	14-inch Pump Suction	40	LF	$140.00	$5,600.00
20	14-inch Gate Valve	2	EA	$2,800.00	$5,600.00
21	12-inch Pump Discharge	40	LF	$120.00	$4,800.00
22	12-Inch Surge Check Valve (PCV)	2	EA	$3,700.00	$7,400.00
23	12-inch Gate Valve	2	EA	$2,400.00	$4,800.00
24	12-inch Ball Valve with Motor Operator	2	EA	$12,000.00	$24,000.00
25	18-inch Piping	200	LF	$180.00	$36,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$23,500.00	$47,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,097,985
ENGINEERING/CONTINGENCY	30%	$384,300
TOTAL:		$1,482,300

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Spence Intake Pump Station

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
9.2 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$60,245.00	$60,245.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	PUMP STATION MECHANICAL				
6	450 HP Pump and Motor	3	EA	$199,000.00	$597,000.00
7	16-inch Pump Discharge Piping	60	LF	$160.00	$9,600.00
8	16-Inch Surge Check Valve (PCV)	3	EA	$3,900.00	$11,700.00
9	16-inch Gate Valve	3	EA	$3,200.00	$9,600.00
10	16-inch Ball Valve with Motor Operator	3	EA	$16,000.00	$48,000.00
11	20-inch Piping	200	LF	$200.00	$40,000.00
12	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	ELECTRICAL BUILDING				
13	Structural Slab	300	SF	$75.00	$22,500.00
14	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
15	Masonry Walls (10' Tall w/70' Perimeter)	700	SF	$35.00	$24,500.00
16	Ventilation System	1	LS	$8,000.00	$8,000.00
17	Lighting	1	LS	$2,000.00	$2,000.00
18	Receptacles	1	LS	$500.00	$500.00
19	Misc Wiring	1	LS	$2,500.00	$2,500.00
20	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
21	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
22	480V SSRVS	3	EA	$29,500.00	$88,500.00
23	120V Panel	1	LS	$10,000.00	$10,000.00
24	SCADA	1	LS	$50,000.00	$50,000.00
25	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,265,145
ENGINEERING/CONTINGENCY	35%	$442,810
TOTAL:		$1,708,000

OPINION OF PROBABLE CONSTRUCTION COST

Upper Colorado River Authority

Booster Pump Station No. 2

Preliminary

ESTIMATOR	CHECKED BY	DATE
KWW	RHM	February 15, 2012

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
9.2 MGD Option w/ 1 Booster Pump Station					
	SITE WORK				
1	Mobilization	1	LS	$55,725.00	$55,725.00
2	Demolition of Old Equipment, Paving, Pipe, Building and Fence	1	LS	$25,000.00	$25,000.00
3	Site Grading	1	LS	$5,000.00	$5,000.00
4	SWPPP	1	LS	$5,000.00	$5,000.00
5	Flexbase Pavement Reconstruction	1,000	SY	$5.00	$5,000.00
6	Chain Link Fence	1,500	LF	$10.00	$15,000.00
	NEW PUMP STATION CIVIL / STRUCTURAL				
12	Excavation	1	LS	$10,000.00	$10,000.00
13	Pump Cans	2	EA	$10,000.00	$20,000.00
14	Pump Can Foundation	20	CY	$750.00	$15,000.00
15	Pump Can Encasement	10	CY	$750.00	$7,500.00
16	Pump slab	10	CY	$750.00	$7,500.00
17	Vault for Valves and Meter	1	LS	$25,000.00	$25,000.00
	PUMP STATION MECHANICAL				
18	350 HP Pump and Motor	2	EA	$177,000.00	$354,000.00
19	18-inch Pump Suction	40	LF	$180.00	$7,200.00
20	18-inch Gate Valve	2	EA	$3,600.00	$7,200.00
21	16-inch Pump Discharge	40	LF	$160.00	$6,400.00
22	16-Inch Surge Check Valve (PCV)	2	EA	$3,900.00	$7,800.00
23	16-inch Gate Valve	2	EA	$3,200.00	$6,400.00
24	16-inch Ball Valve with Motor Operator	2	EA	$16,000.00	$32,000.00
25	20-inch Piping	200	LF	$200.00	$40,000.00
26	Misc Piping Appurtenances	1	LS	$25,000.00	$25,000.00
	GROUND STORAGE TANK IMPROVEMENTS				
26	Steel for Tank	1	LS	$50,000.00	$50,000.00
27	Painting	1	LS	$50,000.00	$50,000.00
	ELECTRICAL BUILDING				
30	Structural Slab	300	SF	$75.00	$22,500
31	Roof Framing and Metal Deck	300	SF	$25.00	$7,500.00
32	Masonry Walls (10' Tall w/110' Perimeter)	700	SF	$35.00	$24,500
33	Ventilation System	1	LS	$8,000.00	$8,000.00
34	Lighting	1	LS	$2,000.00	$2,000.00
35	Receptacles	1	LS	$500.00	$500.00
36	Misc Wiring	1	LS	$2,500.00	$2,500.00
37	SCADA RI/O	1	LS	$8,000.00	$8,000.00
	ELECTRICAL				
46	MCC / Transfer Switch	1	LS	$125,000.00	$125,000.00
47	480 Volt Variable Frequency Drive	2	EA	$26,500.00	$53,000.00
48	120V Panel	1	LS	$10,000.00	$10,000.00
49	SCADA	1	LS	$50,000.00	$50,000.00
50	Electrical Cable / Conduit	1	LS	$75,000.00	$75,000.00

SUBTOTAL OPTION 1:		$1,170,225
ENGINEERING/CONTINGENCY	35%	$409,580
TOTAL:		$1,579,800

APPENDIX F

WATER TREATMENT PLANT IMPROVEMENTS COST ESTIMATES

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
EXISTING WATER QUALITY & NET FLOW = 2.12 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$3,625,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 2,600,000.00	$ 2,600,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 4,759,200.00**
	Reject Facilities	1	LS	$ 4,759,160.00	$ 4,759,200.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

SUBTOTAL:		$ 9,640,200.00
ENGINEERING/CONTINGENCY	**35%**	**$3,374,070.00**
SUBTOTAL:		$13,014,270.00
MOBILIZATION	**5%**	**$650,720.00**
SUBTOTAL:		$13,664,990.00
TOTAL CONSTRUCTION COST		**$13,665,000.00**

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
EXISTING WATER QUALITY & LAKE SPENCE FLOW = 4.6 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$4,335,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 3,310,000.00	$ 3,310,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 6,252,000.00**
	Reject Facilities	1	LS	$ 6,251,940.00	$ 6,252,000.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

SUBTOTAL:		$ 11,843,000.00
ENGINEERING/CONTINGENCY	**35%**	**$4,145,050.00**
SUBTOTAL:		$15,988,050.00
MOBILIZATION	**5%**	**$799,410.00**
SUBTOTAL:		$16,787,460.00
TOTAL CONSTRUCTION COST		**$16,788,000.00**

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
EXISTING WATER QUALITY & LAKE SPENCE FLOW = 6.9 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$5,385,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 4,360,000.00	$ 4,360,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 8,217,700.00**
	Reject Facilities	1	LS	$ 8,217,680.00	$ 8,217,700.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00
		SUBTOTAL:			$ 14,858,700.00
		ENGINEERING/CONTINGENCY		**35%**	**$5,200,550.00**
		SUBTOTAL:			$20,059,250.00
		MOBILIZATION		**5%**	**$1,002,970.00**
		SUBTOTAL:			$21,062,220.00
		TOTAL CONSTRUCTION COST			**$21,063,000.00**

FREESE AND NICHOLS

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
EXISTING WATER QUALITY & LAKE SPENCE FLOW = 9.2 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$6,345,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 5,320,000.00	$ 5,320,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 10,020,900.00**
	Reject Facilities	1	LS	$ 10,020,840.00	$ 10,020,900.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

SUBTOTAL:		$ 17,621,900.00
ENGINEERING/CONTINGENCY	**35%**	**$6,167,670.00**
SUBTOTAL:		$23,789,570.00
MOBILIZATION	**5%**	**$1,189,480.00**
SUBTOTAL:		$24,979,050.00
TOTAL CONSTRUCTION COST		**$24,980,000.00**

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
SECONDARY STANDARD WATER QUALITY & NET FLOW = 2.12 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$4,915,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 3,890,000.00	$ 3,890,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 7,330,900.00**
	Reject Facilities	1	LS	$ 7,330,880.00	$ 7,330,900.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

SUBTOTAL:		$ 13,501,900.00
ENGINEERING/CONTINGENCY	**35%**	**$4,725,670.00**
SUBTOTAL:		$18,227,570.00
MOBILIZATION	**5%**	**$911,380.00**
SUBTOTAL:		$19,138,950.00
TOTAL CONSTRUCTION COST		**$19,139,000.00**

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
SECONDARY STANDARD WATER QUALITY & LAKE SPENCE FLOW = 4.6 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$5,325,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 4,300,000.00	$ 4,300,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 8,099,500.00**
	Reject Facilities	1	LS	$ 8,099,440.00	$ 8,099,500.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

SUBTOTAL:		$ 14,680,500.00
ENGINEERING/CONTINGENCY	**35%**	**$5,138,180.00**
SUBTOTAL:		$19,818,680.00
MOBILIZATION	**5%**	**$990,940.00**
SUBTOTAL:		$20,809,620.00
TOTAL CONSTRUCTION COST		**$20,810,000.00**

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
SECONDARY STANDARD WATER QUALITY & LAKE SPENCE FLOW = 6.9 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$6,355,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 5,330,000.00	$ 5,330,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 10,035,700.00**
	Reject Facilities	1	LS	$ 10,035,620.00	$ 10,035,700.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00
			SUBTOTAL:		$ 17,646,700.00
			ENGINEERING/CONTINGENCY	**35%**	**$6,176,350.00**
			SUBTOTAL:		$23,823,050.00
			MOBILIZATION	**5%**	**$1,191,160.00**
			SUBTOTAL:		$25,014,210.00
			TOTAL CONSTRUCTION COST		**$25,015,000.00**

FREESE AND NICHOLS

UCRA REGIONAL WATER PLANNING
TREATMENT PLANT FEASIBILITY STUDY
SECONDARY STANDARD WATER QUALITY & LAKE SPENCE FLOW = 9.2 MGD

ACCOUNT NO.	ESTIMATOR	CHECKED BY	DATE
URA11379	JKC/DWS	DWS	February 15, 2012

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
NEW WATER TREATMENT PLANT					
YARD PIPING					**$176,000.00**
	Piping (Yard Piping and Building Interior Piping)	1	LS	$ 135,000.00	$ 135,000.00
	Valves and Fittings	1	LS	$ 14,000.00	$ 14,000.00
	Flow Meters	1	LS	$ 14,000.00	$ 14,000.00
	Sample Pumps	1	LS	$ 13,000.00	$ 13,000.00
MEMBRANE BUILDING					**$7,325,000.00**
	Chemical Feed Facilities	1	LS	$ 25,000.00	$ 25,000.00
	RO Membrane Equipment	1	LS	$ 6,300,000.00	$ 6,300,000.00
	Tilt up Building	1	LS	$ 1,000,000.00	$ 1,000,000.00
PRODUCT WATER FACILITIES					**$580,000.00**
	0.5 MG Product Water Tank	1	EA	$ 580,000.00	$ 580,000.00
REJECT FACILITIES					**$ 11,853,600.00**
	Reject Facilities	1	LS	$ 11,853,560.00	$ 11,853,600.00
ELECTRICAL AND INSTRUMENTATION					**$ 500,000.00**
	Electrical & SCADA Work	1	LS	$ 300,000.00	$ 300,000.00
	SCADA and Instrumentation	1	LS	$ 200,000.00	$ 200,000.00

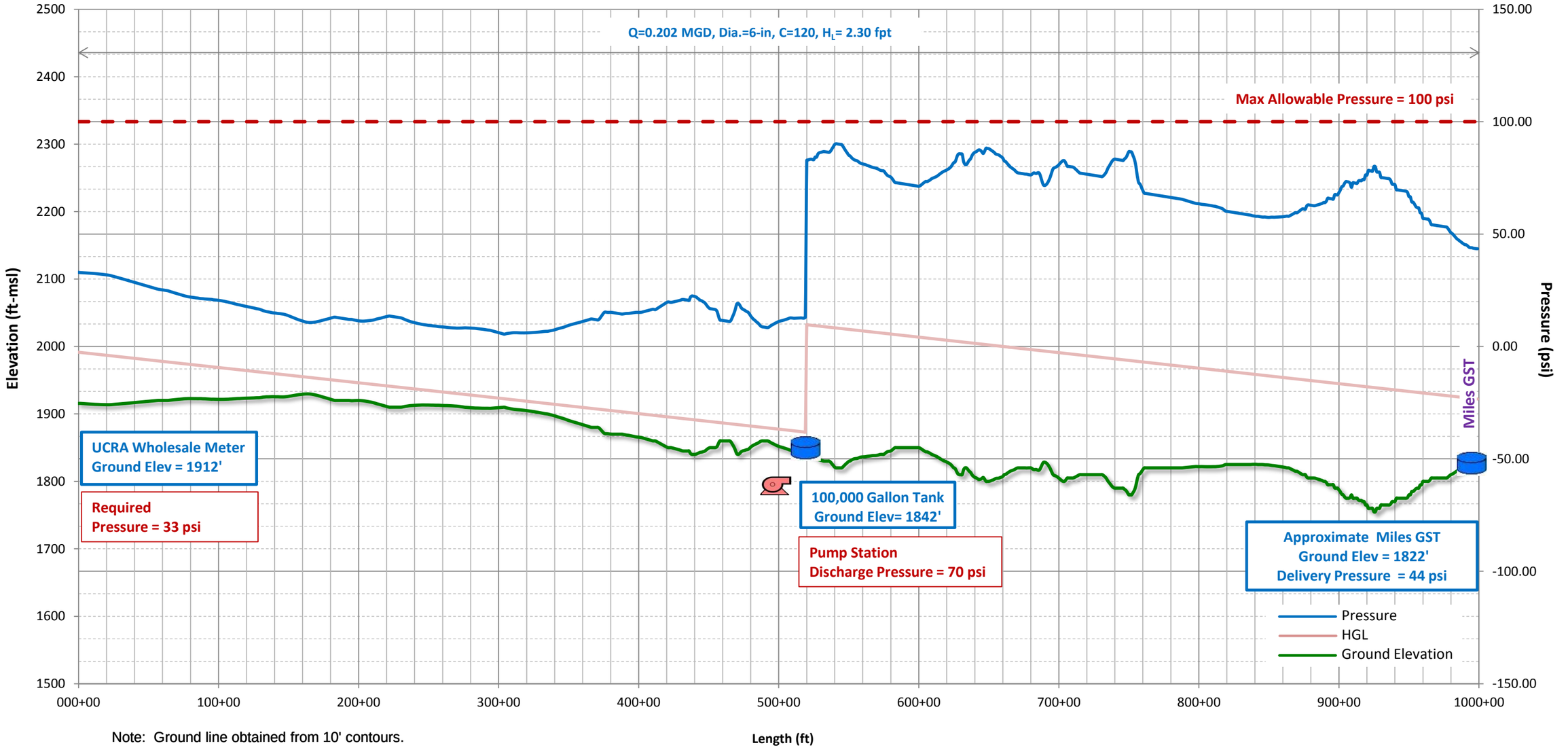
SUBTOTAL:		$ 20,434,600.00
ENGINEERING/CONTINGENCY	**35%**	**$7,152,110.00**
SUBTOTAL:		$27,586,710.00
MOBILIZATION	**5%**	**$1,379,340.00**
SUBTOTAL:		$28,966,050.00
TOTAL CONSTRUCTION COST		**$28,967,000.00**

FREESE AND NICHOLS

APPENDIX G

TREATED WATER DELIVERY IMPROVEMENTS COST ESTIMATES & HGLS

Upper Colorado River Authority
Northeast Water Supply Line Pressure Profile
UCRA Meter #6030 to the City of Miles - Existing 6"



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

NORTHWEST WATER SUPPLY LINE
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

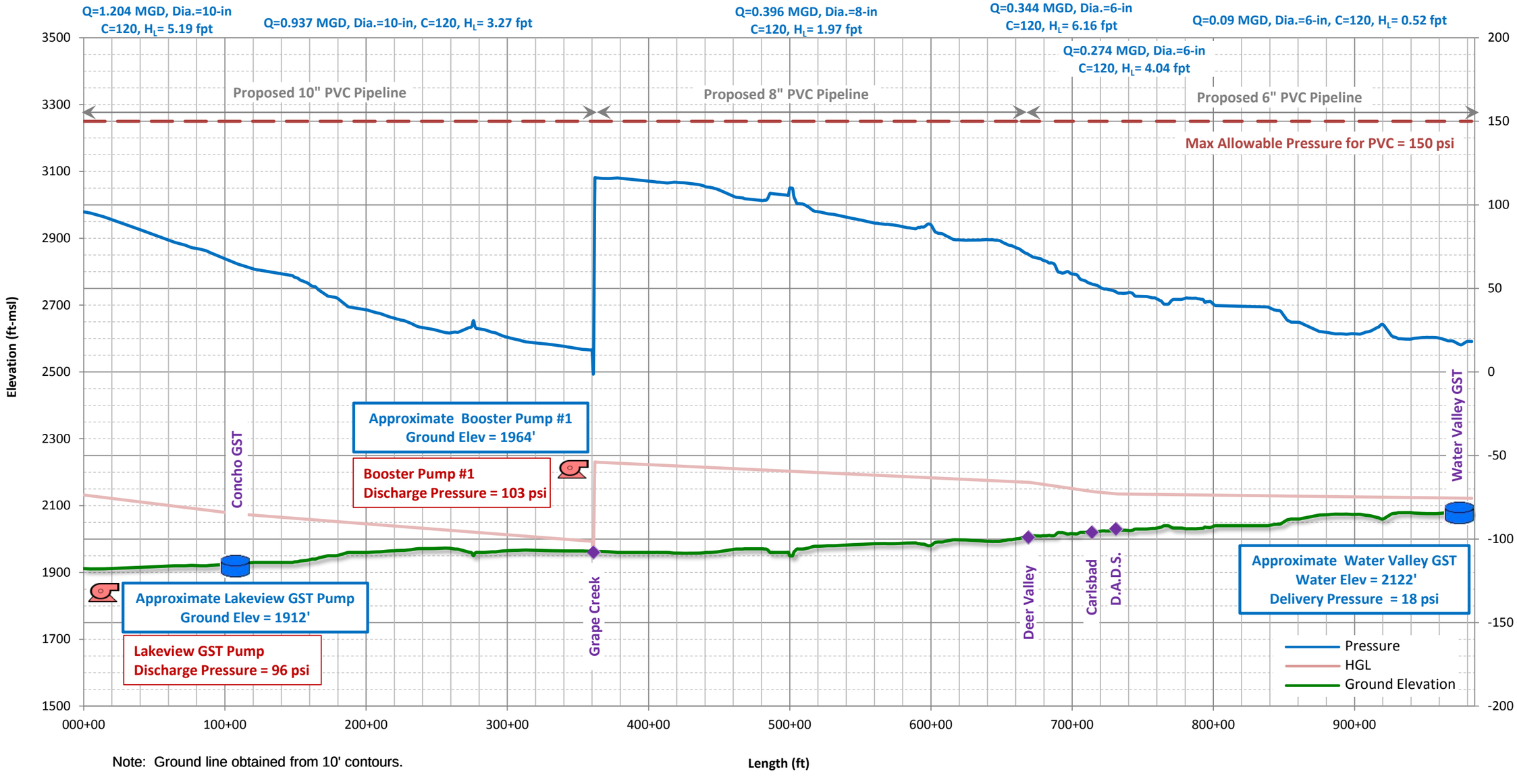
ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB	RAW	URA11379

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" PVC Water Line	36,100	LF	$62.50	$2,256,250.00
2	8" PVC Water Line	30,800	LF	$50.00	$1,540,000.00
3	6" PVC Water Line	47,400	LF	$40.00	$1,896,000.00
4	Pipeline Appurtenances	114,300	LF	$10.00	$1,143,000.00
	SUBTOTAL:				$6,835,250
	ENGINEERING/CONTINGENCY			35%	$2,392,340
	TOTAL:				$9,227,590

PROJECT TOTAL **$9,227,600**

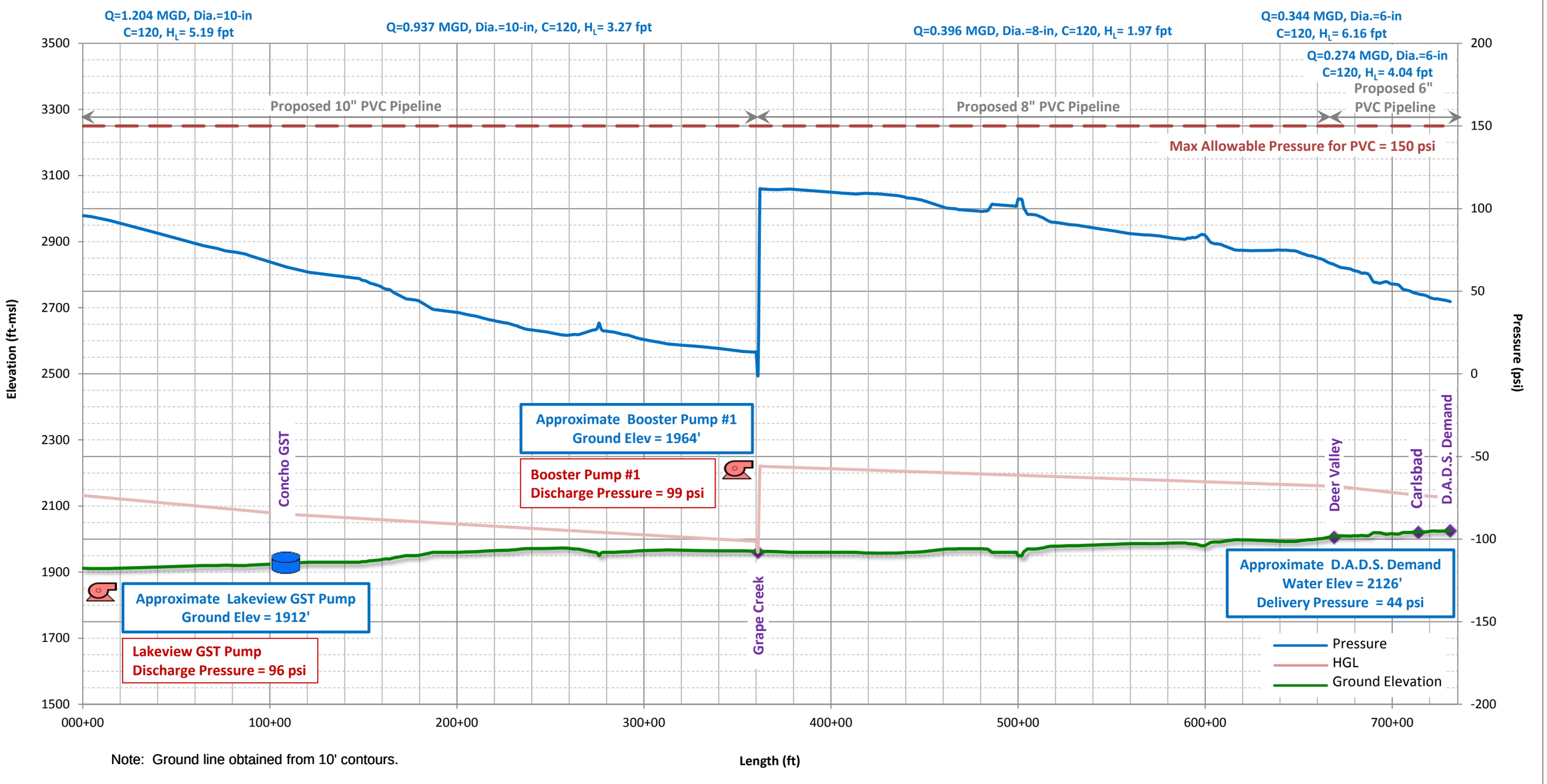
NOTES:

Upper Colorado River Authority
Northwest Water Supply Line Pressure Profile
Lakeview GST & P.S. to Water Valley GST



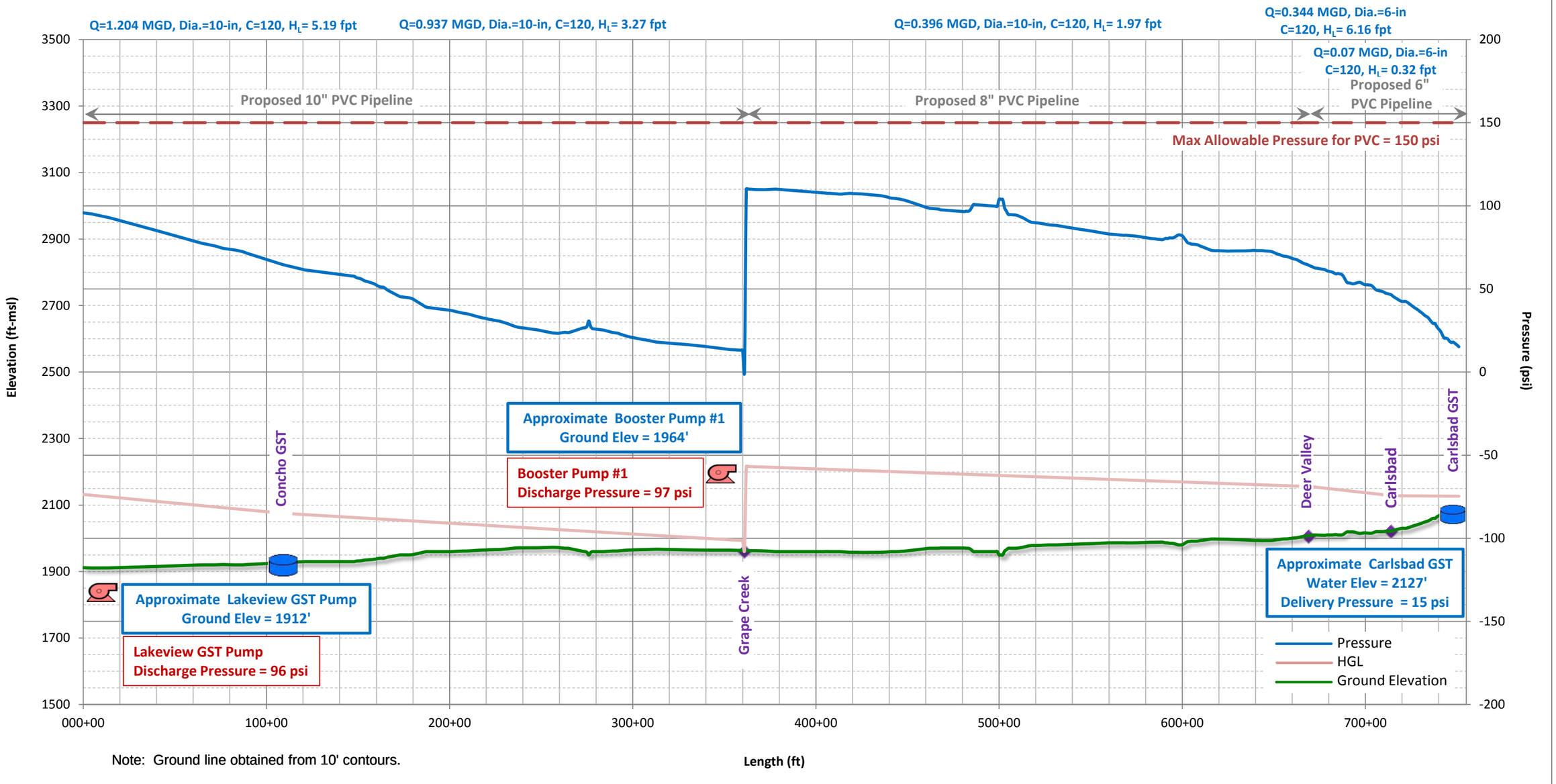
Note: Ground line obtained from 10' contours.

Upper Colorado River Authority
Northwest Water Supply Line Pressure Profile
Lakeview GST & P.S. to D.A.D.S.



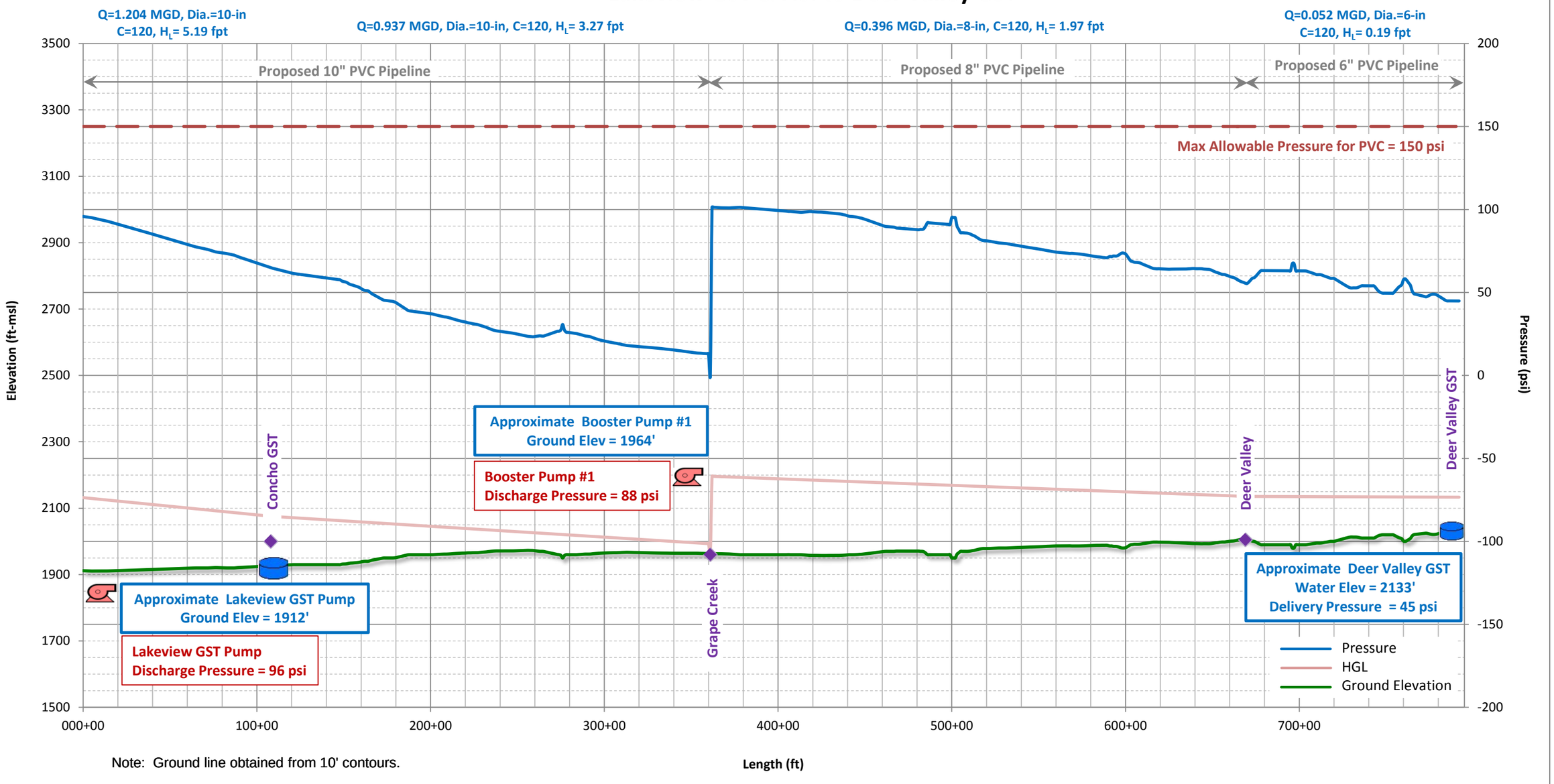
Note: Ground line obtained from 10' contours.

Upper Colorado River Authority
Northwest Water Supply Line Pressure Profile
Lakeview GST & P.S. to Carlsbad GST



Note: Ground line obtained from 10' contours.

Upper Colorado River Authority
Northwest Water Supply Line Pressure Profile
Lakeview GST & P.S. to Deer Valley GST



Note: Ground line obtained from 10' contours.

FREESE AND NICHOLS

SOUTH WATER SUPPLY LINE
UPPER COLORADO RIVER AUTHORITY

OPINION OF PROBABLE CONSTRUCTION COST

JULY 27, 2012

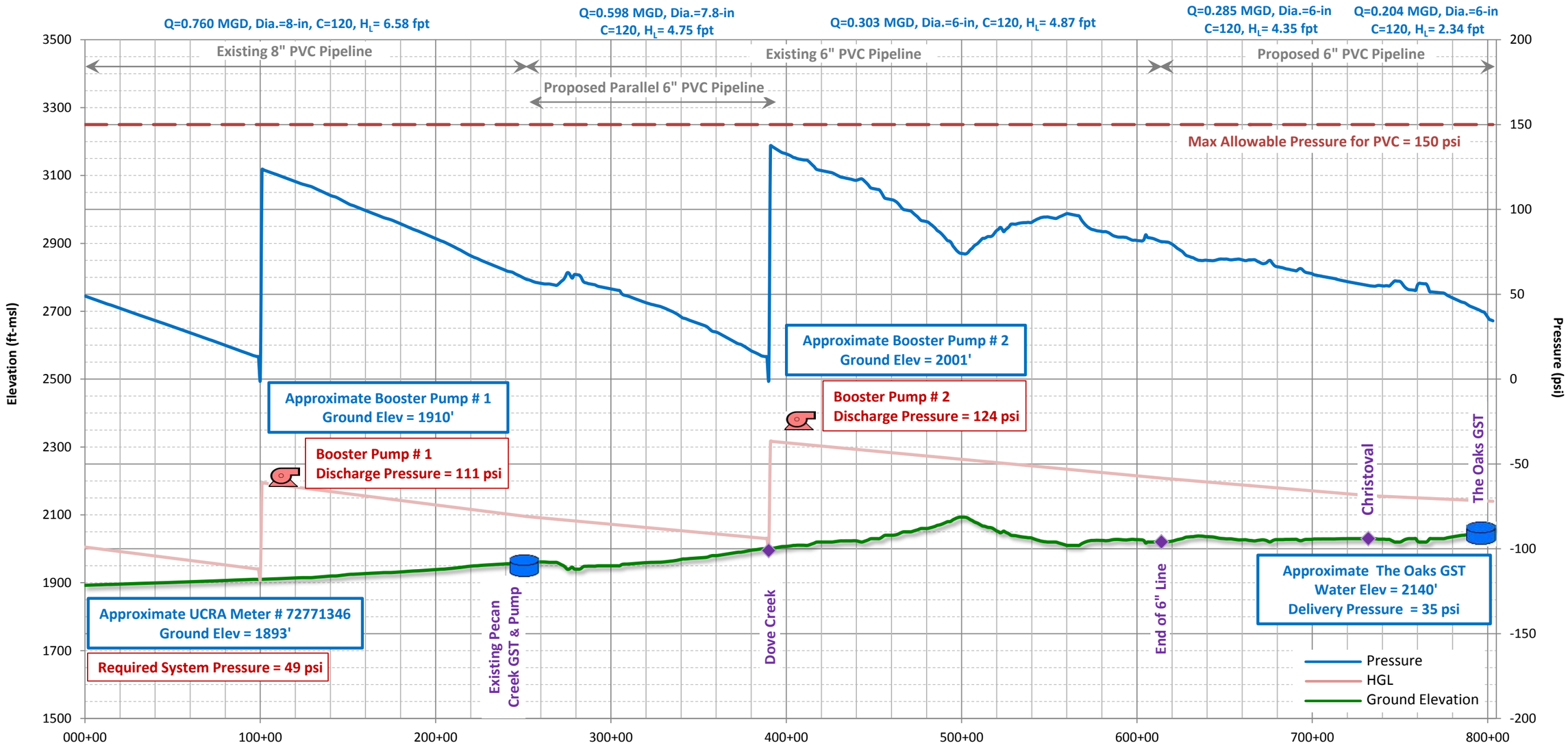
ESTIMATOR	CHECKED BY	ACCOUNT NO
CEB/KJR	RAW	URA11379

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	6" PVC Water Line	74,500	LF	$40.00	$2,980,000.00
2	Pipeline Appurtenances	74,500	LF	$10.00	$745,000.00
3	Boring and Casing	2,000	LF	$300.00	$600,000.00
			SUBTOTAL:		$4,325,000
			ENGINEERING/CONTINGENCY	35%	$1,513,750
			TOTAL:		$5,838,750

PROJECT TOTAL **$5,838,800**

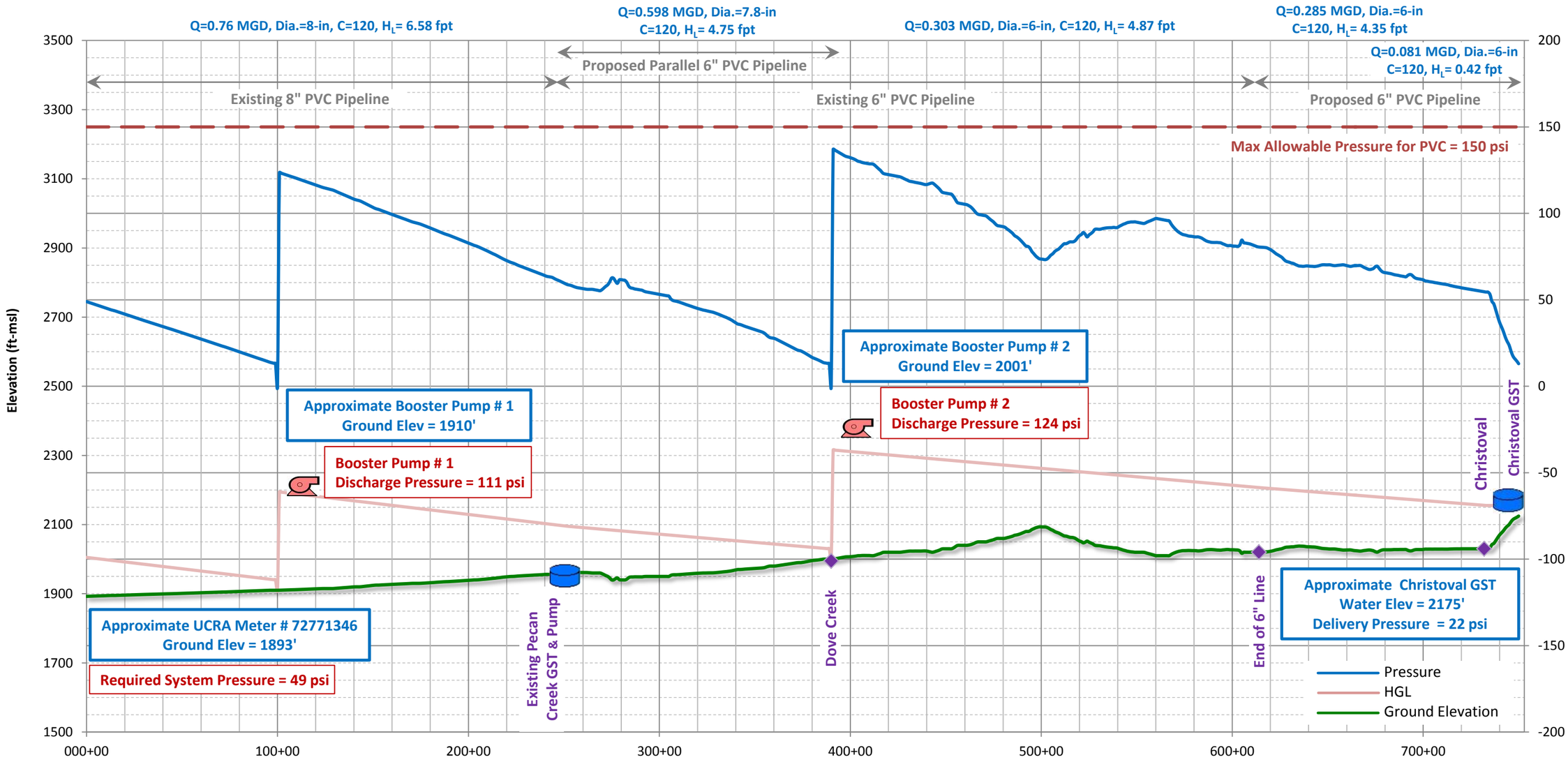
NOTES:

Upper Colorado River Authority
South Water Supply Line Pressure Profile
UCRA Meter to The Oaks GST



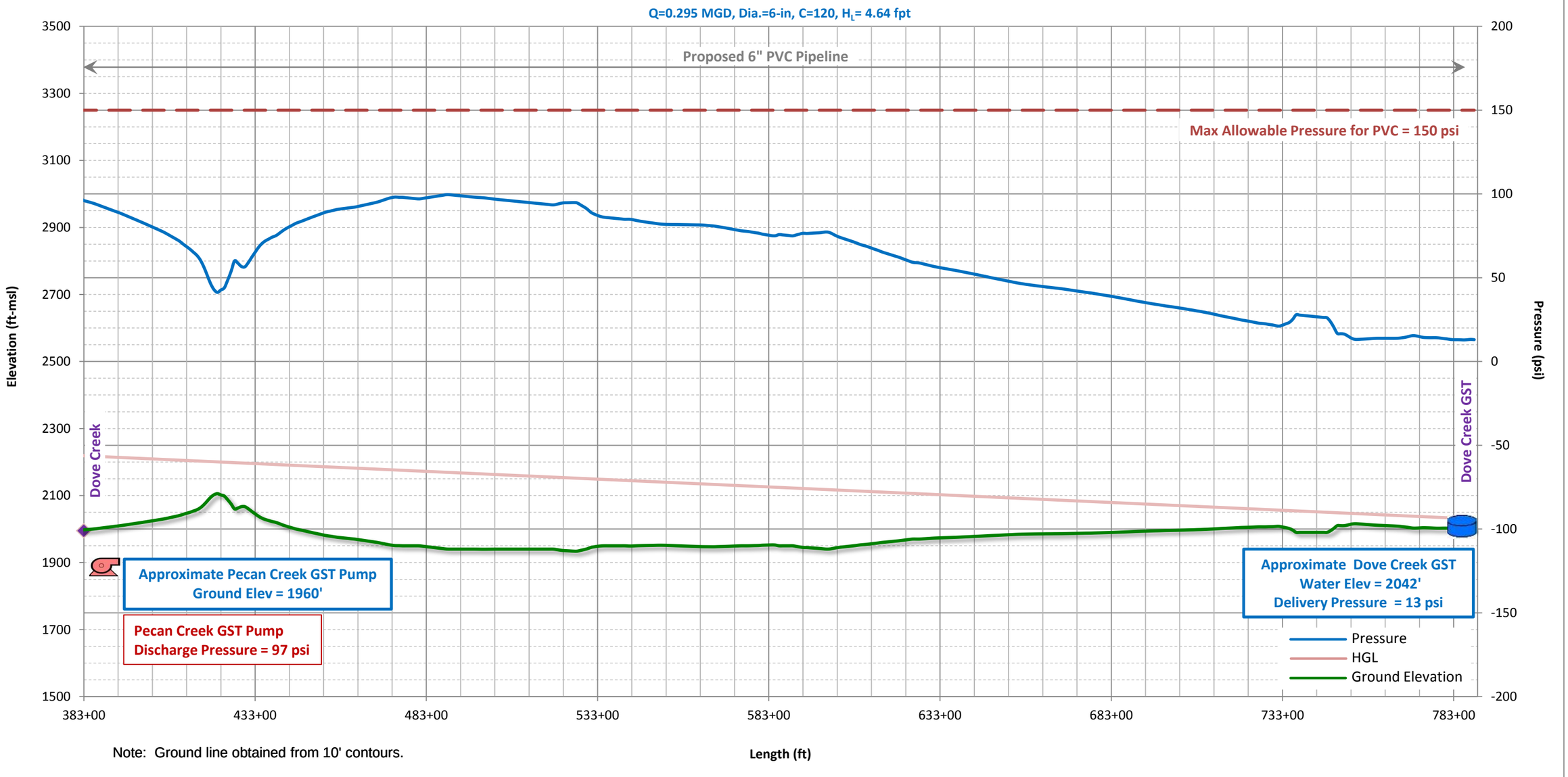
Note: Ground line obtained from 10' contours.

Upper Colorado River Authority
South Water Supply Line Pressure Profile
UCRA Meter to Christoval GST



Note: Ground line obtained from 10' contours.

Upper Colorado River Authority
South Water Supply Line Pressure Profile
Pecan Creek GST to Dove Creek GST



Note: Ground line obtained from 10' contours.

APPENDIX H

THE UCRA WATER CONSERVATION PLAN

&

DROUGHT MANAGEMENT PLAN

WATER CONSERVATION

AND

DROUGHT CONTINGENCY

PLAN

ADOPTED BY THE
UPPER COLORADO RIVER AUTHORITY

FEBRUARY, 2006

REVISED AUGUST, 2009

Table of Contents

PROFILE & WATER CONSERVATION PLAN REQUIREMENTS FOR WHOLESALE PUBLIC WATER SUPPLIERS

Texas Commission on Environmental Quality

This form is provided to assist wholesale public water suppliers in water conservation plan development. Information from this form should be included within a wholesale public water supplier water conservation plan. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource

Name of Entity: Upper Colorado River Authority

Address & Zip: 512 Orient, San Angelo, Texas 76903

Telephone: 325.655.0565 **Fax:** 325.655.1371

Form Completed By: Fred Teagarden

Title: Senior Hydrologist

Signature: _____ **Date:** _____

Name and Phone Number of Person/Department responsible for implementing a water conservation program: Fred Teagarden, 325-655-0565

PROFILE

I. WHOLESALE SERVICE AREA POPULATION AND CUSTOMER DATA

A. Population and Service Area Data (City of Miles), (City of Paint Rock)

1. Service area size in square miles: (1330 acres, Miles) (250 acres Paint Rock)
   Note: See attached map of each City.

2. Current population of service area: (900, Miles) (320, Paint Rock)

3. Current population served for:
   a. water (900, Miles) (320 Paint Rock

b. wastewater _____ (900, Miles) (0 Paint Rock)

4. Population served for previous five years:

Year	Estimated Population Miles	Paint Rock
2001	898	320
2002		
2003		
2004		
2005	900	320

5. Projected population for service area in the following decades:

Year	Estimated Population Miles	Paint Rock*
2010	916	320
2020	915	330
2030	897	350
2040	860	345
2050	835	352

* Based on County wide trends

6. List source or method for the calculation of current and projected population

Region F Water Plan. No population or projections in plan for Paint Rock. Estimates based on County wide trends (minus City of Eden).

B. Customers Data

List (or attach) the names of all wholesale customers, amount of annual contract, and amount of the annual use for each for the previous year:

	Wholesale Customer	Contracted Amount (acre-feet)	Previous Year Amount of Water Delivered (acre-feet)
(1)	City of Miles	200 (Maximum)	95.414 acre feet
(2)	City of Paint Rock	50	0
(3)			
(4)			
(5)			

II. WATER USE DATA FOR SERVICE AREA

A. Water Delivery

Indicated if the water provided under wholesale contracts is treated or raw water and the annual amount for each for previous year:

	Total amount delivered or sold for previous year (acre-feet)
Treated	City of Miles, 95.414 acre feet from City of San Angelo Water Distribution System (2005)
Raw	City of Paint Rock, None delivered last year

B. Water Accounting Data

1. Total amount of water diverted at point of diversion(s) for previous five years for all water uses: City of Miles

Year	2008	2007	2006	2004	2005
January				2.570MG	2.634MG
February				2.296	2.031
March				2.370	2.359
April				2.595	2.876
May				3.664	2.738
June				3.548	3.501
July				3.667	4.111
August				2.912	2.964
September				3.081	3.506
October				2.226	2.641
November				1.995	2.314
December				2.587	2.580
Total	97.327 Ac. Ft.	77.922 Ac. Ft.	90.095 Ac. Ft.	95.0 Ac.Ft	95.414 Ac. Ft

2. Wholesale population served and total amount of water diverted for **municipal use** for previous five years:

Year	Total Population Served	Total Annual Water Diverted for Municipal Use (acre feet)
2004	900	95
2005	900	95.414
2006	900	90.095
2007	900	77.922
2008	900	97.327

C. Projected Water Demands

Neither the City of Miles or the City of Paint Rock is projected to significantly increase in water demand over the next 10 years.

III. WATER SUPPLY SYSTEM DATA

A. Water Supply Sources

List all current water supply sources and the amounts authorized with each:

	Source	Amount Authorized	
Surface Water:	O.C. Fisher Reservoir	1500*	acre feet
Groundwater:			acre feet
Other:			acre feet

* Water right retained by UCRA through agreement with City of San Angelo.

B. Treatment and Distribution System (if provide treated water) N/A

1. Design daily capacity of system: _____ MGD
2. Storage Capacity: Elevated _____ MGD, Ground _____ MGD

3. Please describe the water system and attach. Include the number of treatment plants, wells, and storage tanks. If possible, attach a sketch of the system layout.

Note: City of Miles receives treated water from City of San Angelo at meter in North San Angelo. City of Miles own and operates pipeline.

IV. WASTEWATER SYSTEM DATA N/A

A. Wastewater System Data (if applicable) N/A

1. Design capacity of wastewater treatment plant(s): _____ MGD

2. Briefly describe the wastewater system(s) of the area serviced by the wholesale public water supplier. Describe how treated wastewater is

disposed of. Where applicable, identify treatment plant(s) with the TCEQ name and number, the operator, owner, and, if wastewater is discharged, the receiving stream. If possible, attach a sketch or map which locates the plant(s) and discharge points or disposal sites.

B. Wastewater Data for Service Area (if applicable) N/A

1. Percent of water service area served by wastewater system: _____%

2. Monthly volume treated for previous three years (in 1,000 gallons):

Year					
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Total					

REQUIREMENTS FOR WATER CONSERVATION PLANS FOR WHOLESALE PUBLIC WATER SUPPLIERS

In addition to the description of the wholesaler's service area (profile from above), a water conservation plan for a wholesale public water supplier must include, at a minimum, additional information as required by Title 30, Texas Administrative Code, §288.5. Note: If the water conservation plan does not provide information for each requirement, an explanation must be included as to why the requirement is not applicable.

Specific, Quantified 5 & 10-Year Targets

The recent existing water consumption records for both the City of Miles and the City of Paint Rock reflect consumption under extreme water use constraints due to the on-going drought experienced by the region since 1998 and establishes a "baseline" usage for the entities. Based on this and the lack of any significant projected growth, the UCRA proposes to establish both the 5 year and 10 year target consumption at existing rates. Targets at a lower rate based on the existing conditions would be unrealistic. Therefore, 5 & 10 year target consumption are established at 100 acre feet per year for the City of Miles and 70 acre feet per year for the City of Paint Rock. This target represents a 100 gpcd for the City of Miles and a 195 gpcd for the City of Paint Rock. The per capita use for the City of Paint Rock is recognized as being unexpectedly high and is due to several factors. Several large water users (primarily the School District and the County) exists and consume water disproportionately to the size of the City (approximately 35% of total demand) and the use by the City of a surface water treatment plant. Surface water plants could be expected to utilize in excess of 5% of total pumpage in filter backwash, sludge handling and routine maintenance. Calculating annual usage for the City of Paint Rock minus the above cited factors results in a per capita usage by the remaining customers at approximately 117 gpcd which is below the normally expected rate of consumption.(150gpcd).

Metering Devices

Water delivered to the City of Miles is metered by the City of San Angelo Water Department. Water proposed to be delivered to the City of Paint Rock will be metered by an existing USGS gauging station immediately below Bell Street Reservoir.

Record Management Program

Records of releases to the City of Miles are maintained by the City of San Angelo, the City of Miles and the UCRA. The City of Miles also maintains internal daily records of water delivered to consumers and records of consumption by each consumer.

The City of Paint Rock also maintains internal records of water delivered to consumers and record of consumption by each consumer. Records of any downstream releases by the UCRA will be a part of the USGS data base and available for inspection by anyone on the internet. In addition, the UCRA will maintain records of these releases based on the USGS data and all accompanying calculations of base flows and released flows and also flow checks based on physical measurement of flows by UCRA staff.

Metering/Leak-Detection and Repair Program

The UCRA does not own any water storage, distribution or metering systems. Each of the municipalities have leak detection systems based on records comparison and other means in operation.

Reservoir Systems Operations Plan

The UCRA has discretionary control over 1500 acre feet of water annually from O.C. Fisher Reservoir. This precludes development by the UCRA of any reservoir operations plan.

Contract Requirements for Successive Customer Conservation

This water conservation plan includes a requirement that in every water supply contract entered into or renewed after official adoption of the water conservation plan, and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements of this chapter. If the customer intends to resell the water, then the contract between the UCRA and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with the provisions of Title 30 TAC Chapter 288.

Enforcement Procedure & Official Adoption

See sections 1.0 and 2.0 of this plan.

Coordination with the Regional Water Planning Group(s)

The service area of the Upper Colorado River Authority is located within the Region F water planning area and the Upper Colorado River Authority has provided a copy of this water conservation plan to the Region F water planning group..

Plan Review and Update

Beginning with the date of adoption the Upper Colorado River Authority (UCRA) shall review and update its water conservation plan, as appropriate based on an assessment of previous five-year and ten-year targets and any other new or updated information. The UCRA shall review and update the next revision of its water conservation plan not later than May 1, 2014, and every five years after that date to coincide with the regional water planning group. The revised plan must also include an implementation report.

Appendix A

Definitions of Commonly Used Terms

Conservation – Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

Industrial use – The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

Irrigation – The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

Municipal per capita water use – The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

Municipal use – The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

Municipal use in gallons per capita per day – The total average daily amount of water diverted or pumped for treatment for potable use by a public water supply system. The calculation is made by dividing the water diverted or pumped for treatment for potable use by population served. Indirect reuse volumes shall be credited against total diversion volumes for the purpose of calculating gallons per capita per day for targets and goals.

Public water supplier – An individual or entity that supplies water to the public for human consumption.

Regional water planning group – A group established by the Texas Water Development Board to prepare a regional water plan under Texas Water Code, §16.053.

Retail public water supplier – An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

Reuse – The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

Water conservation plan – A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

Water loss - The difference between water diverted or treated and water delivered (sold). Water loss can result from:

1. inaccurate or incomplete record keeping;
2. meter error;
3. unmetered uses such as firefighting, line flushing, and water for public buildings and water treatment plants;
4. leaks; and
5. water theft and unauthorized use.

Wholesale public water supplier – An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Drought Contingency Plan
For a Wholesale Public Water Supplier
Texas Commission on Environmental Quality

Upper Colorado River Authority

512 Orient Street, San Angelo, Texas 76903

CN 600683908

RN 102630167

August 25, 2009

Section I: Declaration of Policy, Purpose, and Intent

In order to conserve the available water supply and/or to protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the Upper Colorado River Authority adopts the following Drought Contingency Plan (the Plan).

Section II: Public Involvement

Opportunity for the public and wholesale water customers to provide input into the preparation of the Plan was provided by the Upper Colorado River Authority by means of a public hearing during a regular scheduled Board Meeting on August 25, 2009. All water supply customers were notified of the hearing and the meeting was advertised in local media 30 days prior to the meeting.

Section III: Wholesale Water Customer Education

The Upper Colorado River Authority will periodically provide wholesale water customers with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of personal contact with principle officers and governing Boards of each entity and posting on the agency's web site.

Section IV: Coordination with Regional Water Planning Groups

The water service area of the Upper Colorado River Authority is located within the Region F Water Planning Group area and the Upper Colorado River Authority has provided a copy of the Plan to the Region F Planning Group.

Section V: Authorization

The Upper Colorado River Authority Board Chairman is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The Board Chairman, or his/her designee, shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI: Application

The provisions of this Plan shall apply to all customers utilizing water provided by the Upper Colorado River Authority. The term customer as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities. All future water supply agreements entered by the Upper Colorado River Authority (UCRA) including agreement extensions shall contain provisions stating that in case of a shortage of water resulting from drought, any water available to the UCRA shall be divided in accordance with Texas Water Code 11.039.

Section VII: Criteria for Initiation and Termination of Drought Response Stages

The Board Chairman, or his/her designee, shall monitor water supply conditions on a monthly basis and shall determine when conditions warrant initiation or termination of each stage of the Plan. Customer notification of the initiation or termination of drought

response stages will be made by mail or telephone. The news media will also be informed.

The triggering criteria described below are based on triggers established in the City of San Angelo Drought Contingency Plan. This approach has been utilized because any water available to the UCRA for sale will either be from a common water source (O.C. Fisher Reservoir) or from other water sources available to the City through agreement with the UCRA. The City of San Angelo Drought Contingency Plan recognizes only two stages of drought criteria.

Level I Water Shortage Conditions -Triggers

Requirements for initiation By The Upper Colorado River Authority will recognize that a level I water shortage condition exists when the total amount of water available to the City of San Angelo, as determined by the Utilities Director, from it's developed water sources is less that a 24 month supply.

Requirements for termination - Level 1 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of 30 consecutive days. The Upper Colorado River Authority will notify its wholesale customers and the media of the termination of Level I in the same manner as the notification of initiation of Level I of the Plan.

Level II Water Shortage Conditions - Triggers

Requirements for initiation B The Upper Colorado River Authority will recognize that a Level II water shortage condition exists when the water available to the City of San Angelo as determined by the Utilities Director is less than a 12 months supply from developed water sources.

Requirements for termination - Level II of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of 30 consecutive days. Upon termination of Level II, Level I becomes operative. The Upper Colorado River Authority will notify its wholesale customers and the media of the termination of Level II in the same manner as the notification of initiation of Level I of the Plan.

Level III Water Demand Emergencies

In the event that the City of San Angelo Utilities Manager determines that

a water demand emergency exists within the water distribution system for the City of San Angelo and the City Council enacts a resolution to begin emergency measures, the UCRA Board Chairman, if deemed appropriate and necessary to the public benefit, shall impose similar emergency measures to existing UCRA customers.

Requirements for termination – Emergency conditions will be deemed to have terminated following a recommendation by the Water Utilities Manager to the City Council to lift the condition.

Section VIII: Drought Response Stages

The Board Chairman, or his/her designee, shall monitor water supply and/or demand conditions and, in accordance with the triggering criteria set forth in Section VI, shall determine that Level I or II water shortage conditions exist or that an emergency condition exists and shall implement the following actions:

Level I Water Shortage Conditions:

Target: Achieve a voluntary 20 percent reduction in total water use.

Best Management Practices for Supply Management:
Water use restrictions and other means utilized by customer entities of the UCRA shall at a minimum utilize curtailment criteria contained in the most current San Angelo Drought Contingency Plan. In addition the UCRA shall:

- Inform customers of the drought watch condition and request them to inform their customers , if any.
- Notify customers of actions being taken and urge activation of appropriate water conservation measures.
- Meet with customers to discuss the current drought and possible measures to be taken if the drought continues.
- Increase public education on ways to reduce water consumption.
- Investigate alternative ways to supply needs that could be implemented if the drought continues.
- In cooperation with customers, initiate the preparation of a specific drought response plan tailored to existing conditions.
- Implement provisions of the specific drought response plan.
- Contact other agencies to inform them of the action and request appropriate actions. Other agencies would include the TCEQ, USGS and the U.S. Army Corp of Engineers.
- Any other actions deemed appropriate to the existing condition.

Level II Water Shortage Conditions:

Target: Achieve a 30 percent reduction in total water use (an additional 10% decrease from Level I.

Best Management Practices for Supply Management:

Water use restrictions and other means utilized by customer entities of the UCRA shall at a minimum utilize curtailment criteria contained in the most current San Angelo Drought Contingency Plan. In addition, the UCRA shall:

- Continue or initiate any actions available under level I.
- Inform customers of the drought warning condition and request that they inform their customers.
- Notify customers of actions taken and urge activation of appropriate water conservation measures.
- Meet with customers to discuss current drought and possible measures to be taken.
- Require customers to initiate drought management measures.
- Initiate engineering or other studies to evaluate alternative actions if conditions worsen.
- Further accelerate public education efforts in ways to reduce water consumption.
- In cooperation with customers, update the specific drought response plan tailored to existing conditions.
- Implement appropriate provisions of the specific drought response plan.

Level III - Water Demand Emergencies

In the event that the City of San Angelo Utilities Manager determines that a water demand emergency exists within the water distribution system for the City of San Angelo and the City Council enacts a resolution to begin emergency measures, the UCRA Board Chairman, if deemed appropriate and necessary to the public benefit, shall impose similar emergency measures to existing UCRA customers. In addition the UCRA shall:

- Continue or initiate any actions available under level I&II.
- Inform customers of the emergency condition and request them to inform their customers.
- Notify customers of actions taken and urge activation of appropriate water conservation measures.
- Meet with customers to discuss current drought and measures to be taken.
- Implement appropriate provisions of the specific drought response plan.
- Implement viable alternative water supply strategies if available. (This may require approval by the TCEQ)

- **Requires Notification to Executive Director of TCEQ –** Institute a mandated reduction in deliveries to all customers. Such a reduction will be pursuant to Texas Water Code 11.039.

Section IX: Pro Rata Water Allocation

In the event that the triggering criteria specified in Section VII of the Plan for level II Water Shortage Conditions have been met, the Board Chairman is hereby authorized initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code Section 11.039.

Section X: Enforcement

The UCRA Board Chairman shall utilize all existing options including entity water supply agreements and existing statute to insure compliance with provisions of this plan.

Section XI: Variances

The Board Chairman, or his/her designee, may, in writing, grant a temporary variance to the pro rata water allocation policies provided by this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the public health, welfare, or safety and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.

(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Plan shall file a petition for variance with the Board Chairman within 5 days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the UCRA Board of Directors, and shall include the following:

(a) Name and address of the petitioner(s).

(b) Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.

(c) Description of the relief requested.

(d) Period of time for which the variance is sought.

(e) Alternative measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.

(f) Other pertinent information.

Variances granted by the Upper Colorado River Authority shall be subject to the following conditions, unless waived or modified by the Board of Directors or its designee:

(a) Variances granted shall include a timetable for compliance.

(b) Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

Section XII: Severability

It is hereby declared to be the intention of the Upper Colorado River Authority that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the Upper Colorado River Authority Board of Directors without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

1.0 Resolution

2.0 Authority

The Upper Colorado River Authority (UCRA) is a Conservation and Reclamation District created by an act of the 44th Legislature of the State of Texas in 1935. As such, the UCRA is a governmental agency having the authority to control, store, preserve and distribute waters of the Upper Colorado River and it's tributaries for useful purpose. The UCRA's boundaries include Coke, Tom Green and contiguous counties.

3.0 Introduction and Summary

The UCRA currently and has implemented and or participated in numerous water related programs such as the Texas Clean Rivers Program, several CWA section 319 Non-Point Source grant programs, the Texas Brush Control Program and several TWDB funded water programs. The UCRA has also completed or is currently involved in numerous water research projects. In addition, the UCRA has funded numerous water related infrastructure improvement projects within it's jurisdictional boundaries. This has included financing projects for the City of San Angelo, the City of Robert Lee, the City of Bronte and numerous area Water Control and Improvement Districts (WCID's).

The UCRA currently is the owner of record for water rights on two area reservoirs, O.C. Fisher Reservoir located in Tom Green County and Mountain Creek Reservoir located in Coke County. The Mountain Creek water right is totally committed by contract to the City of Robert Lee and the bulk of the water right on O.C. Fisher is committed by contract to the City of San Angelo. On O.C. Fisher Reservoir, a recent re-negotiation of the 50 year old contract resulted in the UCRA retaining a maximum of 1500 acre feet per year of the existing O.C. Fisher water right. This was accomplished in order that the UCRA might be better able to assist area small municipalities in meeting future water supply needs. Following the re-negotiation, the UCRA entered into water supply agreements with the City of Miles and the City of Paint Rock. Therefore, the UCRA is actively involved with four municipalities through contract or agreement in supplying water, but currently is not providing water to anyone on a wholesale basis. In the case of Paint Rock, water will be supplied beginning in the fall of 2009 on a cost per acre foot basis, following approval of the TCEQ of a water right amendment allowing the use of bed and bank of the Concho River below San Angelo to deliver water downstream. Water is supplied to the City of Miles through delivery via pipeline of treated water from the City of San Angelo public water system. In section 6.0 of this document is included a summary of the status of each municipal user, a copy of the water supply agreement and a copy of that municipality's Water Conservation and Drought Contingency Plan.

4.0 Purpose

The purpose of this document is to encourage, promote and provide for the conservation of the water resources that are available to the people living within the jurisdictional boundaries of the Upper Colorado River Authority. In addition, the Board of Directors of the UCRA wish to encourage and assist all water supply purveyors within the boundaries of the Authority to plan and respond to all water supply emergencies including extended drought periods.

5.0 Water Conservation and Drought Contingency Initiatives of the UCRA

Since 1992 the UCRA has been involved in numerous programs and projects that promote water conservation efforts and drought contingency planning. It is the intention of the Board to continue and expand these efforts. A description of some of the on-going UCRA initiatives is as follows.

5.1 **Public Education –** During the last 15 years, a sizable portion of the agency's annual projects budgets has been expended in public education tasks. This work has included public meetings, press releases, media interviews, preparation of documents for public release, seminars, financial support of other entity efforts, presentations to area governmental bodies, use of UCRA web site, teacher workshops and presentations to area public and private schools. Presently, the UCRA public education staff is cooperating with the City of San Angelo water conservation staff in developing and implementing new water conservation initiatives. It is the policy of the UCRA Board of Directors that this overall public education effort will continue utilizing existing and ongoing initiatives and hopefully new initiatives that are developed. The UCRA has also developed a comprehensive water resource and environmental education center (Concho River Basin Aquatic Research and Education Center) and various programs to further enhance the public education effort.

5.2 **Inter-Agency Cooperation and Assistance –** The UCRA has historically provided low interest loans to area water supply entities for the purpose of enhancing existing infrastructure and developing new water resources and facilities. This policy will continue. In addition, the UCRA is currently involved in assisting entities in securing funding through various grant programs. One example is the recently completed groundwater study conducted by the UCRA and the City of San Angelo utilizing water research funding through the Texas Water Development Board (TWDB). This study provided feasibility planning and guidance on evaluating potential brackish water sources The UCRA staff also serves on several water supply advisory groups for area municipalities. Being a regional water resource governmental entity, the UCRA occupies a unique position that is conducive to developing and encouraging inter-agency cooperation and assistance.

The Board intends to utilize this position to the maximum extent in conserving and preserving the water resources of the region.

5.3 **Water Supply Enhancement Initiatives -** As a primary water conservation tool, it is the policy of the Board of Directors of the UCRA to promote and facilitate the removal of phraetophytes (Honey Mesquite. Juniper, Salt Cedar and other brush species) from the watersheds of the streams and reservoirs within the boundaries of the UCRA. The UCRA conducted the initial and following feasibility studies that resulted in the initiation of cost share removal of water robbing brush from the area's watersheds. The initial project was begun on the North Concho River watershed and has since expanded to other area reservoir watersheds. Recently, in cooperation with the United States Army Corp of Engineers, The City of San Angelo, Texas Parks and Wildlidfe Department and the Texas Soil and Water Conservation Board, brush was begun to be treated within the lake basin and surrounding lands at O.C. Fisher Reservoir. This work should conserve considerable quantities of water. A similar project is currently being planned for the lake basin at the Twin Buttes Reservoir in cooperation with the United States Bureau of Reclamation.

5.4 **New and Innovative Technologies and Water Resource Research -** The UCRA is currently involved in long term monitoring and research projects designed to measure both surface and groundwater responses to the brush control program. In addition several research projects to accurately measure evapo-transpiration processes and interception losses in both brush and non-brush environments are being completed. Results of these studies are currently being published in scientific journals. These and other research programs will continue as funding permits.. In addition the UC RA is developing a complete GIS data base for the region that will integrate surface water flows, groundwater levels, water quality data, reservoir levels, geology, soil types, land use and other pertinent information. It is the policy of the UCRA Board of Directors to utilize all available technologies and methods to improve the monitoring, management and utilization of the water resources in the region.

6.0 UCRA Water Supply Agreements

As stated previously in this document, the UCRA has instituted formal water supply relationships with four municipalities in the region. These are – the City of San Angelo, the City of Miles, the City of Robert Lee and the City of Paint Rock. In the sections that follow, each of these relationships will be discussed. This discussion includes a current status, water use projections, copy of the agreement with the UCRA and a copy of each entity's Water Conservation and Drought Contingency Plan.

6.1 The City of San Angelo – In the late 1940's the City of San Angelo utilized the UCRA as a contracting entity with the U.S. Corp of Engineers (COE) to facilitate the construction of O.C. Fisher Reservoir. As a result, the UCRA became the water right holder of record for the reservoir. This right was totally contracted to the City of San Angelo for 50 years and the City paid all costs of the reservoir. At the end of the 50 year contract period, the contract was re-negotiated and the UCRA retained a small portion of the water right (1500 acre feet per year maximum). The remainder was contracted totally to the City of San Angelo. There has never been any wholesale cost per volume of water used imposed on the City of San Angelo by the UCRA. The UCRA has and continues to be a "pass through" agency for the O&M costs imposed by the COE.

Historically, the reservoir has not provided the city with the anticipated availability of water for supply purposes. Filling only once since construction, the reservoir has generally maintained water levels below the conservation elevations. The City of San Angelo currently has water rights or contracts for supply from four additional sources – Lake Nasworthy, Twin Buttes Reservoir, E.V. Spence Reservoir and O.H. Ivie Reservoir. In the past five years, O.H. Ivie has been the primary water source. The City is contracted with the Colorado River Municipal Water District (CRMWD) for 15,000 acre feet per year from this source. This use of this water source has generally met the water needs for the City for the last three years. Water demand has historically been considerably higher, but water restrictions (due to the prolonged drought and low local reservoir levels) and conservation efforts has reduced water consumption to below projected levels. The table below has been taken from the Region F Water Plan and displays both population and water consumption projections.

	1996	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Population	**89,567**	**99,750**	**113,112**	**126,204**	**134,138**	**146,028**	**158,972**
Use (ac.ft.)	**19,252**	**24,693**	**26,607**	**28,273**	**29,450**	**31,733**	**34,368**

The water rights agreement between the City of San Angelo and the UCRA and the City's Water Conservation and Drought Contingency Plan follows this document section.

6.2 **The City of Miles –** In August, 2001 the UCRA entered into an agreement with the City of Miles to provide up to 200 acre feet of water annually for municipal purposes. This agreement was amended in 2003. The City of Miles owns a water line that extend from near the San Angelo northern city limits to Miles. The UCRA in it's agreement with the City of San Angelo has a right to take water from other sources available to the City (to be charged against the UCRA 1500 acre foot allocation from O.C. Fisher) with the consent of the City of San Angelo. Through this arrangement, the City of Miles takes treated water from a point in northern San Angelo and purchases the water from the UCRA and reimburses the City of San Angelo for the treatment costs. During 2008, the City of Miles utilized 31.709 million gallons (approximately 97.327 acre feet) from this source, which comprised the bulk of the water consumed by the city. The table below has been taken from the Region F Water Plan and displays both population and water consumption projections.

	1996	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Population	**909**	**898**	**916**	**915**	**897**	**860**	**835**
Use (ac.ft.)	**98**	**129**	**124**	**117**	**111**	**103**	**99**

The water use agreement between the City of Miles and the UCRA and the City's Water Conservation and Drought Contingency Plan follows this document section.

6.3 **City of Robert Lee –** In the early 1950's the UCRA entered into an agreement with the City of Robert Lee to construct a dam and reservoir in Coke County (Mountain Creek Reservoir) to be used for municipal water supply purposes by the City. The City of Robert Lee though time reimbursed the UCRA for the construction and assumed the responsibility for the day to day maintenance of the facility. In addition, the City paid a modest monthly fee for water use that was to be utilized for administrative cost of the agency in operation of the reservoir. While provisions of the original agreement still basically prevail, the UCRA and the City of Robert Lee have entered into negotiations that will update and renew the old agreement. It is anticipated that the new agreement between the parties will be executed at an early date. Water use from Mountain Creek Reservoir has been totally allocated through contract to the City of Robert Lee and currently no charge is being assessed by the UCRA for water use either potential or actual.

Currently, the City obtains it's potable water from E.V. Spence Reservoir through contract with the Colorado River Municipal Water District. Water use from Mountain Creek Reservoir has been designated as for emergency supply and is not normally utilized. The table below has been taken from the Region F Water Plan and displays both population and water consumption projections.

	1996	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Population	**1295**	**1305**	**1337**	**1353**	**1362**	**1366**	**1368**
Use (ac.ft.)	**193**	**399**	**391**	**377**	**371**	**369**	**368**

The water use agreement between the City of Robert Lee and the UCRA and the City's Water Conservation and Drought Contingency Plan follows this document section.

6.4 The City of Paint Rock - The City of Paint Rock is a small municipality located in Concho County and is the County Seat . The population is approximately 320 persons. The City geographically sits at the intersection of U.S. Highway 83 and State Highway 380 and is adjacent to and South of the Concho River. The City primarily depends upon surface water from the Concho River (Stream Segment 1421) for its domestic water supply. The City owns and operates a surface water treatment plant including a raw water intake and pump and a 70 acre feet reservoir created by an on channel dam located almost immediately below the U.S. Highway 83 bridge.

Historically, the City possessed two water rights permits for diversions from the Concho River obtained in the early 1900's. Each of the permits allowed the diversion of 35 acre feet of water annually for domestic purposes. Through administrative error, one of the 35 acre feet permits was lost several years ago. Since that time, the City obtained a temporary 35 acre feet permit and upon it's expiration, negotiated with an upstream water rights holder for the transfer and lease of a 35 acre feet per year portion of that water right to it's diversion point (Becker, permit number 3345A, September 2001). The City has not been totally satisfied with it's agreement with the upstream water rights holder, and, in late 2004, requested that the Upper Colorado River Authority (UCRA) consider the sale of water from O.C. Fisher Reservoir to the City of Paint Rock. In January, 2005 a tentative agreement was reached between the City and the Upper Colorado River Authority for the sale of fifty (50) acre feet of water annually to the City. In May and June, 2005 the River Authority and the City executed a formal sales agreement. This sales agreement follows in this document. This sale was contingent upon approval by the Texas Commission on Environmental Quality of an amendment to the UCRA water rights permit to utilize the bed and bank of the Concho River to transport the water from Bell Street Reservoir in San Angelo to the City of Paint Rock diversion point. This permit amendment was subsequently granted.

As stated previously in this document, the primary water supply for the City of Paint Rock is treated surface water re-lifted from the Concho River. An auxiliary water supply exist through connection with the Millersview-Doole Water Supply Corporation at the water treatment plant and is utilized only in emergency situations, such as equipment malfunction or extended maintenance of the existing facilities. Water from this source purchased by the City of Paint Rock places a severe financial burden on the City during the period of use since the City is treated by the Water Supply Corporation as any other individual customer. Since the

City of Paint Rock is a water supply purveyor with all of the associated costs of operation, this level of wholesale cost of water is not financially tenable by the City for any extended period of time.

Water consumption records (TWDB) tabulated for the period from 1971 through the present indicates uses of surface waters from the Concho River and purchased groundwater from Millersview-Doole WSC. A review of the records indicates that on several occasions since 1990, the City of Paint Rock has approached or exceeded an annual water consumption of 70 acre feet (22.8 MG). Examination of this data will also show a strong upward trend by the City in total surface water use, with a current requirement near 70 acre feet per year. There is no population or water use projections for the City of Paint Rock in the Region F Water Plan. The UCRA is planning to begin releases to the City of Paint Rock in October, 2009.