DRAFT FEASIBILITY REPORT
FEASIBILITY ANALYSIS OF WATER SUPPLY FOR SMALL PUBLIC WATER SYSTEMS

RIVIERA ISD
PWS ID# 1370019

Prepared for:

THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Prepared by:

THE UNIVERSITY OF TEXAS BUREAU OF ECONOMIC GEOLOGY

AND

PARSONS

Preparation of this report was financed by the Texas Commission on Environmental Quality through the Drinking Water State Revolving Fund Small Systems Assistance Program

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AUGUST 2008

EXECUTIVE SUMMARY

INTRODUCTION

The University of Texas Bureau of Economic Geology (BEG) and its subcontractor, Parsons Transportation Group Inc. (Parsons), was contracted by the Texas Commission on Environmental Quality (TCEQ) to conduct a project to assist with identifying and analyzing alternatives for use by Public Water Systems (PWS) to meet and maintain Texas drinking water standards.

The overall goal of this project was to promote compliance using sound engineering and financial methods and data for PWSs that had recently recorded sample results exceeding maximum contaminant levels (MCL). The primary objectives of this project were to provide feasibility studies for PWSs and the TCEQ Water Supply Division that evaluate water supply compliance options, and to suggest a list of compliance alternatives that may be further investigated by the subject PWS for future implementation.

This feasibility report provides an evaluation of water supply alternatives for the Riviera Independent School District (ISD) PWS, ID #1370019, located in Kleberg County. The Riviera ISD PWS is located approximately ¼ miles east of U.S. Highway 77 at 203 North 9th Street in Riviera, Texas. The water supply system has seven connections and serves a population of 500. The water source for the Riviera ISD PWS comes from one groundwater well completed to a depth of 727 feet in the Evangeline Aquifer (Code 121EVGL). Well #1 (G1370019A) is rated at 280 gallons per minute.

On March 8, 2007, the Riviera ISD PWS recorded a combined uranium concentration value of 0.088 milligrams per liter (mg/L), which exceeds the MCL of 0.030 mg/L. Therefore, it is likely the Riviera ISD PWS faces potential compliance issues under the standard.

Basic system information for the Riviera ISD PWS is shown in Table ES.1.

Table ES.1 Riviera ISD PWS
Basic System Information

Population served	500
Connections	7
Average daily flow rate	0.023 million gallons per day (mgd)
Peak demand flow rate	63.9 gallons per minute
Water system peak capacity	0.403 mgd
Typical combined uranium	0.088 mg/L

STUDY METHODS

The methods used for this project were based on a pilot project performed in 2004 and 2005 by TCEQ, BEG, and Parsons. Methods for identifying and analyzing compliance options were developed in the pilot project (a decision tree approach).

The process for developing the feasibility study used the following general steps:

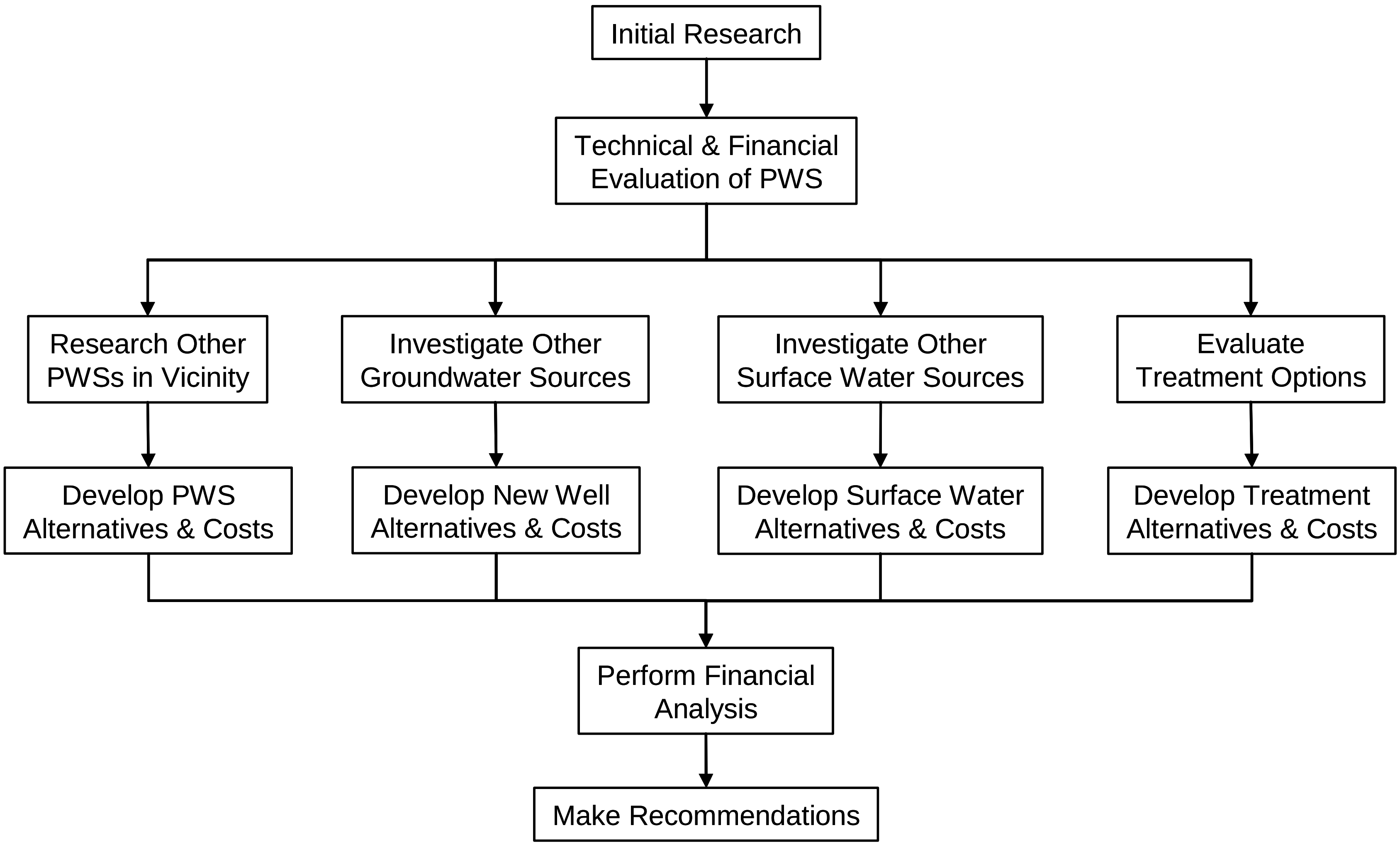
- Gather data from the TCEQ and Texas Water Development Board databases, from TCEQ files, and from information maintained by the PWS;
- Conduct financial, managerial, and technical (FMT) evaluations of the PWS;
- Perform a geologic and hydrogeologic assessment of the study area;
- Develop treatment and non-treatment compliance alternatives which, in general, consist of the following possible options:
- Connecting to neighboring PWSs via new pipeline or by pumping water from a newly installed well or an available surface water supply within the jurisdiction of the neighboring PWS;
- Installing new wells within the vicinity of the PWS into other aquifers with confirmed water quality standards meeting the MCLs;
- Installing a new intake system within the vicinity of the PWS to obtain water from a surface water supply with confirmed water quality standards meeting the MCLs;
- Treating the existing non-compliant water supply by various methods depending on the type of contaminant; and
- Delivering potable water by way of a bottled water program or a treated water dispenser as an interim measure only.
- Assess each of the potential alternatives with respect to economic and non-economic criteria;
- Prepare a feasibility report and present the results to the PWS.

This basic approach is summarized in Figure ES.1.

HYDROGEOLOGICAL ANALYSIS

The Riviera ISD PWS obtains groundwater from the Evangeline subunit of the Gulf Coast Aquifer. Many nearby wells contain acceptable uranium concentrations. The NURE database does not contain enough information to identify these wells, but this finding suggests that further research into nearby wells that might serve as an alternative supply could prove useful. In addition, based on depths of nearby wells that do and do not meet the MCL for uranium, it is possible that deepening the PWS well below 850 feet might decrease uranium levels.

Figure ES.1 Summary of Project Methods



It may also be possible to do down-hole testing on non-compliant wells to determine the source of the contaminants. If the contaminants derive primarily from a single part of the formation, that part could be excluded by modifying the existing well, or avoided altogether by completing a new well.

COMPLIANCE ALTERNATIVES

Overall, the system had a good level of FMT capacity. The system had some areas that needed improvement to be able to address future compliance issues; however, the system does have many positive aspects, including dedicated staff, and an emergency interconnection. Areas of concern for the system included lack of compliance with the uranium standard, lack or long-term planning for compliance and sustainability, and funding limitations.

There are several PWSs within 13 miles of the Riviera ISD PWS. Many of these nearby systems also have water quality problems, but there are some with good quality water. In general, feasibility alternatives were developed based on obtaining water from the nearest PWSs, either by directly purchasing water, or by expanding the existing well field. There is a minimum of surface water available in the area; however, the Baffin Bay Water Supply Corporation is a potential larger regional water supplier that could potentially supply water to Riviera ISD PWS.

Centralized treatment alternatives for radionuclide removal have been developed and were considered for this report, including reverse osmosis, coagulation and filtration, and ion exchange. Developing a new well close to the Riviera ISD PWS is likely to be the best solution if compliant groundwater can be found. Having a new well close to the Riviera ISD PWS is likely to be one of the lower cost alternatives since the PWS already possesses the technical and managerial expertise needed to implement this option. The cost of new well alternatives quickly increases with pipeline length, making proximity of the alternate source a key concern. A new compliant well or obtaining water from a neighboring compliant PWS has the advantage of providing compliant water to all taps in the system.

Central treatment can be cost-competitive with the alternative of new nearby wells, but would require significant institutional changes to manage and operate. Similar to obtaining an alternate compliant water source, central treatment would provide compliant water to all water taps.

FINANCIAL ANALYSIS

A financial analysis of the various alternatives for the Riviera ISD PWS was performed using estimated system revenues and expenses. Table ES.2 provides a summary of the financial impact of implementing selected compliance alternatives, including the rate increase necessary to meet current operating expenses. The alternatives were selected to highlight results for the best alternatives from each different type or category.

Some of the compliance alternatives offer potential for shared or regional solutions. A group of PWSs could work together to implement alternatives for developing a new groundwater source or expanding an existing source, obtaining compliant water from a large regional provider, or for central treatment. Sharing the cost for implementation of these alternatives could reduce the cost on a per user basis. Additionally, merging PWSs or management of several PWSs by a single entity offers the potential for reduction in administrative costs.

Table ES.2 Selected Financial Analysis Results

Alternative	Funding Option	Average Annual Water Cost per Student	Percent of MHI
Current	NA	$10	0.03
To meet current expenses	NA	10	0.03
Purchase water from Baffin Bay WSC	100% Grant	$101	0.3
	Loan/Bond	$262	0.9
Central IX treatment	100% Grant	$90	0.3
	Loan/Bond	$151	0.5

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
BAT	best available technology
BEG	Bureau of Economic Geology
CA	cellulose acetate
CCN	certificate of convenience and necessity
CD	Community Development
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
DWSRF	Drinking Water State Revolving Fund
EDAP	Economically distressed Areas Program
FMT	Financial, managerial, and technical
GAM	Groundwater Availability Model
gpd	gallons per day
HUD	U.S. Department of Housing and Urban Development
ISD	Independent School District
IX	Ion exchange
MCL	Maximum contaminant level
mg/L	Milligram per liter
mgd	Million gallons per day
MHI	Median household income
NF	nanofiltration
NMEFC	New Mexico Environmental Financial Center
NURE	National Uranium Resource Evaluation
O&M	Operation and Maintenance
ORCA	Office of Rural Community Affairs
Parsons	Parsons Transportation Group, Inc.
pCi/L	picoCuries per liter
POE	Point-of-entry
POU	Point-of-use
psi	pounds per square inch
PWS	Public Water System
RFP	Revolving Fund Program
RO	Reverse osmosis
RUS	Rural Utilities Service
RWAF	Rural Water Assistance Fund
SDWA	Safe Drinking Water Act
STEP	Small Towns Environment Program

TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCF	Texas Capital Fund
TDA	Texas Department of Agriculture
TDS	total dissolved solids
TFC	thin film composite
TSS	total suspended solids
TWDB	Texas Water Development Board
USEPA	United States Environmental Protection Agency
WAM	Water Availability Model
WEP	Water and Environment Program
WRT	Water Remediation Technologies, Inc.
WSC	water supply corporation

SECTION 1
INTRODUCTION

The University of Texas Bureau of Economic Geology (BEG) and its subcontractor, Parsons Transportation Group Inc. (Parsons), were contracted by the Texas Commission on Environmental Quality (TCEQ) to assist with identifying and analyzing compliance alternatives for use by Public Water Systems (PWS) to meet and maintain Texas drinking water standards.

The overall goal of this project is to promote compliance using sound engineering and financial methods and data for PWSs that have recently had sample results that exceed maximum contaminant levels (MCL). The primary objectives of this project are to provide feasibility studies for PWSs and the TCEQ Water Supply Division that evaluate water supply compliance options, and to suggest a list of compliance alternatives that may be further investigated by the subject PWS with regard to future implementation. The feasibility studies identify a range of potential compliance alternatives, and present basic data that can be used for evaluating feasibility. The compliance alternatives addressed include a description of what would be required for implementation, conceptual cost estimates for implementation, and non-cost factors that could be used to differentiate between alternatives. The cost estimates are intended for comparing compliance alternatives, and to give a preliminary indication of potential impacts on water rates resulting from implementation.

It is anticipated the PWS will review the compliance alternatives in this report to determine if there are promising alternatives, and then select the most attractive alternative(s) for more detailed evaluation and possible subsequent implementation. This report contains a decision tree approach that guided the efforts for this project, and also contains steps to guide a PWS through the subsequent evaluation, selection, and implementation of a compliance alternative.

This feasibility report provides an evaluation of water supply compliance options for the Riviera Independent School District (ISD) Public Water Supply, PWS ID# 1370019, located in Kleberg County, Texas, hereinafter referred to in this document as the “Riviera ISD PWS.” Recent sample results from the Riviera ISD PWS exceeded the MCL for combined uranium of 0.030 milligrams per liter (mg/L) (USEPA 2008a; TCEQ 2004). The location of the Riviera ISD PWS is shown on Figure 1.1. Various water supply and planning jurisdictions are shown on Figure 1.2. These water supply and planning jurisdictions are used in the evaluation of alternate water supplies that may be available in the area.

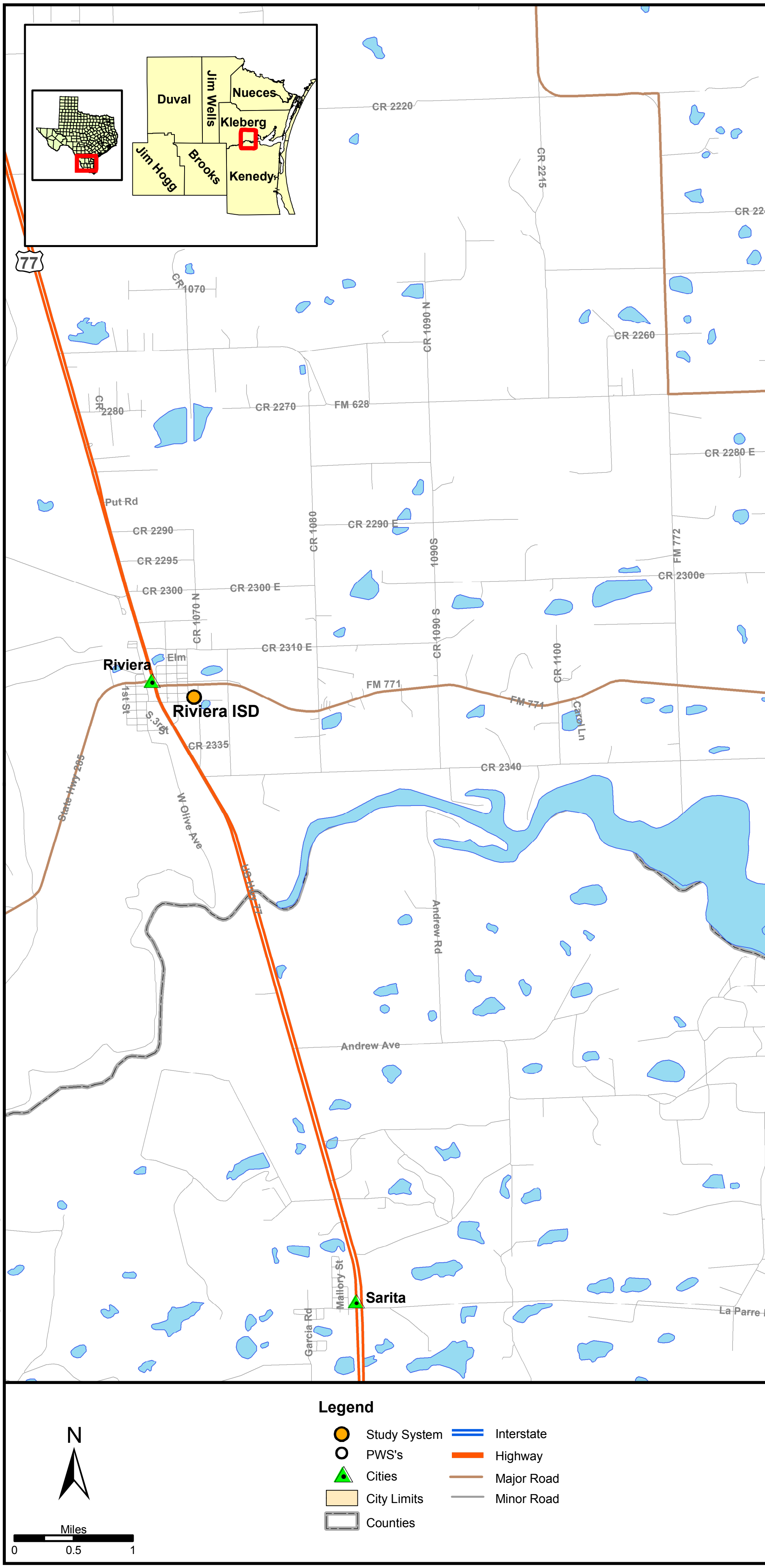

Figure 1.1

RIVIERA ISD

Location Map

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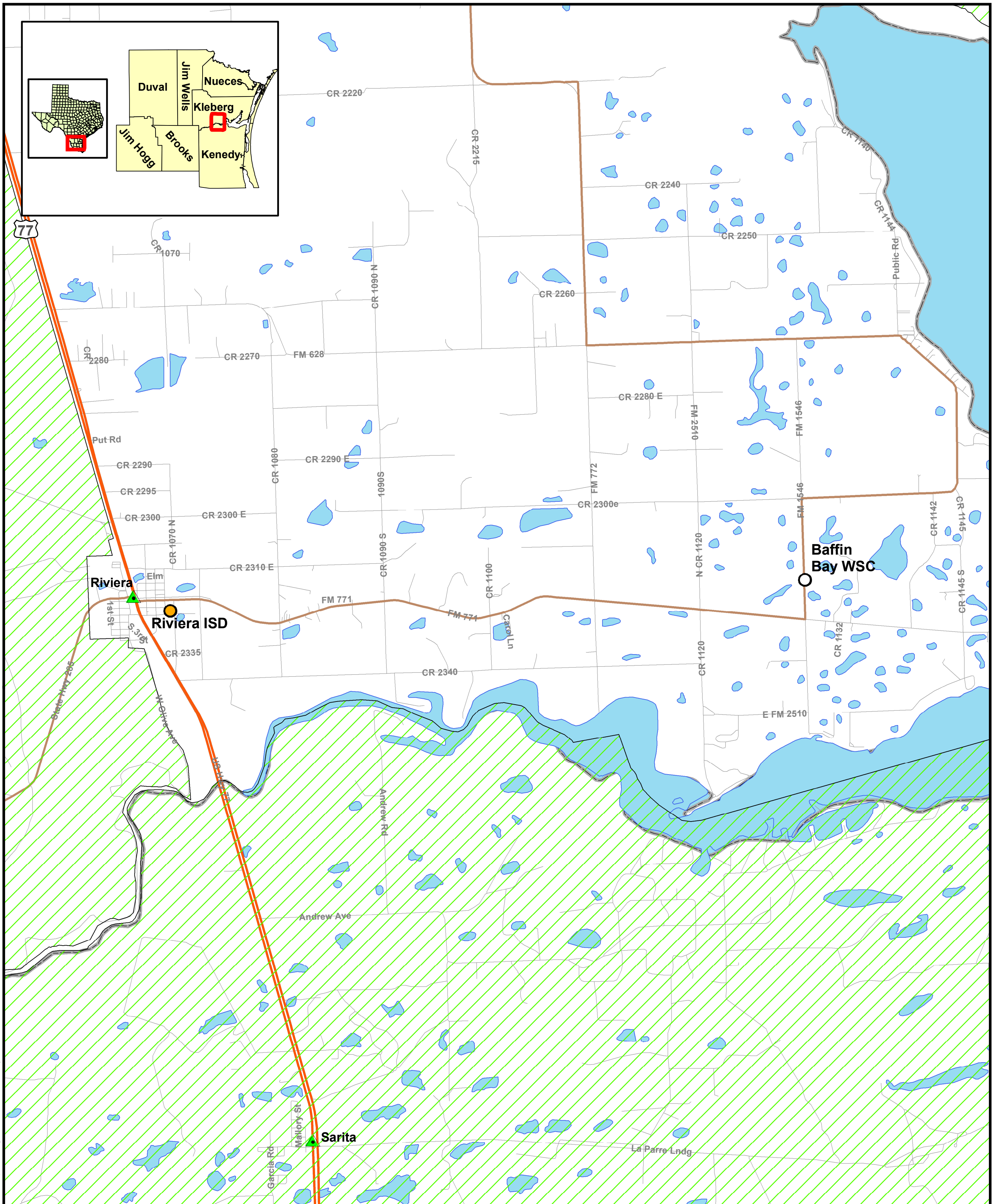

Legend

N

Miles
0 0.5 1

- Study System
- PWS's
- Cities
- City Limits
- Counties
- Interstate
- Highway
- Major Road
- Minor Road
- Kenedy County GCD

Figure 1.2

RIVIERA ISD

Groundwater Conservation Districts

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1.1 PUBLIC HEALTH AND COMPLIANCE WITH MCLs

The goal of this project is to promote compliance for PWSs that supply drinking water exceeding regulatory MCLs. This project only addresses those contaminants and does not address any other violations that may exist for a PWS. As mentioned above, the Riviera ISD PWS had recent sample results exceeding the MCL for combined uranium. In general, contaminant(s) in drinking water above the MCL(s) can have both short-term (acute) and long-term or lifetime (chronic) effects. Long-term ingestion of drinking water with combined uranium above the MCL may increase the risk of cancer and kidney toxicity (USEPA 2008b).

1.2 METHOD

The method for this project follows that of a pilot project performed by TCEQ, BEG, and Parsons. The pilot project evaluated water supply alternatives for PWSs that supplied drinking water with contaminant concentrations above U.S. Environmental Protection Agency (USEPA) and Texas drinking water standards. Three PWSs were evaluated in the pilot project to develop the method (*i.e.*, decision tree approach) for analyzing options for provision of compliant drinking water. This project is performed using the decision tree approach that was developed for the pilot project, and which was also used for subsequent projects.

Other tasks of the feasibility study are as follows:

- Identifying available data sources;
- Gathering and compiling data;
- Conducting financial, managerial, and technical (FMT) evaluations of the selected PWSs;
- Performing a geologic and hydrogeologic assessment of the area;
- Developing treatment and non-treatment compliance alternatives;
- Assessing potential alternatives with respect to economic and non-economic criteria;
- Preparing a feasibility report; and
- Suggesting refinements to the approach for future studies.

The remainder of Section 1 of this report addresses the regulatory background, and provides a summary of combined uranium abatement options. Section 2 describes the method used to develop and assess compliance alternatives. The groundwater sources of combined uranium are addressed in Section 3. Findings for the Riviera ISD PWS, along with compliance alternatives development and evaluation, can be found in Section 4. Section 5 references the sources used in this report.

1.3 REGULATORY PERSPECTIVE

The Utilities & Districts and Public Drinking Water Sections of the TCEQ Water Supply Division are responsible for implementing requirements of the Federal Safe Drinking Water

Act (SDWA), which include oversight of PWSs and water utilities. These responsibilities include:

- Monitoring public drinking water quality;
- Processing enforcement referrals for MCL violators;
- Tracking and analyzing compliance options for MCL violators;
- Providing FMT assessment and assistance to PWSs;
- Participating in the Drinking Water State Revolving Fund program to assist PWSs in achieving regulatory compliance; and
- Setting rates for privately owned water utilities.

This project was conducted to assist in achieving these responsibilities.

1.4 ABATEMENT OPTIONS

When a PWS exceeds a regulatory MCL, the PWS must take action to correct the violation. The MCL exceedances at the Riviera ISD PWS involve combined uranium. The following subsections explore alternatives considered as potential options for obtaining/providing compliant drinking water.

1.4.1 Existing Public Water Supply Systems

A common approach to achieving compliance is for the PWS to make arrangements with a neighboring PWS for water supply. For this arrangement to work, the PWS from which water is being purchased (supplier PWS) must have water in sufficient quantity and quality, the political will must exist, and it must be economically feasible.

1.4.1.1 Quantity

For purposes of this report, quantity refers to water volume, flowrate, and pressure. Before approaching a potential supplier PWS, the non-compliant PWS should determine its water demand on the basis of average day and maximum day. Peak instantaneous demands can be met through proper sizing of storage facilities. Further, the potential for obtaining the appropriate quantity of water to blend to achieve compliance should be considered. The concept of blending involves combining water with low levels of contaminants with non-compliant water in sufficient quantity that the resulting blended water is compliant. The exact blend ratio would depend on the quality of the water a potential supplier PWS can provide, and would likely vary over time. If high quality water is purchased, produced or otherwise obtained, blending can reduce the amount of high quality water required. Implementation of blending will require a control system to ensure the blended water is compliant.

If the supplier PWS does not have sufficient quantity, the non-compliant community could pay for the facilities necessary to increase the quantity to the extent necessary to supply the needs of the non-compliant PWS. Potential improvements might include, but are not limited to:

- Additional wells;
- Developing a new surface water supply,
- Additional or larger-diameter piping;
- Increasing water treatment plant capacity
- Additional storage tank volume;
- Reduction of system losses,
- Higher-pressure pumps; or
- Upsized, or additional, disinfection equipment.

In addition to the necessary improvements, a transmission pipeline would need to be constructed to tie the two PWSs together. The pipeline must tie-in at a point in the supplier PWS where all the upstream pipes and appurtenances are of sufficient capacity to handle the new demand. In the non-compliant PWS, the pipeline must tie in at a point where no down stream bottlenecks are present. If blending is the selected method of operation, the tie-in point must be selected to ensure all the water in the system is blended to achieve regulatory compliance.

1.4.1.2 Quality

If a potential supplier PWS obtains its water from the same aquifer (or same portion of the aquifer) as the non-compliant PWS, the quality of water may not be significantly better. However, water quality can vary significantly due to well location, even within the same aquifer. If localized areas with good water quality cannot be identified, the non-compliant PWS would need to find a potential supplier PWS that obtains its water from a different aquifer or from a surface water source. Additionally, a potential supplier PWS may treat non-compliant raw water to an acceptable level.

Surface water sources may offer a potential higher-quality source. Since there are significant treatment requirements, utilization of surface water for drinking water is typically most feasible for larger local or regional authorities or other entities that may provide water to several PWSs. Where PWSs that obtain surface water are neighbors, the non-compliant PWS may need to deal with those systems as well as with the water authorities that supply the surface water.

1.4.2 Potential for New Groundwater Sources

1.4.2.1 Existing Non-Public Supply Wells

Often there are wells not associated with PWSs located in the vicinity of the non-compliant PWS. The current use of these wells may be for irrigation, industrial purposes, domestic supply, stock watering, and other purposes. The process for investigating existing wells is as follows:

- Existing data sources (see below) will be used to identify wells in the areas that have satisfactory quality. For the Riviera ISD PWS, the following standards could be used in a rough screening to identify compliant groundwater in surrounding systems:
    - Nitrate (measured as nitrogen) concentrations less than 8 mg/L (below the MCL of 10 mg/L);
    - Fluoride concentration less than 2.0 mg/L (below the Secondary MCL of 2 mg/L);
    - Arsenic concentration less than 0.008 mg/L (below the MCL of 0.01 mg/L);
    - Uranium concentration less than 0.024 mg/L (below the MCL of 0.030 mg/L; and
    - Selenium concentration less than 0.04 mg/L (below the MCL of 0.05 mg/L).
- The recorded well information will be reviewed to eliminate those wells that appear to be unsuitable for the application. Often, the "Remarks" column in the Texas Water Development Board (TWDB) hard-copy database provides helpful information. Wells eliminated from consideration generally include domestic and stock wells, dug wells, test holes, observation wells, seeps and springs, destroyed wells, wells used by other communities, etc.
- Wells of sufficient size are identified. Some may be used for industrial or irrigation purposes. Often the TWDB database will include well yields, which may indicate the likelihood that a particular well is a satisfactory source.
- At this point in the process, the local groundwater control district (if one exists) should be contacted to obtain information about pumping restrictions. Also, preliminary cost estimates should be made to establish the feasibility of pursuing further well development options.
- If particular wells appear to be acceptable, the owner(s) should be contacted to ascertain their willingness to work with the PWS. Once the owner agrees to participate in the program, questions should be asked about the wells. Many owners have more than one well, and would probably be the best source of information regarding the latest test dates, who tested the water, flowrates, and other well characteristics.
- After collecting as much information as possible from cooperative owners, the PWS would then narrow the selection of wells and sample and analyze them for quality. Wells with good quality water would then be potential candidates for test pumping. In some cases, a particular well may need to be refurbished before test pumping. Information obtained from test pumping would then be used in combination with information about the general characteristics of the aquifer to determine whether a well at that location would be suitable as a supply source.

- It is recommended that new wells be installed instead of using existing wells to ensure the well characteristics are known and the well meets construction standards.
- Permit(s) would then be obtained from the groundwater control district or other regulatory authority, and an agreement with the owner (purchase or lease, access easements, etc.) would then be negotiated.

1.4.2.2 Develop New Wells

If no existing wells are available for development, the PWS or group of PWSs has an option of developing new wells. Records of existing wells, along with other hydrogeologic information and modern geophysical techniques, should be used to identify potential locations for new wells. In some areas, the TWDB's Groundwater Availability Model (GAM) may be applied to indicate potential sources. Once a general area is identified, land owners and regulatory agencies should be contacted to determine an exact location for a new well or well field. Pump tests and water quality tests would be required to determine if a new well will produce an adequate quantity of good quality water. Permits from the local groundwater control district or other regulatory authority could also be required for a new well.

1.4.3 Potential for Surface Water Sources

Water rights law dominates the acquisition of water from surface water sources. For a PWS, 100 percent availability of water is required, except where a back-up source is available. For PWSs with an existing water source, although it may be non-compliant because of elevated concentrations of one or more parameters, water rights may not need to be 100 percent available.

1.4.3.1 Existing Surface Water Sources

"Existing surface water sources" of water refers to municipal water authorities and cities that obtain water from surface water sources. The process of obtaining water from such a source is generally less time consuming and less costly than the process of developing a new source; therefore, it should be a primary course of investigation. An existing source would be limited by its water rights, the safe yield of a reservoir or river, or by its water treatment or water conveyance capability. The source must be able to meet the current demand and honor contracts with communities it currently supplies. In many cases, the contract amounts reflect projected future water demand based on population or industrial growth.

A non-compliant PWS would look for a source with sufficient spare capacity. Where no such capacity exists, the non-compliant PWS could offer to fund the improvements necessary to obtain the capacity. This approach would work only where the safe yield could be increased (perhaps by enlarging a reservoir) or where treatment capacity could be increased. In some instances water rights, where they are available, could possibly be purchased.

In addition to securing the water supply from an existing source, the non-compliant PWS would need to arrange for transmission of the water to the PWS. In some cases, that could require negotiations with, contracts with, and payments to an intermediate PWS (an intermediate PWS is one where the infrastructure is used to transmit water from a "supplier" PWS to a "supplied" PWS, but does not provide any additional treatment to the supplied water). The non-compliant PWS could be faced with having to fund improvements to the intermediate PWS in addition to constructing its own necessary transmission facilities.

1.4.3.2 New Surface Water Sources

Communication with the TCEQ and relevant planning groups from the beginning is essential in the process of obtaining a new surface water source. Preliminary assessment of the potential for acquiring new rights may be based on surface water availability maps located on the TWDB website. Where water rights appear to be available, the following activities need to occur:

- Discussions with TCEQ to indicate the likelihood of obtaining those rights. The TCEQ may use the Water Availability Model (WAM) to assist in the determination.
- Discussions with land owners to indicate potential treatment plant locations.
- Coordination with U.S. Army Corps of Engineers and local river authorities.
- Preliminary engineering design to determine the feasibility, costs, and environmental issues of a new treatment plant.

Should these discussions indicate that a new surface water source is the best option, the community would proceed with more intensive planning (initially obtaining funding), permitting, land acquisition, and detailed designs.

1.4.4 Identification of Treatment Technologies

Various treatment technologies were also investigated as compliance alternatives for treatment of uranium to regulatory levels (*i.e.*, MCLs). Several options have been identified by the USEPA as best available technologies (BAT) for non-compliant constituents. Identification and descriptions of the various BATs are provided in the following sections.

The MCL for uranium was set at 30 mg/L by the USEPA on December 7, 2000. This MCL applies to all community water systems with 15 or more service connections or 25 residents regularly year round.

The uranium isotopes U-234, U-235, and U-238 combine with carbonate to form complexed anions (*e.g.*, $UO_2(CO_3)_2^{2-}$ and $UO_2(CO_3)_3^{4-}$), which are dissolved in water at pH between 6.0 and 8.2, and are not easily removed by particle filtration. The MCL for total uranium is 0.030 mg/L, which is equivalent to 20.1 picoCuries per liter (pCi/L) as radioactivity.

The following BATs were identified in the Radionuclides Final Rule for achieving compliance with the uranium MCL:

- Ion exchange;
- Reverse osmosis;

- Lime softening; and
- Coagulation/filtration.

In addition, the following technologies are included in the Radionuclides Final Rule as small system compliance technologies:

- Ion Exchange (Centralized and Point-of-use);
- Reverse Osmosis (Centralized and Point-of-use);
- Lime softening;
- Activated Alumina; and
- Coagulation/filtration.

Other technologies that can removal uranium include electrodialysis or electrodialysis reversal and Water Remediation Technologies, Inc. (WRT) Z-92 adsorption.

The Reverse Osmosis (RO) and Ion Exchange (IX) processes are suitable for point-of-use systems.

1.4.5 Treatment Technologies Description

The suitability of a particular BAT depends on multiple factors including the size of the system, the quality of the raw water and the available skill of the operators. The lime softening process requires an advanced level of operator skill and is generally suitable for larger capacity systems. In this section the other three BAT technologies for uranium removal suitable for small community central treatment systems are described.

1.4.5.1 Reverse Osmosis

Process**.** RO is a physical process in which contaminants are removed by applying pressure on the feed water to force it through a semi-permeable membrane. RO membranes reject ions based on size and electrical charge. The raw water is typically called feed; the product water is called permeate; and the concentrated reject is called concentrate. Common RO membrane materials include asymmetric cellulose acetate (CA) or polyamide thin film composite (TFC). The TFC membrane operates at much lower pressure and can achieve higher salt rejection than the CA membranes but is less chlorine resistant. Each material has specific benefits and limitations depending on the raw water characteristics and pre-treatment. A newer, lower pressure type membrane that is similar in operation to spiral wound RO, is nanofiltration (NF), which has higher rejection for divalent ions than mono-valent ions. NF is sometimes used instead of RO for treating water with high hardness and sulfate concentrations. A typical RO installation includes a high pressure feed pump; parallel first and second stage membrane elements (in pressure vessels); and valves and piping for feed, permeate, and concentrate streams. Factors influencing membrane selection are cost, recovery, rejection, raw water characteristics, and pre-treatment. Factors influencing performance are raw water characteristics, pressure, temperature, and regular monitoring and maintenance. Depending on the membrane type and operating pressure, RO is capable of removing 90-98 percent of the uranium. The treatment process is relatively insensitive to pH. Water recovery is 60-80 percent, depending on raw water characteristics. The concentrate volume for disposal can be significant. The conventional RO treatment train for well water uses anti-scalant addition, cartridge filtration, RO membranes, chlorine disinfection, and clearwell storage.

Pre-treatment. RO requires careful review of raw water characteristics, and pre-treatment needs to prevent membranes from fouling, scaling, or other membrane degradation. Removal or sequestering of suspended solids is necessary to prevent colloidal and bio-fouling, and removal of sparingly soluble constituents such as calcium, magnesium, silica, sulfate, barium, *etc*., may be required to prevent scaling. Pretreatment can include media filters to remove suspended particles; IX softening to remove hardness; antiscalant feed; temperature and pH adjustment to maintain efficiency; acid to prevent scaling and membrane damage; activated carbon or bisulfite to remove chlorine (post-disinfection may be required); and cartridge filters to remove any remaining suspended particles to protect membranes from upsets.

Maintenance. Rejection percentages must be monitored to ensure contaminant removal below MCLs. Regular monitoring of membrane performance is necessary to determine fouling, scaling, or other membrane degradation. Use of monitoring equipment to track membrane performance is recommended. Acidic or caustic solutions are regularly flushed through the system at high volume/low pressure with a cleaning agent to remove fouling and scaling. The system is flushed and returned to service. RO stages are cleaned sequentially. Frequency of membrane replacement is dependent on raw water characteristics, pre-treatment, and maintenance.

Waste Disposal. Pre-treatment waste streams, concentrate flows, and spent filters and membrane elements all require approved disposal methods. Disposal of the significant volume of the concentrate stream is a problem for many utilities.

Advantages (RO)

- Produces the highest water quality.
- Can effectively treat a wide range of dissolved salts and minerals, turbidity, health and aesthetic contaminants, and certain organics. Some highly-maintained units are capable of treating biological contaminants.
- Low pressure - less than 100 pounds per square inch (psi), compact, self-contained, single membrane units are available for small installations.

Disadvantages (RO)

- Relatively expensive to install and operate.
- Provides a higher level of treatment than required, especially if total dissolved solids (TDS) reduction not required.

- Frequent membrane monitoring and maintenance; pressure, temperature, and pH requirements to meet membrane tolerances. Membranes can be chemically sensitive.
- Additional water usage depending on rejection rate.
- Concentrate disposal required.

A concern with RO for treatment of inorganics is that if the full stream is treated, then most of the alkalinity and hardness would also be removed. In that event, post-treatment may be necessary to avoid corrosion problems. If feasible, a way to avoid this issue is to treat a slip stream of raw water and blend the slip stream back with the raw water rather than treat the full stream. The amount of water rejected is also an issue with RO. Discharge concentrate flow can be between 10 and 50 percent of the influent flow.

1.4.5.2 Enhanced Coagulation/Filtration

Process – The coagulation-filtration process when enhanced by the addition of iron or aluminum coagulants can remove 50 to 90 percent of the uranium. Filtration can be accomplished with granular media filters or microfilters. The coagulant is added and then the water is mixed to provide 30 to 120 seconds for precipitation of the coagulant. In some systems a longer coagulation period is required, typically determined by pilot or bench scale testing.

The actual capacity to remove uranium by the enhanced coagulation-filtration process depends on a number of factors, including the amount of uranium present, the uranium speciation, pH, amount and type of coagulant used, and the overall water composition. The filters used in groundwater treatment are usually pressure filters fed directly by the well pumps. The filter media can be regular dual media filters or proprietary media such as the engineered ceramic filtration media, Macrolite, developed by Kinetico. Macrolite is a low-density, spherical media designed to allow for filtration rates up to 10 gpm/ft^2, which is a higher loading rate than commonly used for conventional filtration media.

Maintenance – Maintenance is mainly to handle the coagulant chemicals, the coagulant feed system, and to provide for regular backwash of the filters. The filters typically last 5 to 8 years.

Waste Disposal – The waste from the coagulation/filtration process is mainly the iron hydroxide or alum sludge with adsorbed uranium in the backwash water. The backwash water can possibly be discharged to a public sewer if it is available and if the uranium concentration is below regulatory limits. If a sewer is not available, the backwash water can be discharged to a storage-settling tank from where the supernatant is recycled in a controlled rate to the front of the treatment system and the settled sludge can be disposed of appropriately. Depending on the concentration of uranium in the sludge, it may be classified as a radioactive waste and require special disposal.

Advantages (Coagulation/Filtration)

- Established technology for uranium removal; and
- Economical process for uranium removal.

Disadvantages (Coagulation/Filtration)

- Need to handle chemical;
- Need to dispose of regular backwash wastewater; and
- Need to dispose of sludge.

A concern for enhanced coagulation-filtration is management of the filter backwash. This often involves sludge thickening and dewatering. For small capacity systems, the thickened spent backwash can be trucked to an approved disposal site.

1.4.5.3 Ion Exchange

Process – In solution, salts separate into positively charged cations and negatively charged anions. Ion exchange is a reversible chemical process in which ions from an insoluble, permanent, solid resin bed are exchanged for ions in the water. The process relies on the fact that certain ions are preferentially adsorbed on the ion exchange resin. Operation begins with a fully charged cation or anion bed, having enough positively or negatively charged ions to carry out the cation or anion exchange. Usually a polymeric resin bed is composed of millions of spherical beads about the size of medium sand grains. As water passes the resin bed, the charged ions are released into the water, being substituted or replaced with the contaminants in the water (IX). When the resin becomes saturated with the contaminant ions, the bed must be regenerated by passing or pumping a concentrated sodium chloride solution over the resin, displacing the contaminant ions with sodium ions for cation exchange resins and chloride ions for anion exchange resins. Many different types of resins can be used depending on the specific contaminant to be removed.

The IX treatment train for groundwater typically consists of an ion exchange system containing cation or anion resin, chlorine disinfection, and clear well storage. The ion exchange system has provisions for regeneration with salt (sodium chloride) and generates approximately 2 to 4% of waste or “spent” regeneration solutions. Treatment trains for surface water may also include raw water pumps, debris screens, and filters for pre-treatment. Additional treatment or management of the spent regeneration salt solutions and the removed solids will be necessary prior to disposal, especially for radium removal resins which have elevated radioactivity.

For uranium removal, a strong base anionic exchange resin in the chloride form can remove 90 to 95 percent of the uranium. The uranium carbonate complex has a relatively high affinity for strong base anion exchange resins that is over 100 times greater than any common ions, including divalent anions like sulfate and carbonate. Typically 10,000 to 50,000 bed volumes are treated before the resin has to be regenerated.

Pretreatment – Pretreatment guidelines are available on accepted limits for pH, organics, turbidity, and other raw water characteristics. Pretreatment may be required to reduce excessive amounts of total suspended solids (TSS), iron, and manganese, which could plug the resin bed, and typically includes media or carbon filtration.

Maintenance – The IX resin requires regular on-site regeneration, the frequency of which depends on raw water characteristics (especially hardness), the contaminant concentration, and the size and number of IX vessels. Many systems have undersized the IX vessels only to realize higher than necessary operating costs. Preparation of the sodium chloride solution is required. If used, filter replacement and backwashing will be required.

Waste Disposal – Approval from local authorities is usually required for disposal of concentrate from the regeneration cycle (highly concentrated salt solution with radioactivity); occasional solids wastes (in the form of broken resin beads) which are backwashed during regeneration; and if used, spent filters and backwash wastewater.

Advantages

- Well established process for radium removal.
- Fully automated and highly reliable process.
- Suitable for small and large installations.

Disadvantages

- Requires salt storage; regular regeneration.
- Generates a liquid waste requiring disposal.
- Resins are sensitive to the presence of competing ions such as calcium and magnesium which reduces the effectiveness for radium removal.

In considering application of IX for inorganic, it is important to understand what the effect of competing ions will be, and to what extent the brine can be recycled. Spent regenerant is produced during IX bed regeneration, and it may have concentrations of the sorbed contaminants which will be expensive to treat and/or dispose because of hazardous waste regulations.

1.4.6 Point-of-Entry and Point-of-Use Treatment Systems

Point of entry treatment, while a possible alternative for residences, was not considered for Riviera ISD PWS, since the large demands for the school connections would require treatment units similar in size to central treatment units. Similarly, a POU alternative was not considered for Roosevelt ISD due to the difficulty in providing POU units for all possible drinking water taps.

1.4.7 Water Delivery or Central Drinking Water Dispensers

Water delivery and central drinking water dispensers were not considered viable alternatives for a school application.

SECTION 2
EVALUATION METHOD

2.1 DECISION TREE

The decision tree is a flow chart for conducting feasibility studies for a non-compliant PWS. The decision tree is shown in Figures 2.1 through 2.4. The tree guides the user through a series of phases in the design process. Figure 2.1 shows Tree 1, which outlines the process for defining the existing system parameters, followed by optimizing the existing treatment system operation. If optimizing the existing system does not correct the deficiency, the tree leads to six alternative preliminary branches for investigation. The groundwater branch leads through investigating existing wells to developing a new well field. The treatment alternatives address centralized and on-site treatment. The objective of this phase is to develop conceptual designs and cost estimates for the six types of alternatives. The work done for this report follows through Tree 1 and Tree 2, as well as a preliminary pass through Tree 4.

Tree 3, which begins at the conclusion of the work for this report, starts with a comparison of the conceptual designs, selecting the two or three alternatives that appear to be most promising, and eliminating those alternatives that are obviously infeasible. It is envisaged that a process similar to this would be used by the study PWS to refine the list of viable alternatives. The selected alternatives are then subjected to intensive investigation, and highlighted by an investigation into the socio-political aspects of implementation. Designs are further refined and compared, resulting in the selection of a preferred alternative. The steps for assessing the financial and economic aspects of the alternatives (one of the steps in Tree 3) are given in Tree 4 in Figure 2.4.

2.2 DATA SOURCES AND DATA COLLECTION

2.2.1 Data Search

2.2.1.1 Water Supply Systems

The TCEQ maintains a set of files on public water systems, utilities, and districts at its headquarters in Austin, Texas. The files are organized under two identifiers: a PWS identification number and a Certificate of Convenience and Necessity (CCN) number. The PWS identification number is used to retrieve four types of files:

- CO – Correspondence,
- CA – Chemical analysis,
- MOR – Monthly operating reports (quality/quantity), and
- FMT – Financial, managerial and technical issues.

Figure 2.1
TREE 1 – EXISTING FACILITY ANALYSIS

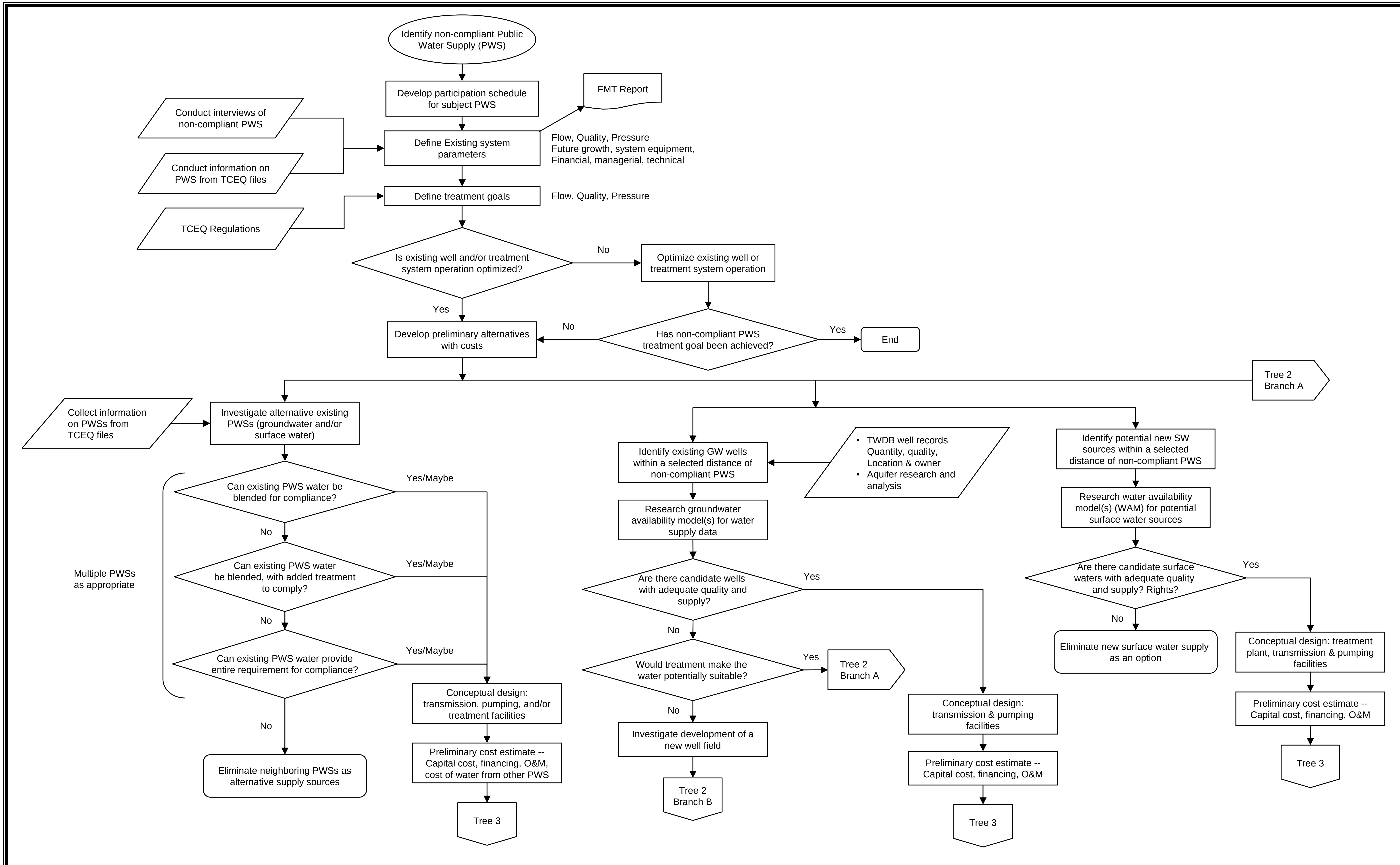
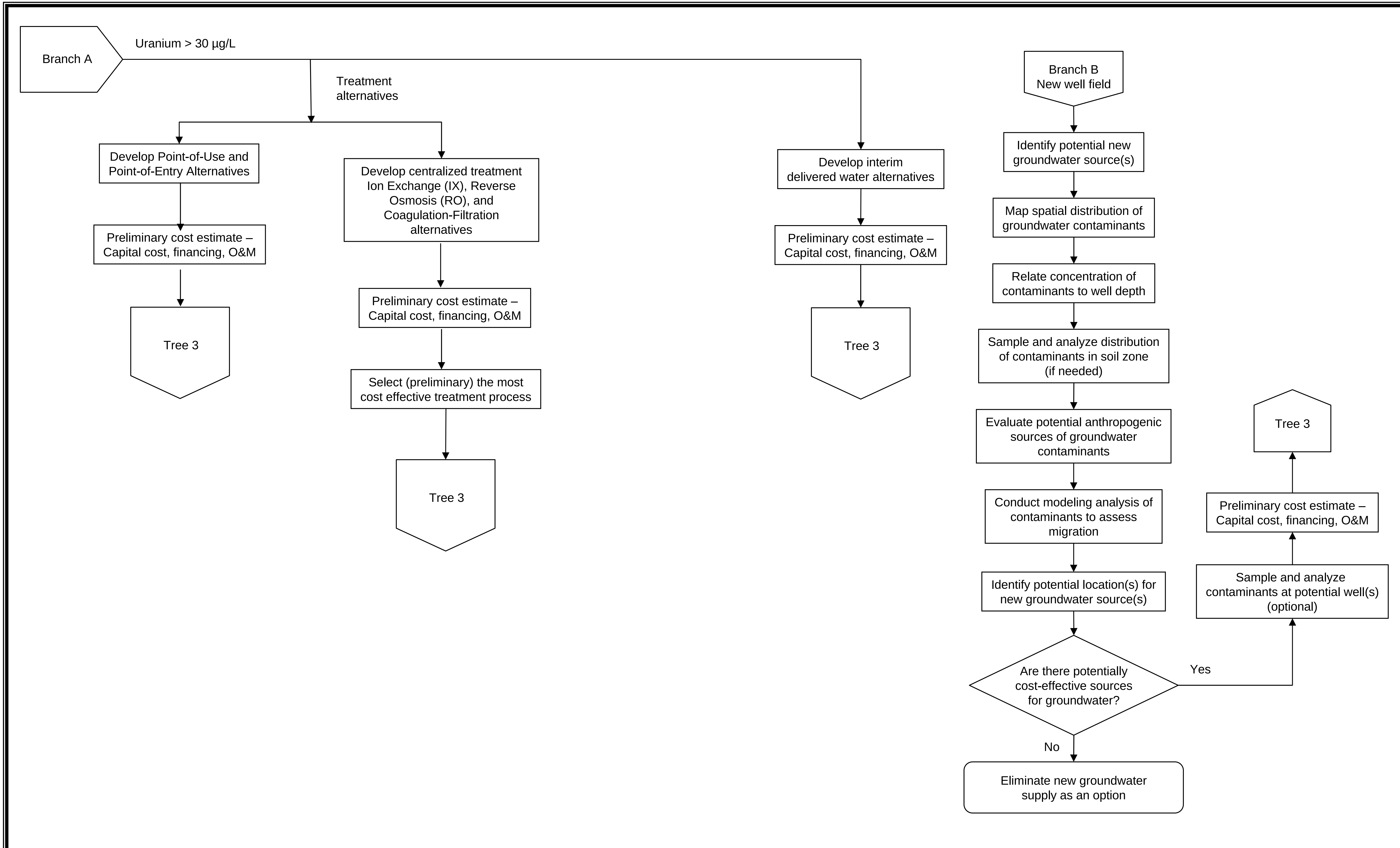


Figure 2.2
TREE 2 – DEVELOP TREATMENT ALTERNATIVES



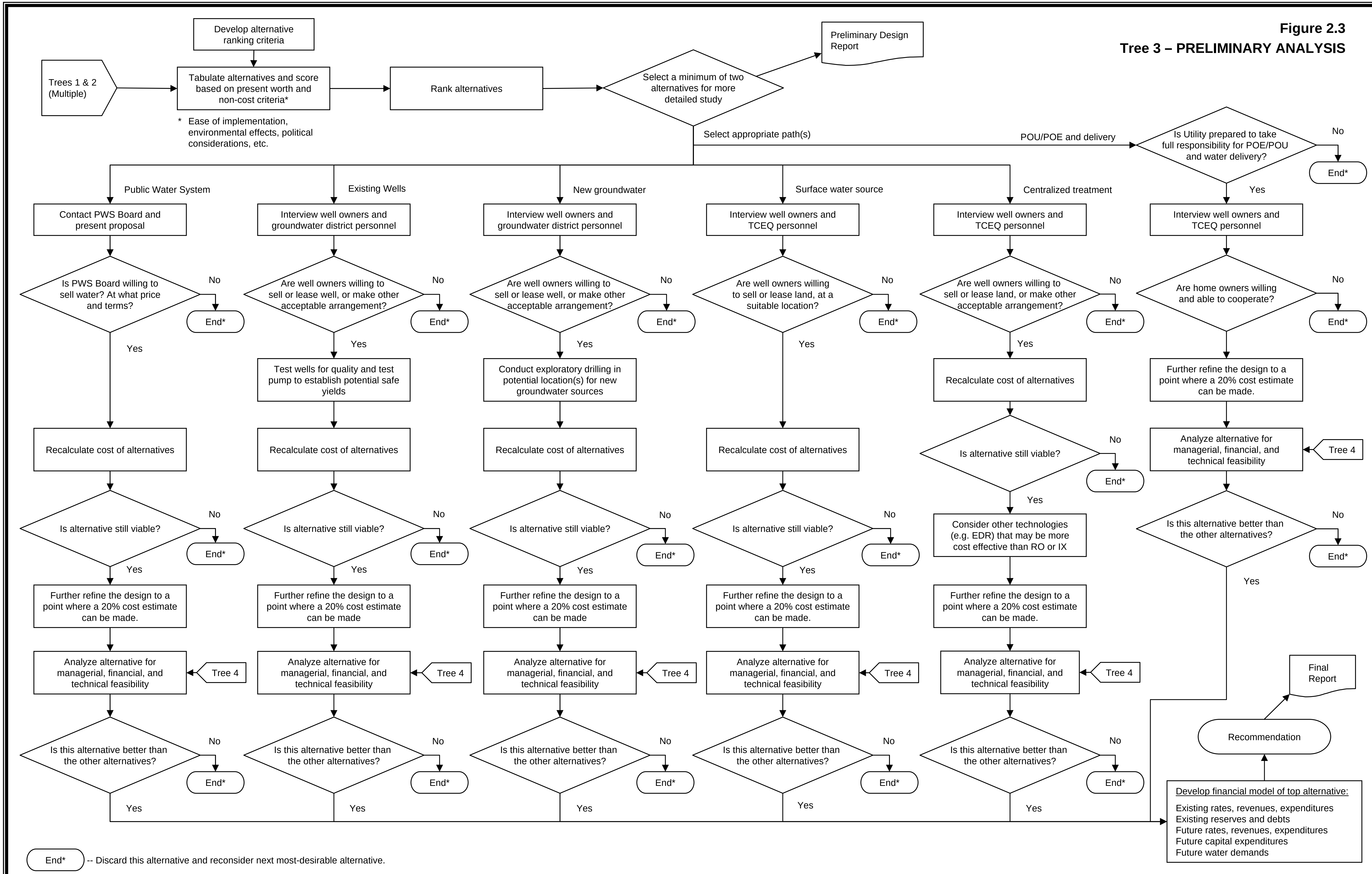
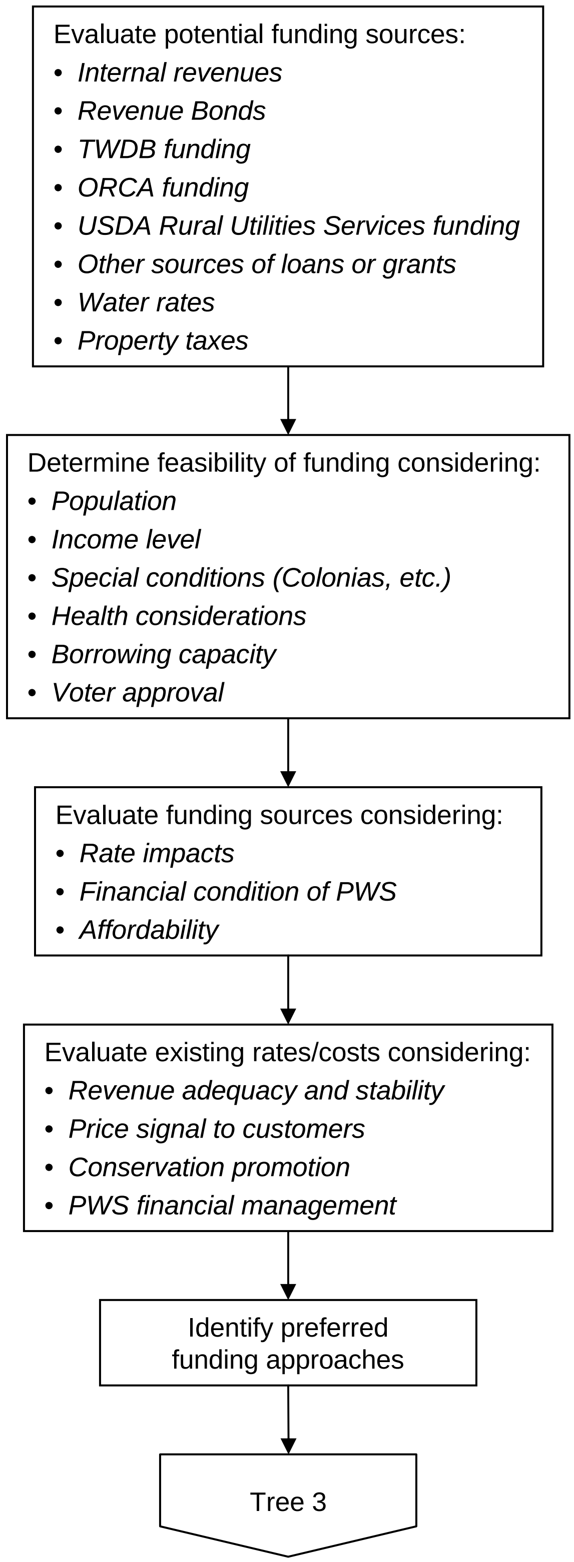


Figure 2.3
Tree 3 – PRELIMINARY ANALYSIS

Figure 2.4
TREE 4 – FINANCIAL



The CCN files generally contain a copy of the system's Certificate of Convenience and Necessity, along with maps and other technical data.

These files were reviewed for the PWS and surrounding systems.

The following websites were consulted to identify the water supply systems in the area:

- Texas Commission on Environmental Quality
  www3.tceq.state.tx.us/iwud/.
- USEPA Safe Drinking Water Information System
  www.epa.gov/safewater/data/getdata.html

Groundwater Control Districts were identified on the TWDB web site, which has a series of maps covering various groundwater and surface water subjects. One of those maps shows groundwater control districts in the State of Texas.

2.2.1.2 Existing Wells

The TWDB maintains a groundwater database available at www.twdb.state.tx.us that has two tables with helpful information. The "Well Data Table" provides a physical description of the well, owner, location in terms of latitude and longitude, current use, and for some wells, items such as flowrate, and nature of the surrounding formation. The "Water Quality Table" provides information on the aquifer and the various chemical concentrations in the water.

2.2.1.3 Surface Water Sources

Regional planning documents were consulted for lists of surface water sources.

2.2.1.4 Groundwater Availability Model

GAMs, developed by the TWDB, are planning tools and should be consulted as part of a search for new or supplementary water sources. The GAM for the southern Gulf Coast Aquifer was investigated as a potential tool for identifying available and suitable groundwater resources.

2.2.1.5 Water Availability Model

The WAM is a computer-based simulation predicting the amount of water that would be in a river or stream under a specified set of conditions. WAMs are used to determine whether water would be available for a newly requested water right or amendment. If water is available, these models estimate how often the applicant could count on water under various conditions (*e.g.*, whether water would be available only one month out of the year, half the year, or all year, and whether that water would be available in a repeat of the drought of record).

WAMs provide information that assist TCEQ staff in determining whether to recommend the granting or denial of an application.

2.2.1.6 Financial Data

An evaluation of existing data will yield an up-to-date assessment of the financial condition of the water system. As part of a site visit, financial data were collected in various forms such as electronic files, hard copy documents, and focused interviews. Financial data were collected through a site visit. Data sought included:

- Annual Budget
- Audited Financial Statements
  - Balance Sheet
  - Income & Expense Statement
  - Cash Flow Statement
  - Debt Schedule
- Water Rate Structure
- Water Use Data
  - Production
  - Billing
  - Customer Counts

2.2.1.7 Demographic Data

Basic demographic data were collected from the 2000 Census to establish incomes and eligibility for potential low cost funding for capital improvements. Median household income (MHI) and number of families below poverty level were the primary data points of significance. If available, MHI for the customers of the PWS should be used. In addition, unemployment data were collected from current U.S. Bureau of Labor Statistics. These data were collected for the following levels: national, state, and county.

2.2.2 PWS Interviews

2.2.2.1 PWS Capacity Assessment Process

Capacity assessment is the industry standard term for evaluation of a water system's FMT capacity to effectively deliver safe drinking water to its customers now and in the future at a reasonable cost, and to achieve, maintain and plan for compliance with applicable regulations. The assessment process involves interviews with staff and management who have a responsibility in the operations and management of the system.

Financial, managerial, and technical capacity are individual yet highly interrelated components of a system's capacity. A system cannot sustain capacity without maintaining adequate capability in all three components.

Financial capacity is a water system's ability to acquire and manage sufficient financial resources to allow the system to achieve and maintain compliance with SDWA regulations. Financial capacity refers to the financial resources of the water system, including but not limited to, revenue sufficiency, credit worthiness, and fiscal controls.

Managerial capacity is the ability of a water system to conduct its affairs so the system is able to achieve and maintain compliance with SDWA requirements. Managerial capacity refers to the management structure of the water system, including but not limited to, ownership accountability, staffing and organization, and effective relationships with customers and regulatory agencies.

Technical capacity is the physical and operational ability of a water system to achieve and maintain compliance with SDWA regulations. It refers to the physical infrastructure of the water system, including the adequacy of the source water, treatment, storage and distribution infrastructure. It also refers to the ability of system personnel to effectively operate and maintain the system and to otherwise implement essential technical knowledge.

Many aspects of water system operations involve more than one component of capacity. Infrastructure replacement or improvement, for example, requires financial resources, management planning and oversight, and technical knowledge. A deficiency in any one area could disrupt the entire operation. A system that is able to meet both its immediate and long-term challenges demonstrates that it has sufficient FMT capacity.

Assessment of FMT capacity of the PWS was based on an approach developed by the New Mexico Environmental Finance Center (NMEFC), which is consistent with the TCEQ FMT assessment process. This method was developed from work the NMEFC did while assisting USEPA Region 6 in developing and piloting groundwater comprehensive performance evaluations. The NMEFC developed a standard list of questions that could be asked of water system personnel. The list was then tailored slightly to have two sets of questions – one for managerial and financial personnel, and one for operations personnel (the questions are included in Appendix A). Each person with a role in the FMT capacity of the system was asked the applicable standard set of questions individually. The interviewees were not given the questions in advance and were not told the answers others provided. Also, most of the questions are open ended type questions so they were not asked in a fashion to indicate what would be the "right" or "wrong" answer. The interviews lasted between 45 minutes to 75 minutes depending on the individual's role in the system and the length of the individual's answers.

In addition to the interview process, visual observations of the physical components of the system were made. A technical information form was created to capture this information. This form is also contained in Appendix A. This information was considered supplemental to the interviews because it served as a check on information provided in the interviews. For example, if an interviewee stated he or she had an excellent preventative maintenance schedule and the visit to the facility indicated a significant amount of deterioration (more than would be expected for the age of the facility) then the preventative maintenance program could be further investigated or the assessor could decide that the preventative maintenance program was inadequate.

Following interviews and observations of the facility, answers that all personnel provided were compared and contrasted to provide a clearer picture of the true operations at the water system. The intent was to go beyond simply asking the question, "Do you have a budget?" to actually finding out if the budget was developed and being used appropriately. For example, if a water system manager was asked the question, "Do you have a budget?" he or she may say, "yes" and the capacity assessor would be left with the impression that the system is doing well in this area. However, if several different people are asked about the budget in more detail, the assessor may find that although a budget is present, operations personnel do not have input into the budget, the budget is not used by the financial personnel, the budget is not updated regularly, or the budget is not used in setting or evaluating rates. With this approach, the inadequacy of the budget would be discovered and the capacity deficiency in this area would be noted.

Following the comparison of answers, the next step was to determine which items noted as a potential deficiency truly had a negative effect on the system's operations. If a system had what appeared to be a deficiency, but this deficiency was not creating a problem in terms of the operations or management of the system, it was not considered critical and may not have needed to be addressed as a high priority. As an example, the assessment may have revealed an insufficient number of staff members to operate the facility. However, it may also have been revealed that the system was able to work around that problem by receiving assistance from a neighboring system, so no severe problems resulted from the number of staff members. Although staffing may not be ideal, the system does not need to focus on this particular issue. The system needs to focus on items that are truly affecting operations. As an example of this type of deficiency, a system may lack a reserve account which can then lead the system to delay much-needed maintenance or repair on its storage tank. In this case, the system needs to address the reserve account issue so that proper maintenance can be completed.

The intent was to develop a list of capacity deficiencies with the greatest impact on the system's overall capacity. Those were the most critical items to address through follow-up technical assistance or by the system itself.

2.2.2.2 Interview Process

PWS personnel were interviewed by the project team, and each was interviewed separately. Interview forms were completed during each interview.

2.3 ALTERNATIVE DEVELOPMENT AND ANALYSIS

The initial objective for developing alternatives to address compliance issues is to identify a comprehensive range of possible options that can be evaluated to determine the most promising for implementation. Once the possible alternatives are identified, they must be defined in sufficient detail so a conceptual cost estimate (capital and operation and maintenance [O&M] costs) can be developed. These conceptual cost estimates are used to compare the affordability of compliance alternatives, and to give a preliminary indication of rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation. The basis for the unit costs used for the compliance alternative cost estimates is summarized in Appendix B. Other non-economic factors for the alternatives, such as reliability and ease of implementation, are also addressed

2.3.1 Existing PWS

The neighboring PWSs were identified, and the extents of their systems were investigated. PWSs farther than 15 miles from the non-compliant PWSs were not considered because the length of the pipeline required would make the alternative cost prohibitive. The quality of water provided was also investigated. For neighboring PWSs with compliant water, options for water purchase and/or expansion of existing well fields were considered. The neighboring PWSs with non-compliant water were considered as possible partners in sharing the cost for obtaining compliant water either through treatment or developing an alternate source.

The neighboring PWSs were investigated to get an idea of the water sources in use and the quantity of water that might be available for sale. They were contacted to identify key locations in their systems where a connection might be made to obtain water, and to explore on a preliminary basis their willingness to partner or sell water. Then, the major system components that would be required to provide compliant water were identified. The major system components included treatment units, wells, storage tanks, pump stations, and pipelines.

Once the major components were identified, a preliminary design was developed to identify sizing requirements and routings. A capital cost estimate was then developed based on the preliminary design of the required system components. An annual O&M cost was also estimated to reflect the change in O&M expenditures that would be needed if the alternative was implemented.

Non-economic factors were also identified. Ease of implementation was considered, as well as the reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.3.2 New Groundwater Source

It was not possible in the scope of this project to determine conclusively whether new wells could be installed to provide compliant drinking water. To evaluate potential new groundwater source alternatives, three test cases were developed based on distance from the PWS intake point. The test cases were based on distances of 10 miles, 5 miles, and 1 mile. It was assumed that a pipeline would be required for all three test cases, and a storage tank and pump station would be required for the 10-mile and 5-mile alternatives. It was also assumed that new wells would be installed, and that their depths would be similar to the depths of the existing wells, or other existing drinking water wells in the area.

A preliminary design was developed to identify sizing requirements for the required system components. A capital cost estimate was then developed based on the preliminary design of the required system components. An annual O&M cost was also estimated to reflect the change (*i.e.*, from current expenditures) in O&M expenditures that would be needed if the alternative was implemented.

Non-economic factors were also identified. Ease of implementation was considered, as well as the reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.3.3 New Surface Water Source

New surface water sources were investigated. Availability of adequate quality water was investigated for the main rivers in the area, as well as the major reservoirs. TCEQ WAMs were inspected, and the WAM was run, where appropriate.

2.3.4 Treatment

Treatment technologies considered potentially applicable to uranium removal are RO, IX, and enhanced coagulation-filtration. RO treatment produces a liquid waste (reject or concentrate) which represents 25 to 40% of the volume of the potable water produced. As a result, the treated volume of water is less than the volume of raw water that enters the treatment system. The amount of raw water used increases to produce the same amount of treated water if RO treatment is implemented. The treatment units were sized based on flow rates, and capital and annual O&M cost estimates were made based on the size of the treatment equipment required. Neighboring non-compliant PWSs were identified to look for opportunities where the costs and benefits of central treatment could be shared between systems.

Non-economic factors were also identified. Ease of implementation was considered, as well as reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.4 COST OF SERVICE AND FUNDING ANALYSIS

The primary purpose of the cost of service and funding analysis is to determine the financial impact of implementing compliance alternatives, primarily by examining the required rate increases, and also the fraction of household income that water bills represent. The current financial situation is also reviewed to determine what rate increases are necessary for the PWS to achieve or maintain financial viability.

2.4.1 Financial Feasibility

A key financial metric is the comparison of an average annual household water bill for a PWS customer to the MHI for the area. MHI data from the 2000 census are used at the most detailed level available for the community. Typically, county level data are used for small rural water utilities due to small population sizes. Annual water bills are determined for existing base conditions, including consideration of additional rate increases needed under current conditions. Annual water bills are also calculated after adding incremental capital and operating costs for each of the alternatives to determine feasibility under several potential funding sources. It has been suggested by agencies such as USEPA that federal and state programs consider several criteria to determine "disadvantaged communities" with one based on the typical residential water bill as a percentage of MHI.

Additionally, the use of standard ratios provides insight into the financial condition of any business. Three ratios are particularly significant for water utilities:

- Current Ratio = current assets (items that could be converted to cash) divided by current liabilities (accounts payable, accrued expenses, and debt) provides insight into the ability to meet short-term payments. For a healthy utility, the value should be greater than 1.0.
- Debt to Net Worth Ratio = total debt (total amount of money borrowed) divided by net worth (total assets minus total liabilities) shows to what degree assets of the company have been funded through borrowing. A lower ratio indicates a healthier condition.
- Operating Ratio = total operating revenues divided by total operating expenses show the degree to which revenues cover ongoing expenses. The value is greater than 1.0 if the utility is covering its expenses.

2.4.2 Median Household Income

The 2000 U.S. Census is used as the basis for MHI. In addition to consideration of affordability, the annual MHI may also be an important factor for sources of funds for capital programs needed to resolve water quality issues. Many grant and loan programs are available to lower income rural areas, based on comparisons of local income to statewide incomes. In the 2000 Census, MHI for the State of Texas was $39,927, compared to the U.S. level of $41,994. The census broke down MHIs geographically by block group and ZIP code. The MHIs can vary significantly for the same location, depending on the geographic subdivision chosen. The MHI for each PWS was estimated by selecting the most appropriate value based on block group or ZIP code based on results of the site interview and a comparison with the surrounding area.

2.4.3 Annual Average Water Bill

The annual average household water bill was calculated for existing conditions and for future conditions incorporating the alternative solutions. Average residential consumption is estimated and applied to the existing rate structure to estimate the annual water bill. The estimates are generated from a long-term financial planning model that details annual revenue, expenditure, and cash reserve requirements over a 30-year period.

2.4.4 Financial Plan Development

The financial planning model uses available data to establish base conditions under which the system operates. The model includes, as available:

- Accounts and consumption data
- Water tariff structure
- Beginning available cash balance
- Sources of receipts:
    - Customer billings
    - Membership fees
    - Capital Funding receipts from:
        - Grants
        - Proceeds from borrowing
- Operating expenditures:
    - Water purchases
    - Utilities
    - Administrative costs
    - Salaries
- Capital expenditures
- Debt service:
    - Existing principal and interest payments
    - Future principal and interest necessary to fund viable operations
- Net cash flow
- Restricted or desired cash balances:
    - Working capital reserve (based on 1-4 months of operating expenses)
    - Replacement reserves to provide funding for planned and unplanned repairs and replacements

From the model, changes in water rates are determined for existing conditions and for implementing the compliance alternatives.

2.4.5 Financial Plan Results

Results from the financial planning model are summarized in two areas: percentage of household income and total water rate increase necessary to implement the alternatives and maintain financial viability.

2.4.5.1 Funding Options

Results are summarized in a table that shows the following according to alternative and funding source:

- Percentage of the median annual household income the average annual residential water bill represents.
- The first year in which a water rate increase would be required
- The total increase in water rates required, compared to current rates

Water rates resulting from the incremental capital costs of the alternative solutions are examined under a number of funding options. The first alternative examined is always funding from existing reserves plus future rate increases. Several funding options were analyzed to frame a range of possible outcomes.

- Grant funds for 100 percent of required capital. In this case, the PWS is only responsible for the associated O&M costs.
- Grant funds for 75 percent of required capital, with the balance treated as if revenue bond funded.
- Grant funds for 50 percent of required capital, with the balance treated as if revenue bond funded.
- State revolving fund loan at the most favorable available rates and terms applicable to the communities.
- If local MHI > 75 percent of state MHI, standard terms, currently at 3.8 percent interest for non-rated entities. Additionally:
    - If local MHI = 70-75 percent of state MHI, 1 percent interest rate on loan.
    - If local MHI = 60-70 percent of state MHI, 0 percent interest rate on loan.
    - If local MHI = 50-60 percent of state MHI, 0 percent interest and 15 percent forgiveness of principal.
    - If local MHI less than 50 percent of state MHI, 0 percent interest and 35 percent forgiveness of principal.
- Terms of revenue bonds assumed to be 25-year term at 6.0 percent interest rate.

2.4.5.2 General Assumptions Embodied in Financial Plan Results

The basis used to project future financial performance for the financial plan model includes:

- No account growth (either positive or negative).
- No change in estimate of uncollectible revenues over time.
- Average consumption per account unchanged over time.
- No change in unaccounted for water as percentage of total (more efficient water use would lower total water requirements and costs).
- No inflation included in the analyses (although the model has provisions to add escalation of O&M costs, doing so would mix water rate impacts from inflation with the impacts from the alternatives being examined).
- Minimum working capital fund established for each district, based on specified months of O&M expenditures.
- O&M for alternatives begins 1 year after capital implementation.
- Balance of capital expenditures not funded from primary grant program is funded through debt (bond equivalent).
- Cash balance drives rate increases, unless provision chosen to override where current net cash flow is positive.

2.4.5.3 Interpretation of Financial Plan Results

Results from the financial plan model are presented in a Table 4.4, which shows the percentage of MHI represented by the annual water bill that results from any rate increases necessary to maintain financial viability over time. In some cases, this may require rate increases even without implementing a compliance alternative (the no action alternative). The table shows any increases such as these separately. The results table shows the total increase in rates necessary, including both the no-action alternative increase and any increase required for the alternative. For example, if the no action alternative requires a 10 percent increase in rates and the results table shows a rate increase of 25 percent, then the impact from the alternative is an increase in water rates of 15 percent. Likewise, the percentage of household income in the table reflects the total impact from all rate increases.

2.4.5.4 Potential Funding Sources

A number of potential funding sources exist for rural utilities, which typically provide service to less than 50,000 people. Both state and federal agencies offer grant and loan programs to assist rural communities in meeting their infrastructure needs. Most are available to "political subdivisions" such as counties, municipalities, school districts, special districts, or authorities of the state with some programs providing access to private individuals. Grant funds are made more available with demonstration of economic stress, typically indicated with

MHI below 80 percent that of the state. The funds may be used for planning, design, and construction of water supply construction projects including, but not limited to, line extensions, elevated storage, purchase of well fields, and purchase or lease of rights to produce groundwater. Interim financing of water projects and water quality enhancement projects such as wastewater collection and treatment projects are also eligible. Some funds are used to enable a rural water utility to obtain water or wastewater service supplied by a larger utility or to finance the consolidation or regionalization of neighboring utilities. Three Texas agencies that offer financial assistance for water infrastructure are:

- Texas Water Development Board has several programs that offer loans at interest rates lower than the market offers to finance projects for public drinking water systems that facilitate compliance with primary drinking water regulations. Additional subsidies may be available for disadvantaged communities. Low interest rate loans with short and long-term finance options at tax exempt rates for water or water-related projects give an added benefit by making construction purchases qualify for a sales tax exemption. Generally, the program targets customers with eligible water supply projects for all political subdivisions of the state (at tax exempt rates) and Water Supply Corporations (at taxable rates) with projects.
- Office of Rural Community Affairs (ORCA) is a Texas state agency with a focus on rural Texas by making state and federal resources accessible to rural communities. Funds from the U.S. Department of Housing and Urban Development Community Development Block Grants (CDBG) are administered by ORCA for small, rural communities with populations less than 50,000 that cannot directly receive federal grants. These communities are known as non-entitlement areas. One of the program objectives is to meet a need having a particular urgency, which represents an immediate threat to the health and safety of residents, principally for low- and moderate-income persons.
- U.S. Department of Agriculture Rural Development Texas (Texas Rural Development) coordinates federal assistance to rural Texas to help rural Americans improve their quality of life. The Rural Utilities Service (RUS) programs provide funding for water and wastewater disposal systems.

The application process, eligibility requirements, and funding structure vary for each of these programs. There are many conditions that must be considered by each agency to determine eligibility and ranking of projects. The principal factors that affect this choice are population, percent of the population under the state MHI, health concerns, compliance with standards, Colonia status, and compatibility with regional and state plans.

2.4.5.5 Texas Community Development Block Grants

Introduction

Every year, the U.S. Department of Housing and Urban Development (HUD) provides federal CDBG funds directly to states, which, in turn, provide the funds to small, rural cities with populations of less than 50,000, and to counties that have a non-metropolitan population under 200,000 and are not eligible for direct funding from HUD. These small communities are called “non-entitlement” areas because they must apply for CDBG dollars through state agencies. The grants may be used for community and economic development activities, but are primarily used for housing rehabilitation, wastewater and drinking water facilities, public works facilities, and economic development. Seventy percent of grant funds must be used for activities that principally benefit low to moderate-income persons.

CDBG funds are administered through the ORCA and the Texas Department of Agriculture (TDA). ORCA administers the Texas CDBG Program and TDA administers the Texas Capital Fund (TCF) through an interagency agreement between ORCA and TDA. ORCA was created not only to focus on rural issues, but to monitor government performance, research problems and find solutions, and to coordinate rural programs among state agencies. TDA offers the infrastructure development program as part of the TCF, which provides assistance with public infrastructure projects needed to by businesses to create or retain jobs for low and moderate income persons.

ORCA’s CDBG program of Texas is the largest in the nation. The rural-focused program serves approximately 1,017 eligible rural communities, 245 rural counties, and provides services to over 375,000 low- to moderate-income beneficiaries each year. Of the 1,017 communities eligible for CDBG funds, 740 have a population of less than 3,000, and 424 have a population of less than 1,000. The demographics and rural characteristics of Texas have shaped a program that focuses on providing basic human needs and sanitary infrastructure to small rural communities in outlying areas.

Eligible Applicants

Eligible applicants are nonentitlement general purpose units of local government, including cities and counties that are not participating or designated as eligible to participate in the entitlement portion of the federal CDBG. Nonentitlement cities that are not participating in urban county programs through existing participation agreements are eligible applicants (unless the city’s population is counted toward the urban county CDBG allocation).

Nonentitlement cities are located predominately in rural areas and are cities with populations less than 50,000 thousand persons; cities that are not designated as a central city of a metropolitan statistical area; and cities that are not participating in urban county programs. Nonentitlement counties are also predominately rural in nature and are counties that generally have fewer than 200,000 persons in the nonentitlement communities and unincorporated areas located in the county.

Eligible Activities

Eligible activities under the Texas CDBG Program are listed in 42 United States Code Section 5305. The Texas CDBG staff reviews all proposed project activities included in applications for all fund categories. The TDA determines the eligibility of activities included in TCF applications.

All proposed activities must meet one of the following three National Program Objectives:

1. Benefit principally low- and moderate-income persons; or
2. Aid in the elimination of slums or blight; or
3. Meet other community development needs of particular urgency that represent an immediate threat to the health and safety of residents of the community.

Ineligible Activities

In general, any type of activity not described or referred to in 42 United States Code Section 5305 is ineligible. Specific activities ineligible under the Texas CDBG Program are:

1. Construction of buildings and facilities used for the general conduct of government (*e.g.* city halls, courthouses, *etc.*);
2. Construction of new housing, except as last resort housing under 49 Code of Federal Regulations (CFR) Part 24 or affordable housing through eligible subrecipients in accordance with 24 CFR 570.204;
3. Financing of political activities;
4. Purchases of construction equipment (except in limited circumstances under the STEP Program);
5. Income payments, such as housing allowances; and
6. Most O&M expenses (including smoke testing, televising/video taping line work, or any other investigative method to determine the overall scope and location of the project work activities)

The TCF will not accept applications in support of public or private prisons, racetracks, and projects that address job creation/retention through a government supported facility. The TCF Program may be used to financially assist/facilitate the relocation of a business when certain requirements, as defined in the application guidelines, are met.

Primary Beneficiaries

The primary beneficiaries of the Texas CDBG Program are low to moderate income persons as defined under HUD, Section 8 Assisted Housing Program (Section l02(c)). Low income families are defined as those earning less than 50 percent of the area MHI. Moderate income families are defined as those earning less than 80 percent of the area MHI. The area median family can be based on a metropolitan statistical area, a non-metropolitan county, or the statewide non-metropolitan MHI figure.

Section 108 Loan Guarantee Program

Section 108 is the loan guarantee provision of the Texas CDBG Program. Section 108 provides communities with a source of financing for economic development, housing rehabilitation, public facilities, and large-scale physical development projects. This makes it one of the most potent and important public investment tools that HUD offers to local governments. It allows these local governments to transform a small portion of their CDBG funds into federally guaranteed loans large enough to pursue physical and economic revitalization projects that can renew entire neighborhoods. Such public investment is often needed to inspire private economic activity, providing the initial resources, or simply the confidence that private firms and individuals may need to invest in distressed areas. Section 108 loans are not risk-free; however, local governments borrowing funds guaranteed by Section 108 must pledge their current and future CDBG allocations to cover the loan amount as security for the loan.

The loan is made by a private lender to an eligible nonentitlement city or county. HUD guarantees the loan; however, Texas CDBG must pledge the state's current and future CDBG nonentitlement area funds to cover any losses. To provide eligible nonentitlement communities an additional funding source, the State is authorizing a loan guarantee pilot program for 2008 consisting of one application up to a maximum of $500,000 for a particular project. An application guide containing the submission date and qualifications will be available for applicants interested in being selected as the pilot project under this program.

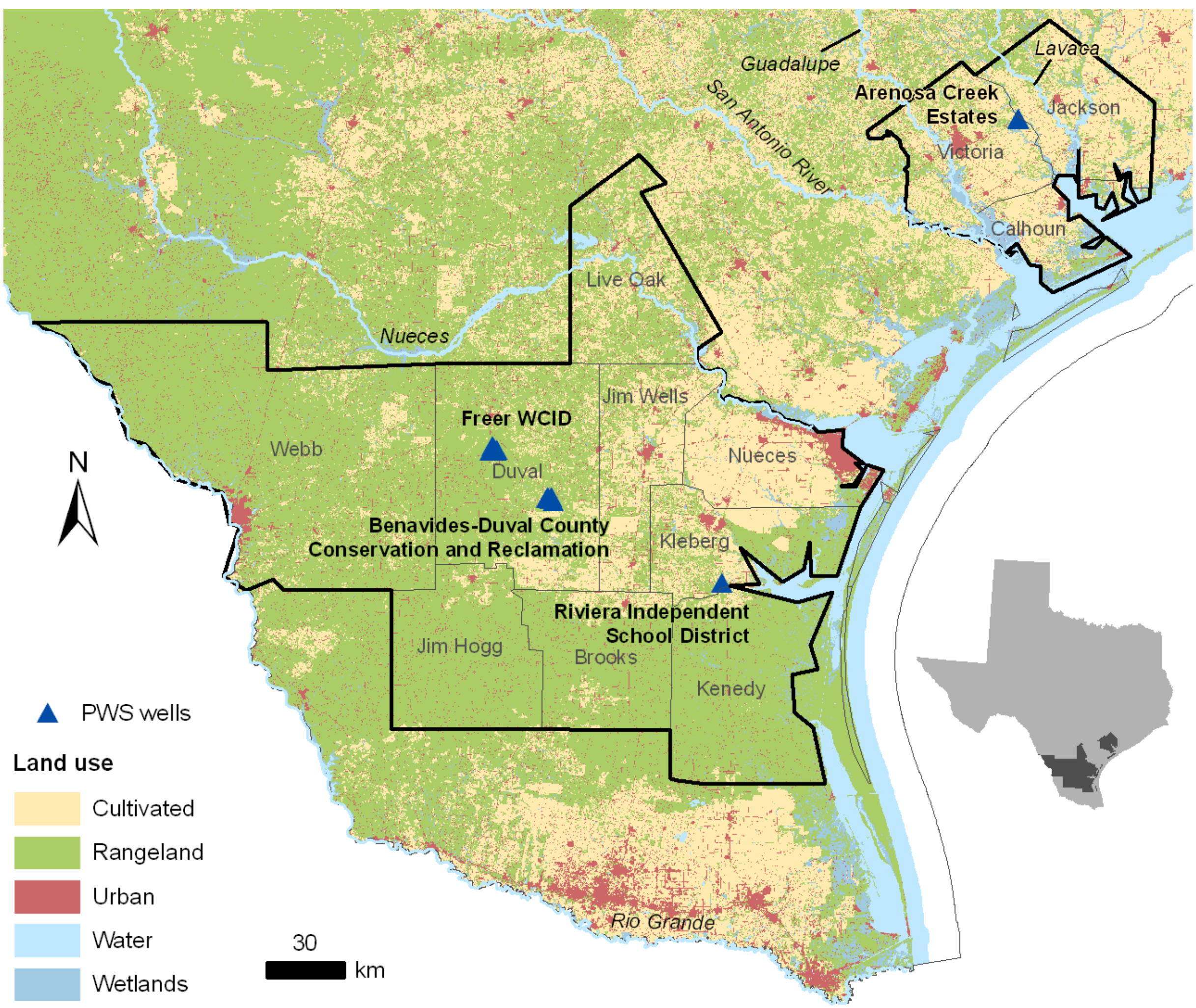
SECTION 3
UNDERSTANDING SOURCES OF CONTAMINANTS

3.1 REGIONAL ANALYSIS

3.1.1 Overview of the Study Area

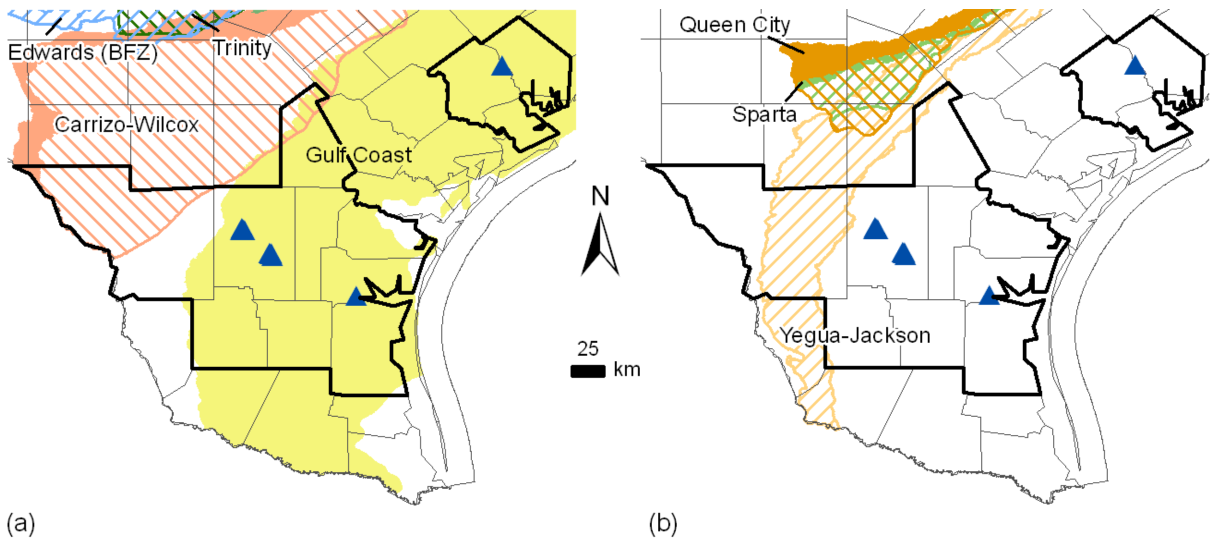
The regional overview below includes data from 12 counties in southeastern Texas, along the coast of the Gulf of Mexico: Brooks, Calhoun, Duval, Jackson, Jim Hogg, Jim Wells, Kenedy, Kleberg, Live Oak, Nueces, Victoria, and Webb (Figure 3.1). Land uses shown here are based on the National Land Cover Database for 2001 (U.S. Department of Agriculture Service Center Agencies 2007).

Figure 3.1 Regional Study Area and Locations of the PWS Wells Assessed



Major and minor aquifers found in this region are shown in Figure 3.2. All PWS wells of concern were drilled within the Gulf Coast aquifer system, which consists of a number of distinct aquifers and is described in more detail below. From oldest to youngest, and from northwest to southeast, these aquifers are known as the Jasper, Evangeline, and Chicot. In addition, the Carrizo-Wilcox and Yegua-Jackson aquifers are present in the western part of the study area. Other aquifers that are near, but not within, the study area include the Edwards (Balcones Fault Zone), Queen City, Sparta, and Trinity aquifers.

Figure 3.2 Major (a) and Minor (b) Aquifers in the Study Area



Solid indicates a portion of an aquifer that lies at the land surface. Hatched indicates a portion of an aquifer that underlies other formations.

Data used for this study include information from three sources:

- Texas Water Development Board groundwater database available at www.twdb.state.tx.us. The database includes information on the location and construction of wells throughout the state as well as historical measurements of water chemistry and levels in the wells.
- Texas Commission on Environmental Quality Public Water Supply database (not publicly available). The database includes information on the location, type, and construction of water sources used by PWSs in Texas, along with historical measurements of water levels and chemistry.
- National Uranium Resource Evaluation (NURE) database available at: tin.er.usgs.gov/nure/water. The NURE dataset includes groundwater quality data collected between 1975 and 1980. The database provides well locations and depths with an array of analyzed chemical data.

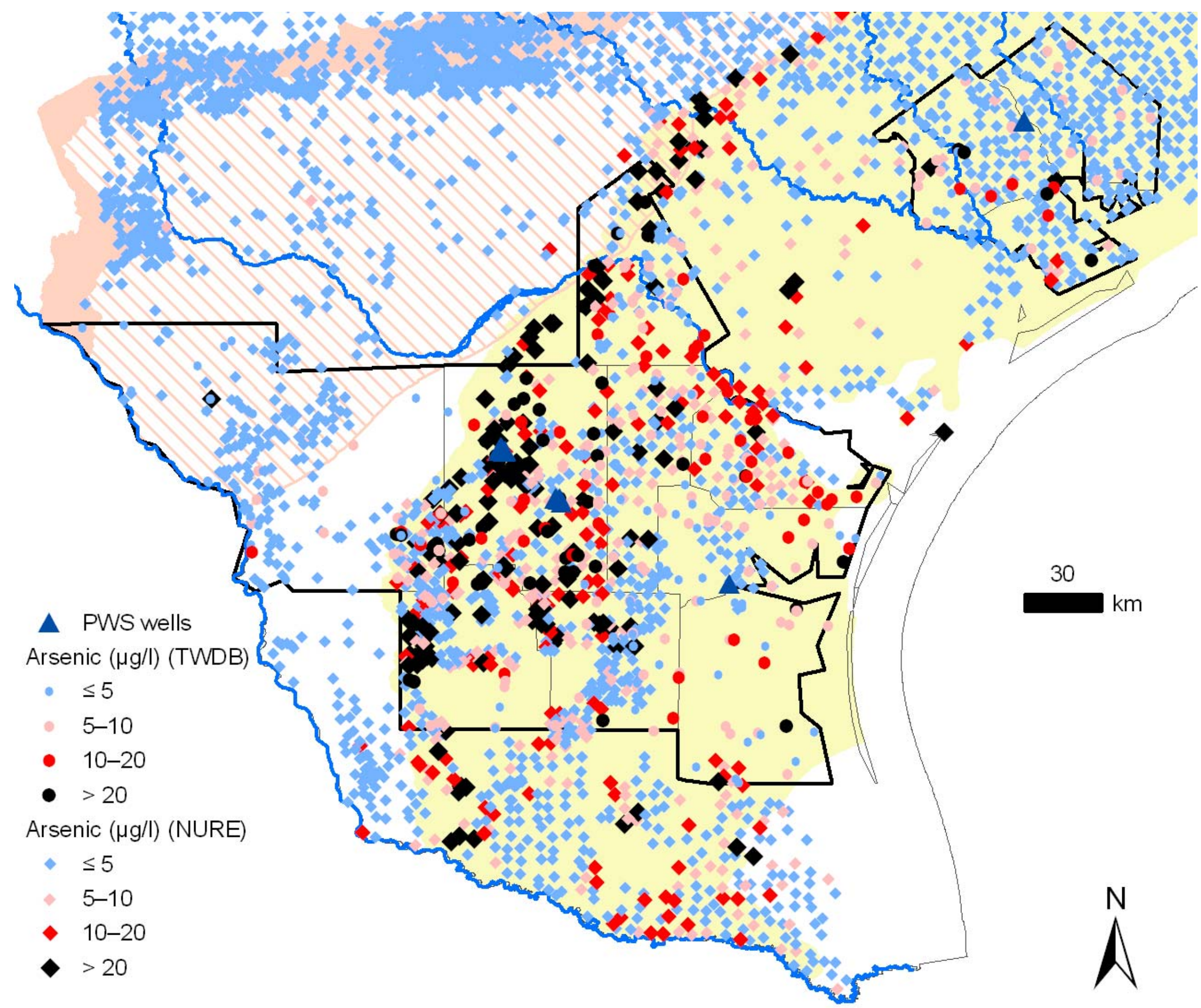
3.1.2 Contaminants of Concern in the Study Area

Contaminants addressed in this study include arsenic, combined radium, gross alpha, and uranium. Groundwater supplies from PWSs in the study area assessed in Section 2 have been found to contain levels of one or more of these contaminants in excess of the USEPA's MCL. The database or databases used to assess each constituent are those with the most available measurements. For individual wells sampled for a given constituent multiple times, the most recent measurement is shown.

Arsenic

Arsenic levels exceed the MCL (10 µg/L) in many wells drilled within the Gulf Coast aquifer system (Figure 3.3). The values shown in these figures are based on the most recent sample for each well. In particular, these maps show many wells with high arsenic concentrations along the western, updip area of the aquifer system.

Figure 3.3 Spatial Distribution of Arsenic Concentrations



The distribution of arsenic within the study area can be further described by looking at the number of wells in each aquifer that exceeds the MCL (Table 3.1). Arsenic concentrations are distinctively higher in the Jasper aquifer, where 62 percent of the wells exceed the MCL for arsenic, than in the rest of the Gulf Coast aquifer system, where 13–24 percent of wells exceed the MCL. Because the units in the aquifer system become progressively older from southeast to northwest, many of the high arsenic wells along the northwest edge of the aquifer likely belong to the Jasper aquifer, the oldest aquifer in the system. All wells in the Carrizo-Wilcox and Yegua-Jackson aquifers contain acceptable levels of arsenic.

The data in Table 3.1 were obtained from the TWDB groundwater database (samples from the NURE database were not included because the database does not associate sampled wells with aquifers). TWDB aquifer codes used to define the aquifers within the Gulf Coast aquifer system include

- Chicot Aquifer: Codes 110AVLS, 112BMLG, 112BMLS, 112BMNT, 112CHCT, 112CHCTL, 112CHCTU, and 112LISS
- Evangeline Aquifer: Codes 110AVGL, 121EVGL, 112GOLD, and 121GOLD.
- Jasper Aquifer: Codes 112CTHL, 112JSPR, 112LGRT, and 112OKVC.

Wells in the Gulf Coast aquifer system that are not identified as being within one of these aquifers are not included.

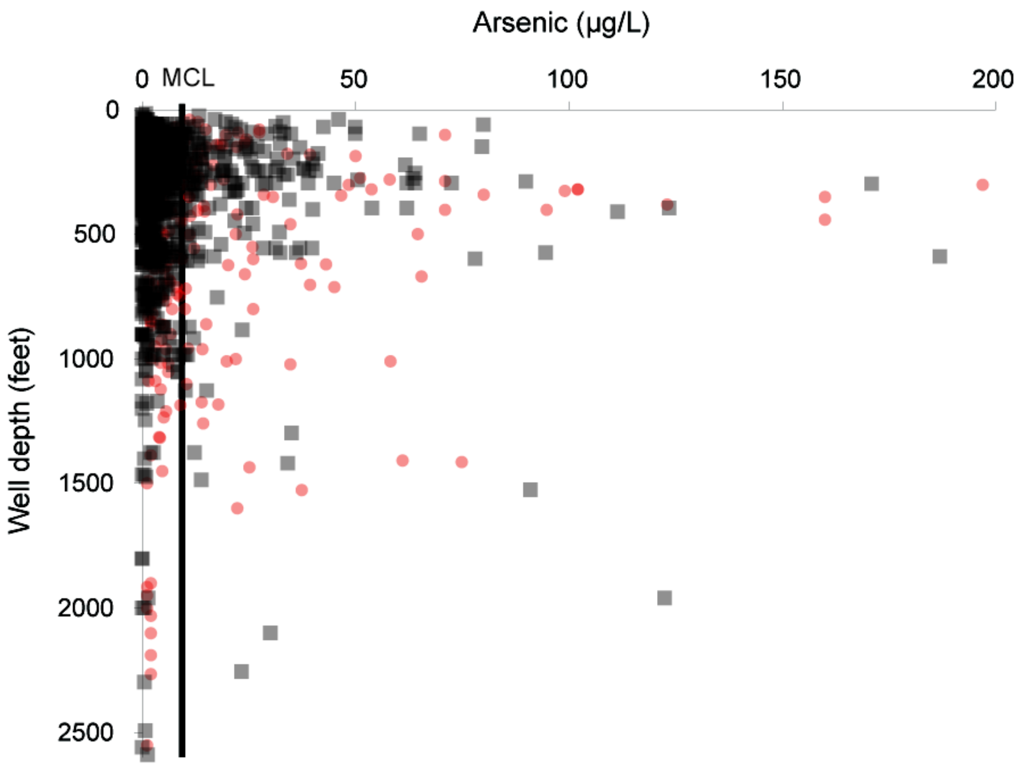
Table 3.1 Summary of Wells that Exceed the MCL for Arsenic, by Aquifer

Aquifer	Wells with measurements	Wells that exceed 10 μg/L	Percentage of wells that exceed 10 μg/L
Chicot	39	5	13
Evangeline	175	42	24
Jasper	69	43	62
Carrizo-Wilcox	16	0	0
Yegua-Jackson	4	0	0
other	21	6	29

Data from the TWDBD Database.

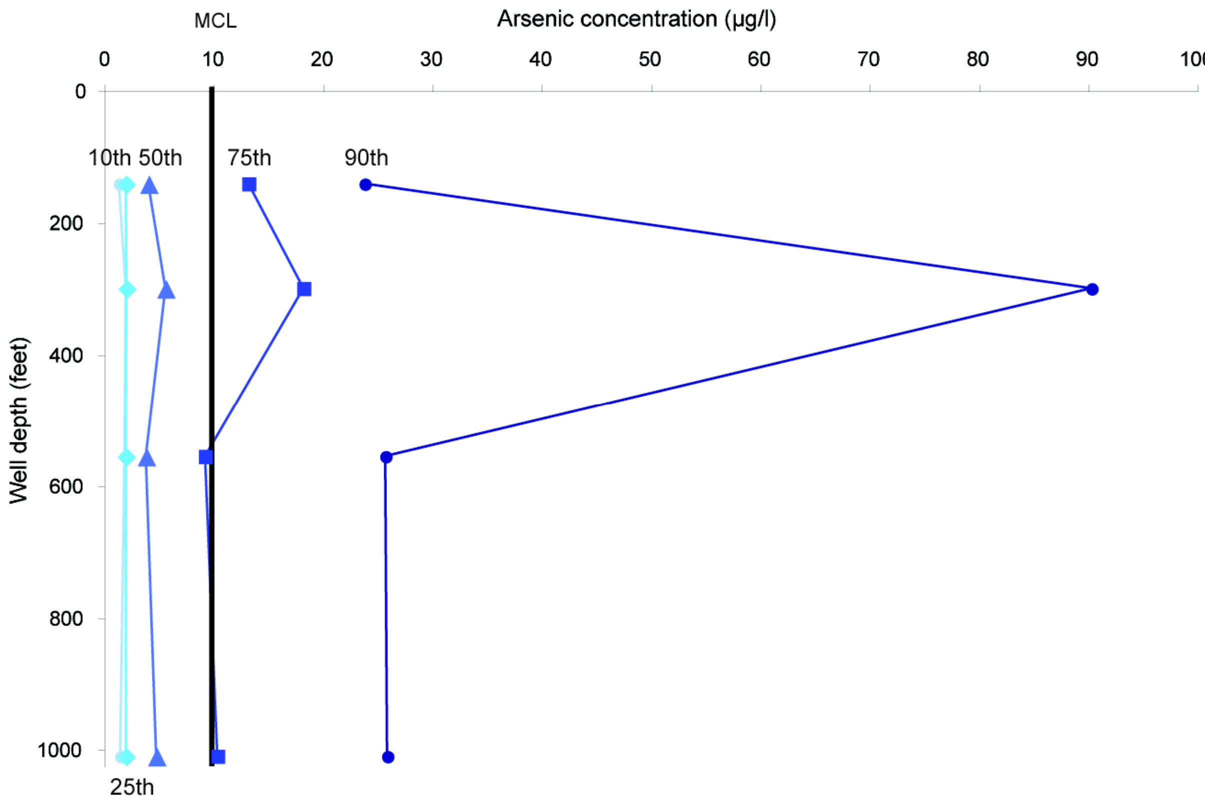
In addition, arsenic concentrations are generally associated with well depths within the study area (Figures 3.4 and 3.5). Wells between about 230 and 400 feet deep are more likely to have arsenic concentrations above the MCL (Figure 3.5). This suggests that deepening shallow wells or casing off portions of wells above or below this depth range might decrease arsenic concentrations. However, the thickness of the Gulf Coast aquifer system, and thus the depth of the aquifer, increases toward the coast. Along the updip edge of the aquifer, where the saturated thickness may be limited to relatively shallow depths, deepening wells might not be a viable option.

Figure 3.4 Arsenic Concentrations and Well Depths within the Study Area



Gray squares indicate NURE data; red circles indicate TWDB data.

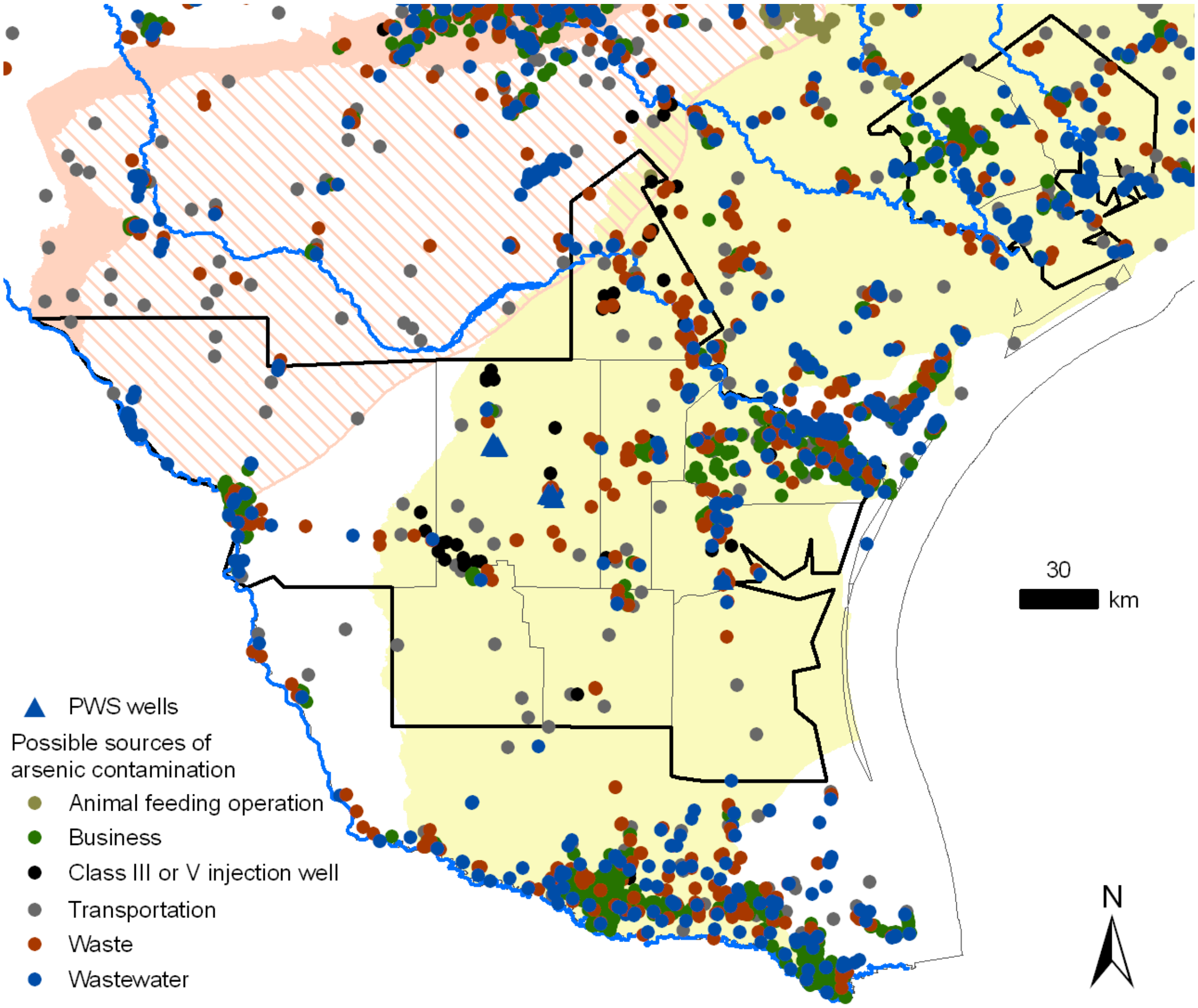
Figure 3.5 Arsenic Concentrations and Well Depths in the Study Area from the TWDB Database



Depths plotted are the medians of the 25th, 50th, 75th, and 100th percentiles. Concentrations represent the 10th, 25th, 50th, 75th, and 90th percentiles of values within each depth range.

Some of the high arsenic levels in the region might be explained by point source contaminants. The TCEQ Source Water Assessment and Protection program compiled a database of potential sources of arsenic contamination, such as animal feeding operations, certain businesses, injection wells used in oil production, transportation-related sites, and sites that store waste and wastewater (Figure 3.6). These anthropogenic sources of arsenic might explain high arsenic levels along the Rio Grande, Nueces, and Guadalupe Rivers (Figure 3.3).

1 **Figure 3.6 Locations of Possible Sources of Arsenic Contamination**

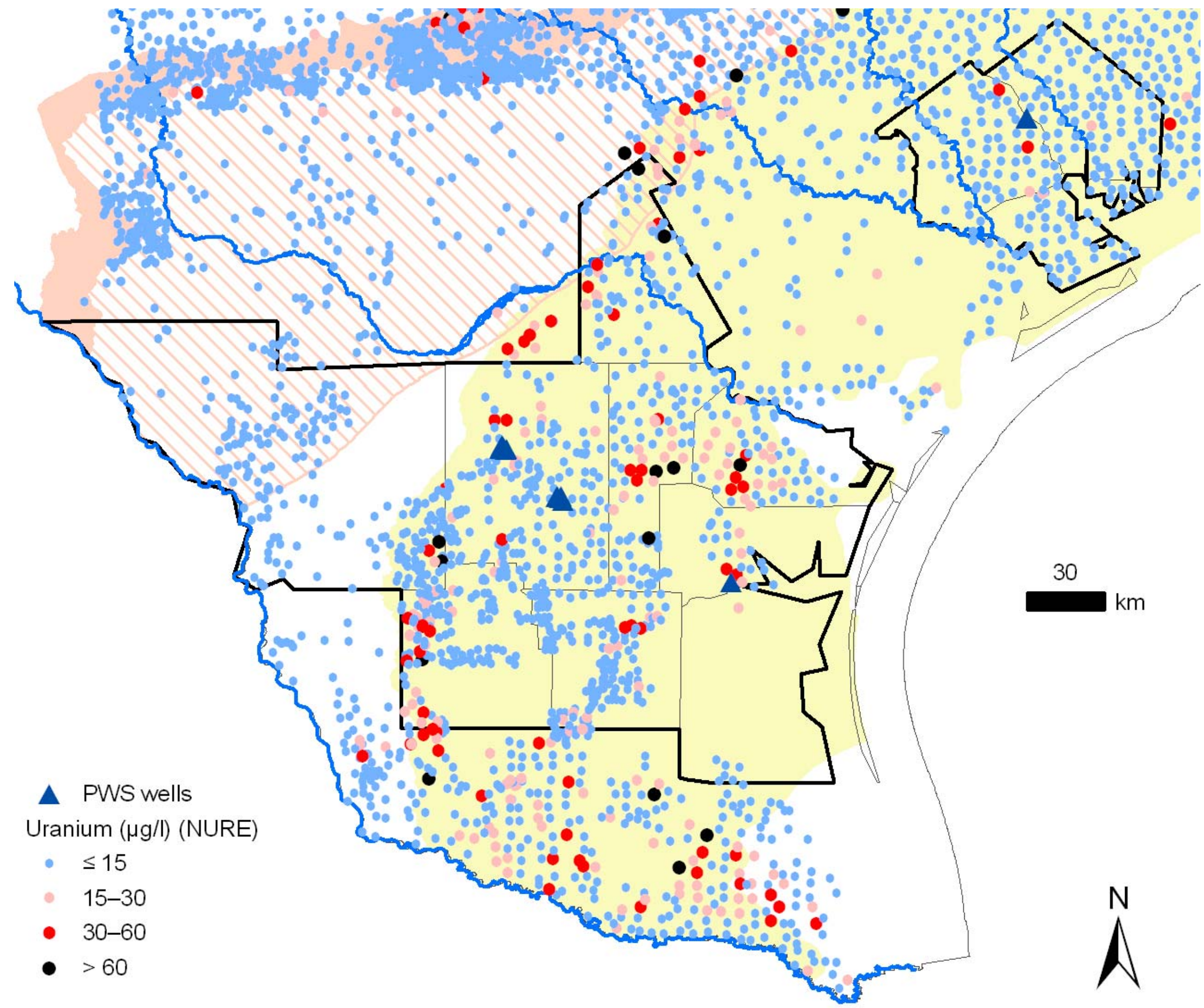


2

Uranium

A small but significant number of wells in the area contain uranium concentrations that exceed the MCL for uranium (30 µg/L). The distribution of measured uranium levels in groundwater in the study area from the NURE database is shown in Figure 3.7. This map indicates that many of the high uranium levels occur along the updip edge of the Gulf Coast aquifer system and in the Rio Grande valley.

Figure 3.7 Spatial Distribution of Uranium Concentrations



Because the NURE database does not include information about which aquifer the sampled wells represent, it is not possible to compare uranium concentrations by aquifer. However, because well depths are included in the database, differences in uranium concentrations in wells of different depths can be compared (Figure 3.8 and 3.9). Based on Figure 3.9, the lowest uranium concentrations are generally found in wells between about 140 and 260 feet deep. However, only three wells below 800 feet exceed the MCL for uranium. The relatively small number of wells more than about 900 feet deep make the trend in uranium levels in these deeper wells more difficult to discern.

Figure 3.8 Uranium Concentrations and Well Depths within the Study Area

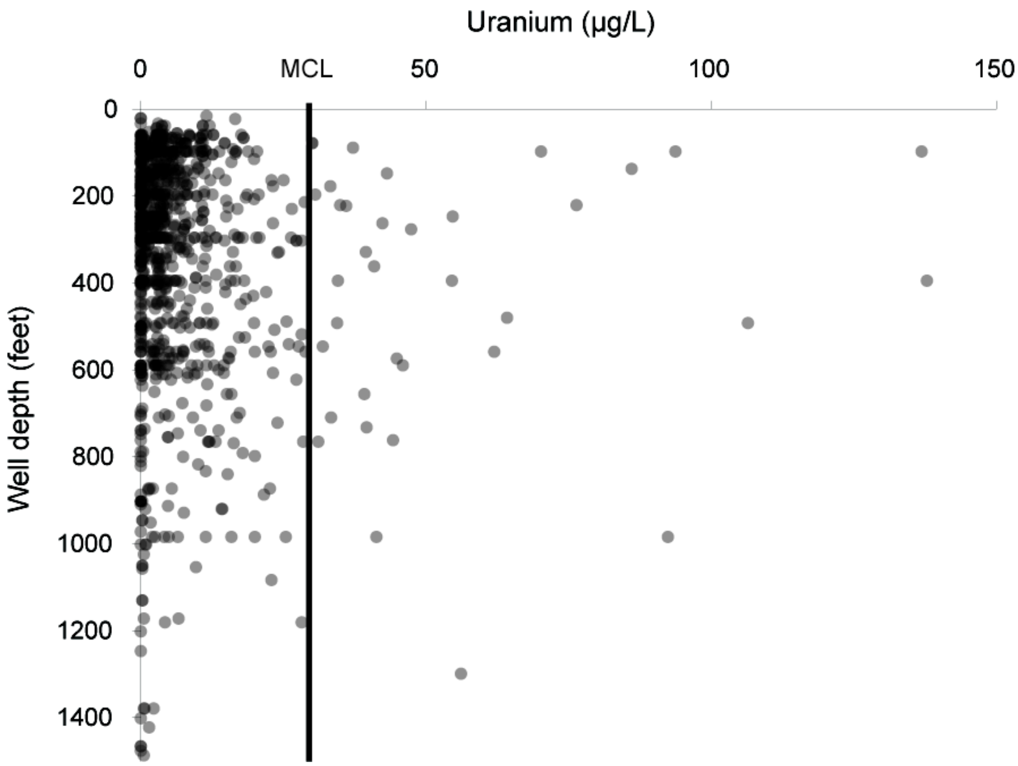
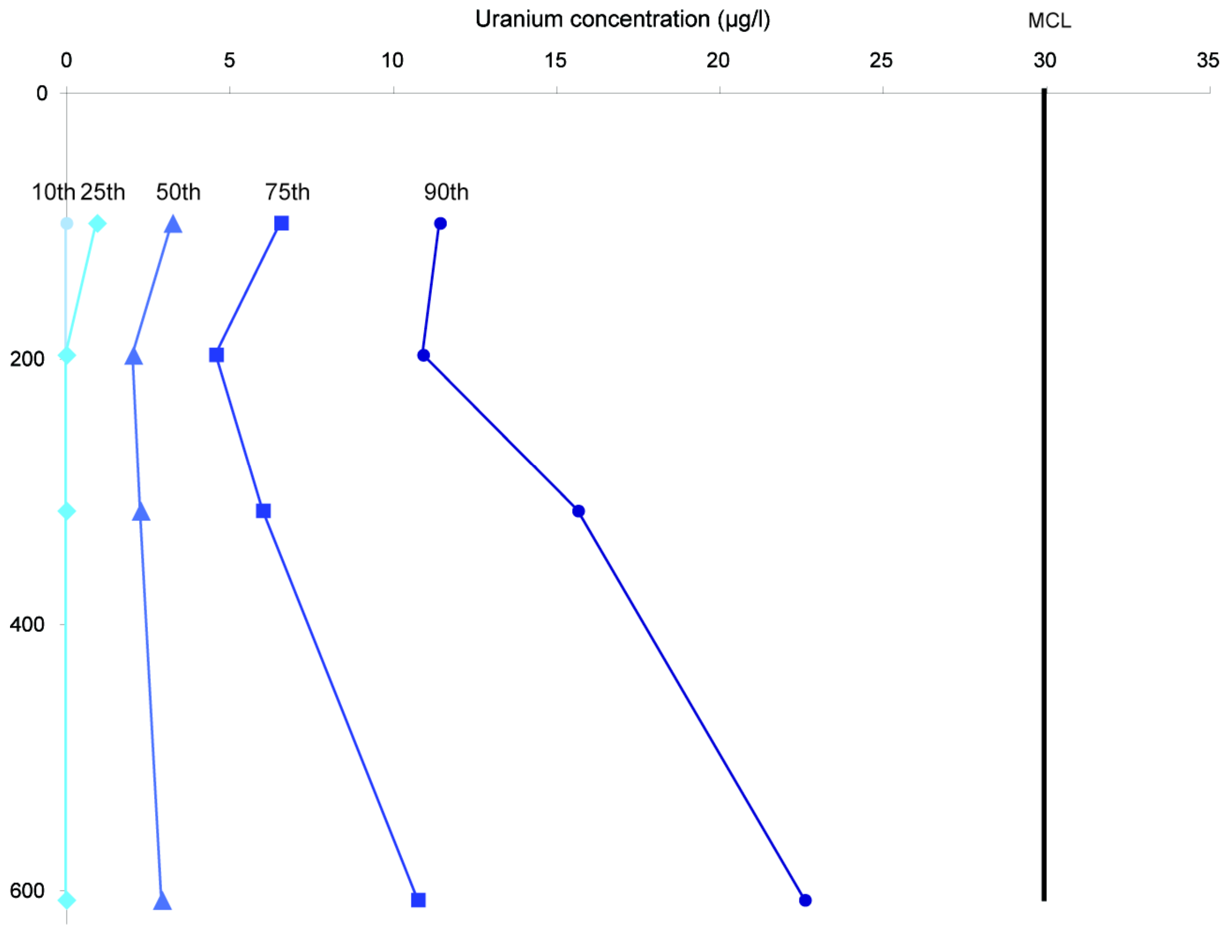


Figure 3.9 Uranium Concentrations and Well Depths in the Study Area from the NURE Database

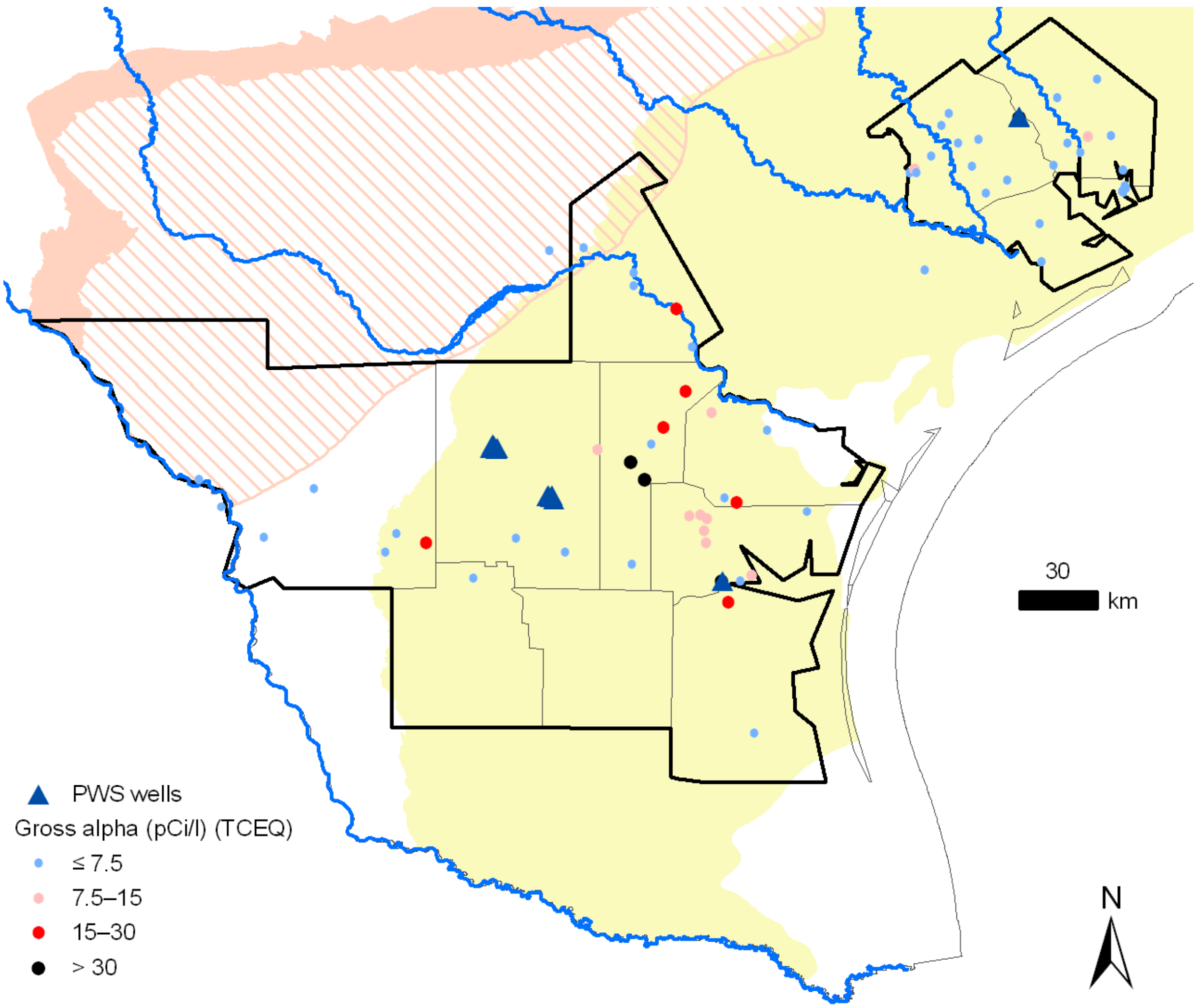


Depths plotted are the medians of the 25th, 50th, 75th, and 100th percentiles. Concentrations represent the 10th, 25th, 50th, 75th, and 90th percentiles of values within each depth range.

Gross Alpha

Based on the small number of gross alpha measurements available, the highest concentrations appear to occur in the central part of the study area, while most other wells show acceptable levels. Figure 3.10 shows the distribution of gross alpha measured in wells in the study area. Because measurements from the TCEQ database are commonly from samples that are a mixture of water from multiple wells, an assessment of how gross alpha concentrations vary with well depth or aquifer is not possible.

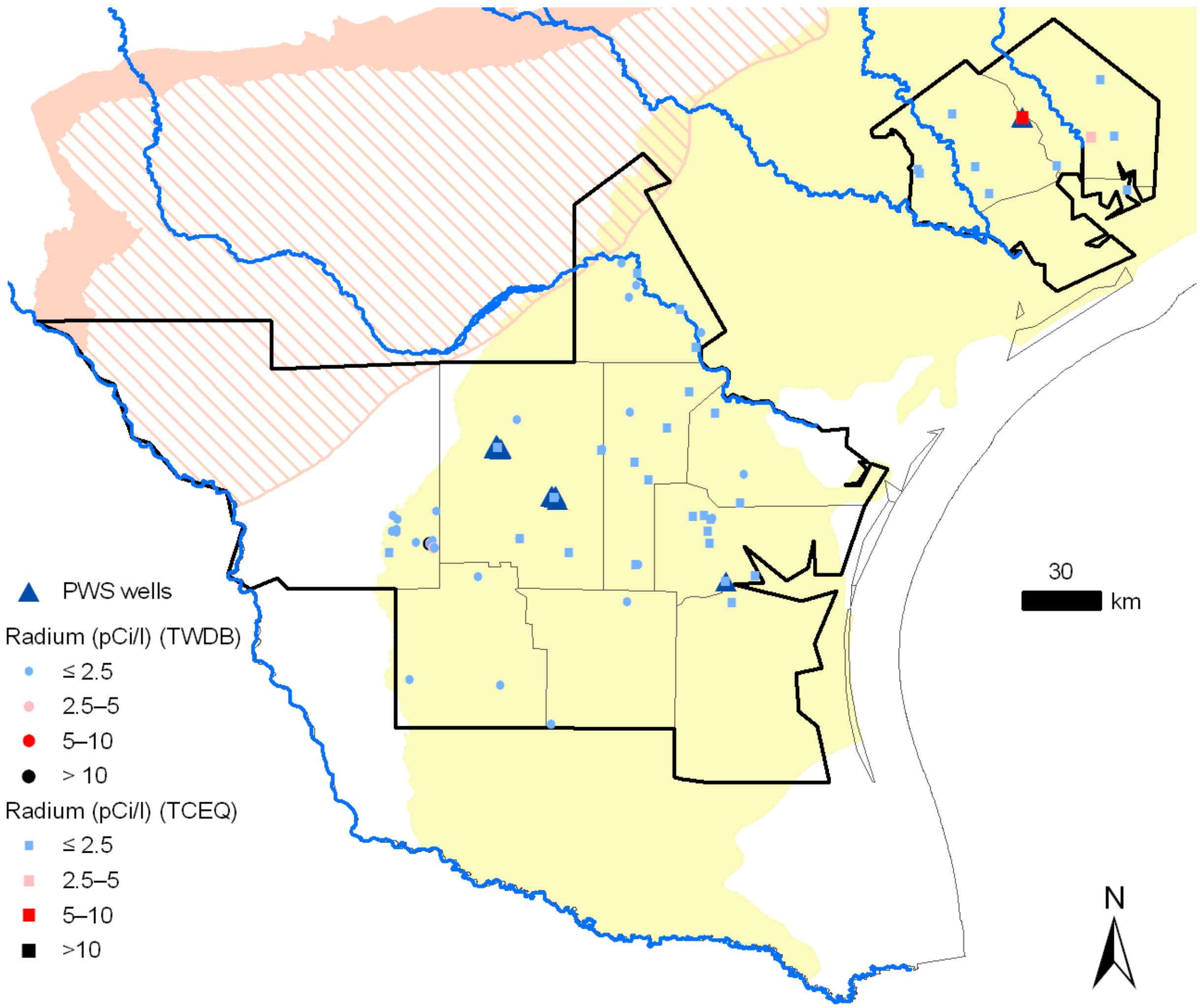
Figure 3.10 Spatial Distribution of Gross Alpha Concentrations in the Study Area



Combined Radium

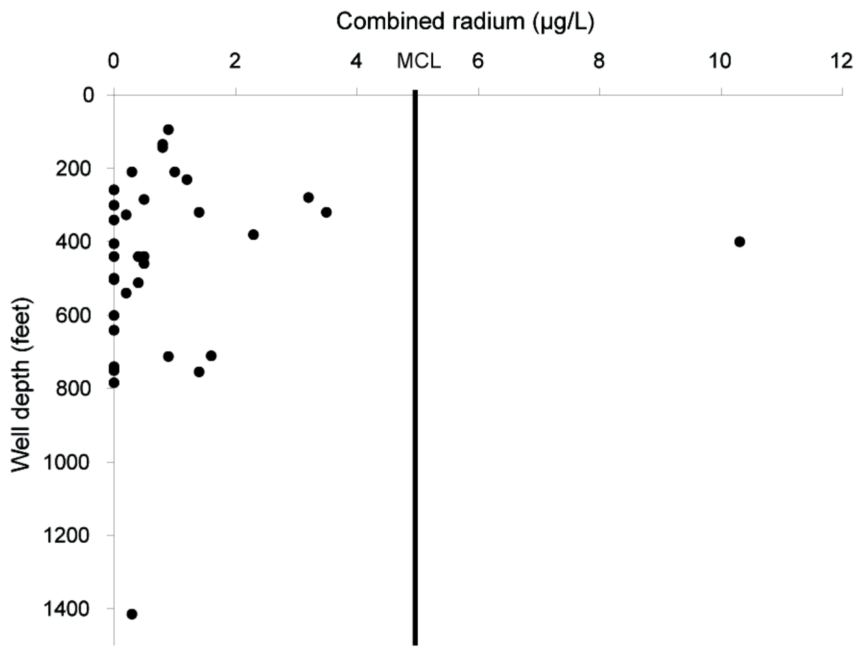
The concentration of combined radium, which refers to radium 226 plus radium 228, is generally below the MCL (5 pCi/L) throughout the study area. An exception is the combined radium measured at the Arenosa Creek Estates PWS, discussed in more detail below. The distribution of available combined radium measurements is shown in Figure 3.11. The values shown in this analysis represent an upper limit of the possible concentration, because in wells that contained less than 1 pCi/L of radium 228 (the detection limit), 1 pCi/L was used in the combined concentration.

Figure 3.11 Spatial Distribution of Combined Radium Concentrations in the Study Area



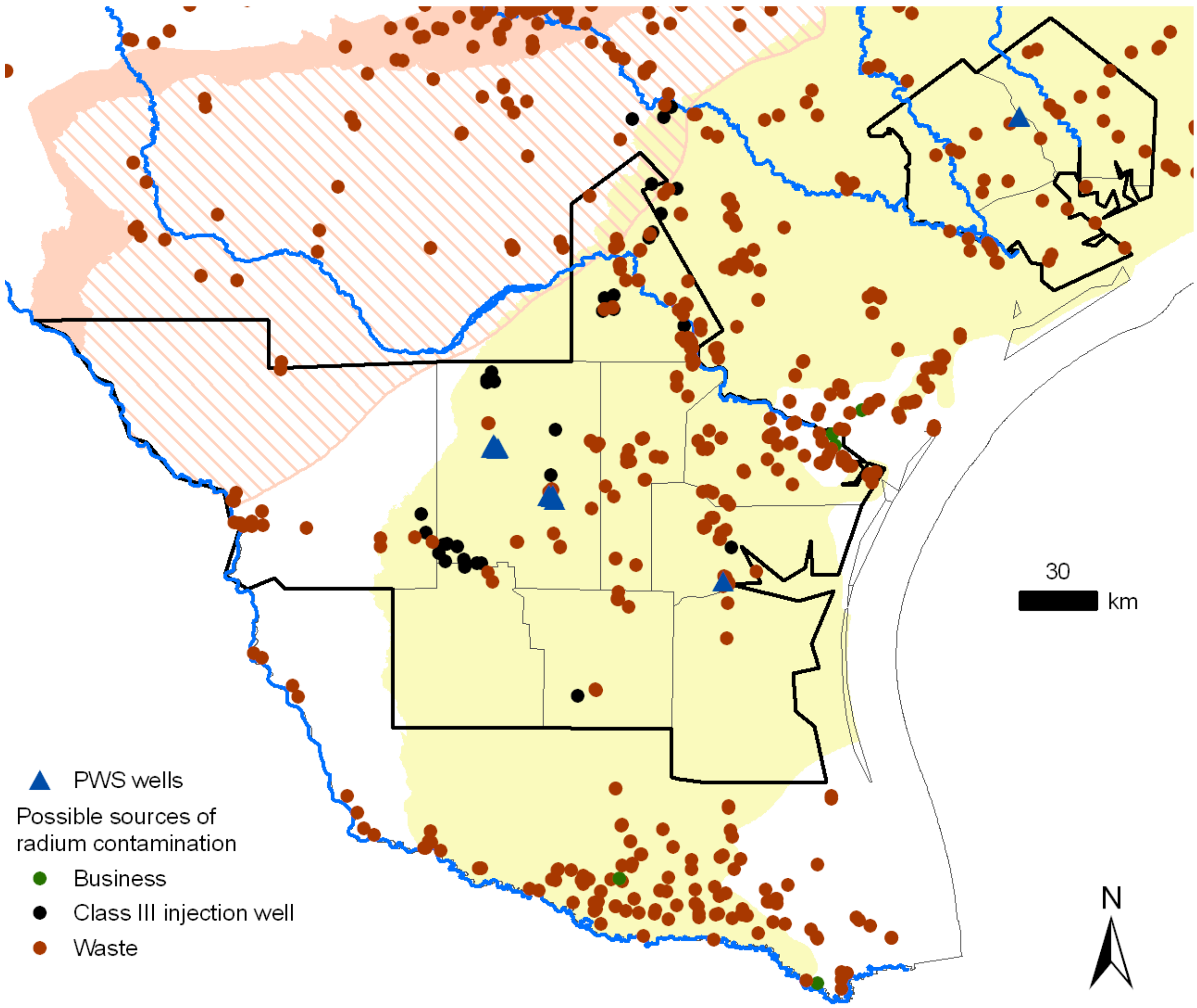
There is no clear correlation between combined radium concentration and well depth in the study area (Figure 3.12). Although the highest measured concentrations occur in shallower wells, the small number of measurements available makes it difficult to conclusively demonstrate any trend.

Figure 3.12 Combined Radium Concentrations and Well Depths within the Study Area



High radium concentrations can also be caused by anthropogenic sources of contamination. The TCEQ SWAP compiled a database of potential sources of radium contamination, including certain businesses, injection wells related to oil production, and waste disposal sites (Figure 3.13). The low measured levels of combined radium in the region do not indicate significant contamination caused by these sources.

Figure 3.13 Locations of Possible Sources of Radium Contamination in the Study Area



3.1.3 Regional Hydrogeology

The Gulf Coast aquifer system is the primary source of groundwater along the coastal plains of Texas, extending about 62 miles inland from the Gulf of Mexico. South of the study area, this aquifer system extends across the Rio Grande and into Mexico. North of the study area, it extends along the Gulf Coast into Louisiana. The aquifer system consists of several hydrologically connected sedimentary units, Miocene age and younger, composed of interbedded gravel, sand, silt, and clay. These sediments were deposited in alluvial, deltaic, lagoon, beach, and continental shelf environments as the depositional basin that forms the Gulf of Mexico. As a result of the gradual subsidence of the basin, these units all dip toward the coast (Ryder 1996), so the geologic units at the surface are youngest at the coast and oldest inland (Ashworth and Hopkins 1995). The units also generally thicken toward the coast, so the main producing units are very thin at the inland boundary of the aquifer and increase to nearly 6,000 feet thick at the coast within the study area (Baker 1979).

The oldest and deepest formation is the Miocene age Catahoula Tuff or Sandstone, which in most places serves as a confining unit between the Gulf Coast aquifer system and the underlying Jackson Group. Overlying the Catahoula is the Miocene age Jasper aquifer, in which the Oakville Sandstone forms a productive aquifer unit. Above the Jasper aquifer is the Burkeville confining unit, made up primarily of a clay-rich unit known as the Fleming Formation (Baker 1979) or the Lagarto Clay (Shafer and Baker 1973), which separates the Jasper from the overlying Evangeline aquifer. The Evangeline aquifer consists of the Pliocene age Goliad Sand. Above the Evangeline, the top of the Gulf Coast aquifer system, known as the Chicot aquifer, includes the Pleistocene age Lissie, Willis, Bentley, Montgomery, and Beaumont formations, as well as recent alluvial deposits (Baker 1979). Locally, formations that make up the Chicot aquifer might not all be present or discernable (Shafer 1968; Shafer and Baker 1973; Shafer 1974).

Water quality in the Gulf Coast aquifer system is generally good in the shallower parts of the aquifer, but worsens toward the Rio Grande valley. Along the coast, the quality is poor in some locations due to saltwater encroachment (Ashworth and Hopkins 1995). In some areas, including Kleberg, Kenedy, and Jim Wells Counties, improperly cased wells in the Evangeline aquifer have experienced increases in salinity due to leakage of shallow saline water from overlying formations (Shafer and Baker 1973). Saline waters near the surface might be natural or a result of human activities such as oil production or pesticide application, although historically pesticides have not been a known source of contamination (Shafer 1968; Shafer and Baker, 1973; Shafer, 1974).

Other aquifers that provide water supplies in the western part of the study area include the Carrizo-Wilcox and the Yegua-Jackson. The Carrizo-Wilcox aquifer includes the Tertiary age Wilcox Group and the Carrizo Formation (Ashworth and Hopkins 1995). Where it is present in the study area, the Carrizo-Wilcox is primarily located only at depth; it outcrops only in a small area in northwestern Webb County. The Yegua-Jackson aquifer consists of the Eocene age Yegua Formation and the Eocene–Pleistocene Jackson Group, both of which are made up of interbedded sands, silts, and clays, some of which include volcanic sediments, lignite, and uranium (Preston 2006). This aquifer only occurs in the subsurface within the study area.

3.2 DETAILED ASSESSMENT FOR RIVIERA INDEPENDENT SCHOOL DISTRICT

The Riviera ISD PWS has one well: G1370019A. This well is 727 feet deep and is within the Evangeline aquifer. The one historical measurement of uranium in this well is shown in Table 3.2.

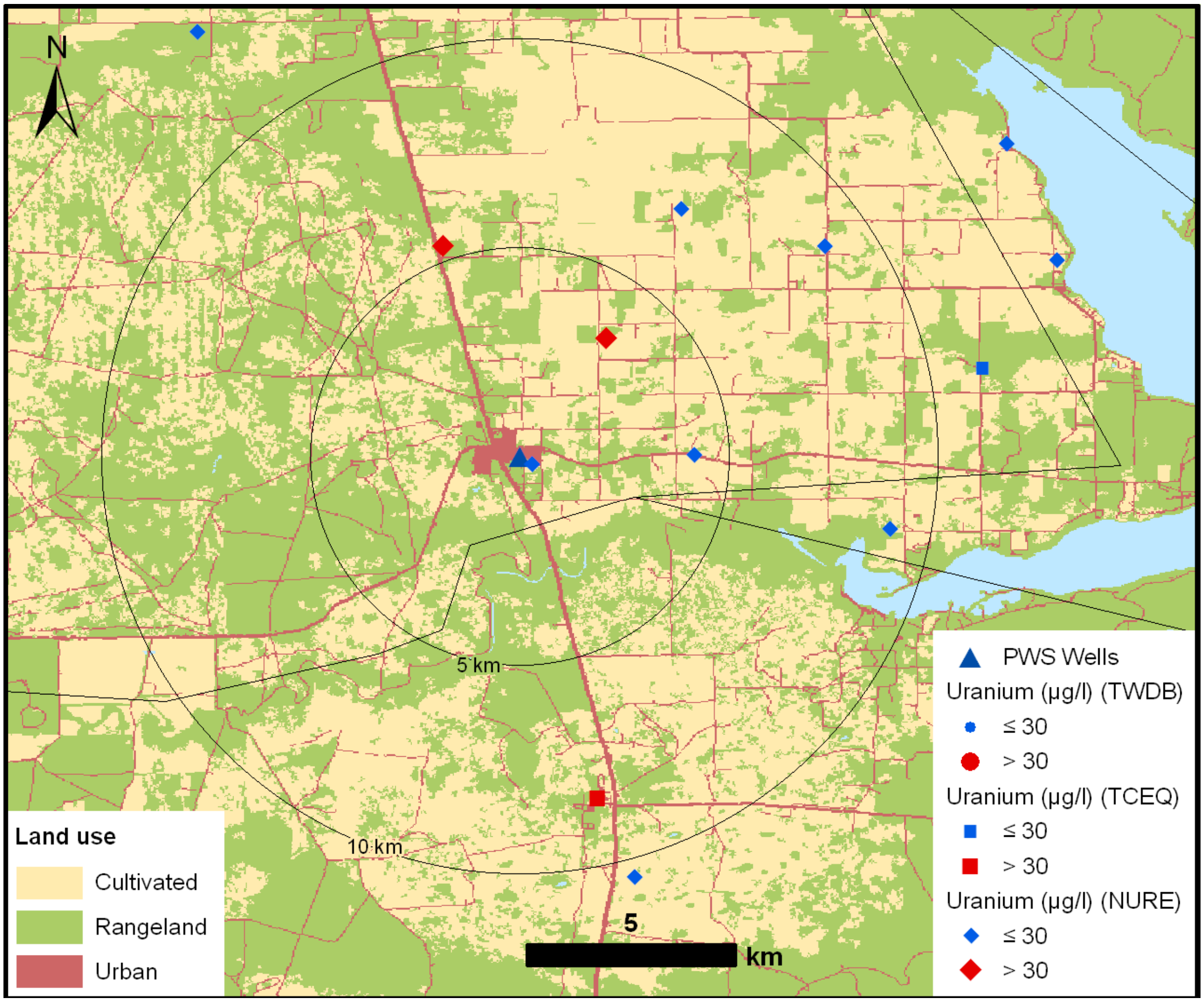
Table 3.2 Uranium Concentration in the Riviera ISD PWS

Date	Uranium (µg/L)	Well sampled
3/8/2007	88	raw sample, G1370019A

Data from the TCEQ PWS Database.

The only available measurement of uranium in this well is 88 µg/L, significantly above the MCL (30 µg/L). The distribution of uranium concentrations measured in nearby wells is shown in Figure 3.14.

Figure 3.14 Uranium Concentrations within 5- and 10-km Buffers around the Riviera ISD PWS



Data are from the TCEQ, TWDB, and NURE databases, although no wells from the TWDB database are present in the vicinity of the PWS. Two types of samples were included in the analysis. Samples from the TCEQ database (shown as squares on the map) represent the most recent sample taken at a PWS, which can be raw samples from a single well or entry point samples that may combine water from multiple sources. Samples from the NURE database (shown as diamonds on the map) are taken from single wells. Where more than one measurement has been made from a source, the most recent concentration is shown.

Several nearby wells in the NURE database, including one close to the PWS well, show uranium levels below the MCL. However, the NURE database does not associate well measurements with state well numbers or owner information; therefore, these measurements cannot be traced to individual wells. The depths of those wells in the NURE database that show acceptable uranium levels range from 735 to 912 feet. The depths of the two wells in the NURE database that exceed the MCL are 709 and 761 feet, and the depths of the PWS wells located approximately 5 miles south-southeast of the Riviera ISD PWS wells, which exceed the MCL, are 800, 802, and 850 feet. Based on this information and the regional assessment, deepening the PWS well below 850 feet might decrease uranium levels.

3.2.1 Summary of Alternative Groundwater Sources for the Riviera ISD PWS

Many nearby wells contain acceptable uranium concentrations. The NURE database does not contain enough information to identify these wells, but this finding suggests that further research into nearby wells that might serve as an alternative supply could prove useful. In addition, based on depths of nearby wells that do and do not meet the MCL for uranium, it is possible that deepening the PWS well below 850 feet might decrease uranium levels.

SECTION 4
ANALYSIS OF THE RIVIERA ISD PWS

4.1 DESCRIPTION OF EXISTING SYSTEM

4.1.1 Existing System

The location of Riviera ISD PWS is shown in Figure 4.1. The Riviera ISD PWS is located approximately ¼ miles east of U.S. Highway 77 at 203 North 9th Street in Riviera, Texas. The water supply system serves a population of 500 and has seven connections. The water sources for this water system is one well, completed in the Evangeline Aquifer (Code 121EVGL), that is approximately 727 feet deep and has a total production 0.403 mgd. Well #1 (G1370019A) is rated at 215 gallons per minute. The water supply system consists of a ground storage tank, service pumps, and 10 pressure tanks. Only three pressure tanks are in use. The water is chlorinated prior to the ground storage tank.

The treatment employed for disinfection is not appropriate or effective for removal of uranium, so optimization is not expected to be effective for increasing removal of this contaminant. However, there is a potential opportunity for system optimization to reduce uranium concentration. It may be possible to deepen the well and improve water quality. It may also be possible to identify uranium-producing strata through comparison of well logs or through sampling of water produced by various strata intercepted by the well screen.

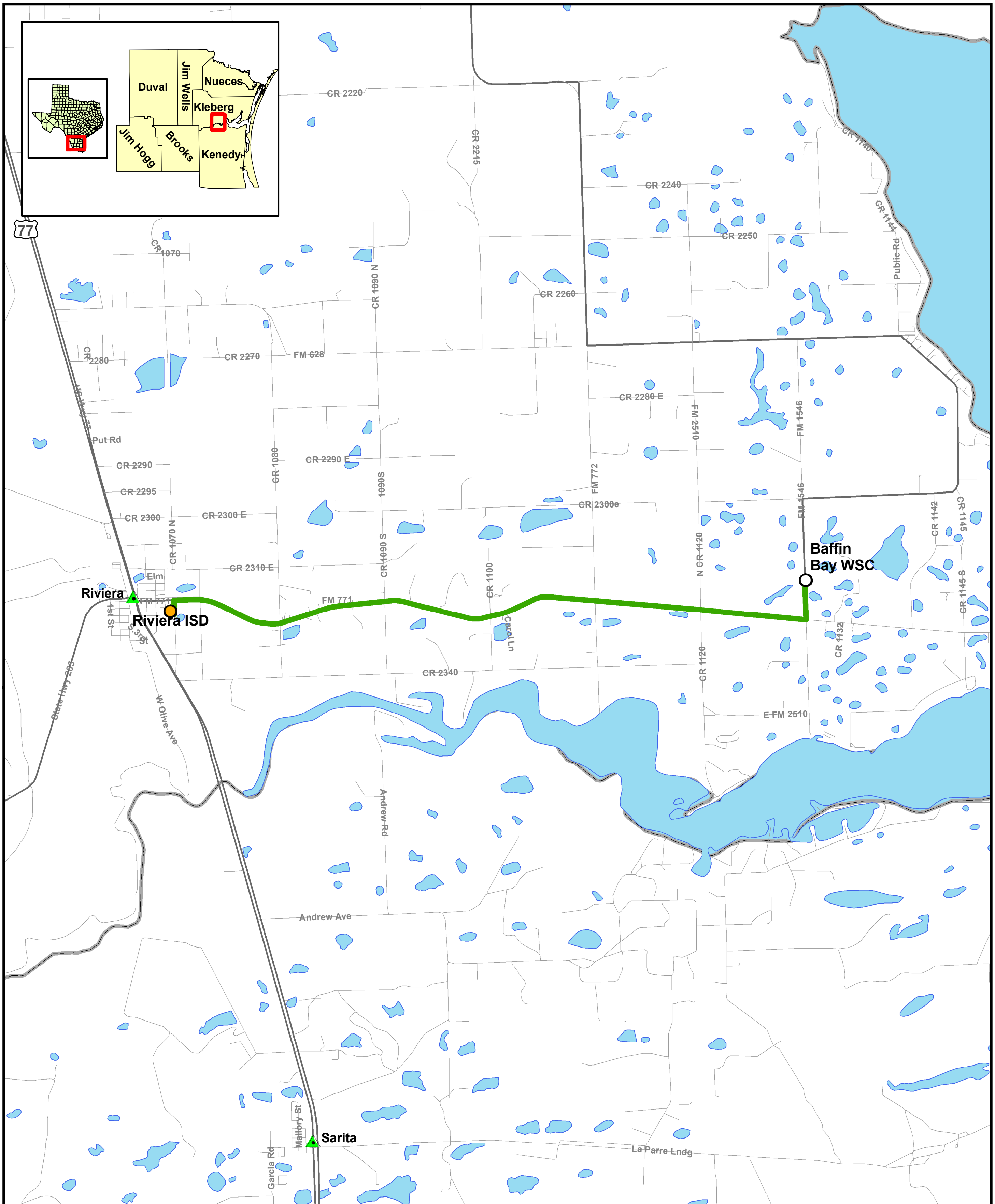
On March 8, 2007, the Riviera ISD PWS recorded a combined uranium concentration value of 0.088 mg/L, which exceeds the MCL of 0.030 mg/L. Therefore, it is likely the Riviera ISD PWS faces potential compliance issues under the standard.

Basic system information is as follows:

- Population served: 500
- Connections: 7
- Average daily flow: 0.023 mgd
- Total production capacity: 0.403 mgd

Basic system raw water quality data are as follows

- Typical uranium: 0.088 mg/L
- Typical arsenic range: <0.00204 to 0.0049 mg/L
- Typical calcium range: 21.2 to 25 mg/L
- Typical chloride range: 183 to 190 mg/L
- Typical fluoride range: 0.72 to 0.8 mg/L
- Typical iron: <0.051 mg/L



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Legend

- Study System
- PWS's
- Cities
- City Limits
- Counties
- Major Road
- Minor Road
- CRMWA Pipeline
- Lubbock Pipeline
- Grass Valley Pipeline
- RI-1 Baffin Bay WSC - 6.8 Miles

N

Miles
0 0.5 1

Figure 4.1

RIVIERA ISD

Pipeline Alternative

- Typical magnesium range: 5 to 6.71 mg/L
- Typical manganese range: <0.008 to 0.00203 mg/L
- Typical nitrate range: 0.31 to 0.4 mg/L
- Typical selenium range: 0.0128 to 0.0161 mg/L
- Typical sodium range: 269 to 300 mg/L
- Typical sulfate range: 174 to 178 mg/L
- Total Hardness as CaCO3 range: 77 to 85 mg/L
- Typical pH range: 7.6 to 8.03
- Total alkalinity as CaCO3 range: 273 to 280 mg/L
- Typical bicarbonate range: 339 to 342 mg/L
- Typical total dissolved solids range: 872 to 875 mg/L

The typical ranges for water quality data listed above are based on a TCEQ database that contains data updated through the beginning of 2005.

4.1.2 Capacity Assessment for the Riviera ISD PWS

The project team conducted a capacity assessment of the Riviera ISD PWS on August 4, 2008. Results of this evaluation are separated into four categories: general assessment of capacity, positive aspects of capacity, capacity deficiencies, and capacity concerns. The general assessment of capacity describes the overall impression of FMT capability of the water system. The positive aspects of capacity describe the strengths of the system. These factors can provide the building blocks for the system to improve capacity deficiencies. The capacity deficiencies noted are those aspects creating a particular problem for the system related to long-term sustainability. Primarily, those problems are related to the system's ability to meet current or future compliance, ensure proper revenue to pay the expenses of running the system, and ensure proper operation of the system. The last category, capacity concerns, are items that are not causing significant problems for the system at this time. However, the system may want to address them before they become problematic.

Because of the challenges facing very small water systems, it is increasingly important for them to develop the internal capacity to comply with all state and federal requirements for public drinking water systems. For example, it is especially important for very small water systems to develop long-term plans, set aside money in reserve accounts, and track system expenses and revenues because they cannot rely on increased growth and economies of scale to offset their costs. In addition, it is crucial for the owner, manager, and operator of a very small water system to understand the regulations and participate in appropriate training. Providing safe drinking water is the responsibility of every public water system, including those very small water systems that face increased challenges with compliance.

The project team interviewed the following individuals.

- Ernest Havner, Riviera ISD Superintendent
- Dana Hickey, Riviera ISD Business Manager
- Bill Shronfeld, Contract Water Operator
- Billy Griffith, Board Member

Others who attended the meeting but did not participate included:

- Wilson Martin, Board Member
- Sylvia Arguijo, Board Member
- George Samanko, Riviera ISD Maintenance Supervisor
- Roy Cantu, County Commissioner
- Poncho Hubert, Concerned Citizen

4.1.2.1 General Structure of the Water System

The Riviera ISD PWS, classified as a non-community, non-transit water system, provides water to school buildings serving approximately 500 students. The school district contracts with Bill Shronfeld for water and wastewater operations. However, when the maintenance supervisor receives his license, the contract operator will be used only as needed. The Riviera ISD is designated a Chapter 41 school by the Texas Education Agency and receives 75 percent of its annual funding from the local taxes and 25 percent from the state. The district's budget is capped at $5,000,000 annually.

The district water system exceeds the standards for uranium and is under a Compliance Order with TCEQ.

4.1.2.2 General Assessment of Capacity

Based on the team's assessment, this system has a good level of capacity. There are several positive managerial, financial and technical aspects of the water system, but there are also some areas that need improvement. The deficiencies noted could prevent the water system from being able to meet compliance now or in the future and may also impact the water system's long-term sustainability.

4.1.2.3 Positive Aspects of Capacity

In assessing a system's overall capacity, it is important to look at all aspects – positive and negative. It is important for systems to understand those characteristics that are working well, so those activities can be continued or strengthened. In addition, these positive aspects can assist the system in addressing the capacity deficiencies or concerns. The factors particularly important for the Riviera ISD are listed below.

- **Dedicated Staff –** The school superintendent, board members, business manager, and water operator are very concerned about the non-compliance issues and in learning about the best options to protect health of the students. In addition, there is a great deal of community concern about the short-term as well as long-term impacts of uranium on the students. It appears the school will provide an alternate source for drinking water for the students for the upcoming school year.

- **Emergency Interconnection** – Riviera ISD water system has an interconnection with the Riviera community water system for emergencies.

4.1.2.4 Capacity Deficiencies

The following capacity deficiencies were noted in conducting the assessment and seriously impact the ability of the water system to comply with current and future regulations and ensure long-term sustainability.

- **Lack of Compliance with Uranium Standards –** The Riviera ISD PWS is not in compliance with the uranium standard and has been under a Compliance Agreement with TCEQ since 2006.
- **Lack of Long-Term Planning for Compliance and Sustainability** – The school district does not have a long-term capital plan in place for water system improvements. This lack of a long-term plan makes it difficult to know the financial impact on the district's budget of future projects, including installation of treatment to meet compliance. Having a long-term plan for capital improvements is especially important if the school district must rely on grants to fund capital projects

4.1.2.5 Potential Capacity Concerns

The following items were concerns regarding capacity but no specific operational, managerial, or financial problems can be attributed to these items at this time. The system should address the items listed below to further improve FMT capabilities to improve the system's long-term sustainability.

- **Funding Limitations –** The district's school's funding amount is set by the Comptrollers Office, which is based on formulas and the number of students attending the school. Expenses for the water and wastewater system are included in the "plant maintenance and operations" budget line item. Emergency expenses for the water system are paid for out of the fund balance and must be repaid. Because the district's funding is capped at $5,000,000 annually, there is a potentially a lack of available funds to ensure the ability of the district to comply with current and future drinking water regulations.

4.2 ALTERNATIVE WATER SOURCE DEVELOPMENT

4.2.1 Identification of Alternative Existing Public Water Supply Sources

Using data drawn from the TCEQ drinking water and TWDB groundwater well databases, the PWSs surrounding the Riviera ISD PWS were reviewed with regard to their reported drinking water quality and production capacity. PWSs that appeared to have water supplies with water quality issues were ruled out from evaluation as alternative sources, while those without identified water quality issues were investigated further. Small systems were only considered if they were within 15 miles of the Riviera ISD PWS. Large systems or systems capable of producing greater than four times the daily volume produced by the study system were considered if they were within 15 miles of the study system. A distance of 15 miles was considered to be the upper limit of economic feasibility for constructing a new water line. Table 4.1 is a list of the selected PWSs based on these criteria for large and small PWSs within 15 miles of the Riviera ISD PWS. If it was determined these PWSs had excess supply capacity and might be willing to sell the excess, or might be a suitable location for a new groundwater well, the system was taken forward for further consideration and identified with "EVALUATE FURTHER" in the comments column of Table 4.1.

Table 4.1 Selected Public Water Systems within 15 Miles of the Riviera ISD PWS

PWS ID	PWS Name	Distance from the Riviera ISD PWS (miles)	Comments/Other Issues
1370007	RIVIERA WATER SUPPLY	0.26	Larger GW System. WQ issues: Combined Uranium and Gross Alpha.
1370033	EAST RIVIERA WATER SYSTEM	3.64	Larger GW System. No uranium data. Do not evaluate further.
1310001	SARITA SEWER SERVICE & WATER SUPPLY	5.19	Larger GW System. WQ issues: Combined Uranium and Sulfate.
1370032	BAFFIN BAY WATER SUPPLY CORP	6.26	Larger GW System. Marginal gross alpha issues. **Evaluate Further**
1370006	RICARDO WATER SUPPLY CORP	9.75	Larger GW System. WQ issues: gross alpha.
1370009	PRESBYTERIAN PAN AMERICAN SCHOOL	11.01	Larger Non-residential. GW System. No WQ issues.
1310005	US HWY 77 COMFORT STA SARIT	11.37	Larger Non-residential. GW System. No WQ issues.
1370034	ESCONDIDO CREEK WATER SYSTEM	12.59	Larger GW System. No WQ issues. This PWS no longer uses its well. It receives water from the City of Kingsville.

WQ = water quality
GW = groundwater

After the PWSs in Table 4.1 with water quality problems were eliminated from further consideration, the remaining PWSs were screened by proximity to the Riviera ISD PWS and sufficient total production capacity for selling or sharing water. Based on the initial screening summarized in Table 4.1, one alternative was selected for further evaluation. The alternative is summarized in Table 4.2. The alternative is a connection to the Baffin Bay Water Supply Corporation (WSC) system. A description of the Baffin Bay WSC follows Table 4.2.

Table 4.2 Public Water Systems within the Vicinity of the Riviera ISD PWS Selected for Further Evaluation

PWS ID	PWS Name	Pop	Connec-tions	Total Production (mgd)	Avg Daily Usage (mgd)	Approx. Dist. from the Riviera ISD PWS	Comments/Other Issues
1370032	BAFFIN BAY WSC	750	335	0.605	0.119	6.26	Larger GW System. Recommend additional analysis of gross alpha

4.2.1.1 Baffin Bay Water Supply Corporation (1370032)

Baffin Bay WSC is located approximately 6 miles east from the Riviera ISD PWS. Records indicate that its groundwater production is 80,000 gallons per day with current service to about 380 connections. Baffin Bay WSC has two wells and three storage tanks. According to available information on this PWS, there are no reported exceedances for constituents of concern above the associated MCLs. However, the PWS has no excess capacity. The cost to expand the system has been estimated at $1.2 million. The WSC is willing to consider selling water if its current system is expanded.

Baffin Bay recorded a single gross alpha result of 15.9 pCi/L (18.9 pCi/L $\pm$ 3 pCi/L error rate) in May 2000. There have also been lower gross alpha particle activity results of <2.0 pCi/L and 11.5 pCi/L (14.5 pCi/L – 3 pCi/L error rate). Therefore additional analyses of gross alpha are needed to identify whether the contaminant currently exceeds the MCL of 15 pCi/L prior to any agreements to use the source of water as an alternative for Riviera ISD PWS.

4.2.2 Potential for New Groundwater Sources

4.2.2.1 Installing New Compliant Wells

Developing new wells or well fields is recommended, provided good quality groundwater available in sufficient quantity can be identified. Since a number of water systems in the area have water quality problems, it should be possible to share in the cost and effort of identifying compliant groundwater and constructing well fields.

Installation of a new well in the vicinity of the system intake point is likely to be an attractive option provided compliant groundwater can be found, since the PWS is already familiar with operation of a water well. As a result, existing nearby wells with good water quality should be investigated. Re-sampling and test pumping would be required to verify and determine the quality and quantity of water at those wells.

The use of existing wells should probably be limited to use as indicators of groundwater quality and availability. If a new groundwater source is to be developed, it is recommended that a new well or wells be installed instead of using existing wells. This would ensure well characteristics are known and meet standards for drinking water wells.

Some of the alternatives suggest new wells be drilled in areas where existing wells have acceptable water quality. In developing the cost estimates, Parsons assumed the aquifer in these areas would produce the required amount of water with only one well. Site investigations and geological research, which are beyond the scope of this study, could indicate whether the aquifer at a particular site and depth would provide the amount of water needed or if more than one well would need to be drilled in separate areas.

4.2.2.2 Results of Groundwater Availability Modeling

The southern section of the Gulf Coast Aquifer supplies groundwater throughout Kleberg County, where the PWS is located, as well as surrounding counties. One of five hydrogeological units that comprise the Gulf Coast Aquifer, the Evangeline Aquifer, is the water source for a single 727-foot deep well operated by the Riviera ISD PWS.

A search of registered wells was conducted using TCEQ's Public Water Supply database to assess groundwater sources utilized within a 10-mile radius of the PWS. The search indicated that in the search area, all public water supply and domestic wells are completed in the Goliad Sand Formation of the Evangeline Aquifer. This Formation, one of two components of the aquifer, is also the groundwater source for most irrigation, stock watering and industrial supply wells within the search area.

Groundwater Supply

The Gulf Coast Aquifer, the main groundwater source in Kleberg and surrounding counties, is a high-yield aquifer composed of discontinuous sand, silt, clay and gravel beds that extends over the entire Texas coastal region. Municipal and irrigation uses account for 90 percent of the total pumpage from the aquifer. The Gulf Coast Aquifer, which has an average freshwater thickness of 1,000 feet (TWDB 2007), consists of five hydrogeologic units; from the land surface downward, those units are the Chicot Aquifer, the Evangeline Aquifer, the Burkenville Formation, the Jasper Aquifer, and the Catahoula Sandstone Formation.

In the southern section of the Gulf Coast Aquifer, where the PWS is located, the groundwater yield is relatively low compared to the north section and central sections of the aquifer, and of lower water quality due to a high content of total dissolved solids (TWDB 2007). The State Water Plan, updated in 2007 by the TWDB, estimated that availability of water from the Gulf Coast Aquifer water will have a moderate decrease, from over 1.8 million acre-feet per year (AFY) in 2010 to slightly less that 1.7 million AFY in the year 2060.

Groundwater Availability

Regional groundwater withdrawal in the PWS area is extensive, and likely to increase over current levels over the next decades. The 2007 State Water Plan summarized estimates of groundwater supply and demand over a 50-year planning period, from current values extrapolated to the year 2010 to projections for the year 2060. For Kleberg County it was estimated that, with implementation of additional water management strategies, projected water supply estimates will meet the increasing water demand. For the 50-year planning period, the additional water need would be associated with municipal water use, and limited to 155 AFY.

A GAM was developed by TWDB for the southern section of the Gulf Coast Aquifer, including Kleberg and adjacent counties. On a regional basis, the GAM model predicted that by the year 2050, current aquifer utilization would increase more than 10 percent (Chowdhury and Mace, 2003). A GAM evaluation was not run for the PWS. Water use by the system would represent a minor addition to regional withdrawal conditions, making potential changes in aquifer levels beyond the spatial resolution of the regional GAM model.

4.2.3 Potential for New Surface Water Sources

The Riviera ISD PWS is located is located within the Nueces-Rio Grande Coastal Basin where current demand for surface water is expected to increase over the next 50 years due increased population, and decline in the groundwater supply due to overpumping and salinization. The Texas State Water Plan, updated by the TWDB in 2007, estimates that the basin's surface water availability in the year 2010 will be approximately 8,900 AFY.

In Kleberg County, where the PWS is located, the entire water supply will be allocated for municipal use. The 2007 State Water Plan estimated that, with implementation of additional water management strategies, the projected water supply estimates will meet the increasing water demand in the county. For the 50-year planning period, the additional water need would be associated with municipal water use, and limited to 155 AFY.

There is a minimum potential for development of new surface water sources for the Riviera ISD PWS, as indicated by limited water availability within the site vicinity. The surface water availability model for the Nueces-Rio Grande Coastal Basin, developed by the TWDB as a tool to determine the maximum amount of water available during the drought of record over the simulation period, indicates that in PWS vicinity there is a minimum availability of surface water for new uses. Surface water availability maps developed by TCEQ for the Nueces-Rio Grande Basin --illustrating percent of months of flow per year-- indicate that in the site vicinity, and over all of Kleberg County, unappropriated flows for new applications are typically available less than 50 percent of the time. This availability is inadequate for development of new municipal water supplies as a 100 percent year-round availability is required by TCEQ for new surface water source permit applications.

4.2.4 Options for Detailed Consideration

The initial review of alternative sources of water results in the following options for more-detailed consideration:

1. Baffin Bay Water Supply Corp. Compliant water would be purchased from the Baffin Bay WSC to be used by the Riviera ISD PWS. A pipeline would be constructed to convey water from Baffin Bay WSC to the Riviera ISD PWS (Alternative RI-1).

2. New Wells at 10, 5, and 1 mile. Installing a new well within 10, 5, or 1 mile of the Riviera ISD PWS may produce compliant water in place of the water produced by the existing active well (Alternatives RI-2, RI-3, and RI-4).

4.3 CENTRAL TREATMENT OPTIONS

Centralized treatment of the well water is identified as a potential option. Reverse Osmosis, coagulation filtration, and ion exchange treatment are potential applicable processes. The central RO treatment alternative is Alternative RI-5, the central coagulation filtration treatment alternative is Alternative RI-6, and the central ion exchange treatment process alternative is Alternative RI-7.

4.4 ALTERNATIVE DEVELOPMENT AND ANALYSIS

A number of potential alternatives for compliance with the MCL for combined uranium have been identified. Each of the potential alternatives is described in the following subsections. It should be noted that the cost information given is the capital cost and change in O&M costs associated with implementing the particular alternative. Appendix C contains cost estimates for the compliance alternatives. These compliance alternatives represent a range of possibilities, and a number of them are likely not feasible. However, all have been presented to provide a complete picture of the range of alternatives considered. It is anticipated that a PWS will be able to use the information contained herein to select the most attractive alternative(s) for more detailed evaluation and possible subsequent implementation.

4.4.1 Alternative RI-1: Purchase Water from Baffin Bay WSC

This alternative involves purchasing compliant water from the Baffin Bay WSC, which will be used to supply the Riviera ISD PWS. According to the TCEQ's Water Utilities Database, the Baffin Bay WSC currently has sufficient excess capacity for this alternative to be feasible. It is assumed that Riviera ISD would obtain all its water from the Baffin Bay WSC.

This alternative would require constructing a pipeline from the Baffin Bay WSC's water main to the existing storage tank for the Riviera ISD system. A pump station and 5,000 gallon feed tank would also be required to overcome pipe friction and the elevation differences between Baffin Bay WSC and Riviera ISD. The required pipeline would be 4-inches in diameter, and approximately 6.8 miles long.

The pump station would include two pumps, including one standby, and would be housed in a building. A 5,000 gallon feed tank would also be constructed for the pumps to draw from. It is assumed the pumps and piping would be installed with capacity to meet all water demand for the Riviera ISD, since the incremental cost would be relatively small, and would provide operational flexibility.

By definition this alternative involves regionalization, since Riviera ISD would be obtaining drinking water from an existing larger supplier. Also, other PWSs near Riviera ISD are in need of compliant drinking water and could share in implementation of this alternative if Baffin Bay WSC expands their well field.

The estimated capital cost for this alternative includes constructing the pipeline, feed tank, pump house, and pump station. The estimated O&M cost for this alternative includes the purchase price for the treated water minus the cost related to current operation of the Riviera ISD wells, plus maintenance cost for the pipeline, and power and O&M labor and materials for the pump station. The estimated capital cost for this alternative is $1.03 million, with an estimated annual O&M cost of $45,400.

The reliability of adequate amounts of compliant water under this alternative should be good; however, Baffin Bay has recorded an instance where gross alpha particle activity exceeded the MCL. Baffin Bay WSC provides water on a larger scale, facilitating adequate O&M resources. From the Riviera ISD PWS's perspective, this alternative would be characterized as easy to operate and repair, since O&M and repair of pipelines and pump stations is well understood. If the decision was made to perform blending then the operational complexity would increase.

The feasibility of this alternative is dependent on an agreement being reached with the Baffin Bay WSC to purchase treated drinking water. Additional analyses of gross alpha are needed to identify whether the contaminant currently exceeds the MCL prior to any use agreements. There is a limited number of small PWSs relatively close to the Riviera ISD PWS that have water quality problems and would be good candidates for sharing the cost for obtaining water from Baffin Bay. The cost to Riviera ISD for this alternative could be reduced if the other PWSs would be willing to share the costs. The analysis for a shared solution is presented in Appendix E. This analysis shows that Riviera ISD could expect a capital cost savings between $371,300 to $726,600 if they were to implement a shared solution like this, which would be a savings between 37 to 72 percent..

4.4.2 Alternative RI-2: New Well at 10 miles

This alternative consists of installing one new well within 10 miles of the Riviera ISD PWS that would produce compliant water in place of the water produced by the existing well. At this level of study, it is not possible to positively identify an existing well or the location where a new well could be installed.

This alternative would require constructing one new 727-foot well, a new pump station with a 5,000-gallon feed tank near the new well, an additional pump station and 5,000 gallon feed tank along the pipeline, and a pipeline from the new well/feed tank to the existing intake point for the Riviera ISD PWS. The pump stations and feed tanks would be necessary to overcome pipe friction and changes in land elevation. For this alternative, the pipeline is assumed to be approximately 10 miles long, and would be a 4-inches in diameter and discharge to the existing storage tank at the Riviera ISD PWS. Each pump station would include two transfer pumps, including one standby, and would be housed in a building.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, constructing the pipeline, the pump stations, the feed tanks, service pumps and pump houses. The estimated O&M cost for this alternative includes O&M for the pipeline and pump stations. The estimated capital cost for this alternative is $1.74 million, and the estimated annual O&M cost for this alternative is $54,400.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells, pump stations and pipelines are commonly employed. From the perspective of the Riviera ISD PWS, this alternative would be similar to operate as the existing system. Riviera ISD PWS personnel have experience with O&M of wells, pipelines, and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is likely that an alternate groundwater source would not be found on land owned by Riviera ISD PWS, so landowner cooperation would likely be required.

4.4.3 Alternative RI-3: New Well at 5 miles

This alternative consists of installing one new well within 5 miles of the Riviera ISD PWS that would produce compliant water in place of the water produced by the existing well. At this level of study, it is not possible to positively identify an existing well or the location where new wells could be installed.

This alternative would require constructing one new 727-foot well, a new pump station with a 5,000 gallon feed tank near the new well, and a pipeline from the new well/feed tank to the existing intake point for the Riviera ISD PWS. The pump station and feed tank would be necessary to overcome pipe friction and changes in land elevation. For this alternative, the pipeline is assumed to be 4-inches in diameter, approximately 5 miles long, and would discharge to the existing storage tank at the Riviera ISD PWS. The pump station near the well would include two transfer pumps, including one standby, and would be housed in a building.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, and constructing the pipeline and pump station. The estimated O&M cost for this alternative includes O&M for the pipeline and pump station. The estimated capital cost for this alternative is $966,000, and the estimated annual O&M cost for this alternative is $27,200.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells, pump stations and pipelines are commonly employed. From the perspective of the Riviera ISD PWS, this alternative would be similar to operate as the existing system. Riviera ISD PWS personnel have experience with O&M of wells, pipelines and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is likely an alternate groundwater source would not be found on land owned by the Riviera ISD PWS, so landowner cooperation would likely be required.

4.4.4 Alternative RI-4: New Well at 1 mile

This alternative consists of installing one new well within 1 mile of the Riviera ISD PWS that would produce compliant water in place of the water produced by the existing well. At this level of study, it is not possible to positively identify an existing well or the location where a new well could be installed.

This alternative would require constructing one new 727-foot well and a pipeline from the new well to the existing intake point for the Riviera ISD PWS. Since the new well is relatively close, a pump station would not be necessary. For this alternative, the pipeline is assumed to be 4 inches in diameter, approximately 1 mile long, and would discharge to the existing storage tank at the Riviera ISD PWS.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, and constructing the pipeline. The estimated O&M cost for this alternative includes O&M for the pipeline. The estimated capital cost for this alternative is $319,500, and the estimated annual O&M cost for this alternative is $300.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells and pipelines are commonly employed. From the perspective of the Riviera ISD PWS, this alternative would be similar to operate as the existing system. Riviera ISD PWS personnel have experience with O&M of wells, pipelines, and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is possible an alternate groundwater source would not be found on land owned by Riviera ISD PWS, so landowner cooperation may be required.

4.4.5 Alternative RI-5: Central RO Treatment

This system would continue to pump water from the existing well, and would treat the water through an RO treatment system prior to distribution. For this option, 100 percent of the raw water would be treated to obtain compliant water. The RO process concentrates impurities in the reject stream which would require disposal. It is estimated the total RO reject generation would be approximately 6,500 gallons per day (gpd) when the systems are operated at the average daily consumption (0.023 mgd).

This alternative consists of constructing the RO treatment plant near the existing ground storage tank. The plant includes a 400 square foot building with paved a driveway; a skid with the pre-constructed RO plant; a set of two transfer pumps, a 15,000-gallon tank for storing the treated water, and a connection to the sewer for discharge of the reject water. The treated water would be chlorinated and stored in the new treated water tank prior to being pumped into the existing ground storage tank. The entire facility is fenced.

The estimated capital cost for this alternative is $480,500, and the estimated annual O&M cost is $64,100. Installing a separate irrigation system that would not require treatment would reduce the cost of this alternative.

The reliability of adequate amount of compliant water under this alternative is good, since RO treatment is a common and well-understood treatment technology. However, O&M efforts required for the central RO treatment plant may be significant, and O&M personnel would require training with RO. The feasibility of this alternative is not dependent on the cooperation, willingness, or capability of other water supply entities.

4.4.6 Alternative RI-6: Central Coagulation Filtration Treatment

The system would continue to pump water from the Riviera ISD PWS well, and would treat the water through a coagulation/filtration system prior to distribution. For this option, the entire flow of the raw water will be treated and the flow will be decreased when one of the two 50 percent filters is being backwashed by raw water. It is assumed the existing well pump has adequate pressure to pump the water through the coagulation/filtration system.

The coagulation/filtration plant, located at the Riviera ISD PWS well site, features a 300 ft^2 building with a paved driveway; the pre-constructed filters and a coagulant solution tank on a skid; a 4,000-gallon spent backwash tank, and piping systems. The spent backwash would be allowed to settle in the spent backwash tank, and the water would be recycled to the head of the plant, and there would be discharge of the sludge to the sewer system. The entire facility is fenced.

The estimated capital cost for this alternative is $372,700, and the estimated annual O&M cost is $43,400. Installing a separate irrigation system that would not require treatment would reduce the cost of this alternative.

Reliability of supply of adequate amounts of compliant water under this alternative is good, since coagulation/filtration is an established treatment technology for uranium removal. The O&M efforts required is moderate and the operating personnel need to ensure that coagulant is not overfed. The spent backwash water contains metal oxide particles with sorbed uranium and the level of radioactivity in the backwash is relatively low.

4.4.7 Alternative RI-7: Central IX Treatment

The system would continue to pump water from the Riviera ISD PWS well, and would treat the water through an IX system prior to distribution. For this option, the entire flow of the raw water will be treated to obtain compliant water. Water in excess of that currently produced would be required for backwashing and regeneration of the resin beds.

The IX treatment plant, located at the Riviera ISD PWS well field, features a 300 square foot building with a paved driveway, a skid holding the pre-constructed IX equipment, a brine tank with regeneration equipment, two transfer pumps, a 12,000-gallon feed tank, and a 5,670-gallon tank for storing regenerant waste. Spent backwash water and regenerant waste would be discharged to the sewer at a controlled rate. The treated water would be chlorinated and pump to the existing ground storage tank. The entire facility is fenced.

The estimated capital cost for this alternative is $389,900, and the estimated annual O&M cost is $40,100.

The reliability of adequate amounts of compliant water under this alternative is good, since IX treatment is a common and well-understood technology. IX treatment does not require high pressure, but can be affected by interfering constituents in the water. The O&M efforts required for the central IX treatment plant may be significant, and operating personnel would require training with ion exchange.

4.4.8 Summary of Alternatives

Table 4.3 provides a summary of the key features of each alternative for Riviera ISD PWS.

Table 4.3 Summary of Compliance Alternatives for the Riviera ISD PWS

Alt No.	Alternative Description	Major Components	Capital Cost[1]	Annual O&M Cost	Total Annualized Cost	Reliability	System Impact	Remarks
RI-1	Purchase Water from Baffin Bay WSC	- 1 new pump station / feed tank - 6.8-mile pipeline	$ 1,029,300	$45,400	$ 135,100	Good	N	Agreement must be successfully negotiated with Baffin Bay WSC. Blending may be possible. Costs could possibly be shared with small systems along pipeline route.
RI-2	Install new compliant well at 10 Miles	- New well - 2 new pump stations / feed tanks - 10-mile pipeline	$1,743,600	$54,400	$206,400	Good	N	May be difficult to find well with good water quality. Costs could possibly be shared with small systems along pipeline route.
RI-3	Install new compliant well at 5 Miles	- New well - New pump station / feed tank - 5-mile pipeline	$966,000	$27,200	$111,400	Good	N	May be difficult to find well with good water quality. Costs could possibly be shared with small systems along pipeline route.
RI-4	Install new compliant well at 1 Mile	- New well - 1-mile pipeline	$319,500	$300	$28,100	Good	N	May be difficult to find well with good water quality.
RI-5	Continue operation of Riviera ISD well with central RO treatment	- Central RO treatment plant	$480,500	$64,100	$106,000	Good	T	Costs could possibly be shared with nearby small systems.
RI-6	Continue operation of Riviera ISD well with central coagulation filtration treatment	- Central coagulation filtration treatment plant	$372,700	$43,400	$75,900	Good	T	Costs could possibly be shared with nearby small systems.
RI-7	Continue operation of Riviera ISD well with central IX treatment	- Central IX treatment plant	$389,891	$40,125	$74,117	Good	T	Costs could possibly be shared with nearby small systems.

Notes: *N – No significant increase required in technical or management capability*
T – Implementation of alternative will require increase in technical capability
M – Implementation of alternative will require increase in management capability
1 – See cost breakdown in Appendix C
2 – 20-year return period and 6 percent interest

4.5 COST OF SERVICE AND FUNDING ANALYSIS

To evaluate the financial impact of implementing the compliance alternatives, a 30-year financial planning model was developed. This model can be found in Appendix D. Since the model was developed for water systems that collect revenue from paying customers for water usage, it had to be adapted for Riviera ISD PWS whose water system costs are funded by property taxes and State funds. Data for such models are typically derived from established budgets, audited financial reports, published water tariffs, and consumption data. Riviera ISD PWS does not track expenses for the water system separately.

Since the Riviera ISD is a public school there are no revenues from the sale of water. Information available to complete the financial analysis included estimated expenses for the PWS from Riviera ISD personnel, water production capacity data for the Riviera ISD PWS from the TCEQ website, and estimated water usage based on a per capita usage rate of 30 gallon per day.

This analysis will need to be performed in a more detailed fashion and applied to alternatives deemed attractive and worthy of more detailed evaluation. A more detailed analysis should include additional factors such as:

- Cost escalation,
- Price elasticity effects where increased rates may result in lower water consumption,
- Costs for other system upgrades and rehabilitation needed to maintain compliant operation.

4.5.1 Financial Plan Development

Since financial records for Riviera ISD were not available and no revenues are generated from the sale of water, the following assumptions were made to derive estimates for input into the financial planning model. These assumptions were:

1) Water system expenses are $5,000
2) 2006 revenues equal 2006 expenses for operation of the water system.
3) The existing potable water system is paid for and has been fully depreciated
4) A nominal fee per student/teacher for water use was assigned in order to simulate a revenue stream.
5) An average consumption of 0.023 mgd is held constant across the year to account for irrigation, housekeeping, school events, and other water needs throughout the year.

The Riviera ISD has a population of 500. While students/teachers do not pay for the water they consume, an annual base rate of $10.00 per person was established which accounts for

$5,000 of the water system revenues. This arbitrary value results in a theoretical revenue equal to the $5,000 in operating expenses. These values were used in the financial planning model.

While these assumptions are arbitrary, they help to frame costs of the water system operation and allow impacts of the incremental costs of the various alternatives to be evaluated.

4.5.2 Current Financial Condition

4.5.2.1 Cash Flow Needs

Cash flow needs could not be evaluated for the Riviera ISD PWS because the system provides water to the school campus without cost. The school budget covers the operation of the water system. However, since it was assumed that theoretical water revenues are equal to the operating expenses, any capital improvements to the water system would require additional funding.

4.5.2.2 Ratio Analysis

Current Ratio

The Current Ratio for the Riviera ISD PWS could not be determined due to lack of necessary financial data to determine this ratio.

Debt to Net Worth Ratio

A Debt-to-Net-Worth Ratio also could not be determined owing to lack of the necessary financial data to determine this ratio.

Operating Ratio

Because of the lack of complete separate financial data specifically related to the Riviera ISD PWS, the Operating Ratio could not be accurately determined.

4.5.3 Financial Plan Results

Each of the compliance alternatives for the Riviera ISD PWS was evaluated using the financial model to determine the overall increase in water rates that would be necessary to pay for the improvements. Each alternative was examined under the various funding options described in Section 2.4.

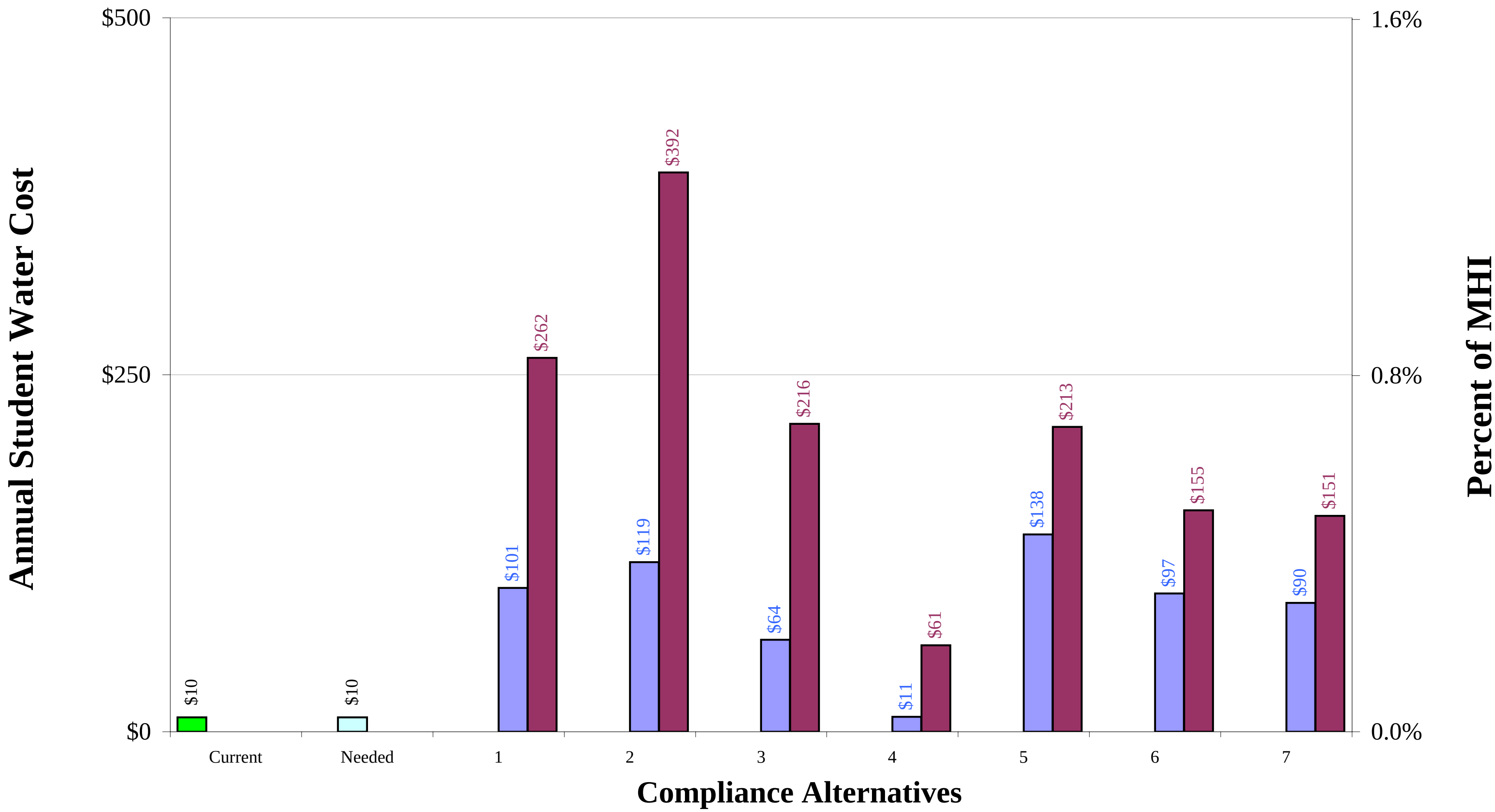
Results of the financial impact analysis are provided in Table 4.4 and Figure 4.2. Table 4.4 and Figure 4.2 present rate impacts assuming that revenues match expenses, without funding reserve accounts, and that operations and implementation of compliance alternatives are funded with revenue and are not paid for from reserve accounts. Figure 4.2 provides a bar chart that, in terms of the yearly billing to an average customer, shows the following:

- Current annual average bill,

Riviera ISD
Table 4.4 Financial Impact on Students

Alternative	Description		All Revenue	100% Grant	75% Grant	50% Grant	SRF	Bond
1	Purchase Water from Baffin Bay WSC	Maximum % of MHI	6.7%	0.3%	0.5%	0.6%	0.8%	0.9%
		Percentage Rate Increase Compared to Current	20585%	908%	1310%	1713%	2278%	2518%
		Average Annual Water Bill	$2,069	$101	$141	$181	$238	$262
2	New Well at 10 Miles	Maximum % of MHI	11.4%	0.4%	0.6%	0.8%	1.1%	1.3%
		Percentage Rate Increase Compared to Current	34873%	1089%	1770%	2452%	3411%	3816%
		Average Annual Water Bill	$3,497	$119	$187	$255	$351	$392
3	New Well at 5 Miles	Maximum % of MHI	6.3%	0.2%	0.3%	0.5%	0.6%	0.7%
		Percentage Rate Increase Compared to Current	19319%	544%	922%	1300%	1831%	2056%
		Average Annual Water Bill	$1,942	$64	$102	$140	$193	$216
4	New Well at 1 Mile	Maximum % of MHI	2.1%	0.0%	0.1%	0.1%	0.2%	0.2%
		Percentage Rate Increase Compared to Current	6389%	6%	130%	255%	431%	505%
		Average Annual Water Bill	$649	$11	$23	$36	$53	$61
5	Central Treatment - RO	Maximum % of MHI	3.2%	0.4%	0.5%	0.6%	0.7%	0.7%
		Percentage Rate Increase Compared to Current	9611%	1283%	1471%	1659%	1923%	2035%
		Average Annual Water Bill	$971	$138	$157	$176	$202	$213
6	Central Treatment - Coag/filtration	Maximum % of MHI	2.5%	0.3%	0.4%	0.4%	0.5%	0.5%
		Percentage Rate Increase Compared to Current	7454%	868%	1014%	1160%	1364%	1451%
		Average Annual Water Bill	$755	$97	$111	$126	$146	$155
7	Central Treatment - IE	Maximum % of MHI	2.6%	0.3%	0.3%	0.4%	0.5%	0.5%
		Percentage Rate Increase Compared to Current	7798%	803%	955%	1107%	1322%	1412%
		Average Annual Water Bill	$790	$90	$105	$121	$142	$151

Figure 4.2
Alternative Cost Summary: Riviera ISD



Current Average Monthly Cost = $0.83
Mediuan Household Income = $30750
Average Monthly Student Usage = 1399 gallons

Current
Needed
With 100% Grant Funding
With 100% Loan/Bond Funding

- Projected annual average bill including rate increase, if needed, to match existing expenditures, and
- Projected annual bill including rate increases needed to fund implementation of a compliance alternative (this does not include funding for reserve accounts).

The two bars shown for each compliance alternative represent the rate changes necessary for revenues to match total expenditures assuming 100 percent grant funding and 100 percent loan/bond funding. Most funding options will fall between 100 percent grant and 100 percent loan/bond funding, with the exception of 100 percent revenue financing. Establishing or increasing reserve accounts would require an increase in rates. If existing reserves are insufficient to fund a compliance alternative, rates would need to be raised before implementing the compliance alternative. This would allow for accumulation of sufficient reserves to avoid larger but temporary rate increases during the years the compliance alternative was being implemented.

4.5.4 Evaluation of Potential Funding Options

There are a variety of funding programs available to entities as described in Section 2.4. Riviera ISD PWS is most likely to obtain funding from programs administered by the TWDB, ORCA, and Rural Development. This report contains information that would be used for an application for funding. Information such as financial analyses, water supply assessment, and records demonstrating health concerns, failing infrastructure, and financial need, may be required by these agencies. This section describes the candidate funding agencies and their appropriate programs as well as information and steps needed to begin the application process.

This report should serve to document the existing water quality issues, infrastructure need and costs, and water system information needed to begin the application process. Although this report is at the conceptual level, it demonstrates that significant funding will be needed to meet Safe Drinking Water Standards. The information provided in this report may serve as the needed documentation to justify a project that may only be possible with significant financial assistance.

4.5.4.1 TWDB Funding Options

The programs offered by the TWDB include the Drinking Water State Revolving Fund (DWSRF), Rural Water Assistance Fund (RWAF), State Loan Program (Development Fund II), and Economically Distressed Areas Program (EDAP).

Drinking Water State Revolving Fund

The DWSRF offers net long-term interest lending rates below the rate the borrower would receive on the open market for a period of 20 years. A cost-recovery loan origination charge is imposed to cover the administrative costs of operating the DWSRF, but an additional interest rate subsidy is offered to offset the charge. The terms of the loan typically require a revenue or tax pledge. Depending on how the origination charge is handled, interest rates can be as low as 0.95 percent below market rates with the possibility of additional federal subsidies for total interest rates 1.95 percent below market rates. Disadvantaged communities may obtain loans at interest rates between 0 percent and 1 percent.

The loan application process has several steps: pre-application, application and commitment, loan closing, funding and construction monitoring, and any other special requirements. In the pre-application phase, prospective loan applicants are asked to submit a brief DWSRF Information Form to the TWDB that describes the applicant's existing water facilities, additional facility needs and the nature of projects being considered for meeting those needs, project cost estimates, and "disadvantaged community" status. The TCEQ assigns a priority rating that includes an applicant's readiness to proceed. TWDB staff notify prospective applicants of their priority rating and encourage them to schedule a pre-planning conference for guidance in preparing the engineering, planning, environmental, financial, and water conservation portions of the DWSRF application.

Additional information can be found online at the TWDB website under the Assistance tab, Financial Assistance section, Public Works Infrastructure Construction subsection, and under the links "Clean Water State Revolving Fund Loan Program."

State Loan Program (Development Fund II)

The State Loan Program is a diverse lending program directly from state funding sources. As it does not receive federal subsidies, it is more streamlined. The loans can incorporate more than one project under the umbrella of one loan. Political subdivision of the state are eligible for tax exempt rates. Projects can include purchase of water rights, treatment plants, storage and pumping facilities, transmission lines, well development, and acquisitions.

The loan requires that the applicant pledge revenue or taxes. The maximum financing life is 50 years. The average financing period is 20 to 23 years. The lending rate scale varies according to several factors, but is set by the TWDB based on cost of funds to the board, risk factors of managing the board loan portfolio, and market rate scales. The TWDB seeks to make reasonable loans with minimal risk to the state. The TWDB post rates for comparison for applicants and in August 2008, the TWDB showed their rates for a 22-year, taxable loan at 5.5 percent where the market was at 7.84 percent.

The TWDB staff can discuss the terms of the loan and assist applicants during preparation of the application, and a preapplication conference is encouraged. The application materials must include an engineering feasibility report, environmental information, rates and customer base, operating budgets, financial statements, and project information. The TWDB considers the needs of the area; benefits of the project; the relationship of the project to the overall state water needs and the State Water Plan; and the availability of all sources of revenue to the rural utility for the ultimate repayment of the loan. The board considers applications monthly.

Additional information can be found online at the TWDB website under the Assistance tab, Financial Assistance section, Public Works Infrastructure Construction subsection, and under the link "Water and Wastewater Loan Program."

Economically Distressed Areas Program

The EDAP Program was designed to assist areas along the U.S./Mexico border in areas that were economically distressed. In 2008, this program was extended to apply to the entire state so long as requirements are met. This program provides financial assistance through the provision of grants and loans to communities where present facilities are inadequate to meet residents minimal needs. Eligible communities are those that have median household income less than 75 percent of the state household income. Non-profit water supply corporations can apply, but they must be capable of maintaining and operating the completed system, and hold or be in the process of obtaining a Certificate of Convenience and Necessity. The county where the project is located must adopt model rules for the regulation of subdivisions prior to application for financial assistance. If the applicant is a city, the city must also adopt Model Subdivision Rules of TWDB (31 Texas Administrative Code [TAC] Chapter 364). The program funds design, construction, improvements, and acquisition, and includes measures to prevent future substandard development. The TWDB works with the applicant to find ways to leverage other state and federal financial resources.

The loan requires that the applicant pledge revenue or taxes. The maximum financing life is 50 years. The average financing period is 20 to 23 years. The lending rate scale varies according to several factors but is set by the TWDB based on cost of funds to the board, risk factors of managing the board loan portfolio, and market rate scales. The TWDB seeks to make reasonable loans with minimal loss to the state. The TWDB posts rates for comparison for applicants and in August 2008 the TWDB showed its rates for a 22-year, tax exempt loan at 5.11 percent where the market was at 5.60 percent. Most projects have a financial package with the majority of the project financed with grants. Many have received 100 percent grants.

The first step in the application process is to meet with TWDB staff to discuss the terms of the loan and assist applicants during preparation of the application. Major components of the application materials must include an engineering feasibility report, environmental information, rates and customer base, operating budgets, financial statements, community information, project information, and other legal information.

Additional information can be found online at the TWDB website under the Assistance tab, Financial Assistance section, Public Works Infrastructure Construction subsection, and under the link “Economically Distressed Area Program.”

4.5.4.2 ORCA Funding Options

Created in 2001, ORCA seeks to strengthen rural communities and assist them with community and economic development and healthcare by providing a variety of rural programs, services, and activities. Of their many programs and funds, the most appropriate programs related to drinking water are the Community Development (CD) Fund, and Texas Small Towns Environment Program (STEP). These programs offer attractive funding packages to help make improvements to potable water systems to mitigate potential health concerns.

Community Development Fund

The CD Fund is a competitive grant program for water system improvements as well as other utility services (wastewater, drainage improvements, and housing activities). Funds are distributed between 24 state planning regions where funds are allocated to address each region's utility priorities. Funds can be used for various types of public works projects, including water system improvements. Cities with a population of less than 50,000 that are not eligible for direct CDBG funding from the U.S. Department of Housing and Urban Development are eligible. Funds are awarded on a competitive basis decided twice a year by regional review committees using a defined scoring system (past performance with CDBG is a factor). Awards are no less then $75,000 and cannot exceed $800,000. More information can be found at the Office of Community Affairs website under Community Development Fund.

Texas Small Towns Environment Program

Under special occasions some communities are invited to participate in grant programs when self-help is a feasible method for completing a water project, the community is committed to self-help, and the community has the capacity to complete the project. The purpose is to significantly reduce the cost of the project by using the communities' own human, material, and financial capital. Projects typically are repair, rehabilitation, improvements, service connections, and yard services. Reasonable associated administration and engineering cost can be funded. A letter of interest is first submitted, and after CDBG staff determine eligibility, an application may be submitted. Awards are only given twice per year on a priority basis so long as the project can be fully funded ($350,000 maximum award). Ranking criteria are project impact, local effort, past performance, percent of savings, and benefit to low to medium-income persons.

4.5.4.3 Rural Development

The RUS agency of Rural Development established a Revolving Fund Program (RFP) administered by the staff of the Water and Environment Program (WEP) to assist communities with water and wastewater systems. The purpose is to fund technical assistance and projects to help communities bring safe drinking water and sanitary, environmentally sound, waste disposal facilities to rural Americans in greatest need. WEP provides loans, grants, and loan guarantees for drinking water, sanitary sewer, solid waste, and storm drainage facilities in rural areas and cities and towns with a population of 10,000 or less. Recipients must be public entities such as municipalities, counties, special purpose districts, Indian tribes, and corporations not operated for profit. Projects include all forms of infrastructure improvement, acquisition of land and water rights, and design fees. Rural Development attempts to provide some level of assistance to all communities that apply. Funds are provided on a first come, first serve basis; however, staff do evaluate need and assign priorities as funds are limited. Grant/loan mixes vary on a case by case basis and some communities may have to wait though several funding cycles until funds become available.

Water and Wastewater Disposal Program

The major components of the RFP are loan, loan guarantees, and grant funding for water and waste disposal systems. Entities must demonstrate that they cannot obtain reasonable loans at market rates, but have the capacity to repay loans, pledge security, and operate the facilities. Grants can be up to 75 percent of the project costs, and loan guarantees can be up to 90 percent of eligible loss. Loans are not to exceed a 40-year repayment period, require tax or revenue pledges, and are offered at three rates:

- Poverty Rate - The lowest rate is the poverty interest rate of 4.5 percent. Loans must be used to upgrade or construct new facilities to meet health standards, and the MHI in the service area must be below the poverty line for a family of four or below 80 percent of the statewide MHI for non-metropolitan communities.
- Market Rate – Where the MHI in the service exceeds the state MHI, the rate is based on the average of the “Bond Buyer” 11-Bond Index over a four week period.
- Intermediate Rate – the average of the Poverty Rate and the Market Rate, but not to exceed seven percent.

SECTION 5
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APPENDIX A
PWS INTERVIEW FORM

CAPACITY DEVELOPMENT ASSESSMENT FORM

*Prepared By*___________________________________ *Date*___________________________

Section 1. Public Water System Information

1. PWS ID # [ ] 2. Water System Name [ ]

3. County [ ]

4. Owner [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

5. Admin [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

6. Operator [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

7. Population Served [ ] 8. No. of Service Connections [ ]

9. Ownership Type [ ] 10. Metered (Yes or No) [ ]

11. Source Type [ ]

12. Total PWS Annual Water Used [ ]

13. Number of Water Quality Violations (Prior 36 months)

Total Coliform [ ] Chemical/Radiological [ ]

Monitoring (CCR, Public Notification, etc.) [ ] Treatment Technique, D/DBP [ ]

A. Basic Information

1. Name of Water System:

2. Name of Person Interviewed:

3. Position:

4. Number of years at job:

5. Number of years experience with drinking water systems:

6. Percent of time (day or week) on drinking water system activities, with current position (how much time is dedicated exclusively to the water system, not wastewater, solid waste or other activities):

7. Certified Water Operator (Yes or No):

    If Yes,
    7a. Certification Level (water):

    7b. How long have you been certified?

8. Describe your water system related duties on a typical day.

B. Organization and Structure

1. Describe the organizational structure of the Utility. Please provide an organizational chart. (Looking to find out the governance structure (who reports to whom), whether or not there is a utility board, if the water system answers to public works or city council, etc.)

2. If not already covered in Question 1, to whom do you report?

3. Do all of the positions have a written job description?

   3a. If yes, is it available to employees?

   3b. May we see a copy?

C. Personnel

1. What is the current staffing level (include all personnel who spend more than 10% of their time working on the water system)?

2. Are there any vacant positions? How long have the positions been vacant?

3. In your opinion, is the current staffing level adequate? If not adequate, what are the issues or staffing needs (how many and what positions)?

4. What is the rate of employee turnover for management and operators? What are the major issues involved in the turnover (e.g., operator pay, working conditions, hours)?

5. Is the system staffed 24 hours a day? How is this handled (on-site or on-call)? Is there an alarm system to call an operator if an emergency occurs after hours?

D. Communication

1. Does the utility have a mission statement? If yes, what is it?

2. Does the utility have water quality goals? What are they?

3. How are your work priorities set?

4. How are work tasks delegated to staff?

5. Does the utility have regular staff meetings? How often? Who attends?

6. Are there separate management meetings? If so, describe.

7. Do management personnel ever visit the treatment facility? If yes, how often?

8. Is there effective communication between utility management and state regulators (e.g., NMED)?

9. Describe communication between utility and customers.

E. Planning and Funding

1. Describe the rate structure for the utility.

2. Is there a written rate structure, such as a rate ordinance? May we see it?

   2a. What is the average rate for 6,000 gallons of water?

3. How often are the rates reviewed?

4. What process is used to set or revise the rates?

5. In general, how often are the new rates set?

6. Is there an operating budget for the water utility? Is it separate from other activities, such as wastewater, other utilities, or general city funds?

7. Who develops the budget, how is it developed and how often is a new budget created or the old budget updated?

8. How is the budget approved or adopted?

9. In the last 5 years, how many budget shortfalls have there been (i.e., didn’t collect enough money to cover expenses)? What caused the shortfall (e.g., unpaid bills, an emergency repair, weather conditions)?

    9a. How are budget shortfalls handled?

10. In the last 5 years how many years have there been budget surpluses (i.e., collected revenues exceeded expenses?

    10a. How are budget surpluses handled (i.e., what is done with the money)?

11. Does the utility have a line-item in the budget for emergencies or some kind of emergency reserve account?

12. How do you plan and pay for short-term system needs?

13. How do you plan and pay for long- term system needs?

14. How are major water system capital improvements funded? Does the utility have a written capital improvements plan?

15. How is the facility planning for future growth (either new hook-ups or expansion into new areas)?

16. Does the utility have and maintain an annual financial report? Is it presented to policy makers?

17. Has an independent financial audit been conducted of the utility finances? If so, how often? When was the last one?

18. Will the system consider any type of regionalization with any other PWS, such as system interconnection, purchasing water, sharing operator, emergency water connection, sharing bookkeeper/billing or other?

F. Policies, Procedures, and Programs

1. Are there written operational procedures? Do the employees use them?

2. Who in the utility department has spending authorization? What is the process for obtaining needed equipment or supplies, including who approves expenditures?

3. Does the utility have a source water protection program? What are the major components of the program?

4. Are managers and operators familiar with current SDWA regulations?

5. How do the managers and operators hear about new or proposed regulations, such as arsenic, DBP, Groundwater Rule? Are there any new regulations that will be of particular concern to the utility?

6. What are the typical customer complaints that the utility receives?

7. Approximately how many complaints are there per month?

8. How are customer complaints handled? Are they recorded?

9. (If not specifically addressed in Question 7) If the complaint is of a water quality nature, how are these types of complaints handled?

10. Does the utility maintain an updated list of critical customers?

11. Is there a cross-connection control plan for the utility? Is it written? Who enforces the plan's requirements?

12. Does the utility have a written water conservation plan?

13. Has there been a water audit of the system? If yes, what were the results?

14. (If not specifically answered in 11 above) What is the estimated percentage for loss to leakage for the system?

15. Are you, or is the utility itself, a member of any trade organizations, such as AWWA or Rural Water Association? Are you an active member (i.e., attend regular meetings or participate in a leadership role)? Do you find this membership helpful? If yes, in what ways does it help you?

G. Operations and Maintenance

1. How is decision-making authority split between operations and management for the following items:

    a. Process Control

    b. Purchases of supplies or small equipment

    c. Compliance sampling/reporting

    d. Staff scheduling

2. Describe your utility's preventative maintenance program.

3. Do the operators have the ability to make changes or modify the preventative maintenance program?

4. How does management prioritize the repair or replacement of utility assets? Do the operators play a role in this prioritization process?

5. Does the utility keep an inventory of spare parts?

6. Where does staff have to go to buy supplies/minor equipment? How often?

    6a. How do you handle supplies that are critical, but not in close proximity (for example if chlorine is not available in the immediate area or if the components for a critical pump are not in the area)

7. Describe the system's disinfection process. Have you had any problems in the last few years with the disinfection system?

    7a. Who has the ability to adjust the disinfection process?

8. How often is the disinfectant residual checked and where is it checked?

    8a. Is there an official policy on checking residuals or is it up to the operators?

9. Does the utility have an O & M manual? Does the staff use it?

10. Are the operators trained on safety issues? How are they trained and how often?

11. Describe how on-going training is handled for operators and other staff. How do you hear about appropriate trainings? Who suggests the trainings – the managers or the operators? How often do operators, managers, or other staff go to training? Who are the typical trainers used and where are the trainings usually held?

12. In your opinion is the level of your on-going training adequate?

13. In your opinion is the level of on-going training for other staff members, particularly the operators, adequate?

14. Does the facility have mapping of the water utility components? Is it used on any routine basis by the operators or management? If so, how is it used? If not, what is the process used for locating utility components?

15. In the last sanitary survey, were any deficiencies noted? If yes, were they corrected?

16. How often are storage tanks inspected? Who does the inspection?

    16a. Have you experienced any problems with the storage tanks?

H. SDWA Compliance

1. Has the system had any violations (monitoring or MCL) in the past 3 years? If so, describe.

2. How were the violations handled?

3. Does the system properly publish public notifications when notified of a violation?

4. Is the system currently in violation of any SDWA or state regulatory requirements, including failure to pay fees, fines, or other administrative type requirements?

5. Does the utility prepare and distribute a Consumer Confidence Report (CCR)? Is it done every year? What type of response does the utility get to the CCR from customers?

I. Emergency Planning

1. Does the system have a written emergency plan to handle emergencies such as water outages, weather issues, loss of power, loss of major equipment, etc?

2. When was the last time the plan was updated?

3. Do all employees know where the plan is? Do they follow it?

4. Describe the last emergency the facility faced and how it was handled.

Attachment A

A. Technical Capacity Assessment Questions

1. Based on available information of water rights on record and water pumped has the system exceeded its water rights in the past year? YES ☐ NO ☐

   In any of the past 5 years? YES ☐ NO ☐ How many times? _____

2. Does the system have the proper level of certified operator? *(Use questions a – c to answer.)*
   YES ☐ NO ☐

   a. What is the Classification Level of the system by NMED? _____

   b. Does the system have one or more certified operator(s)? [20 NMAC 7.4.20]

   YES ☐ NO ☐

   c. If YES, provide the number of operators at each New Mexico Certification Level. [20 NMAC 7.4.12]

   _____NM Small System _____Class 2

   _____NM Small System Advanced _____Class 3

   _____Class 1 _____Class 4

3. Did the system correct any sanitary deficiency noted on the most recent sanitary survey within 6 months of receiving that information? [20 NMAC 7.20.504]

   YES ☐ NO ☐ No Deficiencies ☐

   What was the type of deficiency? *(Check all that are applicable.)*

   Source ☐ Storage ☐

   Treatment ☐ Distribution ☐

   Other _____

   From the system's perspective, were there any other deficiencies that were not noted on the sanitary survey? Please describe.

4. Will the system's current treatment process meet known future regulations?

   Radionuclides YES ☐ NO ☐ Doesn't Apply ☐

   Arsenic YES ☐ NO ☐ Doesn't Apply ☐

   Stage 1 Disinfectants and Disinfection By-Product (DBP)

   YES ☐ NO ☐ Doesn't Apply ☐

   Surface Water Treatment Rule YES ☐ NO ☐ Doesn't Apply ☐

5. Does the system have a current site plan/map? [20 NMAC 7.10.302 A.1.]

   YES ☐ NO ☐

6. Has the system had a water supply outage in the prior 24 months?

YES ☐ NO ☐

What were the causes of the outage(s)? *(Include number of outages for each cause.)*

Drought _____ Limited Supply _____

System Failure _____ Other _____

7. Has the system ever had a water audit or a leak evaluation?

YES ☐ NO ☐ Don't Know ☐

If YES, please complete the following table.

Type of Investigation	Date Done	Water Loss (%)	What approach or technology was used to complete the investigation?	Was any follow-up done? If so, describe

8. Have all drinking water projects received NMED review and approval? [20 NMAC 7.10.201]

YES ☐ NO ☐

If NO, what types of projects have not received NMED review and approval.

Source ☐ Storage ☐

Treatment ☐ Distribution ☐

Other ☐ _____

9. What are the typical customer complaints that the utility receives?

10. Approximately how many complaints are there per month? _____

11. How are customer complaints handled? Are they recorded?

12. What is the age and composition of the distribution system? ***(Collect this information from the Sanitary Survey)***

Pipe Material	Approximate Age	Percentage of the system	Comments
			Sanitary Survey Distribution System Records Attached

13. Are there any dead end lines in the system?
YES ☐ NO ☐

14. Does the system have a flushing program?
YES ☐ NO ☐
If YES, please describe.

15. Are there any pressure problems within the system?
YES ☐ NO ☐
If YES, please describe.

16. Does the system disinfect the finished water?
YES ☐ NO ☐
If yes, which disinfectant product is used? ______

Interviewer Comments on Technical Capacity:

B. Managerial Capacity Assessment Questions

17. Has the system completed a 5-year Infrastructure Capital Improvement Plan (ICIP) plan?
YES ☐ NO ☐
If YES, has the plan been submitted to Local Government Division?
YES ☐ NO ☐

18. Does the system have written operating procedures?
YES ☐ NO ☐

19. Does the system have written job descriptions for all staff?
YES ☐ NO ☐

20. Does the system have:

A preventative maintenance plan?
YES ☐ NO ☐
A source water protection plan?
YES ☐ NO ☐ N/A ☐
An emergency plan?
YES ☐ NO ☐
A cross-connection control program?
YES ☐ NO ☐
An emergency source?
YES ☐ NO ☐
System security measures?
YES ☐ NO ☐

21. Does the system report and maintain records in accordance with the drinking water regulations concerning:

Water quality violations
YES ☐ NO ☐

Public notification
YES ☐ NO ☐

Sampling exemptions
YES ☐ NO ☐

22. Please describe how the above records are maintained:

23. Describe the management structure for the water system, including board and operations staff. Please include examples of duties, if possible.

24. Please describe type and quantity of training or continuing education for staff identified above.

25. Describe last major project undertaken by the water system, including the following: project in detail, positive aspects, negative aspects, the way in which the project was funded, any necessary rate increases, the public response to the project, whether the project is complete or not, and any other pertinent information.

26. Does the system have any debt? YES ☐ NO ☐

If yes, is the system current with all debt payments?
YES ☐ NO ☐

If no, describe the applicable funding agency and the default.

27. Is the system currently contemplating or actively seeking funding for any project?
YES ☐ NO ☐

If yes, from which agency and how much?

Describe the project?

Is the system receiving assistance from any agency or organization in its efforts?

28. Will the system consider any type of regionalization with other PWS? *(Check YES if the system has already regionalized.)*

YES ☐ NO ☐

If YES, what type of regionalization has been implemented/considered/discussed? *(Check all that apply.)*

System interconnection ☐
Sharing operator ☐
Sharing bookkeeper ☐
Purchasing water ☐
Emergency water connection ☐
Other: _____

29. Does the system have any of the following? *(Check all that apply.)*

Water Conservation Policy/Ordinance ☐ Current Drought Plan ☐
Water Use Restrictions ☐ Water Supply Emergency Plan ☐

Interviewer Comments on Managerial Capacity:

C. Financial Capacity Assessment

30. Does the system have a budget?

YES ☐ NO ☐

If YES, what type of budget?

Operating Budget ☐

Capital Budget ☐

31. Have the system revenues covered expenses and debt service for the past 5 years?

YES ☐ NO ☐

If NO, how many years has the system had a shortfall? _____

32. Does the system have a written/adopted rate structure?

YES ☐ NO ☐

33. What was the date of the last rate increase? _____

34. Are rates reviewed annually?

YES ☐ NO ☐

IF YES, what was the date of the last review? _____

35. Did the rate review show that the rates covered the following expenses? *(Check all that apply.)*

Operation & Maintenance ☐

Infrastructure Repair & replacement ☐

Staffing ☐

Emergency/Reserve fund ☐

Debt payment ☐

36. Is the rate collection above 90% of the customers?

YES ☐ NO ☐

37. Is there a cut-off policy for customers who are in arrears with their bill or for illegal connections?

YES ☐ NO ☐

If yes, is this policy implemented?

38. What is the residential water rate for 6,000 gallons of usage in one month. _____

39. In the past 12 months, how many customers have had accounts frozen or dropped for non-payment? _____

[Convert to % of active connections

Less than 1% ☐ 1% - 3% ☐ 4% - 5% ☐ 6% - 10% ☐

11% - 20% ☐ 21% - 50% ☐ Greater than 50% ☐]

40. The following questions refer to the process of obtaining needed equipment and supplies.

a. Can the water system operator buy or obtain supplies or equipment when they are needed?

YES ☐ NO ☐

b. Is the process simple or burdensome to the employees?

c. Can supplies or equipment be obtained quickly during an emergency?

YES ☐ NO ☐

d. Has the water system operator ever experienced a situation in which he/she couldn't purchase the needed supplies?

YES ☐ NO ☐

e. Does the system maintain some type of spare parts inventory?

YES ☐ NO ☐

If yes, please describe.

41. Has the system ever had a financial audit?

YES ☐ NO ☐

If YES, what is the date of the most recent audit? ______

42. Has the system ever had its electricity or phone turned off due to non-payment? Please describe.

Interviewer Comments on Financial Assessment:

43. What do you think the system capabilities are now and what are the issues you feel your system will be facing in the future? In addition, are there any specific needs, such as types of training that you would like to see addressed by NMED or its contractors?

APPENDIX B
COST BASIS

This section presents the basis for unit costs used to develop the conceptual cost estimates for the compliance alternatives. Cost estimates are conceptual in nature (+50%/-30%), and are intended to make comparisons between compliance options and to provide a preliminary indication of possible rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation. Capital cost includes an allowance for engineering and construction management. It is assumed that adequate electrical power is available near the site. The cost estimates specifically do not include costs for the following:

- Obtaining land or easements.
- Surveying.
- Mobilization/demobilization for construction.
- Insurance and bonds

In general, unit costs are based on recent construction bids for similar work in the area; when possible, consultations with vendors or other suppliers; published construction and O&M cost data; and USEPA cost guidance. Unit costs used for the cost estimates are summarized in Table B.1.

Unit costs for pipeline components are based on 2008 RS Means Site Work & Landscape Cost Data. The number of borings and encasements and open cuts and encasements is estimated by counting the road, highway, railroad, stream, and river crossings for a conceptual routing of the pipeline. The number of air release valves is estimated by examining the land surface profile along the conceptual pipeline route. It is assumed that gate valves and flush valves would be installed, on average, every 5,000 feet along the pipeline. Pipeline cost estimates are based on the use of C-900 PVC pipe. Other pipe materials could be considered for more detailed development of attractive alternatives.

Pump station unit costs are based on experience with similar installations. The cost estimate for the pump stations include two pumps, station piping and valves, station electrical and instrumentation, minor site improvement, installation of a concrete pad, fence and building, and tools. The number of pump stations is based on calculations of pressure losses in the proposed pipeline for each alternative. Back-flow prevention is required in cases where pressure losses are negligible, and pump stations are not needed. Construction cost of a storage tank is based on consultations with vendors and 2008 R.S. Means Site Work & Landscape Cost Data.

Labor costs are estimated based on 2008 RS Means Site Work & Landscape Cost Data specific to the Nueces County region.

Electrical power cost is estimated to be $0.175 per kWH, as supplied by Nueces electric Co-op. The annual cost for power to a pump station is calculated based on the pumping head and volume, and includes 11,800 kWH for pump building heating, cooling, and lighting, as recommended in USEPA publication, *Standardized Costs for Water Supply Distribution Systems* (1992).

In addition to the cost of electricity, pump stations have other maintenance costs. These costs cover: materials for minor repairs to keep the pumps operating; purchase of a maintenance vehicle, fuel costs, and vehicle maintenance costs; utilities; office supplies, small tools and equipment; and miscellaneous materials such as safety, clothing, chemicals, and paint. The non-power O&M costs are estimated based on the USEPA publication, *Standardized Costs for Water Supply Distribution Systems* (1992), which provides cost curves for O&M components. Costs from the 1992 report are adjusted to 2008 dollars based on the ENR construction cost index.

Pipeline maintenance costs include routine cleaning and flushing, as well as minor repairs to lines. The unit rate for pipeline maintenance is calculated based on the USEPA technical report, *Innovative and Alternate Technology Assessment Manual MCD 53* (1978). Costs from the 1978 report are adjusted to 2008 dollars based on the ENR construction cost index.

Storage tank maintenance costs include cleaning and renewal of interior lining and exterior coating. Unit costs for storage tank O&M are based on USEPA publication *Standardized Costs for Water Supply Distribution Systems* (1992). Costs from the 1992 report are adjusted to 2008 dollars based on the ENR construction cost index.

The purchase price for point-of-use (POU) water treatment units is based on vendor price lists for treatment units, plus installation. O&M costs for POU treatment units are also based on vendor price lists. It is assumed that a yearly water sample would be analyzed for the contaminant of concern.

The purchase price for point-of-entry (POE) water treatment units is based on vendor price lists for treatment units, plus an allowance for installation, including a concrete pad and shed, piping modifications, and electrical connection. O&M costs for POE treatment units are also based on vendor price lists. It is assumed that a yearly water sample would be analyzed for the contaminant of concern.

Central treatment plant costs include pricing for buildings, utilities, and site work. Costs are based on pricing given in the various R.S. Means Construction Cost Data References, as well as prices obtained from similar work on other projects. Pricing for treatment equipment was obtained from vendors.

Well installation costs are based on 2008 RS Means Site Work & Landscape Cost Data. Well installation costs include drilling, a well pump, electrical and instrumentation installation, well finishing, piping, and water quality testing. O&M costs for water wells include power, materials, and labor. It is assumed that new wells located more than 1 mile from the intake point of an existing system would require a storage tank and pump station.

Purchase price for the treatment unit dispenser is based on vendor price lists, plus an allowance for installation at a centralized public location. The O&M costs are also based on vendor price lists. It is assumed that weekly water samples would be analyzed for the contaminant of concern.

Costs for bottled water delivery alternatives are based on consultation with vendors that deliver residential bottled water. The cost estimate includes an initial allowance for set-up of the program, and a yearly allowance for program administration.

The cost estimate for a public dispenser for trucked water includes the purchase price for a water truck and construction of a storage tank. Annual costs include labor for purchasing the water, picking up and delivering the water, truck maintenance, and water sampling and testing. It is assumed the water truck would be required to make one trip each week, and that chlorine residual would be determined for each truck load.

Table B.1
Summary of General Data
Riviera ISD
1370019
General PWS Information

Service Population	500	**Number of Connections**	7
Total PWS Daily Water Usage	0.023 (mgd)	**Source**	Site visit list

Unit Cost Data

General Items	**Unit**	**Unit Cost**
Treated water purchase cost	See alternative	
Water purchase cost (trucked)	$/1,000 gals	$ 17.50
Contingency	20%	n/a
Engineering & Constr. Management	25%	n/a
Procurement/admin (POU/POE)	20%	n/a

Pipeline Unit Costs	**Unit**	**Unit Cost**
PVC water line, Class 200, 04"	LF	$ 12
Bore and encasement, 10"	LF	$ 240
Open cut and encasement, 10"	LF	$ 130
Gate valve and box, 04"	EA	$ 710
Air valve	EA	$ 2,050
Flush valve	EA	$ 1,025
Metal detectable tape	LF	$ 2.00
Bore and encasement, length	Feet	200
Open cut and encasement, length	Feet	50

Pump Station Unit Costs	**Unit**	**Unit Cost**
Pump	EA	$ 8,000
Pump Station Piping, 04"	EA	$ 550
Gate valve, 04"	EA	$ 710
Check valve, 04"	EA	$ 755
Electrical/Instrumentation	EA	$ 10,250
Site work	EA	$ 2,560
Building pad	EA	$ 5,125
Pump Building	EA	$ 10,250
Fence	EA	$ 6,150
Tools	EA	$ 1,025
5,000 gal feed tank	EA	$ 10,000
Backflow preventer, 4"	EA	$ 2,295
Backflow Testing/Certification	EA	$ 105

Well Installation Unit Costs	**Unit**	**Unit Cost**
Well installation	See alternative	
Water quality testing	EA	$ 1,280
5HP Well Pump	EA	$ 2,750
Well electrical/instrumentation	EA	$ 5,635
Well cover and base	EA	$ 3,075
Piping	EA	$ 3,075
10,000 gal ground storage tank	EA	$ 15,000
Electrical Power	$/kWH	$ 0.175
Building Power	kWH	11,800
Labor	$/hr	$ 60
Materials	EA	$ 1,540
Transmission main O&M	$/mile	$ 275
Tank O&M	EA	$ 1,025

POU/POE Unit Costs		
POU treatment unit purchase	EA	$ 615
POU treatment unit installation	EA	$ 155
POE treatment unit purchase	EA	$ 5,125
POE - pad and shed, per unit	EA	$ 2,050
POE - piping connection, per unit	EA	$ 1,025
POE - electrical hook-up, per unit	EA	$ 1,025
POU Treatment O&M, per unit	$/year	$ 230
POE Treatment O&M, per unit	$/year	$ 1,540
Treatment analysis	$/year	$ 205
POU/POE labor support	$/hr	$ 40

Dispenser/Bottled Water Unit Costs		
POE-Treatment unit purchase	EA	$ 7,175
POE-Treatment unit installation	EA	$ 5,125
Treatment unit O&M	EA	$ 2,050
Administrative labor	hr	$ 45
Bottled water cost (inc. delivery)	gallon	$ 1.60
Water use, per capita per day	gpcd	1.0
Bottled water program materials	EA	$ 5,125
5,000 gal ground storage tank	EA	$ 10,000
Site improvements	EA	$ 3,075
Potable water truck	EA	$ 75,000
Water analysis, per sample	EA	$ 205
Potable water truck O&M costs	$/mile	$ 3.00

Central Treatment Unit Costs	**Unit**	**Unit Cost**
General		
Site preparation	acre	$ 4,000
Slab	CY	$ 1,000
Building	SF	$ 60
Building electrical	SF	$ 8.00
Building plumbing	SF	$ 8.00
Heating and ventilation	SF	$ 7.00
Fence	LF	$ 15
Paving	SF	$ 2.00
General O&M		
Building power	kwh/yr	$ 0.175
Equipment power	kwh/yr	$ 0.175
Labor, O&M	hr	$ 40
Analyses	test	$ 200
Reject Pond		
Reject pond, excavation	CYD	$ 3
Reject pond, compacted fill	CYD	$ 7
Reject pond, lining	SF	$ 1.50
Reject pond, vegetation	SY	$ 1.50
Reject pond, access road	LF	$ 30
Reject water haulage truck	EA	$ 100,000
Water haulage truck	day	$ 250
Reverse Osmosis		
Electrical	JOB	$ 40,000
Piping	JOB	$ 20,000
RO package plant	UNIT	$ 137,000
Transfer pumps (3 hp)	EA	$ 3,000
Permeate/product tank	gal	$ 3
RO materials and chemicals	kgal	$ 0.75
RO chemicals	year	$ 2,000
Backwash disposal mileage cost	miles	$ 1.50
Backwash disposal fee	1,000 gal/yr	$ 5.00
EDR		
Electrical	JOB	$ 45,000
Piping	JOB	$ 20,000
Product storage tank	gal	$ 3.00
EDR package plant	UNIT	$ 168,000
EDR materials	kgal	$ 0.48
EDR chemicals	kgal	$ 0.40
Backwash disposal mileage cost	miles	$ 1.50
Backwash disposal fee	1,000 gal/yr	$ 5.00
Transfer pumps (3 hp)	EA	$ 3,000
Ion Exchange		
Electrical	JOB	$ 30,000
Piping	JOB	$ 15,000
IX package plant	UNIT	$ 110,000
Backwash tank	GAL	$ 2.00
Sewer connection fee	EA	$ 15,000
Supplies and Materials	YR	$ 4,000
Resin replacement/disposal	CF	$ 220.00
Spent regenerate disposal	1000 gallons	$ 5.00
Coagulation/filtration		
Electrical	JOB	$ 30,000
Piping	JOB	$ 15,000
Coagulation package plant	UNIT	$ 108,000
Backwash tank	GAL	$ 2.00
Coagulant tank	GAL	$ 3.00
Coagulation/Filtration Materials	year	$ 4,000
Chemicals, Coagulation	year	$ 1,100
Backwash disposal/sewer discharge	kgal	$ 5.00

APPENDIX C
COMPLIANCE ALTERNATIVE CONCEPTUAL COST ESTIMATES

This appendix presents the conceptual cost estimates developed for the compliance alternatives. The conceptual cost estimates are given in Tables C.1 through C.7. The cost estimates are conceptual in nature (+50%/-30%), and are intended for making comparisons between compliance options and to provide a preliminary indication of possible water rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation.

Table C.1

PWS Name *Riviera ISD*
Alternative Name *Purchase Water from Baffin Bay WSC*
Alternative Number *RI-1*

Distance from Alternative to PWS (along pipe)	6.8	miles
Total PWS annual water usage	8.395	MG
Treated water purchase cost	$ 4.50	per 1,000 gals
Pump Stations needed w/ 1 feed tank each	1	
On site storage tanks / pump sets needed	0	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	13	n/a	n/a	n/a
PVC water line, Class 200, 04"	35,968	LF	$ 12	$ 431,616
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	650	LF	$ 130	$ 84,500
Gate valve and box, 04"	7	EA	$ 710	$ 5,107
Air valve	21	EA	$ 2,050	$ 43,050
Flush valve	7	EA	$ 1,025	$ 7,373
Metal detectable tape	35,968	LF	$ 2	$ 71,936
Subtotal				**$ 643,583**
Pump Station(s) Installation				
Pump	2	EA	$ 8,000	$ 16,000
Pump Station Piping, 04"	1	EA	$ 550	$ 550
Gate valve, 04"	4	EA	$ 710	$ 2,840
Check valve, 04"	2	EA	$ 755	$ 1,510
Electrical/Instrumentation	1	EA	$ 10,250	$ 10,250
Site work	1	EA	$ 2,560	$ 2,560
Building pad	1	EA	$ 5,125	$ 5,125
Pump Building	1	EA	$ 10,250	$ 10,250
Fence	1	EA	$ 6,150	$ 6,150
Tools	1	EA	$ 1,025	$ 1,025
5,000 gal feed tank	1	EA	$ 10,000	$ 10,000
10,000 gal ground storage tank	-	EA	$ 15,000	$ -
Backflow Preventor	-	EA	$ 2,295	$ -
Subtotal				**$ 66,260**
Subtotal of Component Costs				**$ 709,843**
Contingency	20%			$ 141,969
Design & Constr Management	25%			$ 177,461
TOTAL CAPITAL COSTS				**$ 1,029,272**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	6.8	mile	$ 275	$ 1,873
Subtotal				**$ 1,873**
Water Purchase Cost				
From PWS	8,395	1,000 gal	$ 4.50	$ 37,778
Subtotal				**$ 37,778**
Pump Station(s) O&M				
Building Power	11,800	kWH	$ 0.175	$ 2,065
Pump Power	2,590	kWH	$ 0.175	$ 453
Materials	1	EA	$ 1,540	$ 1,540
Labor	365	Hrs	$ 60.00	$ 21,900
Tank O&M	-	EA	$ 1,025	$ -
Backflow Test/Cert	0	EA	$ 105	$ -
Subtotal				**$ 25,958**
O&M Credit for Existing Well Closure				
Pump power	45,088	kWH	$ 0.175	$ (7,890)
Well O&M matl	1	EA	$ 1,540	$ (1,540)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (20,230)**
TOTAL ANNUAL O&M COSTS				**$ 45,379**

Table C.2

PWS Name *Riviera ISD*
Alternative Name *New Well at 10 Miles*
Alternative Number *RI-2*

Distance from PWS to new well location	10.0	miles
Estimated well depth	727	feet
Number of wells required	1	
Well installation cost (location specific)	$149	per foot
Pump Stations needed w/ 1 feed tank each	2	
On site storage tanks / pump sets needed	0	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	19	n/a	n/a	n/a
PVC water line, Class 200, 04"	52,800	LF	$ 12	$ 633,600
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	950	LF	$ 130	$ 123,500
Gate valve and box, 04"	11	EA	$ 710	$ 7,498
Air valve	31	EA	$ 2,050	$ 63,550
Flush valve	11	EA	$ 1,025	$ 10,824
Metal detectable tape	52,800	LF	$ 2	$ 105,600
Subtotal				**$ 944,572**
Pump Station(s) Installation				
Pump	4	EA	$ 8,000	$ 32,000
Pump Station Piping, 04"	2	EA	$ 550	$ 1,100
Gate valve, 04"	8	EA	$ 710	$ 5,680
Check valve, 04"	4	EA	$ 755	$ 3,020
Electrical/Instrumentation	2	EA	$ 10,250	$ 20,500
Site work	2	EA	$ 2,560	$ 5,120
Building pad	2	EA	$ 5,125	$ 10,250
Pump Building	2	EA	$ 10,250	$ 20,500
Fence	2	EA	$ 6,150	$ 12,300
Tools	2	EA	$ 1,025	$ 2,050
5,000 gal feed tank	2	EA	$ 10,000	$ 20,000
10,000 gal ground storage tank	-	EA	$ 15,000	$ -
Subtotal				**$ 132,520**
Well Installation				
Well installation	727	LF	$ 149	$ 108,323
Water quality testing	2	EA	$ 1,280	$ 2,560
Well pump	1	EA	$ 2,750	$ 2,750
Well electrical/instrumentation	1	EA	$ 5,635	$ 5,635
Well cover and base	1	EA	$ 3,075	$ 3,075
Piping	1	EA	$ 3,075	$ 3,075
Subtotal				**$ 125,418**
Subtotal of Component Costs				**$ 1,202,510**
Contingency	20%			$ 240,502
Design & Constr Management	25%			$ 300,627
TOTAL CAPITAL COSTS				**$ 1,743,639**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	10.0	mile	$ 275	$ 2,750
Subtotal				**$ 2,750**
Pump Station(s) O&M				
Building Power	23,600	kWH	$ 0.175	$ 4,130
Pump Power	3,802	kWH	$ 0.175	$ 665
Materials	2	EA	$ 1,540	$ 3,080
Labor	730	Hrs	$ 60.00	$ 43,800
Tank O&M	-	EA	$ 1,025	$ -
Subtotal				**$ 51,675**
Well O&M				
Pump power	45,088	kWH	$ 0.175	$ 7,890
Well O&M matl	1	EA	$ 1,540	$ 1,540
Well O&M labor	180	Hrs	$ 60	$ 10,800
Subtotal				**$ 20,230**
O&M Credit for Existing Well Closure				
Pump power	45,088	kWH	$ 0.175	$ (7,890)
Well O&M matl	1	EA	$ 1,540	$ (1,540)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (20,230)**
TOTAL ANNUAL O&M COSTS				**$ 54,425**

Table C.3

PWS Name *Riviera ISD*
Alternative Name *New Well at 5 Miles*
Alternative Number *RI-3*

Distance from PWS to new well location	5.0	miles
Estimated well depth	727	feet
Number of wells required	1	
Well installation cost (location specific)	$149	per foot
Pump Stations needed w/ 1 feed tank each	1	
On site storage tanks / pump sets needed	0	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	10	n/a	n/a	n/a
PVC water line, Class 200, 04"	26,400	LF	$ 12	$ 316,800
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	500	LF	$ 130	$ 65,000
Gate valve and box, 04"	5	EA	$ 710	$ 3,749
Air valve	15	EA	$ 2,050	$ 30,750
Flush valve	5	EA	$ 1,025	$ 5,412
Metal detectable tape	26,400	LF	$ 2	$ 52,800
Subtotal				**$ 474,511**
Pump Station(s) Installation				
Pump	2	EA	$ 8,000	$ 16,000
Pump Station Piping, 04"	1	EA	$ 550	$ 550
Gate valve, 04"	4	EA	$ 710	$ 2,840
Check valve, 04"	2	EA	$ 755	$ 1,510
Electrical/Instrumentation	1	EA	$ 10,250	$ 10,250
Site work	1	EA	$ 2,560	$ 2,560
Building pad	1	EA	$ 5,125	$ 5,125
Pump Building	1	EA	$ 10,250	$ 10,250
Fence	1	EA	$ 6,150	$ 6,150
Tools	1	EA	$ 1,025	$ 1,025
5,000 gal feed tank	1	EA	$ 10,000	$ 10,000
10,000 gal ground storage tank	-	EA	$ 15,000	$ -
Subtotal				**$ 66,260**
Well Installation				
Well installation	727	LF	$ 149	$ 108,323
Water quality testing	2	EA	$ 1,280	$ 2,560
Well pump	1	EA	$ 2,750	$ 2,750
Well electrical/instrumentation	1	EA	$ 5,635	$ 5,635
Well cover and base	1	EA	$ 3,075	$ 3,075
Piping	1	EA	$ 3,075	$ 3,075
Subtotal				**$ 125,418**
Subtotal of Component Costs				**$ 666,189**
Contingency	20%			$ 133,238
Design & Constr Management	25%			$ 166,547
TOTAL CAPITAL COSTS				**$ 965,974**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	5.0	mile	$ 275	$ 1,375
Subtotal				**$ 1,375**
Pump Station(s) O&M				
Building Power	11,800	kWH	$ 0.175	$ 2,065
Pump Power	1,901	kWH	$ 0.175	$ 333
Materials	1	EA	$ 1,540	$ 1,540
Labor	365	Hrs	$ 60.00	$ 21,900
Tank O&M	-	EA	$ 1,025	$ -
Subtotal				**$ 25,838**
Well O&M				
Pump power	45,088	kWH	$ 0.175	$ 7,890
Well O&M matl	1	EA	$ 1,540	$ 1,540
Well O&M labor	180	Hrs	$ 60	$ 10,800
Subtotal				**$ 20,230**
O&M Credit for Existing Well Closure				
Pump power	45,088	kWH	$ 0.175	$ (7,890)
Well O&M matl	1	EA	$ 1,540	$ (1,540)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (20,230)**
TOTAL ANNUAL O&M COSTS				**$ 27,213**

Table C.4

PWS Name *Riviera ISD*
Alternative Name *New Well at 1 Mile*
Alternative Number *RI-4*

Distance from PWS to new well location	1.0	miles
Estimated well depth	727	feet
Number of wells required	1	
Well installation cost (location specific)	$149	per foot
Pump Stations needed w/ 1 feed tank each	0	
On site storage tanks / pump sets needed	0	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	2	n/a	n/a	n/a
PVC water line, Class 200, 04"	5,280	LF	$ 12	$ 63,360
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	100	LF	$ 130	$ 13,000
Gate valve and box, 04"	1	EA	$ 710	$ 750
Air valve	3	EA	$ 2,050	$ 6,150
Flush valve	1	EA	$ 1,025	$ 1,082
Metal detectable tape	5,280	LF	$ 2	$ 10,560
Subtotal				**$ 94,902**
Pump Station(s) Installation				
Pump	-	EA	$ 8,000	$ -
Pump Station Piping, 04"	-	EA	$ 550	$ -
Gate valve, 04"	-	EA	$ 710	$ -
Check valve, 04"	-	EA	$ 755	$ -
Electrical/Instrumentation	-	EA	$ 10,250	$ -
Site work	-	EA	$ 2,560	$ -
Building pad	-	EA	$ 5,125	$ -
Pump Building	-	EA	$ 10,250	$ -
Fence	-	EA	$ 6,150	$ -
Tools	-	EA	$ 1,025	$ -
5,000 gal feed tank	-	EA	$ 10,000	$ -
10,000 gal ground storage tank	-	EA	$ 15,000	$ -
Subtotal				**$ -**
Well Installation				
Well installation	727	LF	$ 149	$ 108,323
Water quality testing	2	EA	$ 1,280	$ 2,560
Well pump	1	EA	$ 2,750	$ 2,750
Well electrical/instrumentation	1	EA	$ 5,635	$ 5,635
Well cover and base	1	EA	$ 3,075	$ 3,075
Piping	1	EA	$ 3,075	$ 3,075
Subtotal				**$ 125,418**
Subtotal of Component Costs				**$ 220,320**
Contingency	20%			$ 44,064
Design & Constr Management	25%			$ 55,080
TOTAL CAPITAL COSTS				**$ 319,464**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	1.0	mile	$ 275	$ 275
Subtotal				**$ 275**
Pump Station(s) O&M				
Building Power	-	kWH	$ 0.175	$ -
Pump Power	-	kWH	$ 0.175	$ -
Materials	-	EA	$ 1,540	$ -
Labor	-	Hrs	$ 60.00	$ -
Tank O&M	-	EA	$ 1,025	$ -
Subtotal				**$ -**
Well O&M				
Pump power	45,088	kWH	$ 0.175	$ 7,890
Well O&M matl	1	EA	$ 1,540	$ 1,540
Well O&M labor	180	Hrs	$ 60	$ 10,800
Subtotal				**$ 20,230**
O&M Credit for Existing Well Closure				
Pump power	45,088	kWH	$ 0.175	$ (7,890)
Well O&M matl	1	EA	$ 1,540	$ (1,540)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (20,230)**
TOTAL ANNUAL O&M COSTS				**$ 275**

Table C.5

PWS Name *Riviera ISD*
Alternative Name *Central Treatment - Reverse Osmosis*
Alternative Number *RI-5*

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Reverse Osmosis Unit Purchase/Installation				
Site preparation	0.30	acre	$ 4,000	$ 1,200
Slab	15	CY	$ 1,000	$ 15,000
Building	400	SF	$ 60	$ 24,000
Building electrical	400	SF	$ 8	$ 3,200
Building plumbing	400	SF	$ 8	$ 3,200
Heating and ventilation	400	SF	$ 7	$ 2,800
Fence	400	LF	$ 15	$ 6,000
Paving	1,500	SF	$ 2	$ 3,000
Electrical	1	JOB	$ 40,000	$ 40,000
Piping	1	JOB	$ 20,000	$ 20,000
Reverse osmosis package including:				
High pressure pumps - 20 hp				
Cartridge filters and vessels				
RO membranes and vessels				
Control system				
Chemical feed systems				
Freight cost				
Vendor start-up services	1	UNIT	$ 137,000	$ 137,000
Transfer pumps	2	EA	$ 3,000	$ 6,000
Permeate tank	-	gal	$ 3	$ -
Feed Tank	15,000	gal	$ 3	$ 45,000
Brine Pipeline to Sewer	1	EA	$ 25,000	$ 25,000
Subtotal of Design/Construction Costs				**$ 331,400**
Contingency	20%			$ 66,280
Design & Constr Management	25%			$ 82,850
TOTAL CAPITAL COSTS				**$ 480,530**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Reverse Osmosis Unit O&M				
Building Power	3,500	kwh/yr	$ 0.175	$ 613
Equipment power	49,000	kwh/yr	$ 0.175	$ 8,575
Labor	800	hrs/yr	$ 40.00	$ 32,000
RO materials and Chemicals	8,400	kgal	$ 0.75	$ 6,300
Analyses	24	test	$ 200	$ 4,800
Subtotal				**$ 52,288**
Reject (brine) disposal				
Reject (brine) disposal fee	2,372	kgal/yr	$ 5.00	$ 11,860
Subtotal				**$ 11,860**
TOTAL ANNUAL O&M COSTS				**$ 64,147**

Table C.6

PWS Name ***Riviera ISD***
Alternative Name ***Central Treatment - Coagulation filtration***
Alternative Number ***RI-6***

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Coagulation/Filtration Unit Purchase/Installation				
Site preparation	0.20	acre	$ 4,000	$ 800
Slab	11	CY	$ 1,000	$ 11,250
Building	300	SF	$ 60	$ 18,000
Building electrical	300	SF	$ 8	$ 2,400
Building plumbing	300	SF	$ 8	$ 2,400
Heating and ventilation	300	SF	$ 7	$ 2,100
Fence	300	LF	$ 15	$ 4,500
Paving	1,500	SF	$ 2	$ 3,000
Electrical	1	JOB	$ 30,000	$ 30,000
Piping	1	JOB	$ 15,000	$ 15,000
Coagulant/filter package including:				
Chemical feed system				
Pressure ceramic filters				
Controls & Instruments	1	UNIT	$ 108,000	$ 108,000
Spent Backwash Tank	3,840	GAL	$ 2	$ 7,680
Coagulant Tank	300	GAL	$ 3	$ 900
Feed Tank	12,000	gal	$ 3	$ 36,000
Spent BW Pipeline to Sewer	1	EA	$ 15,000	$ 15,000
Subtotal of Component Costs				**$ 257,030**
Contingency	20%			$ 51,406
Design & Constr Management	25%			$ 64,258
TOTAL CAPITAL COSTS				**$ 372,694**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Coagulation/Filtration Unit O&M				
Building Power	2,500	kwh/yr	$ 0.175	$ 438
Equipment power	6,078	kwh/yr	$ 0.175	$ 1,064
Labor	800	hrs/yr	$ 40	$ 32,000
Materials	1	year	$ 4,000	$ 4,000
Chemicals	1	year	$ 1,100	$ 1,100
Analyses	24	test	$ 200	$ 4,800
Backwash discharge to sewer		MG/yr	$ 45,000	$ -
Subtotal				**$ 43,401**
Sludge Disposal				
Reject (brine) disposal fee	701	kgal	$ 5.00	$ 3,504
Subtotal				**$ 3,504**
TOTAL ANNUAL O&M COSTS				**$ 43,401**

Table C.7

PWS Name *Riviera ISD*
Alternative Name *Central Treatment - Ion Exchange*
Alternative Number *RI-7*

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Adsorption Unit Purchase/Installation				
Site preparation	0.10	acre	$ 4,000	$ 400
Slab	10	CY	$ 1,000	$ 9,750
Building	300	SF	$ 60	$ 18,000
Building electrical	300	SF	$ 8	$ 2,400
Building plumbing	300	SF	$ 8	$ 2,400
Heating and ventilation	300	SF	$ 7	$ 2,100
Fence	300	LF	$ 15	$ 4,500
Paving	2,000	SF	$ 3	$ 6,000
Electrical	1	JOB	$ 30,000	$ 30,000
Piping	1	JOB	$ 15,000	$ 15,000
		Subtotal		$ 90,550
Ion Exchange package including:				
2 - IX vessels				
anionic exchange resin				
Controls & instruments	1	UNIT	$ 110,000	$ 110,000
Spent Regenerate Tank	5,670	GAL	$ 2	$ 11,340
Spent Regenerate PL to Sewer	1	EA	$ 15,000	$ 15,000
Transfer/backwash pumps	2	EA	$ 3,000	$ 6,000
Product water tank	-	gal	$ 3	$ -
Feed Tank	12,000	gal	$ 3	$ 36,000
Subtotal of Component Costs				**$ 268,890**
Contingency	20%			$ 53,778
Design & Constr Management	25%			$ 67,223
TOTAL CAPITAL COSTS				**$ 389,891**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Adsorption Unit O&M				
Building Power	2,500	kwh/yr	$ 0.175	$ 438
Equipment power	4,558	kwh/yr	$ 0.175	$ 798
Labor	600	hrs/yr	$ 40	$ 24,000
Media replacement/disposal	21	cf	$ 220	$ 4,576
Analyses	24	test	$ 200	$ 4,800
Regeneration Salt	33,600	lbs	$ 0.01	$ 336
Supplies and Equipment	1	yr	$ 4,000	$ 4,000
Subtotal				**$ 38,947**
Reject (brine) disposal fee	235	kgal	$ 5.00	$ 1,177
Subtotal				**$ 1,177**
TOTAL ANNUAL O&M COSTS				**$ 40,125**

APPENDIX D
EXAMPLE FINANCIAL MODEL

Riviera ISD

Number of Alternatives	7	Selected from Results Sheet
Input Fields are Indicated by:		

General Inputs		
Implementation Year	2009	
Months of Working Capital	0	
Depreciation	$ -	
Percent of Depreciation for Replacement Fund	0%	
Allow Negative Cash Balance (yes or no)	No	
Median Household Income	$ 30,750	Riviera ISD
Median HH Income -- Texas	$ 39,927	
Grant Funded Percentage	0%	Selected from Results
Capital Funded from Revenues	$ -	

	Base Year Growth/Escalation	2007
Accounts & Consumption		
Metered Residential Accounts		
Number of Accounts	0.0%	500
Number of Bills Per Year		12
Annual Billed Consumption		8,395,000
Consumption per Account Per Pay Period	0.0%	1,399
Consumption Allowance in Rates		100,000
Total Allowance		600,000,000
Net Consumption Billed		(591,605,000)
Percentage Collected		100.0%
Unmetered Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Percentage Collected		100.0%
Metered Non-Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Non-Residential Consumption		-
Consumption per Account	0.0%	-
Consumption Allowance in Rates		-
Total Allowance		-
Net Consumption Billed		-
Percentage Collected		0.0%
Unmetered Non-Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Percentage Collected		100.0%
Water Purchase & Production		
Water Purchased (gallons)	0.0%	-
Average Cost Per Unit Purchased	0.0%	$ -
Bulk Water Purchases	0.0%	$ -
Water Production	0.0%	8,395,000
Unaccounted for Water		-
Percentage Unaccounted for Water		0.0%

Appendix D
General Inputs

Riviera ISD

Number of Alternatives 7 Selected from Results Sheet

Input Fields are Indicated by:

Residential Rate Structure	Allowance within Tier	
Base Monthly Payment	-	$ 0.83
		$ -
Non-Residential Rate Structure		
	-	
Estimated Average Water Rate ($/1000gallons)		$ -
INITIAL YEAR EXPENDITURES	Inflation	Initial Year
Operating Expenditures:		
Salaries & Benefits	0.0%	-
Contract Labor	0.0%	-
Water Purchases	0.0%	-
Chemicals, Treatment	0.0%	-
Utilities	0.0%	-
Repairs, Maintenance, Supplies	0.0%	-
Repairs	0.0%	-
Maintenance	0.0%	-
Supplies	0.0%	-
Administrative Expenses	0.0%	
Accounting and Legal Fees	0.0%	-
Insurance	0.0%	-
Automotive and Travel	0.0%	-
Professional and Directors Fees	0.0%	-
Bad Debts	0.0%	-
Garbage Pick-up	0.0%	-
Miscellaneous	0.0%	-
Other 3	0.0%	5,000
Other 4	0.0%	-
Incremental O&M for Alternative	0.0%	-
Total Operating Expenses		5,000
Non-Operating Income/Expenditures		
Interest Income	0.0%	-
Other Income	0.0%	-
Other Expense	0.0%	-
Transfers In (Out)	0.0%	-
Net Non-Operating		-

Esisting Debt Service		
Bonds Payable, Less Current Maturities		$ -
Bonds Payable, Current		$ -
Interest Expense		$ -

Debt Service for Riviera ISD
Alternative Number = 7
Funding Source = Loan/Bond

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Existing Debt Service	$ -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal Payments		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest Payment	0.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	25																															
Revenue Bonds		-	-	389,891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	389,891	382,785	375,252	367,267	358,803	349,831	340,321	330,241	319,555	308,229	296,223	283,496	270,006	255,706	240,549	224,482	207,451	189,398	170,262	149,978	128,477	105,685	81,527	55,918	28,773	0	0	0	0
Principal		-	-	7,106	7,533	7,985	8,464	8,972	9,510	10,081	10,685	11,327	12,006	12,727	13,490	14,300	15,158	16,067	17,031	18,053	19,136	20,284	21,501	22,791	24,159	25,608	27,145	28,773	-	-	-	-
Interest	6.00%	-	-	23,393	22,967	22,515	22,036	21,528	20,990	20,419	19,814	19,173	18,494	17,773	17,010	16,200	15,342	14,433	13,469	12,447	11,364	10,216	8,999	7,709	6,341	4,892	3,355	0	0	0	0	0
Total Debt Service		-	-	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	28,773	0	0	0	0
New Balance		-	-	382,785	375,252	367,267	358,803	349,831	340,321	330,241	319,555	308,229	296,223	283,496	270,006	255,706	240,549	224,482	207,451	189,398	170,262	149,978	128,477	105,685	81,527	55,918	28,773	0	0	0	0	0
Term	20																															
State Revolving Fund		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	2.90%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	10																															
Bank/Interfund Loan				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	8.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	25																															
RUS Loan			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%		-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	5.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Cashflow Projections for Riviera ISD
Alternative Number = 7
Funding Source = Loan/Bond

Estimated At Sept. 30 of Each Year

	Growth/ Escalation	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CASH FLOW PROJECTIONS																																
Beginning Unrestricted Cash Balance		$ -	-	-	-	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
RECEIPTS																																
Operating Revenues																																
Water Base Rate-- Residential	-	5,000	5,000	35,500	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	73,898	45,125	45,125	45,125	45,125
Water: Tier 1 -- Res	100,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 2 -- Res	100,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 3 -- Res	200,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 4 -- Res	300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unmetered Residential		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Base Rate - Non Residential	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 1 -- NR	100,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 2 -- NR	100,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 3 -- NR	200,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water: Tier 4 -- NR	300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unmetered Non Residential		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sewer Sales		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other 1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other 2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other 3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Revenues		$ 5,000	$ 5,000	$ 35,500	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 75,625	$ 73,898	$ 45,125	$ 45,125	$ 45,125	$ 45,125
Capital Receipts																																
Grants Received		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SRF Proceeds		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank/Interfund Loan Proceeds		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RUS Loan Proceeds		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bond Proceeds		-	-	389,891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Receipts		-	-	389,891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Receipts		5,000	5,000	425,391	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	73,898	45,125	45,125	45,125	45,125
EXPENDITURES																																
Operating Expenditures:																																
Salaries & Benefits	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Contract Labor	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Purchases	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemicals, Treatment	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utilities	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Repairs, Maintenance, Supplies	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Repairs	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Supplies	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Administrative Expenses	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accounting and Legal Fees	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insurance	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Automotive and Travel	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Professional and Directors Fees	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bad Debts	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garbage Pick-up	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other 3	0.0%	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Other 4	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Incremental O&M for Alternative	0.0%	-	-	-	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125	40,125
Total Operating Expenses		5,000	5,000	5,000	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125	45,125
Non-Operating Income/Expenditures																																
Interest Income	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Income	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Expense	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transfers In (Out)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Non-Operating		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt Service																																
Existing		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proposed:																																
Revenue Bonds		-	-	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	28,773	0	0	0	0
State Revolving Fund		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Loan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RUS Loan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	30,500	28,773	0	0	0	0
Capital Expenditures	$ 389,891																															
Funded From Revenues/Reserves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Funded From Grants	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Funded From SRF Loans		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Funded from Bank/Interfund Loans		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Funded from RUS Loan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Funded from Bonds		-	-	389,891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Expenditures		-	-	389,891	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Expenditures		5,000	5,000	425,391	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	75,625	73,898	45,125	45,125	45,125	45,125
What Water Rev Needs to be		(5,000)	(5,000)	(35,500)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(75,625)	(73,898)	(45,125)	(45,125)	(45,125)	(45,125)
Water Rate Increase		0.00%	0.00%	610.00%	113.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-2.28%	-38.94%	0.00%	0.00%	0.00%
Net Cash Flow		-	-	-	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Reserves:																																
Working Capital (Months O&M)	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Replacement Reserve		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Required Reserves		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average Annual Water Bill	$ 151	$ 10	$ 10	$ 71	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 151	$ 148	$ 90	$ 90	$ 90	$ 90
Median Household Income		$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750	$ 30,750
Maximum % of MHI	0.5%	0.0%	0.0%	0.2%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.3%	0.3%	0.3%	0.3%
Percentage Rate Increase Compared to Current	1412.5%		0.0%	610.0%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1412.5%	1378.0%	802.5%	802.5%	802.5%	802.5%

APPENDIX E
ANALYSIS OF SHARED SOLUTIONS FOR OBTAINING WATER FROM BAFFIN BAY WATER SYSTEM

E.1 OVERVIEW OF METHOD USED

There is a limited number of small PWSs with water quality problems located in the vicinity of the Riviera ISD PWS that could benefit from joining together and cooperating to share the cost for obtaining compliant drinking water. This cooperation could involve creating a formal organization of individual PWSs to address obtaining compliant drinking water, consolidating to form a single PWS, or having the individual PWSs taken over or bought out by a larger regional entity.

The small PWSs with water quality problems near Riviera ISD are listed in Table E.1, along with their average water consumption and estimates of the capital cost for each PWS to construct an individual pipeline. It is assumed for this analysis that all the systems would participate in a shared solution.

This analysis focuses on compliance alternatives related to obtaining water from large water providers interested in providing water outside their current area, either by wholesaling to PWSs, or by expanding their service areas. This type of solution is most likely to have the best prospects for sustainability, and a reliable provision of compliant drinking water.

The purpose of this analysis is to approximate the level of capital cost savings that could be expected from pursuing a shared solution versus a solution where the study PWS obtains compliant drinking water on its own. Regardless of the form a group solution would take, water consumers would have to pay for the infrastructure needed for obtaining compliant water. To keep this analysis as straightforward and realistic as possible, it is assumed the individual PWSs would remain independent, and would share the capital cost for the infrastructure required. Also, to maintain simplicity, this analysis is limited to estimating capital cost savings related to pipeline construction, which is likely to be by far the largest component of the overall capital cost. A shared solution could also produce savings in O&M expenses as a result of reduction in redundant facilities and the potential for shared O&M resources, and these savings would have to be evaluated if the PWSs are interested in implementing a shared solution.

There are many ways pipeline capital costs could be divided between participating PWSs, and the final apportioning of costs would likely be based on negotiation between the participating entities. At this preliminary stage of analysis it is not possible to project results from negotiations regarding cost sharing. For this reason, three methods are used to allocate cost between PWSs in an effort to give an approximation of the range of savings that might be attainable for an individual PWS.

Method A is based on allocating capital cost of the shared pipeline solution proportionate to the amount of water used by each PWS. In this case, the capital cost for the shared pipeline and the necessary pump stations is estimated, and then this total capital cost is allocated based on the fraction of the total water used by each PWS. For example, PWS #1 has an average daily water use of 0.1 mgd and PWS #2 has an average daily use of 0.3 mgd. Using this method, PWS #1 would be allocated 25 percent of the capital cost of the shared solution. This method is a reasonable method for allocating cost when all the PWSs are different in size but are relatively equidistant from the shared water source.

Method B is also based on allocating capital cost of the shared pipeline solution proportionate to the amount of water used by the PWSs. However, rather than allocating the *total* capital cost of the shared solution between each participating PWS, this approach splits the shared pipeline into segments and allocates flow-proportional costs to the PWSs using each segment. Costs for a pipeline segment are not shared by a PWS if the PWS does not use that particular segment. For example, PWS #1 has an average daily water use of 0.3 mgd and PWS #2 has an average daily use of 0.2 mgd. A 3-mile long pipeline segment is common to both PWSs, while PWS #2 requires an additional 4-mile segment. Using this method, PWS #2 would be allocated 40 percent of the cost of the 3-mile segment and 100 percent of the cost of the 4-mile segment. This method is a reasonable method for allocating cost when all the PWSs are different in size and are located at different distances from the shared water source.

Method C is based on allocating capital cost of the shared pipeline solution proportionate to the cost each PWS would have to pay to obtain compliant water if it were to implement an individual solution. In this case, the total capital cost for the shared pipeline and the necessary pump stations is estimated as well as the capital cost each PWS would have for obtaining its own pipeline. The total capital cost for the shared solution is then allocated between the participating PWSs based on what each PWS would have to pay to construct its own pipeline. For example, the individual solution cost for PWS #1 is $4 million and the individual solution cost for PWS #2 is $1 million. Using this method, PWS #1 would be allocated 80 percent of the cost of the shared solution. This method is a reasonable method for allocating cost when the PWS are located at different distances from the water source.

For any given PWS, all three of these methods should generate costs for the shared solution that produce savings for the PWS over an individual solution. However, for different PWSs participating in a shared solution, each of these three methods can produce savings of varying magnitudes: for one PWS, Method A might show the best cost savings while for another Method C might provide the best savings. For this reason, this range is considered to be representative of possible savings that could result from an agreement that should be fair and equitable to all parties involved.

E.2 SHARED SOLUTION FOR OBTAINING WATER FROM BAFFIN BAY

This alternative would consist of constructing approximately 7 miles of 4-inch joint pipeline from Baffin Bay to a split where one branch would continue to Riviera ISD and the other branch would continue to Riviera WSC. The pipeline routing is shown in Figure E.1 at the end of this appendix. It is assumed three pump stations would be required to transfer the water from Baffin Bay to the two public water systems.

The capital costs for each pipe segment and the total capital cost for the shared pipeline are summarized in Table E.2. Table E.3 shows the capital costs allocated to each PWS using Method A. Table E.4 shows the capital costs allocated to each PWS using Method B. Table E.5 shows the allocation of pipeline capital costs to each of the PWSs using Method C, as described above. Table E.6 provides a summary of the pipeline capital costs estimated for each PWS, and the savings that could be realized compared to developing individual pipelines. More detailed cost estimates for the pipe segments are shown at the end of this appendix in Tables E.7 through E.10.

Based on these estimates, the range of pipeline capital cost savings to Riviera ISD could be between $371,300 to $726,600 if they were to implement a shared solution like this, which would be a savings between 37 to 72 percent. These estimates are hypothetical and are only provided to approximate the magnitude of potential savings if this shared solution is implemented as described.

Table E.1
Summary Information for PWSs Participating in Shared Solution

PWS	PWS #	Average Water Demand (mgd)	Water Demand as Percent of Total	Pipeline Capital Cost for Individual Solutions for Riviera ISD and Riviera WSC	Percent of Sum of Capital Costs for Individual Solutions for Riviera ISD and Riviera WSC
Riviera ISD	1370019	0.015	18%	$ 1,002,500	41%
Riviera WSC	1370007	0.069	82%	$ 1,451,600	59%
	Totals	**0.084**	**100%**	**$ 2,454,100**	**100%**

Table E.2
Capital cost for Shared Pipeline from East Riviera WS

Pipe Segment	Capital Cost
Pipe 1	$ 1,401,732
Pipe A	$ 34,543
Pipe B	$ 108,891
Totals	**$ 1,545,166**

Table E.3
Pipeline Capital Cost Allocation by Method A
Shared Pipeline Assesment for Riviera ISD and Riviera WS

PWS	PWS #	Percentage Based On Flow	Total Costs
Riviera ISD	1370019	18%	$ 275,923
Riviera WSC	1370007	82%	$ 1,269,244
	Totals	**100%**	**$ 1,545,166**

Table E.4
Pipeline Capital Cost Allocation by Method B
Shared Pipeline Assesment for Riviera ISD and Riviera WS

Pipeline Segment	Pipe Segment Capital Cost	Riviera ISD		Riviera WSC	
		Percent Allocation Based on Water Use	Allocated Cost	Percent Allocation Based on Water Use	Allocated Cost
Pipe 1	$ 1,401,732	18%	$ 250,309	82%	$ 1,151,423
Pipe A	$ 34,543	100%	$ 34,543	0%	$ -
Pipe B	$ 108,891	0%	$ -	100%	$ 108,891
Totals	**$ 1,545,166**		**$ 284,853**		**$ 1,260,314**

Table E.5
Pipeline Capital Cost Allocation by Method C
Shared Pipeline Assesment for Lubbock

PWS	PWS #	Cost for Individual Pipelines	Percentage based on Individual Solutions	Allocated Capital Cost
Riviera ISD	1370019	$ 1,002,500	41%	$ 631,201
Riviera WSC	1370007	$ 1,451,600	59%	$ 913,966
	Totals	**$ 2,454,100**	**100%**	**$ 1,545,166**

Table E.6
Pipeline Capital Cost Summary
Shared Pipelilne Assessment for Lubbock

PWS	Individual Pipeline Capital Costs	Shared Solution Capital Cost Allocation			Shared Solution Cost Savings			Shared Solution Percentage Savings		
		Method A	**Method B**	**Method C**	**Method A**	**Method B**	**Method C**	**Method A**	**Method B**	**Method C**
1370019	$ 1,002,500	$ 275,923	$ 284,853	$ 631,201	$ 726,577	$ 717,647	$ 371,299	72%	72%	37%
1370007	$ 1,451,600	$ 1,269,244	$ 1,260,314	$ 913,966	$ 182,356	$ 191,286	$ 537,634	13%	13%	37%
Totals	**$ 2,454,100**	**$ 1,545,166**	**$ 1,545,166**	**$ 1,545,166**	**$ 908,934**	**$ 908,934**	**$ 908,934**			

Table E.7

Main Link # 1

Total Pipe Length	6.81	miles
Number of Pump Stations Needed	3	
Pipe Size	04"	inches

Capital Costs

Cost Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	13	n/a	n/a	n/a
PVC water line, Class 200, 04"	35,968	LF	$ 12	$ 431,616
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	650	LF	$ 130	$ 84,500
Gate valve and box, 04"	8	EA	$ 710	$ 5,680
Air valve	7	EA	$ 2,050	$ 14,350
Flush valve	8	EA	$ 1,025	$ 8,200
Metal detectable tape	35,968	LF	$ 2.00	$ 71,936
Subtotal				**$ 616,282**
Pump Station(s) Installation				
Pump	6	EA	$ 8,000	$ 48,000
Pump Station Piping, 04"	6	EA	$ 550	$ 3,300
Gate valve, 04"	12	EA	$ 710	$ 8,520
Check valve, 04"	6	EA	$ 755	$ 4,530
Electrical/Instrumentation	3	EA	$ 10,250	$ 30,750
Site work	3	EA	$ 2,560	$ 7,680
Building pad	3	EA	$ 5,125	$ 15,375
Pump Building	3	EA	$ 10,250	$ 30,750
Fence	3	EA	$ 6,150	$ 18,450
Tools	3	EA	$ 1,025	$ 3,075
50,000 gal ground storage tank	3	EA	$ 60,000	$ 180,000
Subtotal				**$ 350,430**
Subtotal of Component Costs				**$ 966,712**
Contingency	20%			$ 193,342
Design & Constr Management	25%			$ 241,678
TOTAL CAPITAL COSTS				**$ 1,401,732**

Table E.8

Segment A

Riviera ISD

Private Pipe Size	04"	
Total Pipe Length	0.18	miles
Total PWS annual water usage	5.5	MG
Number of Pump Stations Needed	0	

Capital Costs

Cost Item	**Quantity**	**Unit**	**Unit Cost**		**Total Cost**	
Pipeline Construction						
Number of Crossings, bore	-	n/a	n/a		n/a	
Number of Crossings, open cut	1	n/a	n/a		n/a	
PVC water line, Class 200, 04"	967	LF	$	12	$	11,604
Bore and encasement, 10"	-	LF	$	240	$	-
Open cut and encasement, 10"	50	LF	$	130	$	6,500
Gate valve and box, 04"	1	EA	$	710	$	710
Air valve	1	EA	$	2,050	$	2,050
Flush valve	1	EA	$	1,025	$	1,025
Metal detectable tape	967	LF	$	2.00	$	1,934
Subtotal					**$**	**23,823**
Pump Station(s) Installation						
Pump	-	EA	$	8,000	$	-
Pump Station Piping, 04"	-	EA	$	550	$	-
Gate valve, 04"	-	EA	$	710	$	-
Check valve, 04"	-	EA	$	755	$	-
Electrical/Instrumentation	-	EA	$	10,250	$	-
Site work	-	EA	$	2,560	$	-
Building pad	-	EA	$	5,125	$	-
Pump Building	-	EA	$	10,250	$	-
Fence	-	EA	$	6,150	$	-
Tools	-	EA	$	1,025	$	-
10,000 gal ground storage tank	-	EA	$	15,000	$	-
Subtotal					**$**	**-**
Subtotal of Component Costs					**$**	**23,823**
Contingency	20%				$	4,765
Design & Constr Management	25%				$	5,956
TOTAL CAPITAL COSTS					**$**	**34,543**

Table E.9

Segment B

Riviera WSC

Private Pipe Size	04"	
Total Pipe Length	0.44	miles
Total PWS annual water usage	25.2	MG
Number of Pump Stations Needed	0	

Capital Costs

Cost Item	**Quantity**	**Unit**	**Unit Cost**		**Total Cost**	
Pipeline Construction						
Number of Crossings, bore	-	n/a	n/a		n/a	
Number of Crossings, open cut	6	n/a	n/a		n/a	
PVC water line, Class 200, 04"	2,308	LF	$	12	$	27,696
Bore and encasement, 10"	-	LF	$	240	$	-
Open cut and encasement, 10"	300	LF	$	130	$	39,000
Gate valve and box, 04"	1	EA	$	710	$	710
Air valve	1	EA	$	2,050	$	2,050
Flush valve	1	EA	$	1,025	$	1,025
Metal detectable tape	2,308	LF	$	2.00	$	4,616
Subtotal					**$**	**75,097**
Pump Station(s) Installation						
Pump	-	EA	$	8,000	$	-
Pump Station Piping, 04"	-	EA	$	550	$	-
Gate valve, 04"	-	EA	$	710	$	-
Check valve, 04"	-	EA	$	755	$	-
Electrical/Instrumentation	-	EA	$	10,250	$	-
Site work	-	EA	$	2,560	$	-
Building pad	-	EA	$	5,125	$	-
Pump Building	-	EA	$	10,250	$	-
Fence	-	EA	$	6,150	$	-
Tools	-	EA	$	1,025	$	-
50,000 gal ground storage tank	-	EA	$	60,000	$	-
Subtotal					**$**	**-**
Subtotal of Component Costs					**$**	**75,097**
Contingency	20%				$	15,019
Design & Constr Management	25%				$	18,774
TOTAL CAPITAL COSTS					**$**	**108,891**

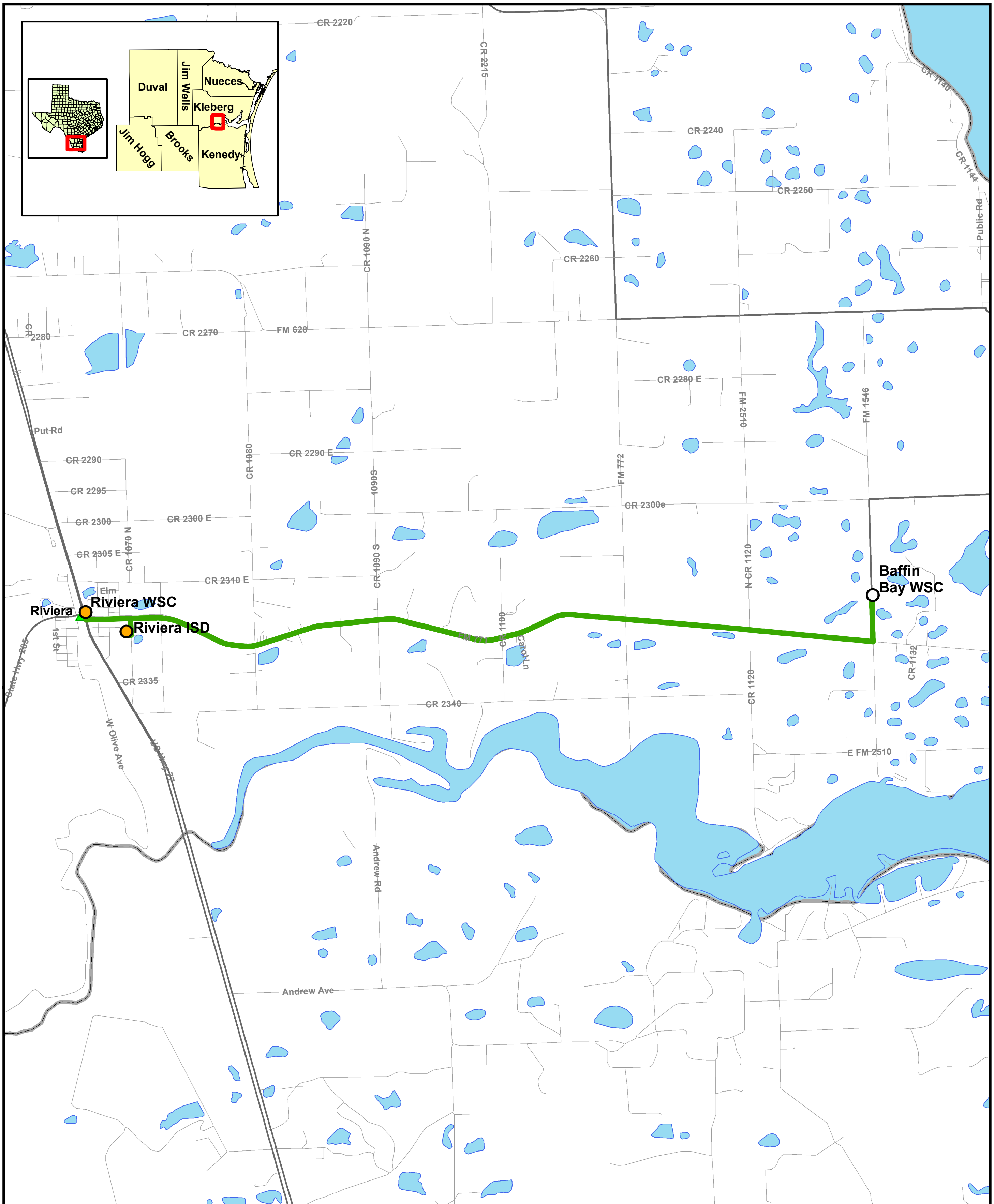
Table E.10

Main Link # 1

Total Pipe Length	7.25	miles
Number of Pump Stations Needed	3	
Pipe Size	04"	inches

Capital Costs

Cost Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	13	n/a	n/a	n/a
PVC water line, Class 200, 04"	38,280	LF	$ 12	$ 459,360
Bore and encasement, 10"	-	LF	$ 240	$ -
Open cut and encasement, 10"	650	LF	$ 130	$ 84,500
Gate valve and box, 04"	8	EA	$ 710	$ 5,680
Air valve	8	EA	$ 2,050	$ 16,400
Flush valve	8	EA	$ 1,025	$ 8,200
Metal detectable tape	38,280	LF	$ 2.00	$ 76,560
Subtotal				**$ 650,700**
Pump Station(s) Installation				
Pump	6	EA	$ 8,000	$ 48,000
Pump Station Piping, 04"	6	EA	$ 550	$ 3,300
Gate valve, 04"	12	EA	$ 710	$ 8,520
Check valve, 04"	6	EA	$ 755	$ 4,530
Electrical/Instrumentation	3	EA	$ 10,250	$ 30,750
Site work	3	EA	$ 2,560	$ 7,680
Building pad	3	EA	$ 5,125	$ 15,375
Pump Building	3	EA	$ 10,250	$ 30,750
Fence	3	EA	$ 6,150	$ 18,450
Tools	3	EA	$ 1,025	$ 3,075
50,000 gal ground storage tank	3	EA	$ 60,000	$ 180,000
Subtotal				**$ 350,430**
Subtotal of Component Costs				**$ 1,001,130**
Contingency	20%			$ 200,226
Design & Constr Management	25%			$ 250,283
TOTAL CAPITAL COSTS				**$ 1,451,639**



Legend

N

- Study System
- PWS's
- Cities
- City Limits
- Counties
- Major Road
- Minor Road
- CRMWA Pipeline
- Lubbock Pipeline
- Grass Valley Pipeline
- RV/RI - 1

Miles

0 0.5 1

Figure E.1

RIVIERA WSC & RIVIERA ISD TO BAFFIN BAY WSC

Shared Pipeline Alternative

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