Control Number: 43605

Item Number: 1

Addendum StartPage: 0

House Bill (HB) 1600 and Senate Bill (SB) 567 83rd Legislature, Regular Session, transferred the functions relating to the economic regulation of water and sewer utilities from the TCEQ to the PUC effective September 1, 2014

43605

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

RECEIVED

2014 OCT 21 PM 3:33

PUBLIC UTILITY COMMISSION
FILING CLERK

SOAH DOCKET NO. 582-99-0965
TNRCC DOCKET NO. 1999-0513-UCR
APPLICATION NO. 32464-D

IN THE MATTER OF THE PETITION OF BOLIVAR WATER SUPPLY CORPORATION FOR A CEASE AND DESIST ORDER AGAINST BRIAN FRAZIER IN COOKE COUNTY,TEXAS	§ § § § §	BEFORE THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

ORDER

The request for dismissal of the petition by Bolivar Water Supply Corporation ("Bolivar") for a Cease and Desist Order against Brian Frazier in Cooke County, Texas was presented to the Executive Director of the Texas Natural Resource Conservation Commission ("Commission") pursuant to Section 5.122 of the Texas Water Code ("Code").

Bolivar provides water service in Cooke County, Texas, and is a retail public utility as defined in Section 13.002(19) of the Code. On January 27, 1999, Bolivar filed a petition with the Commission pursuant to Section 13.252 of the Code requesting an order preventing Brian Frazier from providing drinking water service within Bolivar's certificated area.

Lilo D. Pomerleau, an administrative law judge of the State Office of Administrative Hearings ("SOAH"), conducted a preliminary hearing on June 17, 1999, took jurisdiction of the matter, assigned a procedural schedule, and designated the following parties: Bolivar represented by

Texas Natural Resource Conservation Commission

INTEROFFICE MEMORANDUM

To: Tammy Davis
Office of the Chief Clerk

Date: October 26, 2001

From: Barbara R. Moser
Water Information and Assistance Section
Water Supply Division

Subject: Item for the Executive Director's Signature

Bolivar Water Supply Corporation - Application No. 32464-D CCN #12977

The item listed above is for the Executive Director's Signature. Please present this to Tammy Davis.

Date Stamp This Page Only

DH/tr/brm

Mark H. Zeppa; the Executive Director of the Commission represented by Lara Nehman; the Public Interest Counsel of the Commission, Blas Coy, Jr.; and Brian Frazier represented by Basil Hoyl.

On January 13, 2000, a tentative settlement was reached between the parties calling for Bolivar to release a portion of its certified service area to Brian Frazier upon the payment of specified funds and governmental approval by the Texas Natural Resource Conservation Commission ("TNRCC") and the United States Department of Agriculture ("USDA").

Bolivar filed status reports with the court on November 3, 2000 and December 6, 2000 indicating that the necessary applications had been filed and that the parties were waiting for responses from the TNRCC and the USDA.

On March 7, 2001, Leslie Craven, also an administrative law judge with SOAH, issued an order notifying the parties that absent good cause, the matter would be remanded back to the Executive Director of the Commission ("ED") since it appeared the parties' settlement was moving forward to conclusion, and there remained no dispute requiring a contested hearing. The Judge did not receive any objections or requests for alternative action.

Therefore, on March 19, 2001, Judge Craven dismissed the case from the SOAH contested docket and remanded the matter to the ED for further processing. Bolivar formally filed a notice of withdrawal of its petition on August 28, 2001.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION that:

The petition by Bolivar Water Supply Corporation for a Cease and Desist Order is dismissed without prejudice.

The Chief Clerk of the Texas Natural Resource Conservation Commission shall forward a copy of this Order to the parties.

If any provision, sentence, clause, or phrase of this Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remaining portions of the Order.

Issue Date:

TEXAS NATURAL RESOURCE
CONSERVATION COMMISSION

____

For the Commission

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

Mr. Mark Zeppa, P.C.
Law Offices of Mark Zeppa, P.C.
4833 Spicewood Springs Road, Suite 202
Austin, Texas 78759

Re: Bolivar Water Supply Corporation
Application No. 32464-D
Order Dismissing Cease and Desist Petition

Dear Mr. Zeppa:

Enclosed is a certified copy of an order by the Commission dismissing the Cease and Desist Petition against Brian Frazier.

Should you have any questions, please contact Ms. Teresa Rogers in Utilities and Districts Section, (MC 153), at (512) 239-1734.

Sincerely,

Joseph L Ster, PE

for Doug Holcomb, P. E.
Utilities and Districts Section
Water Supply Division

DH/tr/brm

Mailing List for Docket No. 1999-0513-UCR
(Application No. 32464-D)

Mr. Mark Zeppa, P.C.
Law Offices of Mark Zeppa, P.C.
4833 Spicewood Springs Road, Suite 202
Austin, Texas 78759

Bolivar Water Supply Corporation
P.O. Box 1006
Sanger, Texas 76266

Mr. Brian Frazier
4001 Airport Freeway, Suite 190
Bedford, Texas 76021

Mr. Chase Baromeo, Jr. P.E.
Travis Associates Consulting Engineers, Inc.
1390 Hillside Terrace
Buda, Texas 78610

OVERSIZED

To View OVERSIZED Document(s) Or

For any questions;

you can call CENTRAL RECORDS

main Line

(512) 936.7180

Regional Water System for Portions of Comal, Kendall, and Bexar Counties

Basis of Design Report

Executive Summary

Prepared for

GBRA

GUADALUPE-BLANCO RIVER AUTHORITY

for HDR Engineering, Inc.	**for Malcolm Pirnie, Inc.**
STATE OF TEXAS DAVID C. WHEELOCK 54303 REGISTERED PROFESSIONAL ENGINEER	STATE OF TEXAS ROBERT J. WARREN 53791 REGISTERED PROFESSIONAL ENGINEER
5/31/00	6/1/00
David C. Wheelock, P.E.	**Robert J. (Jud) Warren, P.E.**

June 2000

Table of Contents

List of Figures

List of Tables

Regional Water Supply Project for Portions of Comal, Kendall, and Bexar Counties

Basis of Design Report
Executive Summary

ES-1 Project Concept and Overview

For a number of years, the Guadalupe-Blanco River Authority (GBRA) has actively pursued the implementation of a water supply system to meet the increasing water needs of an area dependent on limited groundwater sources. Historically, the rapidly growing areas in western Comal and southeastern Kendall Counties have relied on the Trinity Aquifer. This aquifer is not adequate to meet projected demands and GBRA has committed a portion of the firm yield of Canyon Lake to supply this part of its service area. Early project configurations resulted in uneconomic project costs due to the distances between Canyon Lake and the relatively small current water demands in western Comal and southeastern Kendall Counties. Realizing this, the GBRA has sought to make the project affordable and to best serve its constituency by two methods:

1. Increasing the project size to reach economies of scale; and
2. Locating customers with large base water demands in order to fully utilize project facilities in the near-term, while reserving capacity to ultimately meet needs of growing areas.

Project Concept

The basic concept of this project is to fully utilize project facilities throughout the year and thereby reduce the cost of produced water to the lowest possible unit cost. Water not needed by In-District participants (i.e., customers in Comal and Kendall Counties), either on an annual or day-by-day basis, will be purchased by either the San Antonio Water System (SAWS) or Bexar Metropolitan Water District (BMWD). With the Bexar County participants (i.e., Out-of-District customers) purchasing any unused water, the project will be able to sell all water that can be produced throughout the year. To do this, the project concept is as follows:

- Participants will contract for an annual delivery of water. The project will deliver that water at a uniform rate throughout the year in order to maximize use of all project facilities. In order for the participants to utilize water from the project throughout the year, they must continue to use their present water supply system to meet peak daily water needs and meet peak hour demands from their own storage facilities.

- The Base Project capacity will be 10,500 acft/yr. A Phased Project Option is possible to deliver additional quantities of water, up to 16,000 acft/yr.
- The system will be sized to deliver water not needed in the short-term by In-District participants to Bexar County entities. As In-District water needs increase, the amount delivered to Bexar County will decrease, but will not be reduced below 4,000 acft/yr total through the year 2037.

All water sold directly from the initial project facilities will be on a uniform system rate schedule for each cost component.

Purpose of This Report

In December 1999, the GBRA retained Malcolm Pirnie, Inc. and HDR Engineering, Inc. to proceed with development of design concepts for each project element, as well as to initiate permitting activities with State and Federal agencies. Engineering design services for the project are divided into two contracts. Malcolm Pirnie, Inc. was awarded Contract A for design of the raw water intake and pump station, treatment plant, and treated water pump station. HDR Engineering, Inc. was awarded Contract B for permitting, pipeline route selection for the raw water and treated water pipelines, and hydraulic design of the treated water pump station, treated water pipeline, and customer delivery facilities.

The purpose of these two engineering contracts and this *Basis of Design Report* is to define each of the project facilities in sufficient detail to enable potential customers to make decisions and to enable the final design process and permitting to proceed expeditiously. Requirements for final design of the treated water pump station, hydraulic requirements of the pipeline, and customer delivery facilities have been defined and this information is used in development of updated project cost estimates. This Design Report also presents a recommended pipeline route and identifies permitting issues as currently understood.

ES-2 Project Capacity and Phasing Option

Delivery Quantities – Base Project

Table ES-1 lists the potential project participants. These entities have expressed interest in purchasing water from the project and can potentially meet the connection criteria to be established for project participation. Table ES-1 also lists the total water commitment annual delivery quantity requested by each entity.

Table ES-1.
Potential Project Participants and Water Delivery Requests

Potential Project Participant	Requested Total Water Commitment (acft)
City of Boerne	1,861
City of Fair Oaks	1,400
San Antonio Water System[1]	1,812.5
Bexar Metropolitan Water District[1]	2,137.5
San Antonio River Authority[1]	50
Comal Independent School District	150
Other Potential In-District Entities (Apex Water Co., Bulverde Hills, Murcia Development Co, Clyde Johnson, Double J Ranch, Cordillera Development, Tapitio Springs Development, and others)	3,116
Total	**10,527**

[1] The GBRA Board of Directors has authorized up to 4,000 acft/yr of Canyon Lake water be available to Bexar County entities. In the original allocation, SARA requested 375 acft/yr for water supply entities in north central Bexar County; SAWS and BMWD split the remaining water evenly, each receiving 1,812.5 acft/yr. Since then, BMWD has purchased some of the entities represented by SARA and 325 acft/yr of those requests are now assigned to BMWD, resulting in an allocation 2,137.5 acft/yr to BMWD, 50 acft/yr to SARA, and SAWS allocation remains at 1,812.5 acft/yr.

For the Base Project configuration, total annual water delivery will be 10,527 acft/yr. The design delivery capacity will be 10 MGD, which allows for scheduled and unscheduled outages while still delivering annual water commitments.

Delivery Quantities – Initial Year

Water not used by In-District customers in the early years of project operation will be delivered to Bexar County entities. Therefore, the design condition governing for most of the system, and particularly for the Bexar County entities, is to be able to meet the Initial Year Conditions. Table ES-2 summarizes the estimated annual deliveries to each entity and the corresponding daily flow rate for initial year conditions. As shown in the right hand column of Table ES-2, the sum of the initial year delivery rates is 9.9 MGD. For reference purposes through this report, the delivery capacity is rounded to 10 MGD; however, hydraulic calculations were made using 9.9 MGD. Figure ES-1 is a graph of expected water deliveries to the larger project participants.

Table ES-2.
Requested Initial Year Water Demand and Delivery Rates

Potential Project Participant	Requested Initial Year Delivery Quantity (acft)	Initial Year Delivery Rate[1] (MGD)
City of Boerne	500	0.47
City of Fair Oaks	800	0.75
Bexar Metropolitan Water District[2]	3,215	3.02
San Antonio River Authority	50	0.05
Comal Independent School District	150	0.14
Other In-District Entities	1,157	1.09
Subtotal	5,872	5.52
San Antonio Water System[3]	4,655	4.38
Total	10,527	9.90

[1] Delivery rate is based on meeting annual delivery quantity in 347 days (95% of the year).
[2] After consideration of hydraulic constraints and water needs in their service area, BMWD has requested that their water delivery be no more than 3,215 acft/yr.
[3] SAWS delivery quantity is the balance left after other project participant's initial year needs have been met.

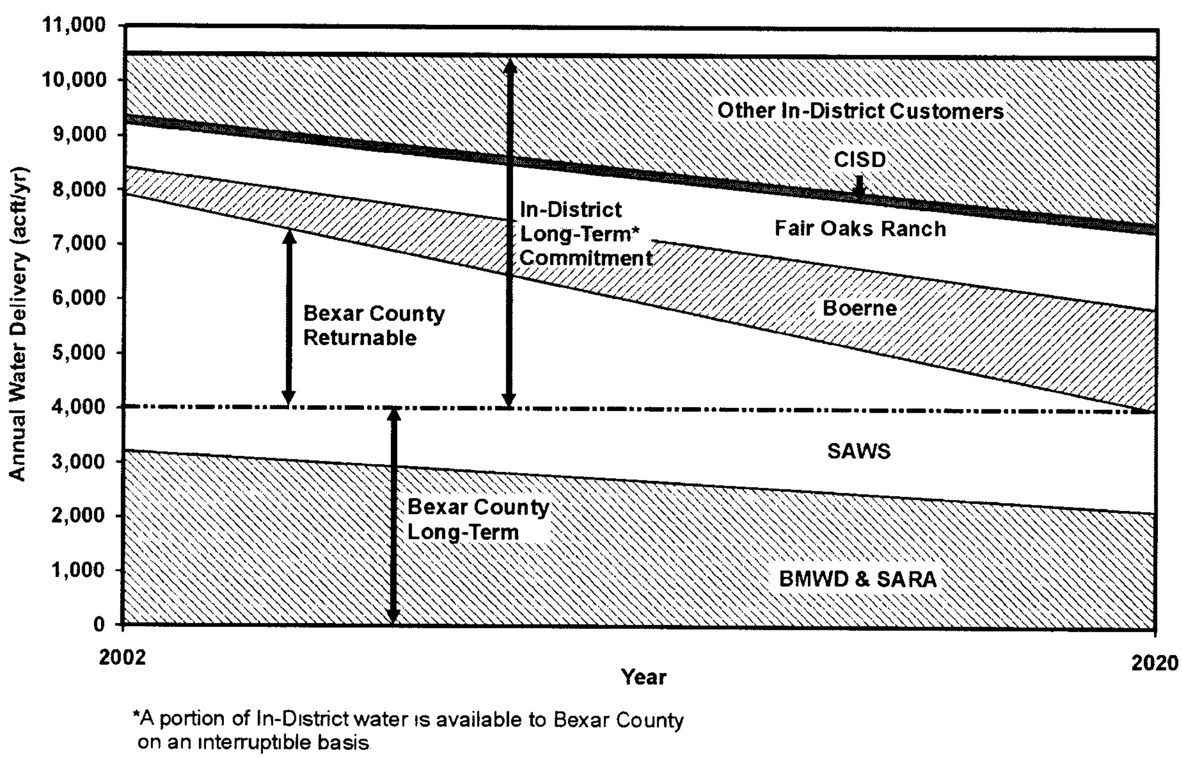


Figure ES-1. Expected Water Delivery – Base Project

Phased Project

In future years, the need may arise to be able to deliver water in excess of the Base Project capacities to meet area needs. To meet possible future demands and to give the operational flexibility to the GBRA, a phased project expansion has been developed. Considering allowances for outages, the delivery capability for the phased option is about 16,000 acft/yr. Table ES-3 lists the potential project participants and delivery rates with total annual production of 16,800 acft/yr for the phased option. The sum of delivery rates to all customers is 15.0 MGD for the Phased Projections shown in Table ES-3.

Table ES-3.
Possible Ultimate Year Water Delivery with Phased Project
(16,000 acft/yr Total Delivery Capacity)

Potential Project Participant	*Requested Ultimate Year Delivery Quantity (acft)*	*Ultimate Year Delivery Rate[1] (MGD)*
City of Boerne	1,861	1.74
City of Fair Oaks	1,400	1.31
San Antonio Water System	1,813	1.70
Bexar Metropolitan Water District	2,138	2.00
San Antonio River Authority	50	0.05
Comal Independent School District	150	0.14
Subtotal	7,412	6.94
Other In-District Entities[2]	8,588	8.06
Total	16,000	15.00

[1] Delivery rate is based on meeting annual delivery quantity in 347 days (95% of the year).
[2] Other In-District deliveries have been increased above Base Project to account for the available additional phased project capacity.

ES-3 Water Source

Raw Water Intake

The raw water intake must satisfy a number of important criteria, including cost, function, reliability, maintainability, aesthetics, safety, and acceptability. In order to draft high quality aerated water, the intake must be able to draw from near the top of the reservoir regardless of the current reservoir level. However, deep water at the intake is required to ensure a reliable water supply, as Canyon Lake may decline as much as 100-feet during a repeat of the drought of record when the lake is fully utilized for water supply. Suitable deepwater locations are limited to those shoreline areas close to the original river channel. The deepwater location in closest proximity to the project is in the area of Comal Park on the south shore of Canyon Lake. Other deepwater locations are available, but would require substantially longer pipelines to convey raw water to the treatment plant. Canyon Lake and surrounding property are owned by the Federal Government and is controlled by the U.S. Army Corps of Engineers. An easement from the Corps of Engineers will be needed and the Corps may require that alternate intake locations be studied.

Four intake alternatives were investigated, including three alternatives for a lake intake and one for a downstream intake. The lake alternatives included a floating intake, a fixed tower intake, and an on-shore shaft intake. A floating intake would be a small, enclosed structure anchored in deep water on the lake. The enclosure would house electric motors and pumps. Access to the pump station would be by boat. The pumps would discharge to flexible connections piped to shore and to the raw water pipeline. A fixed tower intake would be a large concrete structure located in deep water several hundred feet offshore. Access to the intake would be by a concrete bridge. The structure would be elevated above the flood pool of Canyon Lake, approximately 30 feet above the normal lake elevation. An onshore shaft intake would be a deep circular pit constructed into the rock on-shore and would have horizontal shafts constructed out to the lake to allow water into the pit. Vertical turbine pumps would be suspended into the pit. The downstream intake would be located at downstream of Canyon Lake on the Guadalupe River and consist of a concrete structure on the riverbank with steel pipe and intake screens extending into the river.

Conceptual plans and cost estimates for each alternative were developed. A floating intake is recommended and would consist of three vertical turbine pumps with space for a fourth pump. High strength industrial hoses as used in the mining industry would be used to transport the water from the intake to shore. The dimensions, float method, and aesthetic treatment of the intake are being more fully developed for presentation to GBRA and to the Corps of Engineers.

Raw Water Pipeline

Raw water will be conveyed through a 4.9-mile, 30-inch diameter pipeline to a storage reservoir on Startz Hill. The reservoir would be a closed-top steel reservoir that would serve two purposes. First, it will buffer the pumping rate from the raw water pumps, which will vary depending on the lake level. Second, it will provide a head tank for gravity flow to the water treatment plant, thereby providing a fairly uniform head and flowrate to the plant.

The pipeline will be constructed in easements to be obtained through the subdivision near Canyon Lake and then in a new easement along FM 3159. Where easements cannot be obtained through developed areas, the pipeline may be located in county right-of-way.

ES-4 Water Treatment Plant

Regulatory Strategy

Current and pending drinking water regulations were reviewed to develop a regulatory strategy for GBRA for the new 10 MGD water treatment plant and transmission main and the existing distribution systems. In addition to the regulatory overview, an assessment of the potential impacts of current and pending regulations on the treatment of Canyon Lake water and its distribution to consumers when blended with other waters in the participants' distribution systems was performed.

Applicable rules and regulations for GBRA include:

Current and Effective

- Total Coliform Rule
- Lead and Copper Rule
- Surface Water Treatment Rule (SWTR)
- TNRCC, Texas Annotated Codes Chapter 290
- USEPA Primary and Secondary Drinking Water Standards

Promulgated

- Stage 1 Disinfectant/Disinfection By-Products (D/DBP) Rule
- Interim Enhanced Surface Water Treatment Rule (IESWTR)

Future Rules

- Stage 2 D/DBP Rule
- Long Term 2 ESWTR
- Filter Backwash Recycle Rule (FBRR) (as part of the Long Term Rules)
- Groundwater Disinfection Rule (GWDR)

The regulatory strategy therefore consists of meeting the current and promulgated drinking water regulations such as Stage 1 D/DBP and IESWTR as well as future requirements such as Stage 2 D/DBP. The water treatment plant design should include strategies to meet the foreseeable future requirements such as LT2ESWTR.

Water Quality

The purpose of the water quality evaluation was threefold:

1. To understand the raw water conditions in order to appropriately select an efficient and effective treatment technology for the new water treatment plant (WTP);
2. To determine finished water quality goals that address GBRA and their customers' goals and applicable regulations; and
3. To confirm that the delivered water will be compatible with existing customer supplies and distribution system.

To meet these objectives raw and finished water characterizations were completed, applicable regulations were reviewed, probable blending scenarios were defined, and delivered water quality goals were developed.

Raw Water Quality

Table ES-4 describes the water quality parameters that most influence treatment technology selection.

A thorough raw water characterization was formulated primarily from historical information. Additional water samples were collected in January and February 2000 at the proposed intake location. The results of the raw water characterization indicate the following:

- If free chlorine is desired for use as a secondary disinfectant, total organic carbon (TOC) must be removed to minimal levels to minimize disinfection by-product (DBP) formation.
- Raw water turbidity levels are acceptable for direct membrane filtration (without pretreatment) or conventional treatment.
- Ozone treatment may not be feasible for this treatment plant, due to possible elevated bromide levels.
- Taste and odor issues are not expected to be significant. However, due to the desire to reduce taste and odors to minimum levels, taste and odor control facilities should be included in the plant design.
- The lake water is considered hard at an average of 200 mg/L of total hardness. However, because the treatment goal for this water is compatibility with the customer's harder groundwater supplies, the raw water does not require softening.
- Silica levels are low and would not adversely affect membrane treatment.
- Arsenic levels are not problematic.

Table ES-4.
Raw Water Quality Parameters Most Influencing Technology Selection

Quality Parameter	Treatment Impact
Total Organic Carbon (TOC)	If removal is required, a coagulation, adsorption and/or oxidation process must be implemented. TOC levels affect the type of disinfection strategy applied, as TOC is a precurser to regulated and unregulated disinfection byproducts formed in chlorination.
Particles	Turbidity is a measure of particulate materials removed through coagulation and filtration. For membrane plants, high levels of turbidity requires pretreatment prior to filtration in order to optimize effective run times. In Texas, conventional plants are required to have pretreatment.
Bromide	High bromide levels complicate and increase the cost of ozonation during treatment. Ozonation of bromide creates bromate, which is a compound that will be regulated in impending rules.
Taste & Odor	Removal of T&O is accomplished through coagulation (for inorganic T&O substances) and/or the use of adsorbents or oxidants (for organic T&O substances).
Hardness	High levels of hardness in the raw water may require softening. Hardness may cause scaling in pipes, water heaters, and interfere with the activity of soaps.
Total Dissolved Solids (TDS)	TDS levels in raw water indicate the need to incorporate softening into the treatment process.
Silica	Significant levels of silica can preclude the use of membrane treatment.
Arsenic	Removal of arsenic requires a coagulation process or use of higher-pressure membranes.

Based on this preliminary analysis, Canyon Lake water is a high quality source that is amenable to conventional or direct membrane filtration treatment. To minimize DBP formation in the treated water transmission pipeline and customer's systems, it is necessary either to substantially reduce TOC in the raw water in order to support free chlorine as a secondary disinfectant, or to consider using a disinfectant which does not form DBPs, such as chloramines.

Finished Water Quality

Each of the finished waters involved in this project was characterized to determine the compatibility between existing water supplies and the anticipated treated water from Canyon Lake. Historical water quality information was obtained from select customers and summarized according to water source.

Based on a review of the available finished water information, the quality of the waters appears to be generally similar. As a result, compatibility issues due to precipitation or color are not anticipated. However, bench-scale blending studies will confirm this compatibility conclusion. Detailed water quality comparisons and blending analyses are described in the following section.

Blending Evaluations

The objective of the blending evaluations was to confirm the chemical compatibility conclusions established from the finished water quality evaluation. Anticipated blending scenarios, finished water quality comparisons were performed. Table ES-5 shows the parameters that most influence blending.

Table ES-5.
Finished Water Quality Parameters
Most Influencing Blending/Disinfection Approach

Quality Parameter	*Blending Impact*
pH	Lower pH blended water can cause corrosion of the pipe or pipe lining which may result in undesirable taste or color. Blended waters will likely exhibit higher pHs.
TDS	An increase in the TDS levels as a result of blending could lead to undesirable aesthetic changes in water. Blended water will likely result in lower TDS levels.
Temperature	Blending waters with different temperatures may instigate taste and odor problems, degrading the aesthetic quality of the water.
Hardness	Blended waters with significantly different levels of hardness may result in noticeable aesthetic changes at the tap. Hardness can affect the water's clarity, feel, ability to lather with soap, and inclination to form scale.
TOC	TOC levels in waters to be blended will affect the type of disinfection that may be applied. In free chlorine applications, TOC levels that increase as a result of the blend will lead to increased disinfection by-product (DBP) formation.

The possibility of chemical precipitation and color issues between waters using the same disinfectant appears to be minimal. Review of the finished water quality and the previous blending study indicates that the water quality parameters are generally congruent and that blending these waters with treated Canyon Lake water in any ratio should not produce precipitates or other undesirable effects.

Either treatment process, conventional or membrane (utilizing microfilters (MF) or ultrafilters (UF)), when combined with granular activated carbon (GAC) would produce a water of higher quality than the representative waters used in this evaluation. It is recommended that further bench-scale tests be conducted in conjunction with pilot studies of the candidate treatment process.

Delivered Water Quality Goals

Delivered water quality objectives are related to regulatory compliance goals, aesthetic issues, water treatment initiatives (Partnership for Safe Water; Texas Optimization Program; etc). Water quality goals and treatment objectives for GBRA are primarily driven by the need for safe and aesthetically pleasing drinking water. To satisfy these goals, GBRA's objectives are:

- To produce water that complies with all applicable regulations while minimizing or eliminating objections related to aesthetic water quality, and
- To provide water that will blend with treated groundwater in varying amounts while providing no undesirable difference in water quality to the customers.
- To continue the ability to use free chlorine as the secondary disinfectant in the distribution systems while complying with the regulations.

Table ES-6 summarizes the delivered water quality goals and acceptable ranges for the new WTP.

Water Quality Conclusions

Conclusions from the water quality analysis are listed as follows:

- The Canyon Lake water is high quality, and is amenable to either conventional or membrane treatment.
- The treatment process selection should focus on TOC reduction to enable the continued use of free chlorine disinfection in the customers systems.
- Based on anticipated delivered water quality, no precipitation or color issues are expected as a result of blending the treated surface water and groundwater supplies. Chemical reactions between blended waters and pipes should not produce undesirable precipitation or particle formation. Bench scale tests will confirm this.

Treatment Technology Evaluations

Evaluation of the recommended surface water treatment process for the new Canyon Lake Regional Water System was performed to meet the GBRA and their customers' objectives as follows:

- A treated surface water that is chemically compatible with existing customer supplies and results in customer satisfaction.
- A treated surface water that enables the customers to continue using free chlorine disinfection within their distribution systems.

Table ES-6.
Delivered Water Quality Goals[1]

Item	*GBRA Goal*	*Acceptable Upper Bound*
DBPs	Achieve the following target values (80% of Stage 1 D/DBP Rule MCLs): 64 µg/L TTHMs[2] 48 µg/L HAA_5[3] 8 µg/L bromate	Achieve the following maximum "not to exceed" values (Stage 1 D/DBP Rule MCLs): 80 µg/L TTHMs[2] 60 µg/L HAA_5[3] 10 µg/L bromate
	Achieve compliance with the Stage 2 (and potentially Stage 3) D/DBP Rule MCLs when finalized *(through modification of an existing treatment process)*: 40 µg/L TTHMs [2] 30 µg/L HAA_5 [3] (current placeholder MCLs) 5 µg/L bromate Individual DBP MCLs (potential Stage 3 MCLs)	
Other DBPs	Finished water TOC < 0.8 mg/L (to blend with current customer water quality and limit DBP formation)	Finished water TOC < 1.3 mg/L
Combined filter turbidity	Less than 0.1 NTU[4]	Less than 0.2 NTU[4]
Disinfection	Meet all disinfection standards and eliminate transmission of waterborne disease	Meet all disinfection standards Minimize/eliminate transmission of waterborne disease
Taste and odor	No complaints	Less than 50 complaints per month
Hardness	150 to 250 mg/L as CaCO3 (to blend with current customer water quality)	150 to 250 mg/L as CaCO3 (to blend with current customer water quality)
pH	Maintain pH between 7 and 8 (to blend with current customer water quality)	Maintain pH between 7 and 8 (to blend with current customer water quality)
Treatment	Treatment using technologies that facilitate blending with no noticeable change in water quality	Treatment using technologies that facilitate blending with no noticeable change in water quality

1 The goals shown are in addition to meeting current and pending standards for other regulated compounds or water quality parameters.
2 TTHM – total trihalomethanes
3 HAA_5 – Sum of 5 haloacetic acids
4 NTU – Nephelometric turbidity unit

- A treated surface water that complies with the current and pending regulations, including aesthetics such as taste and odor and is flexible to respond to future regulations.
- A treatment process that is economically feasible to construct and operate.

Several processes can produce treated water meeting or exceeding regulatory requirements. The parameter most influencing process selection for the GBRA plant is TTHM resulting from the use of chlorine as the primary and secondary disinfectant. Two commonly employed approaches to reduce TTHM formation is 1) to remove or reduce the naturally occurring organic precursors that form TTHMs when reacted with chlorine, or 2) to utilize an alternative disinfectant which minimizes the formation of TTHMs, such as chloramines or chlorine dioxide.

Chlorine is the stated preference for secondary disinfectant since all of the initial customers currently use chlorine within their system and they would prefer not to change. However, to evaluate the impacts of the ultimate secondary disinfectant choice, the alternatives for process selection were divided into two categories:

- Conventional or advanced treatment with emphasis on organics removal to enable the continued use of chlorine as a secondary disinfectant.
- Conventional or advanced treatment processes with chloramines as a secondary disinfectant.

Screening Evaluation

A screening review was conducted on several candidate liquids-process alternatives to narrow the selection to four to five alternatives for further detailed evaluation. The alternatives ranged from conventional coagulation/filtration processes to advanced treatment with membranes. Primary disinfection ranged from the use of chlorine, chlorine dioxide, ozone, and ultraviolet irradiation.

Conventional Treatment

Conventional treatment or conventional treatment with enhanced coagulation and PAC could potentially reduce the precursor materials low enough to use free chlorine as the secondary disinfectant and meet the Stage 1 DBP levels at the point of delivery to the customer; however, DBPs in the customer's distribution system may increase above the MCLs with the continuance of chlorine.

Membranes

Due to the low to moderate turbidity levels in the source water, MF/UF filtration does not require pre-treatment to meet particle/turbidity reduction requirements. Like the conventional plant, membranes in combination with PAC or pre-treatment with coagulation could reduce TOC levels such that free chlorine potentially could be used as a residual disinfectant without exceeding Stage 1 DBP levels at the point of delivery. However, continued use within customer distribution systems, may cause DBP levels to exceed MCLs.

Disinfection

Ozonation of the water would substantially exceed the 10 μg/L maximum contaminant level for bromate; therefore, ozone is not considered a cost-effective option and is not recommended for further consideration. Conventional treatment is flexible for meeting future disinfection requirements provided UV is installed and is accepted by regulatory agencies for inactivation for *Cryptosporidium*. Membrane technology will likely meet anticipated removal requirements for *Cryptosporidium*.

Detailed Evaluations

From the screening evaluation, the following alternatives were formulated for detailed evaluation:

Conventional

Alternative A – Conventional plant; chlorine or chlorine dioxide for primary disinfection with provisions for addition of UV in future; chloramines for secondary disinfectant through the transmission line.

Alternative B – Conventional plant; GAC for organics reduction; chlorine or chlorine dioxide for primary disinfection with provisions for addition of UV in future; chlorine for secondary disinfectant in the transmission line.

Membrane

Alternative C – MF/UF membranes; chlorine or chlorine dioxide for satisfying inactivation requirements beyond the removal achieved by MF/UF; chloramines for secondary disinfectant through the transmission line.

Alternative D – MF/UF membranes; NF for organics reduction; chlorine or chlorine dioxide for satisfying inactivation requirements beyond the removal achieved by MF/UF; chlorine for secondary disinfectant through the transmission line.

Alternative E – MF/UF membranes; GAC for organics reduction; chlorine or chlorine dioxide for satisfying inactivation requirements beyond the removal achieved by MF/UF; chlorine for secondary disinfectant through the transmission line.

The five alternatives were evaluated in terms of cost-effectiveness and qualitative (non-monetary) criteria. The cost-effectiveness analysis was based on the estimated present worth (25 years at 6 percent) of capital and O&M costs. The qualitative analysis compared the alternatives on criteria such as water treatment effectiveness, treatment reliability, O&M requirements, flexibility, etc.

Recommended Treatment Technology

Based on the evaluation, Alternative C (membrane plant and chloramines disinfection) ranks the highest, while Alternative E (membrane plant and GAC with free chlorine) ranks second. Although the ranking factors for water treatment effectiveness and costs were factored on a level basis, the advantages of the treatment process are not enough to overcome the cost differences.

As a consequence, the decision whether to select Alternative C or E would somewhat be driven by cost unless the foremost objective is to meet the water quality and disinfection objectives. In this case then, only those options that meet those objectives should be compared (Alternatives B, D and E). On this basis, Alternative E ranks highest and is recommended. This alternative has a very similar capital cost to the others; provides superior particle reduction and protection from microbials; and enables the GBRA to meet the requirements of anticipated long-term regulations. In addition, membranes will likely be given credit for removal of *Cryptosporidium* in the future regulations (LT2 ESWTR), whereas a conventional plant will need additional components to achieve inactivation credit (ozone, UV, etc).

Other issues not withstanding, the chloramines alternative would typically be the disinfectant of choice for secondary disinfection due to lower costs, longer transmission residence times, and the presence of organic precursors in Texas surface waters. However, the GBRA and their customers have established water quality objectives whose goal is to minimize tastes and odors and avoid change from their current free-chlorine disinfection practices. It would be very difficult for systems to be isolated for use of chlorarmines in one area and free chlorine in other areas due to the potential returnable water that will be sent out-of-district with varying levels of penetration into those systems. Thus, the free chlorine alternative is the preferred choice. Consequently, the treatment plant process that is selected should incorporate improved organics removal capability so that free chlorine can be used as the secondary disinfectant while complying with the D/DBP requirements for TTHMs and HAAs.

It is recommended that pilot studies of candidate for membranes Alternative E be conducted to select the type of membrane, develop the design flux (loading) rate. Membrane pilot testing will allow for accurate cost opinions, and is necessary for achieving approval from the TNRCC. Independent of the selected treatment process, bench-scale GAC pilot tests are recommended to accurately define GAC filter performance and design criteria.

Due to the emphasis of regulations on microbial and particle reduction, water utilities within this country are considering and implementing membrane plants. While Europe has used membranes for water treatment for some period of time, US utilities recently entered the arena, therefore this country's operating experience and regulatory acceptance of membranes is rather limited. However, membrane treatment is becoming recognized in certain instances as an appropriate technology and costs are competitive with conventional plants.

Within Texas, membrane plants have been installed and accepted by the TNRCC for potable water treatment (San Patricio Municipal Water District and Bexar Metropolitan Water District). A membrane facility provides additional benefits not afforded by conventional treatment such as superior particle removal and the ability to meet future regulations. Coupled with GAC, this treatment technology can meet the water quality objectives stated for this project.

Facilities and Site Planning

Preliminary facility plans were prepared for both a conventional and a microfiltration/ultrafiltration (MF/UF) membrane water treatment plant. A specific site location has not been selected.

Membrane Treatment Plant Structures & Site Plan

Preliminary site planning was performed for the membrane treatment plant option. Major features include the membrane building, GAC contactors, 2 million gallon treated water reservoir, high service/backwash supply pumping station and residuals system. Plant site area would be approximately 20 acres. Ideally the selected site will have at least a 25 to 30 foot change in elevation. This elevation difference will reduce the amount of major excavation and pumping required.

Conventional Treatment Plant Structures & Site Plan

Typically, treatment plant processes and equipment are located outdoors. Buildings would be required for the chemical feed equipment, air blower, filter consoles, electrical/instrumentation equipment, plant operations and maintenance facilities. Major features include the upflow clarifiers/gravity filters, GAC contactors, 2 million-gallon treated water reservoir, chemical feed building, operations/maintenance building, high service/backwash supply pumping station, flow equalization basins and residuals system. Site criteria would be the same as for the membrane plant option at approximately 20 acres of land with a 25 to 30 foot elevation change.

Building Architectural Features

The most flexible and economical approach uses a pre-engineered metal building structural system. These systems are readily available, have favorable delivery lead times, weather-in very quickly, are competitively priced, and are specifically designed for each applications. They can withstand considerable abuse, require limited maintenance, yet provide flexibility for customized exterior finishes, interior space planning, and industrial loadings such as overhead cranes. Erection procedures are also a positive consideration given that heavy construction equipment, i.e. cranes, are typically not required for buildings of the sizes anticipated here. The structure of all working spaces (pump stations, treatment building, maintenance areas) should be hot-dip galvanized to ensure the structural longevity of each building.

The floor plans for the high service pumping station and the water plant should be arranged with all equipment housed in one large open space. Separate rooms or partitioned areas should be provided for electrical gear, certain chemicals, and exceptionally noisy equipment. Often, occupied spaces (e.g., lab, kitchen, office) are located in the same building with the plant's process equipment or pumps. In those cases, there is a need to control any noise, moisture, and physical abuse associated with the working spaces. To provide this control, the interior partitions creating these spaces need to be more substantial in mass and more detailed in terms of wall penetrations. CMU masonry is recommended if occupied or conditioned spaces are provided within buildings housing working spaces.

Consideration should be given to reducing the size of the membrane building by relocating the occupied spaces to an adjacent freestanding “operations building”. This would provide a more controlled environment within the building envelope, which would allow economical office-type construction within the building. It would also provide more flexibility for future modification or expansion of both the membrane building and operations building.

Residuals Management

Residual Approaches

Residual management approaches were developed for each of the treatment alternatives under consideration. Conventional treatment and microfiltration/ultrafiltration (MF/UF) membrane filtration each generate different residuals. Both plant alternatives have granular activated carbon (GAC) contactors to remove total organic carbon (TOC) and potential taste and odor compounds. The conventional treatment plant option will produce residuals from pretreatment, solids contact clarifier, and filtration. The membrane treatment plant option will produce residuals from pretreatment, membrane filter backwashing, and membrane cleaning. GAC contactors will be used with either a conventional or MF/UF membrane treatment plant, and the residuals produced from the GAC apply to both alternatives. GAC systems produce two types of residuals: carbon fines from the initial GAC start-up operation, which are typically washed out in the first day or two of operation; and influent solids which are removed during backwashing of the GAC bed.

The general area (near Canyon Lake) has a net pan evaporation rate of 70 in/yr., which indicates that air-drying systems may be preferred over more operation intensive mechanical systems.

Residual Processes

Flow Equalization

Both the conventional and MF/UF treatment options require flow equalization prior to residuals discharging to the thickening process. For a conventional treatment plant, a flow equalization basin will be provided, consisting of two cells. For MF/UF membrane treatment, a flow equalization tank will be provided for the membrane backwash in the membrane plant option. A separate wash water equalization lagoon is supplied for the GAC backwash.

Thickening Processes

For either the conventional or MF/UF treatment, the residuals should be thickened prior to dewatering. The percent solids achieved is dependent on the particular sludge to be treated and coagulant addition. Options for thickening include dissolved air flotation (DAF) and a gravity thickener.

Gravity Thickener

A gravity thickener is the recommended for the conventional treatment plant option. Residuals from the conventional plant solids contact clarifier and the filter wash water would be discharged to the thickeners. The thickening system includes two gravity thickeners (one standby) and a coagulant feed system.

DAF

DAF thickening is recommended for MF/UF treatment because it can treat low solids concentrations more effectively than gravity thickeners. Wash water from the membranes would be discharged to the DAF for thickening to approximately 4 percent solids. From the DAF, concentrated residuals would be gravity fed to the dewatering facility. The thickening facility would include two DAF systems (one standby), an external air supply, and a coagulant feed system.

Dewatering Processes

Options for dewatering include sludge lagoon beds, sand drying beds, centrifuge dewatering facilities, vacuum assisted drying beds, and belt filter presses. Sludge lagoons or sand drying beds could be used for either conventional or membrane filtration. Sand drying beds are the recommended dewatering process. Although sludge lagoons could be used as part of the dewatering process, the residuals leaving the lagoons would require additional treatment or handling before disposal.

Operations and Maintenance

The facilities to be constructed and operated by GBRA are currently proposed as follows:

- Raw Water Intake and Pump Station
- Raw Water Supply Pipeline System
- Water Supply Project Treatment Plant
- Water Supply Project Transmission Pipeline and Customer Connections.

The treatment process selection criteria in Section 8 included the importance of minimum operator oversight and active process control needs while producing a consistently high quality finished water. Actual staffing requirements for the plant will depend on the selected treatment process. General staffing level recommendations includes operation of the intake, pumping, treatment, and transmission pipeline systems. Staffing is estimated to include:

- 1 Water Treatment Plant System Manager
- 4 Operators
- 3 Technicians

A preliminary operations and maintenance (O&M) cost opinion for the planned water treatment plant was developed. Costs were derived for the conventional plant (Alternative B) and for the membrane plant (Alternative E). Results of these cost evaluations suggest an annual O&M cost of about $0.65 for the membrane alternative and $0.60 for the conventional alternative per thousand gallons, at the anticipated year 2001.

Information Technology/SCADA

The overall control of the proposed water treatment and transmission system as presently envisioned will be implemented via a Supervisory Control and Data Acquisition system (SCADA). In view of the complex system hydraulics and specific customer requirements, the SCADA system must be flexible, reliable, user friendly and effective over a large geographical area.

System Architecture

The central component of this system is the Programmable Logic Controller (PLC). The PLCs of this system will function as both a Remote Terminal Unit (RTU), a logic controller and as a redundant controller. A master redundant processor PLC will be located in the water treatment plant. This PLC will contain logic that will coordinate and supervise the operation of the Water Treatment Plant distributed PLCs, the Raw Water Pump Station PLC and the Remote

Pump Station PLC. The Raw Water Pump Station will utilize tank level information from the Startz Hill Reservoir to determine pump operation.

Each of the customer metering and flow control sites will be equipped with a lower level PLC to serve as a communication device and execute control logic for the flow control equipment.

The Host Computer/OMI will consist of a Personal Computer (PC) with Windows NT operating system running an OMI software such as Wonderware. Operator graphics, data archiving and report generation will be accomplished in this environment.

Telemetry

The overall geographic area encompassed by this project spans approximately 46 miles. To facilitate high speed, reliable information transmission, a licensed, full duplex radio telemetry system similar to the existing GBRA facilities is envisioned. Buried fiber optic cable was considered the most reliable, but extremely high capital costs would be realized and is not cost effective. Spread spectrum radio and leased telephone are not considered reliable for this application.

ES-5 Treated Water Delivery System

Pipeline Route

As part of the preliminary engineering effort, pipeline route criteria was developed to help in the route selection process. Based on comments from the GBRA and the customers, the criteria were then refined and categorized as high, medium, or low significance. The initial pipeline route alternatives were developed with attention to the all of the high importance criteria except for the hydraulic requirements. The hydraulic analyses were then completed for each of the principal route alternatives. These analyses eliminated some of the alternatives from further consideration due to the limit selected for maximum working pressure in the pipeline. The remaining alternatives were then discussed with the GBRA and refined by closer examination of the medium and low importance criteria.

After all criteria were examined, two significant route alternatives remained along with several minor route possibilities. Figure ES-2 presents the recommended pipeline route along with the other alternative pipeline route. The most significant route decision was between the route following the LCRA power transmission line or along Ammann Road. The power line

OVERSIZED Map

To View OVERSIZED Document(s) Or

For any questions;

you can call CENTRAL RECORDS

main Line

(512) 936.7180

route is slightly longer than the Ammann Road alternative, but the difference in capital cost was found to be about 1 percent. Since the cost difference of the two alternatives was small, the route along the existing electric transmission line is recommended for the following reasons:

- The power line is an established, straight easement that can be paralleled.
- There is the possibility to overlap the pipeline construction easements with the existing power line easements, which may make easement acquisition less difficult.
- The power line route has less development along the route resulting in lower land prices and fewer driveway crossings.
- The power line corridor has already been disturbed and may present fewer environmental challenges.

The recommended pipeline route for the treated water delivery system is 40.4.5 miles in length.

Delivery Points

Water delivery locations to the main project participants are as follows:

<u>In-District Delivery Points:</u>

City of Boerne: at a new ground storage tank to be constructed near Cascade Cavern Road between I-10 and Ranch Drive. City of Boerne will construct and own the storage tank.

City of Fair Oaks Ranch: at a new ground storage tank to be built on the north side of Balcones Creek at a final location to be coordinated with the City. City of Fair Oaks Ranch will construct and own the storage tank.

Comal ISD: the school district has indicated that water service will be needed at Smithson Valley Middle School, Bulverde Primary School, Bulverde Elementary School; other schools that might require additional water supply include Arlon Seay Intermediate School, Spring Branch Middle School, Bill Brown Elementary School, and Smithson Valley High School. For each campus needing water, and the school location is adjacent to the pipeline, the new supply will delivered into their existing water storage tank. In all cases, a tap and approach main from the GBRA pipeline will be installed by the school.

<u>Out-of-District Delivery Points:</u>

San Antonio Water System: at a new ground storage tank to be constructed in Lakeside Acres Subdivision on the south side of I-10 about 0.5 miles west of the Fair Oaks Parkway/Old Fredericksburg Road intersection. SAWS will construct and own the storage tank.

Bexar Metropolitan Water District: at a new elevated storage tank to be built in the Hill County Water System on the west side of US Hwy 281, about 1 mile south of Estate Gate Drive. BMWD will construct and own the storage tank.

Pipeline Hydraulics

The hydraulic criteria and constraints applied to the pipeline design include:

- A minimum pipeline working pressure of 10 psi. This value was developed with consideration for Texas Natural Resource Conservation Commission (TNRCC) guidelines for potable water transfer lines, for which the TNRCC has developed minimum pressure criteria that are less than typically required for potable water systems.
- A maximum working pressure of 200 psi throughout most of system.
- A minimum velocity guideline of approximately 2 feet per second (fps) required for maintaining adequate scour of sediment.

The resulting pipeline sizes range from 30-inch diameter for the main pipeline from the treatment plant to 14-inch diameter for the Bexar Met delivery point south of Bulverde, 18-inch diameter for the SAWS delivery, 12-inch diameter to the Bergheim area (Cordillera), 20-inch line passes through Fair Oaks Ranch (smaller pipeline tap will supply Fair Oaks Ranch delivery point), and 12-inch diameter to the City of Boerne. Table ES-7 lists the pipeline diameters, pipeline pressure class, and length of pipeline within each pressure class for the treated water delivery system.

With an optimal maximum pipeline working pressure of 200 psi, a remote pump station in addition to a pump station at the water treatment plant is required. The remote pump station would be located near Ammann Road and Dietz-Elkhorn Road.

The chosen hydraulic design configuration allows for flexibility in location of the water treatment plant, and offers advantages to the overall system control strategy. Location of the pump station at the water treatment plant permits the plant to be located at a lower elevation than would possible otherwise, and also allows flow from the proposed raw water reservoir at Startz Hill to be conveyed by gravity to the plant.

Pipeline Material

Several alternate pipe materials will be acceptable for use in the project and will be bid against each other in order to take advantage of market conditions at the time of bidding and contractor preferences. For transmission piping 18-inches diameter and greater, ductile iron

Table ES-7.
Summary of Approximate
Treated Water Piping Lengths by Pipe Class

Pipe Diameter (inches)	Pressure Class (psi)	Pipe Length (feet)
30	250	2,060
30	200	68,288
30	150	2,805
24	200	11,407
24	150	7,488
24	100	29,772
20	100	27,138
18	150	11,790
14	250	4,853
14	200	22,572
14	150	3,018
12	150	22,340

pipe, concrete steel cylinder pipe, and welded steel pipe (pending GBRA concurrence) will be included as acceptable materials. For piping less than 18-inches diameter, ductile iron pipe and PVC will be included as acceptable materials.

Easement Widths and Pipeline Construction

The permanent easement should consist of a minimum 30-foot permanent easement. A 70-foot temporary easement should be provided to accommodate construction activities. Depending on the location of the right-of-way, the temporary construction easement will either be all on one side of the permanent easement, or split with 35 feet on each side. The permanent easement will be cleared of vegetation and grass will be established after construction. The permanent easement will be mowed to keep it clear of woody vegetation and allow pipeline maintenance. The temporary easement will be mostly cleared of vegetation, although large trees will be left, where possible.

The pipeline will be installed using open-cut construction with a minimum depth of cover of 4 feet over the top of the pipeline. At road crossings, the pipeline will be installed by boring and _____ under the roadway. After construction, the disturbed area will be graded to original contours, place the topsoil moved and stored from before construction, and seeded with grass.

Treated Water Pump Stations

Of the several alternative pumping scenarios and operating pressures investigated, the recommended delivery system uses two treated water pump stations with a maximum pressure of 200 psi in the delivery system to deliver the base project capacity of 10 MGD. One pump station should be located at the WTP, and the other is to be a remote pump station located along the route west to Boerne near the Fair Oaks Ranch delivery point. Vertical turbine pumps are recommended for both the WTP and remote pump stations based on economic, layout, and expandability considerations. The proposed piping would be capable of delivering 15 MGD under the phased expansion scenario, and expansion of the system's capacity would only require adding a fourth pump at each pump station and upgrading the pumps and motors at the WTP.

Treated Water Storage Facilities

Storage within the treated water delivery system should be provided both at the water treatment plant and the remote pump station. Storage provided at the remote pump station eliminates the need for constructing the remote pump station as an in-line booster pump station, and the reservoir level provides a reliable control input for the pumps located at the remote pump station and water treatment plant. The volume of the reservoir at the water treatment plant will depend largely on the treatment process selected (refer to the Contract A Basis of Design Report for more information on the water treatment plant reservoir). The estimated volume of the reservoir located at the remote pump station is 250,000 gallons.

ES-6 Customer Connections

Customer Connection Criteria

In order for the GBRA to evaluate requests for water purchase contracts to obtain water made available by the regional water system, Customer Connection Criteria has been developed.

Connection Design Criteria

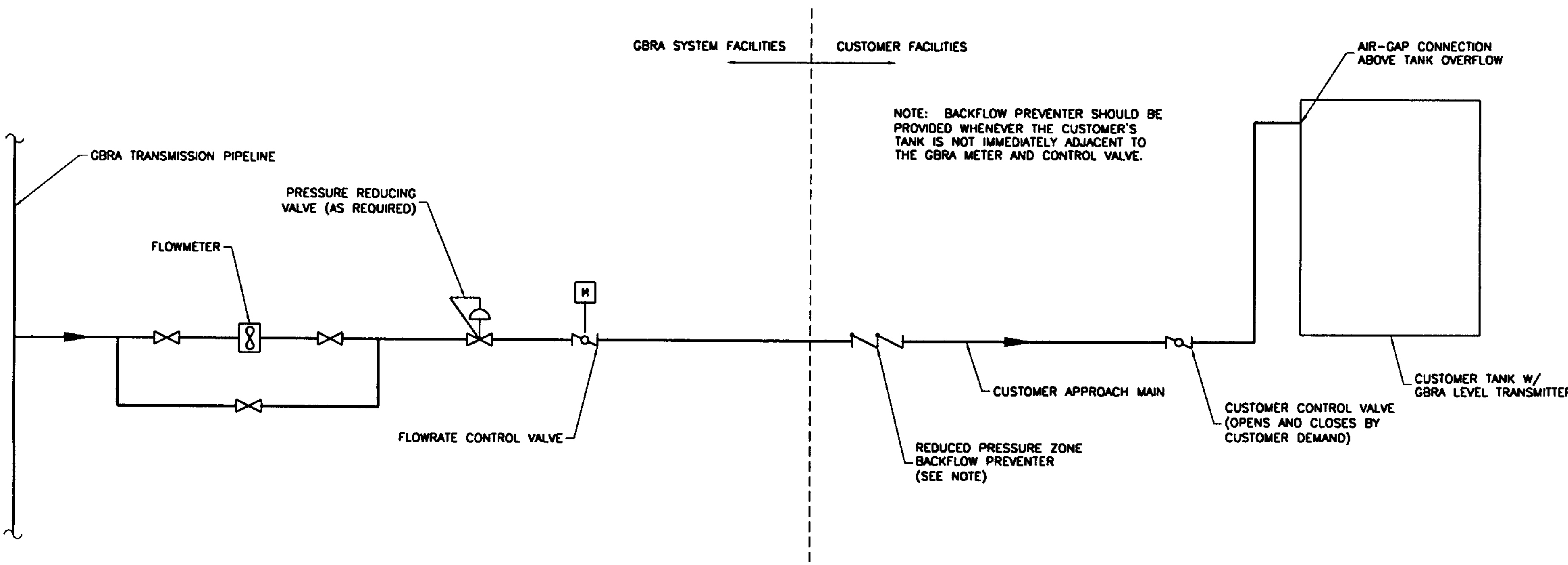
1. Existing pipeline taps installed during pipeline construction must be utilized where available. Pipeline taps will be installed on the pipeline for all customers identified at the time of design.

2. Minimum delivery volume is 50 acft per year delivered uniformly throughout the year (approximately 60 gpm) delivered through a minimum 2-inch diameter meter. With approval of GBRA, In-District public non-community customers could receive less water than this minimum.
3. Minimum pipeline diameter from the transmission pipeline to the customer's storage tank is 4 inches. The actual diameter required may be larger depending on the customer's commitment and will be determined by GBRA after an engineering review of the pipeline hydraulics.
4. Taps on the customer's approach main between the GBRA transmission pipeline and the customer's storage tank will not be allowed without written approval of the GBRA.
5. Water delivery must be made to a water storage tank through an air gap except for In-District public non-community customers, with approval of GBRA. A reduced-pressure zone backflow preventer is also required if the customer's tank is not located on a tract of land that is contiguous with the GBRA's easement for the flow meter and flow control valve.
6. Water storage capacity in conjunction with other water supplies (if any) must be shown to be sufficient to provide water supply at average day flow rates during outages of GBRA supplied water of up to 24 hours.
7. The customer must provide a minimum 20'x30' easement to locate delivery and control facilities, including an underground concrete valve vault, control/radio cabinet, antenna mast, and other required facilities.
8. The customer must provide electric service to control enclosure.
9. The customer must provide an agreement for the GBRA to install a level transmitter and associated SCADA equipment and radio telemetry on and/or adjacent to the customer's tank. Furnish electrical power to the equipment.
10. The customer must have a Certificate of Convenience and Necessity.

A schematic of a typical in-district customer connection is shown in Figure ES-3.

Provisions for Future Connections

Connections made after initial construction must be made in accordance the adopted Customer Connection Criteria (Appendix E, Basis of Design Report for Contract B). If an existing tap is not available in proximity to a customer as determined by GBRA, GBRA will provide a tapped connection to the pipeline at the customer's expense. All associated costs for the tap, control valves, meter, and instrumentation will be at the new customer's costs.



TYPICAL IN-DISTRICT CUSTOMER CONNECTION

HDR Engineering, Inc.

GBRA - REGIONAL WATER SUPPLY PROJECT	Date JUNE, 2000
TYPICAL CUSTOMER CONNECTION	Figure No ES-3

Customer-Owned Facilities

Approach Mains: The customer may own and maintain the approach main pipeline downstream of the GBRA meter and control valve vault.

Storage: The customer will own and maintain the water storage tank. Water storage capacity in conjunction with other water supplies available to the customer must be shown to be sufficient to provide water supply at average day flow rates during outages of GBRA-supplied water of up to 24 hours.

Disinfection at Customer Connections

Although a disinfection booster station is not shown to be required along the transmission line, residual monitoring will be performed at various points. Residual adjustment facilities will be provided at the remote pump station. Measurement of residual at the remote pump station, SAWS, and Bexar Metropolitan Water District will provide indication that adequate disinfection residual is being maintained throughout the transmission system.

Residual adjustment facilities will be provided at the remote pump station in the unlikely event that the residual decay is greater than expected or unforeseen events lead to a reduction in the chlorine residual. The facilities should provide flow-paced chlorination based on the residual in the reservoir versus a set-point residual required in the pump station's discharge. The facilities should include cylinder storage and handling, vacuum feed with automatic switchover, on-line cylinder weighing, and dual chlorinators. The customer should monitor disinfection levels.

ES-7 Project Costs

Base Project – Membrane WTP

Table ES-8 summarizes project costs for the Base Project (i.e., 10-MGD) with a membrane water treatment plant. Total capital cost for all project facilities is estimated to be $52,590,000. Total project cost, including engineering, land acquisition, financing, and interest during construction totals $68,154,000 (Table ES-8). Annual costs are reported in the lower half of Table ES-8, including debt service ($5,330,000), debt service coverage ($533,000), WTP O&M ($1,324,000), electric power ($1,237,000), and purchase of water ($676,000). Total annual cost is $9,346,000 (Table ES-8). For delivery of 10,527 acft/yr, the unit cost of water will be $888 per acft, or about $2.72 per 1,000 gallons.

Table ES-8.
Cost Estimate Summary
Base Project – 10 MGD Membrane WTP
(Costs are mid-2001 dollars)

Item	Estimated Cost
Capital Costs	
Lake Intake and Raw Water Pump Station	$3,000,000
Raw Water Pipeline and Storage Tank	4,224,000
Water Treatment Plant (Membrane)	18,272,000
WTP Pump Station	1,339,000
Remote Pump Stations	1,469,000
Treated Water Transmission Pipeline	22,577,000
Customer Connections/Valves/SCADA	1,280,000
Remote Storage Tanks	429,000
Total Capital Costs	**$52,590,000**
Engineering and Other Professional Fees	$4,994,000
Environmental Studies and Mitigation	320,000
Land Acquisition	3,888,000
Reserve Account and Financing Costs	1,602,000
Interest During Construction	4,760,000
Total Project Cost	**$68,154,000**
Annual Costs	
Annual Debt Service (6 percent for 25 years)	$5,330,000
Annual Debt Service Coverage	533,000
Annual Operation and Maintenance:	
Water Treatment Plant	1,324,000
Pump Stations	85,000
Transmission Facilities	151,000
Storage Facilities	10,000
Annual Power Cost	1,237,000
Purchase of Stored Water[1]	676,000
Total Annual Cost	**$9,346,000**
Annual Water Delivery (acft)	**10,527**
Unit Cost of Water ($ per acft)	**$888**
Unit Cost of Water ($ per 1,000 gal)	**$2.72**

[1] Cost of stored water purchased from GBRA is currently $61 per acft. Quantity purchased includes 5 percent allowance for treatment and transmission losses.

Phased Project – Expansion to 15 MGD with Membrane WTP

Table ES-9 summarizes project costs for the expansion of the Base Project from 10 MGD to 15 MGD with a membrane water treatment plant. Costs shown in Table ES-9 are in mid-2001 dollars. Capital costs to expand project capacity to 15 MGD are $6,757,000, including expansion of the raw water intake, water treatment plant expansion, and pump station improvements. Total project cost to expand the system, including engineering, financing, and interest during construction totals $8,180,000 (Table ES-9). Annual costs for the expanded system as reported in the lower half of Table ES-9, are inclusive of costs for the base 10 MGD project. Debt service, O&M costs, power, purchase of water and other annual costs for the full 15 MGD system total $11,813,000 (Table ES-9), or about $2,467,000 more than the cost of the base 10 MGD project. For delivery of 16,000 acft/yr, the unit cost of water for the expanded system drops to a blended rate of $738 per acft, or about $2.27 per 1,000 gallons.

Base Project – Conventional WTP

Table ES-10 summarizes project costs for the Base Project (i.e. 10 MGD) with a conventional water treatment plant. Total capital cost for all project facilities is estimated to be $52,649,000. Total project cost, including engineering, land acquisition, financing, and interest during construction totals $68,213,000 (Table ES-10). Annual costs are reported in the lower half of Table ES-10, including debt service ($5,334,000), debt service coverage ($533,000), WTP O&M ($1,191,000), electric power ($1,214,000), and purchase of water ($676,000). Total annual cost is $9,194,000 (Table ES-10). For delivery of 10,527 acft/yr, the unit cost of water will be $873 per acft, or about $2.68 per 1,000 gallons.

Phased Project – Expansion to 15 MGD with Conventional WTP

Table ES-11 summarizes project costs for the expansion of the Base Project from 10 MGD to 15 MGD with a conventional water treatment plant. Costs shown in Table ES-11 are in mid-2001 dollars. Capital costs to expand project capacity to 15 MGD are $7,526,000, including expansion of the raw water intake, water treatment plant expansion, and pump station improvements. Total project cost to expand the system, including engineering, financing, and interest during construction totals $9,109,000 (Table ES-11). Annual costs for the expanded system as reported in the lower half of Table ES-11, are inclusive of costs for the base 10-MGD

Table ES-9.
Cost Estimate Summary
Phased Expansion from 10 MGD to 15 MGD Membrane WTP
(costs are mid-2001 dollars)

Item	Estimated Cost
Capital Costs	
Raw Water Intake Expansion	$219,000
Water Treatment Plant Expansion (Membrane)	5,635,000
WTP Pump Station Expansion	497,000
Remote Pump Stations Expansion	306,000
Total Capital Costs	**$6,757,000**
Engineering and Other Professional Fees	$811,000
Environmental Studies and Mitigation	0
Land Acquisition	0
Reserve Account and Financing Costs	0
Interest During Construction	612,000
Total Project Cost	**$8,180,000**
Annual Costs	
Annual Debt Service for Base Project (10 MGD)[1]	$5,330,000
Annual Debt Service for Expansion to 15 MGD (6 percent for 25 years)	640,000
Annual Debt Service Coverage, incl. Base Project	597,000
Annual Operation and Maintenance for 15 MGD[2]	
Water Treatment Plant	1,854,000
Pump Stations	119,000
Transmission Facilities	151,000
Storage Facilities	10,000
Annual Power Cost[2]	2,085,000
Purchase of Stored Water[3]	1,027,000
Total Annual Cost	**$11,813,000**
Annual Water Delivery (acft)	**16,000**
Unit Cost of Water ($ per acft)	**$738**
Unit Cost of Water ($ per 1,000 gal)	**$2.27**

[1] From Table 7-2.
[2] Includes costs for Base Project.
[3] Cost of stored water purchased from GBRA is currently $61 per acft. Quantity purchased includes 5 percent allowance for treatment and transmission losses.

Table ES-10.
Cost Estimate Summary
Base Project – 10 MGD Conventional WTP
(costs are mid-2001 dollars)

Item	Estimated Cost
Capital Costs	
Lake Intake and Raw Water Pump Station	$3,000,000
Raw Water Pipeline and Storage Tank	4,224,000
Water Treatment Plant (Conventional)	18,331,000
WTP Pump Station	1,339,000
Remote Pump Stations	1,469,000
Treated Water Transmission Pipeline	22,577,000
Customer Connections/Valves/SCADA	1,280,000
Remote Storage Tanks	429,000
Total Capital Costs	**$52,649,000**
Engineering and Other Professional Fees	$4,994,000
Environmental Studies and Mitigation	320,000
Land Acquisition	3,888,000
Reserve Account and Financing Costs	1,602,000
Interest During Construction	4,760,000
Total Project Cost	**$68,213,000**
Annual Costs	
Annual Debt Service (6 percent for 25 years)	$5,334,000
Annual Debt Service Coverage	533,000
Annual Operation and Maintenance	
Water Treatment Plant	1,191,000
Pump Stations	85,000
Transmission Facilities	151,000
Storage Facilities	10,000
Annual Power Cost	1,214,000
Purchase of Stored Water[1]	676,000
Total Annual Cost	**$9,194,000**
Annual Water Delivery (acft)	**10,527**
Unit Cost of Water ($ per acft)	**$873**
Unit Cost of Water ($ per 1,000 gal)	**$2.68**

[1] Cost of stored water purchased from GBRA is currently $61 per acft. Quantity purchased includes 5 percent allowance for treatment and transmission losses.

Table ES-11.
Cost Estimate Summary
Phased Expansion from 10 MGD to 15 MGD Conventional WTP
(costs are mid-2001 dollars)

Item	Estimated Cost
Capital Costs	
Raw Water Intake Expansion	$219,000
Water Treatment Plant Expansion (Conventional)	6,404,000
WTP Pump Station Expansion	497,000
Customer Connections/Valves/SCADA	100,000
Remote Pump Stations Expansion	306,000
Total Capital Costs	**$7,526,000**
Engineering, Contingencies, and Legal Costs	$903,000
Environmental Studies and Mitigation	0
Land Acquisition	0
Reserve Account and Financing Costs	0
Interest During Construction	680,000
Total Project Cost	**$9,109,000**
Annual Costs	
Annual Debt Service for Base Project (10 MGD)[1]	$5,334,000
Annual Debt Service for Expansion to 15 MGD (6 percent for 25 years)	712,000
Annual Debt Service Coverage, incl. Base Project	605,000
Annual Operation and Maintenance for 15 MGD[2]	
Water Treatment Plant	1,667,000
Pump Stations	119,000
Transmission Facilities	151,000
Storage Facilities	10,000
Annual Power Cost[2]	2,053,000
Purchase of Stored Water[3]	1,027,000
Total Annual Cost	**11,678,000**
Annual Water Delivery (acft)	**16,000**
Unit Cost of Water ($ per acft)	**$730**
Unit Cost of Water ($ per 1,000 gal)	**$2.24**

[1] From Table 7-4.
[2] Includes costs for Base Project.
[3] Cost of stored water purchased from GBRA is currently $61 per acft. Quantity purchased includes 5 percent allowance for treatment and transmission losses.

project. Debt service, O&M costs, power, purchase of water and other annual costs for the full 15 MGD system total $11,678,000 (Table ES-11), or about $2,484,000 more than the cost of the base 10 MGD project. For delivery of 16,000 acft/yr, the unit cost of water for the expanded system drops to $730 per acft, or about $2.24 per 1,000 gallons.

Cost Allocations

Annual cost allocations for each major participant should consider expected expenditures within the first 10 years of system operation including:

- Raw water purchase;
- Firm annual commitment;
- Additional water; and
- Returnable water.

Cost allocation tables for each project participant will be prepared showing each of these cost elements.

Guadalupe Blanco River Authority

Western Comal Regional Water System

June 2000

GBRA

Basis of Design Report - Final - Contract A

MALCOLM PIRNIE

3928-002

Regional Water Supply Project for Portions of Comal, Kendall, and Bexar Counties Basis of Design Report – Contract A

Table of Contents