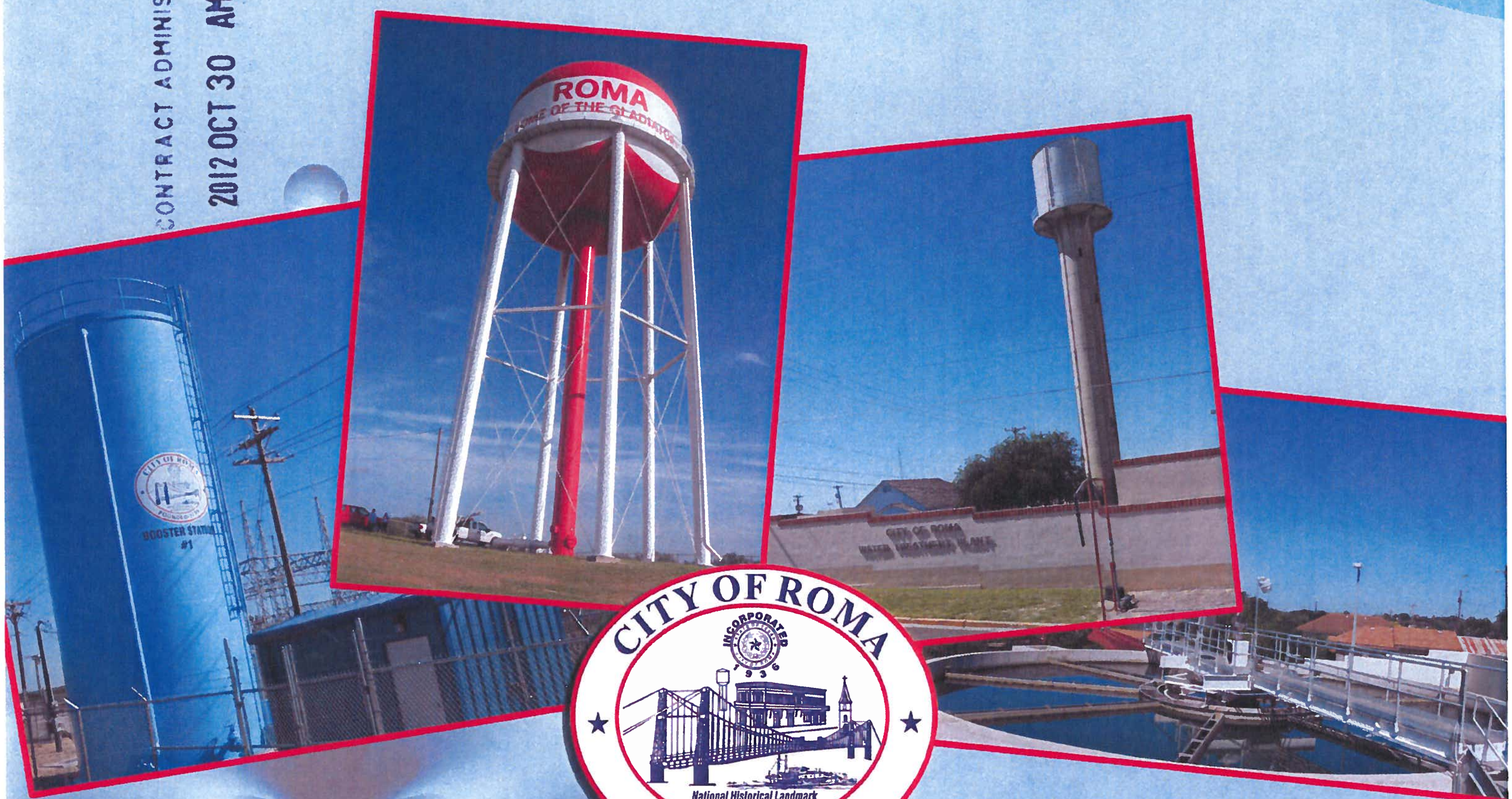
REGIONAL WATER PLANNING STUDY

Submitted by:

CITY OF ROMA, TEXAS



Submitted to:

Texas Water Development Board

October, 2012

Prepared by:

EHT

1148311260_Final Report

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REGIONAL WATER PLANNING STUDY

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BACKGROUND

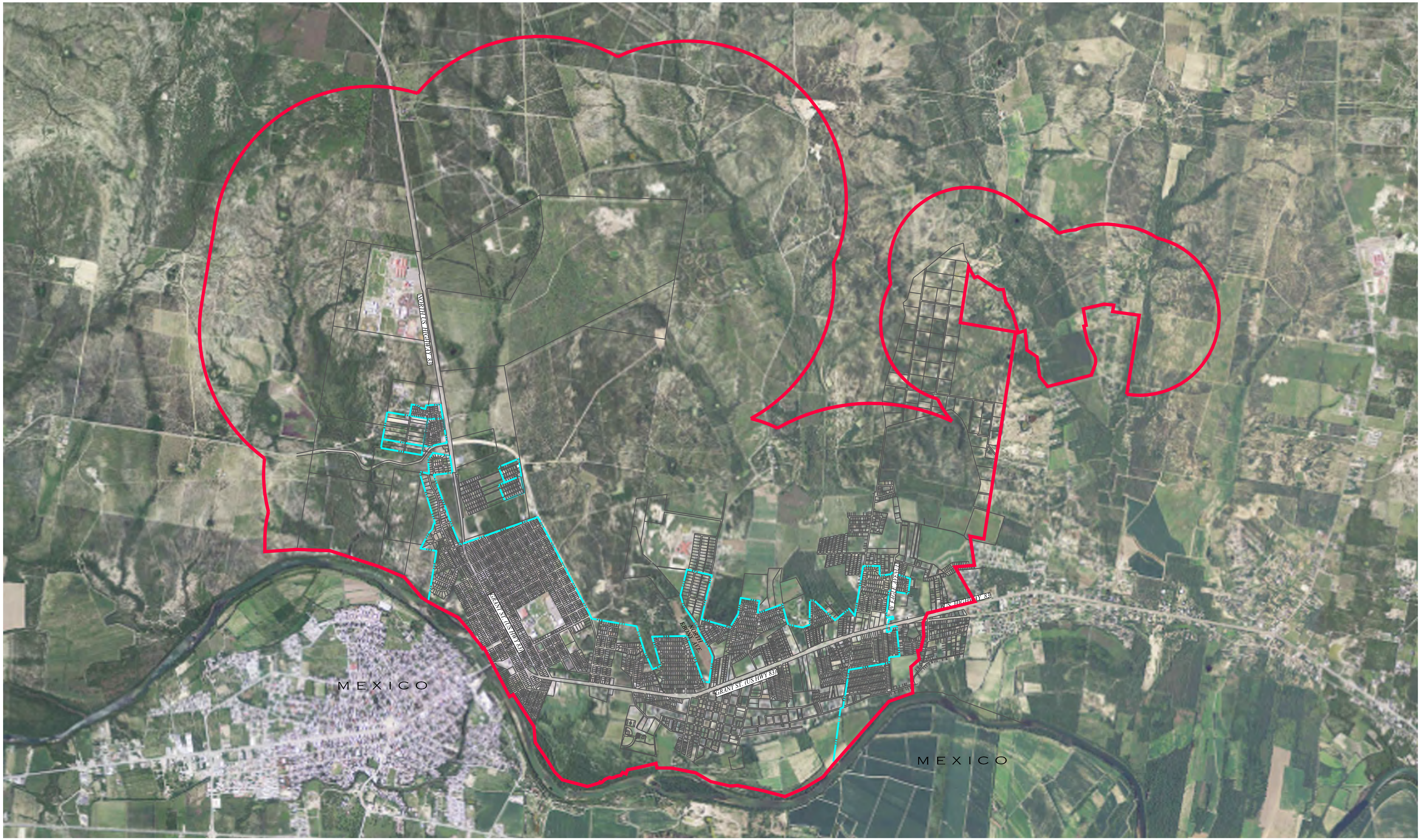
This Executive Summary document summarizes the findings of each task and the recommendations included in the City of Roma (City) Regional Water Planning Study (the Study). This Study is not a blueprint for the dissolution of the variety of water supply corporations in the area. Rather the Study was conducted to identify regional win-win projects. The terms "Regional" or "Regionalization" have political connotations that infer a single, regional authority which is not the intent when the term is used in this Study. The direction and goal for this Study has been to establish the existing infrastructure and conditions of the region and to identify win-win consolidation opportunities for infrastructure between the participants that benefit the Study Area and it's ratepayers in a regional manner.

The Study had several tasks to accomplish which included the following:

- ✓ Establish existing conditions for water facilities of the five entities in the Study Area;
- ✓ Identify specific water regionalization projects and their associated costs and implementation schedule;
- ✓ Prepare an environmental assessment of the recommended regionalization projects;
- ✓ Analyze regional opportunities and the potential funding mechanisms; and,
- ✓ Develop a stand-alone Water Conservation and Drought Contingency Plan for a proposed Regional Water Treatment Plant.

The development of data for the Study included direct and indirect communication with the City and water supply corporations while other key sources of data included the Texas Commission on Environmental Quality (TCEQ) Water Utilities Database (WUD), U.S. 2010 Census data and the SB 1 Region M Water Plan. It should be noted that the TCEQ WUD database was used as the basis for establishing the existing and projected connections, population, water demand and wastewater flows. The 2010 Census data and TCEQ WUD database data were used because the data was specific to the utilities in the Study Area, whereas the Region M data primarily focused on cities in Starr County, and did not include specific information for the separate water supply corporations.

The Study, in geographic terms, includes the current city limits of Roma, as well as its extra-territorial jurisdiction (ETJ) and portions of Starr and Zapata County. As stipulated by Chapter 42 of the Texas Local Government Code, based on the City's population size, the City's ETJ extends 1.0 mile beyond the City limits. In addition to the City, the other four entities in the Study are located north, west and east of the City in both Starr and Zapata County. Exhibits E-1 and E-2 show the Study Area and participants. The Study participants are shown in Table E-1.



N

500 0 1500

SCALE IN FEET

EXHIBIT E-1
CITY OF ROMA EXISTING CITY LIMITS
AND ETJ BOUNDARY

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
10/26/2012

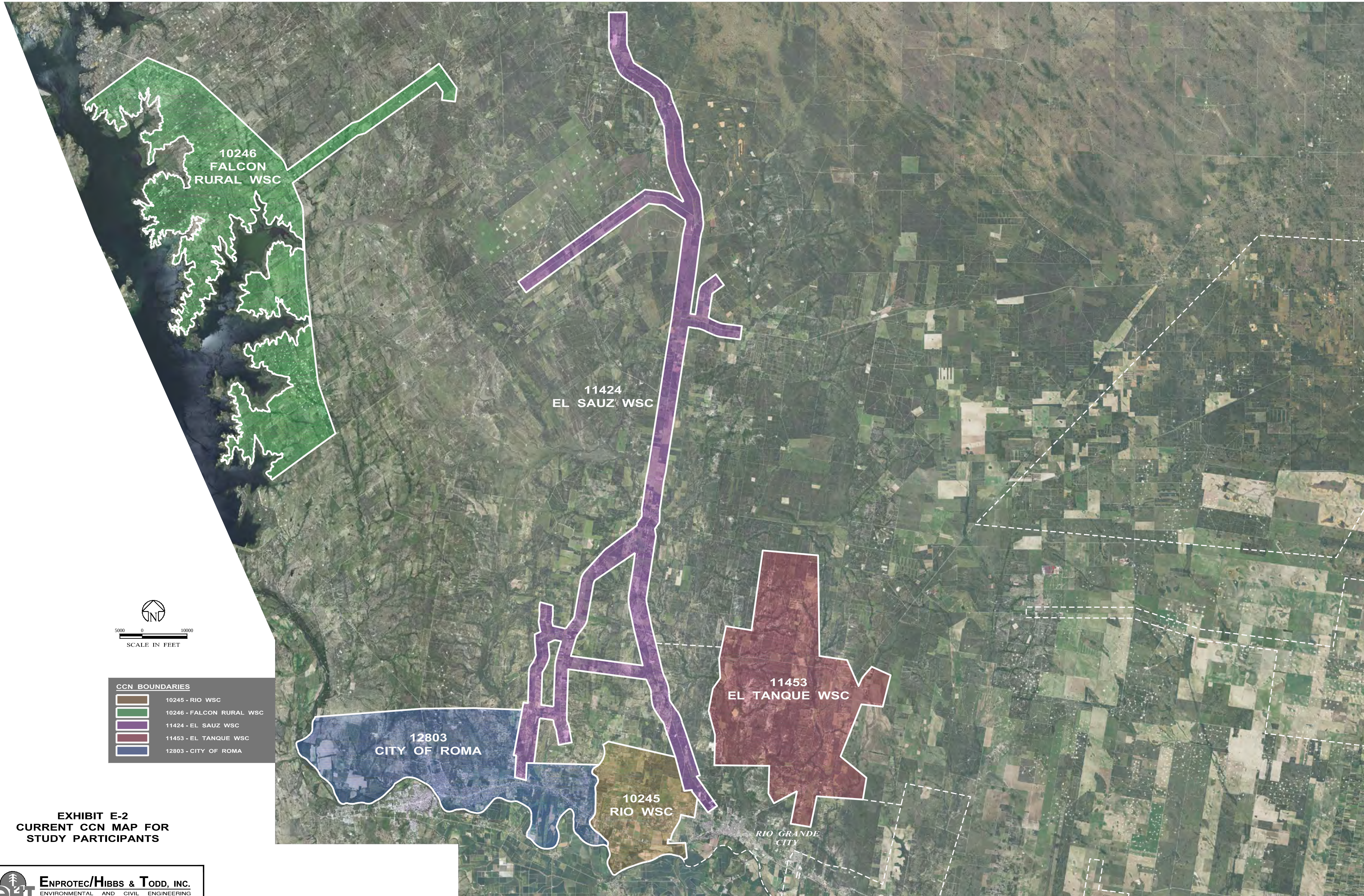


EXHIBIT E-2
CURRENT CCN MAP FOR
STUDY PARTICIPANTS

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
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325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

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Table E-1 Regional Planning Participants
City of Roma
Falcon Rural WSC
El Sauz WSC
El Tanque WSC
Rio WSC

The following summarizes each Section of the Study as shown in the Table of Contents.

SECTION 1

Section 1 is referred to as the "Existing Conditions" section. In this section all of the existing information for the Study Area such as existing water utilities, population, water demand, treatment capacity and others factors are identified and mapped as appropriate. In addition to identifying the current conditions, factors such as population, numbers of connections, water demand and water treatment capacity were projected to the horizon of the Study (Year 2040) and through build-out. Table E-2 provides a summary of these findings.

Table E-2
Existing & Projected Conditions for Study Area

Study Parameter	Current (2010)	2015	2020	2025	2030	2035	2040	Build Out
Connections	9,814	10,681	11,627	12,661	13,792	15,028	16,379	22,294
Population	28,427	30,945	33,696	36,703	39,990	43,587	47,522	64,751
Total Recommended WTP Capacity (MGD)	10.0	10.9	11.8	12.9	14.0	15.3	16.7	22.7

Connections

The current 2010 connections for the Study participants vary from 370 to 6,300 for a total of 9,814 connections for the Study Area. Using the updated actual connection counts collected from the entities rather than the 2010 projected counts from the Region M data, and following the historical growth patterns, the projected connection counts were estimated in 5-year increments to the year 2040 and ultimate build-out. The 2010 total connections for the Study Area are 9,814 and increase to 16,379 by 2040.

Population

Using the projected connection counts discussed above and assuming the average persons per housing unit will remain the same over time, the projected population was estimated in 5-year increments to the year 2040 and build-out. From year 2010 to 2040 the Study Area is projected to increase from 28,427 to 47,522 persons – an additional 19,095 persons over the next 30 years or approximately 637 persons per year. Table E-3 shows the current and projected population for each entity and the total for the Study Area.

Table E-3
Current and Projected Population Counts

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	18,467	19,852	21,341	22,941	24,662	26,512	28,500	37,050
Falcon Rural WSC	2,600	2,860	3,146	3,461	3,807	4,187	4,606	6,448
El Sauz WSC	1,510	1,687	1,886	2,107	2,355	2,632	2,941	4,323
El Tanque WSC	1,950	2,179	2,435	2,721	3,041	3,398	3,798	5,583
Rio WSC	3,900	4,366	4,888	5,472	6,126	6,858	7,677	11,347
Total Projected Population	**28,427**	**30,945**	**33,696**	**36,703**	**39,990**	**43,587**	**47,522**	**64,751**

Water Demand

The projected required WTP capacity was obtained by multiplying the number of connections by the standard TCEQ design requirement per connection per day, allowing for compliance with the 85% Capacity Rule. The actual daily water demand was calculated in the Study by dividing the annual average daily flow (either treated or purchased as wholesale) by the connection count.

The current TCEQ-required water production capacity is 10.0 MGD for the Study Area with a projected water demand in year 2040 of 16.7 MGD and a build-out demand of 22.7 MGD. Table E-4 shows the current and projected water demand for each entity and the total for the Study Area.

Table E-4 Current and Projected Recommended Water Treatment Plant Capacity								
Study Participant	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	6.40	6.88	7.40	7.96	8.55	9.19	9.88	12.85
Falcon Rural WSC	1.24	1.36	1.50	1.65	1.81	2.00	2.20	3.07
El Sauz WSC	0.38	0.42	0.47	0.52	0.59	0.66	0.73	1.08
El Tanque WSC	0.64	0.71	0.79	0.89	0.99	1.11	1.24	1.82
Rio WSC	1.32	1.48	1.66	1.85	2.08	2.32	2.60	3.84
Total Recommended WTP Capacity	**9.98**	**10.86**	**11.82**	**12.87**	**14.02**	**15.28**	**16.65**	**22.66**
Notes								
1 - WTP capacity in mgd.								
2 - Connections based on historical number of persons per household								
3 - Growth based on utility-specific annual growth								
4 - Sizing based on TCEQ criteria of 0.6 gpm per connection, increased so that demand is no greater than 85% of provided treatment capacity.								

Water Source

The water used by the entities within the Study Area comes from surface water, the Rio Grande River. Of the five participating entities, currently two of the entities treat surface water themselves (City of Roma and Falcon Rural WSC), whereas the three remaining entities (El Sauz WSC, El Tanque WSC and Rio WSC) purchase treated water from a utility not included in the Study Area (Rio Grande City). Data on the existing water rights owned by each entity was obtained from the TCEQ Water Rights Database and is presented in Table E-5.

Table E-5 Current Participant-Owned Water Rights			
Study Participant	**Municipal Water Rights (ac-ft)**	**Class A Irrigation Water Rights (ac-ft)**	**Class B Irrigation Water Rights (ac-ft)**
City of Roma	2,841.18	551.40	588.25
Falcon Rural WSC	249.00	0.00	0.00
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**
Notes			
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.			

Water Treatment

There are currently 2 water treatment plants (WTPs) operating within the Study Area, with a third WTP being proposed (currently under planning/design for Rio WSC thus construction and start-up dates are unknown). Exhibits E-3 and E-4 show the locations of the existing WTPs within the Study Area.

EXHIBIT E-3
CITY OF ROMA
EXISTING WATER TREATMENT PLANT

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287 10/26/2012

MATCH LINE "A"

1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT E-4
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
10/26/2012

Total water treatment capacity currently available is 6.45 MGD. All of the WTPs use surface water as a source. The smallest WTP is at Falcon Rural WSC at 1.3 MGD while the largest belongs to the City of Roma with a total capacity of 5.15 MGD. Table E-6 shows the existing WTPs and their associated service areas.

Table E-6
Existing Water Treatment Plants

Number	Name	Location	Current Permitted Capacity
1	City of Roma WTP	803 N Portscheller St.	5.15 mgd
2	Falcon Rural WSC WTP	439 River Rd.	1.30 mgd
Total Permitted Capacity = 6.45 mgd			

Water Distribution

The existing water distribution system for the Study Area consists of water transmission and distribution piping of various sizes, types and ages. Each entity is responsible for construction and maintenance of its individual distribution system. Age, condition, type and sizing of water lines were evaluated in this Study only to the extent of determining necessary improvements when considering potential regionalization alternatives. Within the service areas of the five participating Study entities, there are currently approximately 300 miles of water transmission and distribution piping installed, of various size and condition.

SECTION 2

Existing Water Supplies

Of the five participants in the Study Area, there are only three of the five participants that currently own any water rights: the City of Roma (City); Falcon Rural WSC; and Rio WSC. Since three of the five participants (El Sauz WSC, El Tanque WSC and Rio WSC) are currently purchasing water wholesale from Rio Grande City, this situation is to be expected. The breakdown of water rights owned by each participant is listed in Table E-7.

Table E-7 Current Participant-Owned Water Rights			
Study Participant	**Municipal Water Rights (ac-ft)**	**Class A Irrigation Water Rights (ac-ft)**	**Class B Irrigation Water Rights (ac-ft)**
City of Roma	2,841.18	551.40	588.25
Falcon Rural WSC	249.00	0.00	0.00
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**
Notes			
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.			

While the City of Roma appears to have sufficient water rights at this time, the actual secure volume of water available annually (firm yield) is less certain. While municipal water rights are guaranteed for each entity, in the Rio Grande Valley, irrigation water rights have historically received the lowest priority for withdrawal of water from the Rio Grande River. Furthermore, Class A irrigation water rights also tend to receive higher priority than Class B irrigation water rights. Therefore, in the case of a drought (based on when Lake Amistad and Lake Falcon are operating at less than 50% level), an entity should be able to count on its municipal water rights for raw water usage, but it is likely that the irrigation water rights will not be available. In essence, each utility that balances a combination of municipal and irrigation water rights is gambling that sufficient water rights will be available in the event of a drought. This situation of municipal rights taking seniority over irrigation rights is unique to this part of the State of Texas, whereas in almost every other area of the State the active rule is “First in time, first in right.” As a result, in the Rio Grande Valley, municipal rights generated in 2012 have the same seniority as municipal rights generated in 1980, which is far different from the rest of the State.

Conversion of Water Rights

When considering converting irrigation water rights to municipal water rights, the class of irrigation rights impacts the final amount of municipal water rights created. Class A irrigation water rights typically convert to municipal at a rate of 50%; in other words, 1,000 ac-ft of Class A irrigation water rights would convert to 500 ac-ft of municipal water rights. However, Class B irrigation water rights typically converts to municipal at a rate of 40%; in other words, 1,000 ac-ft of Class B irrigation water rights would convert to 400 ac-ft of municipal water rights. In addition, once the irrigation water rights are converted to municipal use, the seniority of the converted water rights do not take precedence over older municipal water rights owned by other utilities. However, TCEQ now allows for the merging of newly converted municipal water rights into a utility’s oldest water rights account, so a utility can take advantage of the age of the older water rights to now gain seniority for the newly converted water rights. Table E-8 shows what municipal water rights could be available to each Study participant by completing conversion of irrigation water rights to municipal. In addition, Tables E-9 and E-10 show the additional amounts of water rights needed and when specific amounts of water rights are needed for each participating utility through buildout.

Table E-8
Potential Total Municipal Water Rights

Study Participant	Current Municipal Water Rights (ac-ft)	Converted from Class A Irrigation Water Rights (ac-ft)	Converted from Class B Irrigation Water Rights (ac-ft)	Total Potential Municipal Water Rights (ac-ft)
City of Roma	2,841.18	275.70	235.30	3,352.18
Falcon Rural WSC	249.00	0.00	0.00	249.00
El Sauz WSC	0.00	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00	0.00
Rio WSC	527.11	0.00	197.80	724.91
Total	**3,617.29**	**275.70**	**433.10**	**4,326.09**

Notes
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.
2 - Water right conversion rates per Rio Grande River Watermaster.

Table E-9
Current and Projected Required Water Rights (Or Alternative Supplies)

Study Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	3,081	3,312	3,560	3,827	4,114	4,423	4,754	6,181
Falcon Rural WSC	437	591	651	716	787	866	953	1,334
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	627	702	786	880	985	1,103	1,235	1,825
Total Estimated Necessary Water Rights	**4,694**	**5,219**	**5,682**	**6,189**	**6,743**	**7,348**	**8,011**	**10,911**

Notes
1 - Water demand in acre-feet.
2 - Projected demand based on current water usage per utility.

Table E-10 Required Additional Water Rights Using All Existing Water Rights								
Study Participant	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	-	-	-	-	133	442	773	2,200
Falcon Rural WSC	188	342	402	467	538	617	704	1,085
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	-	-	-	-	-	81	213	804
Total Estimated Additional Water Rights Needed	**737**	**956**	**1,087**	**1,233**	**1,528**	**2,097**	**2,759**	**5,659**
Notes								
1 - Water demand in acre-feet.								
2 - Projected demand based on current water usage per utility.								
3 - Total additional water rights needed by deducting all existing Municipal, Class A Irrigation and Class B Irrigation water rights.								
4 - Cells with a dash signify that existing water rights should be sufficient to meet projected water demands.								

Alternatives for Developing New Water Supplies

When considering development of new water supplies, the type and quality of water, availability, cost and overall feasibility to procure those water supplies must be evaluated closely to determine which investment has the lowest risk. With regard to evaluating water supplies over a thirty-year period, the cost frequently is fairly high, so identifying anticipated advantages, disadvantages and potential fatal flaws with each proposed new water supply is critical in identifying projects to implement as a result of this Study. The potential areas for developing additional water supplies are identified below:

- Purchase of new water rights;
- Lease of water rights;
- Acquisition of new water rights via Bed and Banks reuse provision;
- New water supply via indirect potable reuse;
- New water supply via direct potable reuse; and
- New water supply via brackish groundwater.

Future Regulations and Impact on Supply and Treatment

The existing WTPs in the Study Area are of a conventional type. Conventional WTPs consist of coagulation, flocculation, sedimentation and dual-media filtration. The primary goal of conventional treatment WTPs is to remove most suspended solids, which can contain suspended organics, bacteria and viruses. However, a conventional WTP cannot remove fine particles of suspended solids and dissolved solids. Over the past 10 years utilities using conventional WTP processes have been seeing increased difficulty in maintaining the same quality of finished water because the raw water quality has deteriorated, especially during the summer time, when the Rio

Grande River water temperature is higher, organic content is higher, and evaporation is at its highest, resulting in a higher concentration of salts in the water.

While the TCEQ has not yet begun widespread enforcement of Secondary Drinking Water Standards (SDWS) limits, many utilities over the past five years have begun to invest in alternative and innovative treatment technologies to improve the quality of their drinking water. One example of this is utilizing membrane filtration in lieu of granular media filtration that is still used in most conventional WTPs. Membrane filtration, such as microfiltration (MF) or ultrafiltration (UF), provides significantly improved performance in removing smaller suspended particles in the finished water, making it much easier for utilities to maintain compliance with the recent, more stringent Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

Alternative Recommendations and Costs

The potential advantages and disadvantages for water supply alternatives are identified below in Table E-11. For the sake of providing a comparable evaluation of feasibility and anticipated capital costs, the water supply goal was based on acquiring 1,000 ac-ft of municipal raw water supply from each supply alternative.

Table E-11 Advantages and Disadvantages for Water Supply Alternatives		
Water Supply Alternative	**Advantages**	**Disadvantages**
Purchasing water rights	Simpler than other water supply alternatives to accomplish.	May not be able to find sufficient water rights to purchase when needed. Irrigation water rights purchased should be converted to guaranteed municipal rights. May not qualify for funding via traditional funding methods. Does not provide an improvement in finished water quality.
Leasing water rights	Simplest of water supply alternatives to accomplish. Could provide necessary surface water rights at one of the lowest costs in the evaluated alternatives.	May not be able to find sufficient water rights to lease when needed. The more limited the availability of water rights to lease, the higher the cost of leasing per ac-ft. Water rights leased in one year may not be available the following year. May not qualify for funding via traditional funding methods. Does not provide an improvement in finished water quality.
Obtain water rights via Bed and Banks authorization	Lowest cost in the evaluated alternatives to provide additional water rights. Water rights should convey as municipal use at 1:1. If a Bed and Banks authorization is approved, collection and treatment of wastewater from other areas could increase available Bed and Banks water.	Bed and Banks authorization may not be approved due to downstream opposition. Does not provide an improvement in finished water quality. A Bed and Banks authorization may not grant full amount of water rights in comparison to effluent put back into river. May not qualify for funding via traditional funding methods.
Develop new raw water supply via indirect potable reuse	Provides an improvement in finished water quality. Provides additional raw water without purchasing additional water rights. Can reduce salt concentrations in blended raw water, improving finished water quality from WTP. Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality.	Community opposition due to “yuck” factor. Disposal of membrane treatment system wastewater (RO concentrate). Requires additional training to operate advanced treatment systems. No official approval of direct potable reuse in Texas by the TCEQ.
Develop new finished water supply via direct potable reuse	Provides an improvement in finished water quality. Provides additional water without purchasing additional water rights. Can reduce salt concentrations in blended finished water, improving finished water quality in distribution system. Provides additional treated water without re-treating at the WTP. Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality.	Community opposition due to “yuck” factor. Disposal of membrane treatment system wastewater (RO concentrate). Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints. Requires additional training to operate advanced treatment systems.
Develop new raw/finished water supply via brackish groundwater	Provides an improvement in either raw or finished water quality. Provides water without purchasing additional water rights or re-treating at the WTP. Can reduce salt concentrations in blended raw and/or finished water, improving raw and/or finished water quality. Can blend RO permeate with raw water to enhance raw water quality. Cost to provide additional water can be lower than other alternatives when accounting for improved water quality.	Disposal of membrane treatment system wastewater (RO concentrate). Requires additional training to operate advanced treatment systems. Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints. Based on historical groundwater usage in Starr County, there appears to limited availability of groundwater in the Study Area.

SECTIONS 3 - 7

Anticipated Life Cycle Costs for Each Study Participant

The goal of these sections are to develop potential regionalization alternatives that result in savings for the Study participants, including determining anticipated life cycle costs of all the water systems in the Study Area, and comparing regional alternative life cycle costs versus stand-alone life cycle costs. Given the five participating entities, there are sixteen potential alternatives for regionalization, which will ultimately take into account anticipated treatment and distribution capital and O&M costs. The regionalization scenarios evaluated in this Study are included in Table E-12.

Table E-12
Regionalization Scenarios

Scenario	City of Roma	Falcon WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

Notes
1 - Implementation of any of the scenarios would likely require the construction of a new regional WTP.
2 - Existing WTPs would likely remain online for their respective remaining useful life to serve as a backup to a regional WTP.

Regionalization Project Recommendations and Costs

The Study identified various water projects for treatment, storage and transmission infrastructure improvements. There are 5 regionalization project packages recommended at a total cost of $104,824,400 as shown in Tables E-13, E-14, E-15, E-16 and E-17. It should be noted that while the recommended regionalization project at this time is based on Scenario 16 (serving all five Study participants), depending on the proposed capacity of the proposed new Rio WSC WTP, the ultimate regionalization of all five Study participants may not be realistic. Therefore, prior to completion of this Study, it is recommended that additional coordination be completed with Rio WSC to determine the true extent of outside water service needed by Rio WSC in the future and what role Rio WSC would ultimately play in any regionalization by the other Study participants.

Regionalization Project Package No. 1

Proposed infrastructure improvements under Project Package No. 1 include construction of a new regional WTP and storage improvements to serve the City of Roma. These improvements are proposed to begin construction by the end of 2015, so the costs shown have been escalated by 3.5% annually for three years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 1 are included in Table E-13.

Table E-13
Project Package No. 1 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$4,539,225	$4,539,300
2	Construct new 36-inch RW transmission main	LF	9,100	$293	$2,666,300
3	Construct new 184 MG reservoir adjacent to Rio Grande River	LS	1	$2,180,400	$2,180,400
4	Phase I WTP - 3 mgd	LS	1	$6,000,000	$6,000,000
5	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
6	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,136,000
				Contingencies (20%)	$3,427,200
				TOTAL ESTIMATED CONSTRUCTION COST	$20,563,200
				Engineering & Testing (18%)	$3,701,400
				TOTAL ESTIMATED CAPITAL COST	**$24,264,600**
				Annual Escalation	$2,547,800
				TOTAL ESTIMATED CAPITAL COST BY 2015	**$26,812,400**

Notes
1 - 75% of PS improvements budget included in PP No. 1 to allow for construction of structure and initial pumps.
2 - 50% of reservoir budget allocated to PP No. 1 to construct the first large raw water reservoir.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

It should also be noted that in developing the scenarios, there is a significant difference in piping unit cost when comparing the raw water transmission line cost against distribution system transmission piping. For example, the unit cost for 30-inch distribution piping is roughly $150 per linear foot, whereas the unit cost for the proposed 36-inch raw water transmission line is approximately $293 per linear foot. It is anticipated in the project that additional property acquisition will be required for the pipe alignment; in addition, since there is no clear, undisturbed pathway from the Rio Grande River (raw water supply) to the proposed WTP site, it is anticipated that the majority of the piping will need to be installed via either boring or directional drilling to cross US Highway 83 and to minimize utility conflicts throughout the developed sections of the City of Roma. However, the cost for distribution piping is reduced, as the proposed alignment of the piping is intended to parallel US Highway 83, and the piping is anticipated to be installed via typical open-cut trenching within TxDOT ROW outside of the road, which will significantly reduce the unit cost for installation of the distribution piping.

Regionalization Project Package No. 2

Proposed infrastructure improvements under Project Package No. 2 include expansion of the new regional WTP and distribution improvements to serve both the City of Roma and Falcon Rural WSC. These improvements are proposed to begin construction by the end of 2020, so the costs shown have been escalated by 3.5% annually for eight years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 2 are included in Table E-14.

Table E-14
Project Package No. 2 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase II WTP - 6 mgd	LS	1	$6,000,000	$6,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$750,000	$750,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	30-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$150	$2,097,800
7	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
8	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
9	Site improvements for new ESTs	EA	2	$250,000	$500,000
10	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection within TxDOT ROW	LF	26,277	$75	$1,970,800
11	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection within TxDOT ROW	LF	7,286	$100	$728,600
				subtotal	$14,050,500
				Contingencies (20%)	$2,810,100
				TOTAL ESTIMATED CONSTRUCTION COST	$16,860,600
				Engineering & Testing (18%)	$3,035,000
				TOTAL ESTIMATED CAPITAL COST	**$19,895,600**
				Annual Escalation	$5,570,800
				TOTAL ESTIMATED CAPITAL COST BY 2020	**$25,466,400**

Notes
1 - 25% of remaining PS improvements budget included in PP No. 2 to allow for installation of additional pumps.
2 - No reservoir improvements proposed under PP No. 2.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Regionalization Project Package No. 3

Proposed infrastructure improvements under Project Package No. 3 include expansion of the new regional WTP and distribution improvements to serve the City of Roma, Falcon Rural WSC and El Sauz WSC. These improvements are proposed to begin construction by the end of 2025, so the costs shown have been escalated by 3.5% annually for thirteen years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 3 are included in Table E-15.

Table E-15
Project Package No. 3 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase III WTP - 9 mgd	LS	1	$6,000,000	$6,000,000
4	Construct one new 0.25 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection within TxDOT ROW	LF	26,329	$100	$2,632,900
8	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
9	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$13,351,400
				Contingencies (20%)	$2,670,300
				TOTAL ESTIMATED CONSTRUCTION COST	$16,021,700
				Engineering & Testing (18%)	$2,884,000
				TOTAL ESTIMATED CAPITAL COST	**$18,905,700**
				Annual Escalation	$8,602,100
				TOTAL ESTIMATED CAPITAL COST BY 2025	**$27,507,800**

Notes
1 - 25% of remaining PS improvements budget included in PP No. 2 to allow for installation of additional pumps.
2 - Start of construction of second large reservoir proposed under PP No. 3.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Regionalization Project Package No. 4

Proposed infrastructure improvements under Project Package No. 4 include expansion of the new regional WTP and distribution improvements to serve the City of Roma, Falcon Rural WSC, El Sauz WSC and Rio WSC. These improvements are proposed to begin construction by the end of 2030, so the costs have been escalated by 3.5% annually for eighteen years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 4 are included in Table E-16.

Table E-16 Project Package No. 4 - Proposed Treatment and Distribution Improvements					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase IV WTP - 13 mgd	LS	1	$8,000,000	$8,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$750,000	$750,000
4	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	24-inch transmission main from El Sauz WSC service connection to Rio WSC service connection within TxDOT ROW	LF	38,074	$125	$4,759,300
7	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
8	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,137,600
				Contingencies (20%)	$3,427,600
				TOTAL ESTIMATED CONSTRUCTION COST	$20,565,200
				Engineering & Testing (18%)	$3,701,800
				TOTAL ESTIMATED CAPITAL COST	**$24,267,000**
				Annual Escalation	$15,288,300
				TOTAL ESTIMATED CAPITAL COST BY 2030	**$39,555,300**
Notes					
1 - 25% of remaining PS improvements budget included in PP No. 4 to allow for installation of additional pumps.					
2 - No reservoir improvements proposed under PP No. 4.					
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.					

Regionalization Project Package No. 5

Proposed infrastructure improvements under Project Package No. 5 include expansion of the new regional WTP and distribution improvements to serve all five Study participants. These improvements are proposed to begin construction by the end of 2035, so the costs shown have been escalated by 3.5% annually for twenty-three years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 5 are included in Table E-17.

Table E-17 Project Package No. 5 - Proposed Treatment and Distribution Improvements					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase V WTP - 16.7 mgd	LS	1	$7,400,000	$7,400,000
4	Construct one new 0.25 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Tanque WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from Rio WSC service connection to El Tanque WSC service connection within TxDOT ROW	LF	12,250	$100	$1,225,000
8	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection within TxDOT ROW	LF	6,789	$75	$509,200
				subtotal	$12,352,700
				Contingencies (20%)	$2,470,600
				TOTAL ESTIMATED CONSTRUCTION COST	$14,823,300
				Engineering & Testing (18%)	$2,668,200
				TOTAL ESTIMATED CAPITAL COST	**$17,491,500**
				Annual Escalation	$14,080,700
				TOTAL ESTIMATED CAPITAL COST BY 2035	**$31,572,200**
Notes					
1 - 25% of remaining PS improvements budget included in PP No. 5 to allow for installation of additional pumps.					
2 - Completion of construction of second large reservoir proposed under PP No. 5.					
3 - WTP capacity is based on the assumption that the existing Roma WTP is no longer operational at this time.					

With both capital and O&M costs developed for each regionalization scenario, a projected 30-year life cycle cost has been developed and is identified in Table E-18.

Table E-18 30-Year Life Cycle Cost for Each Scenario					
SCENARIO	WTP CAPITAL COST	DISTRIBUTION CAPITAL COST	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	30-YR LIFE CYCLE COST
1	$44,362,300	$6,372,000	$1,400,900	$105,375	$78,438,000
2	$51,724,300	$15,431,500	$1,688,555	$145,518	$100,889,000
3	$46,421,800	$12,395,900	$1,496,272	$145,518	$89,014,000
4	$49,014,200	$24,795,200	$1,562,417	$224,800	$106,680,000
5	$52,955,300	$22,812,900	$1,740,856	$210,750	$111,663,000
6	$54,305,500	$19,587,300	$1,783,927	$180,643	$110,026,000
7	$55,312,300	$30,138,700	$1,850,072	$231,825	$123,742,000
8	$59,441,800	$29,990,000	$2,028,510	$224,800	$130,875,000
9	$50,817,200	$24,777,900	$1,657,790	$217,775	$110,091,000
10	$55,012,600	$24,256,600	$1,836,228	$210,750	$116,918,000
11	$56,578,200	$30,939,200	$1,902,373	$235,338	$126,835,000
12	$57,532,700	$33,628,400	$1,945,444	$279,996	$132,092,000
13	$61,987,100	$31,795,400	$2,123,883	$262,434	$137,672,000
14	$63,578,100	$38,478,000	$2,190,028	$287,021	$147,615,000
15	$58,805,300	$33,275,600	$1,997,745	$283,509	$134,038,000
16	$65,814,900	$39,009,000	$2,285,400	$297,559	$152,330,000
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					
4 - Costs in 2012 dollars.					

In addition to comparison of the life cycle costs in the table above, a phased cash draw analysis was developed for the water improvements, as shown in Table E-19, to determine the impact of the potential debt service to be incurred from creating a regionalized water treatment, storage and transmission system.

Table E-19 Projected Cash Draw for Proposed Water Improvements					
Year	**Project 1**	**Project 2**	**Project 3**	**Project 4**	**Total Cost for Water Projects**
2011-2015	Construct Phase I of the new Regional WTP	Construct EST along US 83 in Northwest Roma	Apply for Bed and Banks Reuse Authorization	Conduct Groundwater Availability Study	-
Project Cost [1]	$24,074,200	$2,738,200	-	-	**$26,812,400**
2016-2020	Construct Phase II of the Regional WTP	Construct Transmission Line and ESTs along US 83 to Proposed US 83 Bypass	Construct Transmission Line and ESTs along US 83 to Falcon Rural WSC	Begin Purchasing Additional Surface Water Rights and/or Begin Developing Alternative Water Supplies	-
Project Cost [1]	$11,560,400	$7,200,800	$6,705,200	-	**$25,466,400**
2021-2025	Construct Phase III of the Regional WTP	Construct a New EST in Northern Roma	Construct Transmission Line and ESTs along US 83 Bypass to El Sauz WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-
Project Cost [1]	$15,387,100	$3,090,500	$9,030,200	-	**$27,507,800**
2026-2030	Construct Phase IV of the Regional WTP	Construct a New EST in Eastern Roma	Construct Transmission Line and ESTs along US 83 Bypass to Rio WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-
Project Cost [1]	$19,337,800	$3,462,200	$16,755,300	-	**$39,555,300**
2031-2035	Construct Phase V of the Regional WTP	Construct Transmission Line and ESTs along US 83 Bypass to El Tanque WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-	-
Project Cost [1]	$22,666,800	$8,905,400	-	-	**$31,572,200**
2036-2040	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-	-	-	
Project Cost [1]	-	-	-	-	-
Total	**$150,915,000**				
Notes:					
1 - Note that these costs (for infrastructure improvements only) are higher than the costs discussed in TM No. 6 (shown in 2012 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this Study. This cost is based on the timeline for projects discussed in TM No. 6 and this TM and assumes that projects will be funded toward the middle of each 5-year implementation period.					

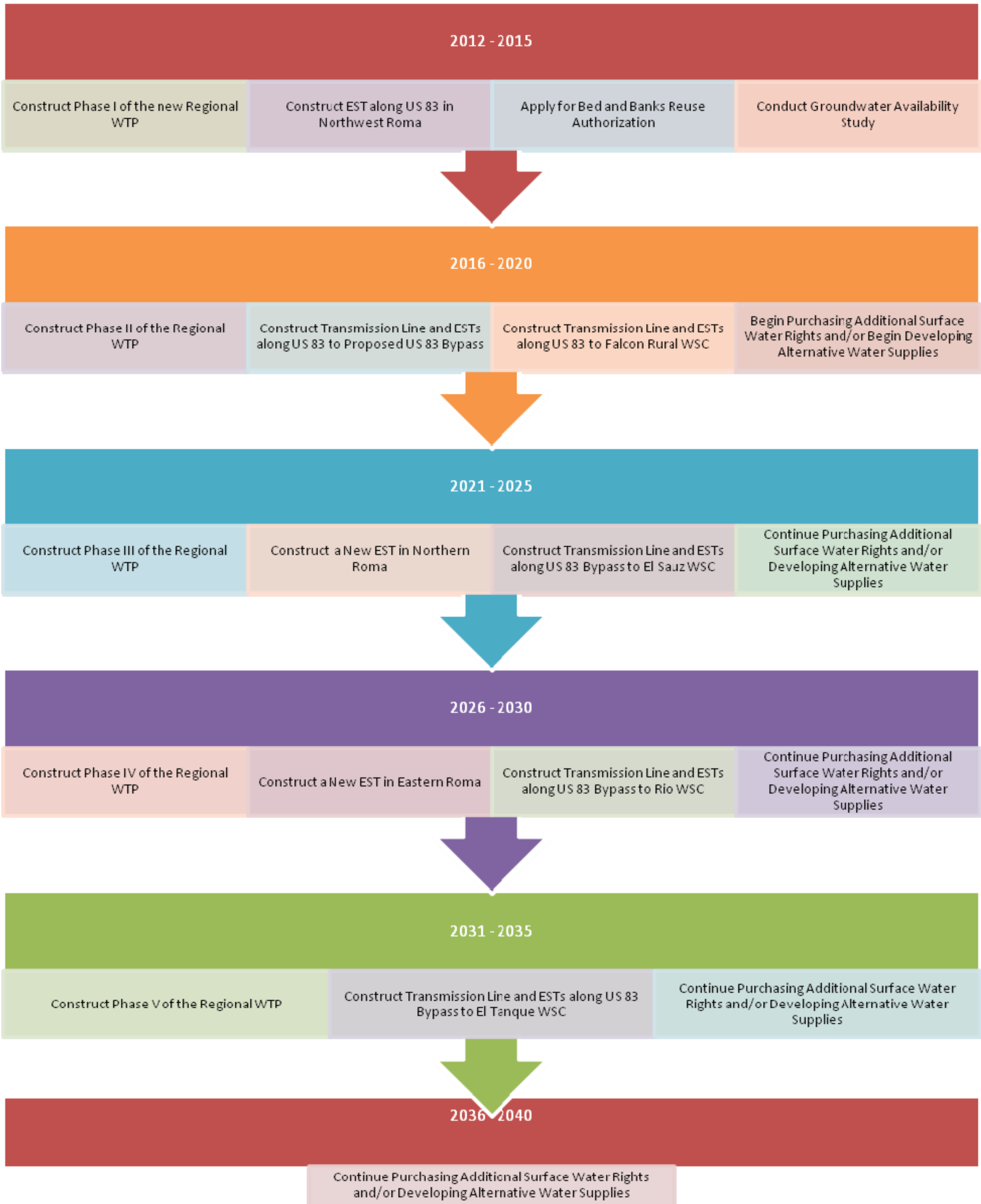
The total cost (in 2012 dollars) for all of the projects identified in the Study is $104,824,400.

Implementation Schedule

An implementation schedule for various water regionalization projects that are identified in Sections 3, 4, 5 and 6 of this Study was prepared. The timing of the implementation for these projects was based on information from the entities and the inherent nature and characteristics of the projects. However, it should be noted that a number of factors can and will impact the schedule presented in the flow chart in Section 7 of this Study and shown on the following page.

These include but are not limited to the following factors.

- ✓ The projects identified are at a pre-planning level at this point. Preliminary design may delay or accelerate the projects once begun.
- ✓ Implementation of the projects is dependent on available funding.
- ✓ Utility conflicts, Rights-of-Way and easement acquisition can substantially delay projects.
- ✓ Many of the recommended regionalization projects will involve agreements and contracts between the City of Roma and individual water supply corporations, including project costs and payment agreements. These negotiated agreements may delay implementation.
- ✓ A slow down or acceleration in projected growth within the Study Area may impact the implementation schedule.
- ✓ Stricter water or wastewater treatment regulations could accelerate the implementation schedule.


2012 - 2015
Construct Phase I of the new Regional WTP
Construct EST along US 83 in Northwest Roma
Apply for Bed and Banks Reuse Authorization
Conduct Groundwater Availability Study
2016 - 2020
Construct Phase II of the Regional WTP
Construct Transmission Line and ESTs along US 83 to Proposed US 83 Bypass
Construct Transmission Line and ESTs along US 83 to Falcon Rural WSC
Begin Purchasing Additional Surface Water Rights and/or Begin Developing Alternative Water Supplies
2021 - 2025
Construct Phase III of the Regional WTP
Construct a New EST in Northern Roma
Construct Transmission Line and ESTs along US 83 Bypass to El Sauz WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2026 - 2030
Construct Phase IV of the Regional WTP
Construct a New EST in Eastern Roma
Construct Transmission Line and ESTs along US 83 Bypass to Rio WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2031 - 2035
Construct Phase V of the Regional WTP
Construct Transmission Line and ESTs along US 83 Bypass to El Tanque WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2036 - 2040
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies

SECTION 8

Project Funding and Consolidation

The Study identified various water projects for treatment, storage and transmission infrastructure improvements. There are 5 project packages incorporating treatment, storage and transmission. The total cost for the recommended water project packages in the Study is $104,823,900.

Obviously not all of the funding would be needed at the same time but with the current tightening of the bond market and the fact that the requests for water funding is always greater than the funding available, the identification of funding sources is crucial. Section 8 of the Study describes a variety of funding sources available from the TWDB and other potential funding agencies in addition to private bonds and funding agreements.

The conclusions regarding the funding of consolidation or regional projects are listed below.

- ❖ Municipalities can typically issue bonds at lower interest rates than water supply corporations or IOUs.
- ❖ Using a City-financed model for the proposed new regional WTP is applicable to the larger water regionalization projects.
- ❖ The smaller water distribution projects may be financed via interlocal agreements between the affected water supply corporations and the City.

SECTION 9

Public Outreach

A key part of the Study's effort was coordination with the five entities within the Study Area. Communication included retrieving existing information on their facilities, recommendations for consolidation projects and regional projects and a schedule of implementation in addition to requesting comments on the overall Study. Three types of communication to facilitate this effort were utilized.

1. **Direct Communication** - The entities were contacted directly for information and were provided the opportunity to review and comment on the information in the Study via review of hard copies of draft technical memorandums as the Study progressed.

2. **Onsite Visits** - Onsite visits to each entity's water facilities were conducted.

3. **Public Meetings** - Two public meetings were held and invitations were sent to each entity requesting them to attend, in addition to the public posting of the meeting date and subject. One meeting was held at the start of the Study and a second meeting was held at the 50% completion level of the Study. A final public meeting will be held once the review process of the Study is completed.

SECTION 10

Environmental Assessment

An EA was prepared for the projects that were identified and is included in Section 10 of the Study. Many of the components such as USGS Quad maps, FEMA maps, Aerial Photos and others are included, as well as a rudimentary discussion of each component of the EA per the TWDB guidelines. These foundation elements of this EA will be valuable for future environmental investigations. However, the EA is only intended for a very preliminary planning level and is not intended to provide environmental clearance for any of the projects recommended herein. Additional environmental investigations should be conducted, as warranted, for those projects that proceed beyond the planning level of this Study.

WATER CONSERVATION PLAN AND DROUGHT CONTINGENCY PLAN

The WCP/DCP have been drafted for a new regional WTP and are included in the appendices of this Study. The WCP/DCP are formatted per the TCEQ requirements. The current drafts are preliminary in that the City and participating regionalizing entities will need to fine tune the trigger points, stages and associated agreements and other WCP/DCP affected by the adoption of the WCP/DCP for a regional WTP. The WCP/DCP will become stand-alone documents upon adoption following TWDB review of the draft WCP/DCP document; in addition, as agreements are set in place for providing a regional water supply, the WCP/DCP will need to be modified to match the utilities served at each project package milestone of the project.

CONCLUSIONS

A total of over 16 scenarios were completed to evaluate capital, O&M and life-cycle costs. The result is that consolidation to a single, regional WTP is the most cost-effective scenario despite the costs for pumping of water to the other service areas. The various methods of analysis and conclusions are discussed in detail in Sections 3, 4 and 5.

The recommended scenario of consolidating all treatment to a single regional WTP within the City of Roma CCN area will have its share of challenges for the reasons listed below.

- **Regionalization is optional.** Currently a regulation does not exist to force regionalization of utilities. Regionalization of infrastructure is encouraged by the regulatory agencies but not required.

- **Lack of Financial Incentives.** Just as there is not a "stick" to force regionalization, a "carrot" does not exist either to encourage regionalization. For example, if abutting water supply corporations are better off constructing individual plants from a construction cost perspective, there is no mechanism to bridge the financial gap to make regionalization a viable option.

- **Individual Control.** While costs are important, control is paramount. Generally speaking the number one problem of regionalization involves the fear of losing autonomy, including concerns about loss of control or power by one group or another and not being able to control their own destiny.

- **Occupational Resistance.** With the proliferation of water supply corporations in the Study Area and the nature of providing water services, there are numerous professions involved in the industry through the operation and maintenance, billing, engineering, financial and legal services. In addition to resistance to regionalization by a water supply corporation Board due to control reasons, resistance is also encountered from those who work for the water supply corporations. With a reduced number of plants and plant owners through regionalization or consolidation, there may be the perception that the water industry will turn into a "winner take all" system of engineering, financial, legal and maintenance contracts.

There are two existing and one proposed WTPs in the Study region varying in size from 1.3 million gallons per day (mgd) to 5.15 mgd for a total capacity of 6.45 mgd for the Study Area. For the most part the common wisdom states that it is inherently difficult to complete consolidation or regionalization of multiple small WTPs due to the following reasons listed below.

- Usually the costs for conveying finished water from multiple, smaller WTPs to a single, larger WTP are frequently not cost-effective. By and large it is still cheaper to operate non-regional plants than to bear capital costs required to supply water from a single large facility after development has occurred. While there are certainly reductions in treatment costs with a larger plant due to the economy of scale, the up-front conveyance/construction costs associated with consolidation usually dissuade municipalities and water supply corporations from consolidating existing plants. However, it should be noted that this dynamic normally changes when the smaller plant(s) requires expansion or needs significant rehabilitation due to age or changes in regulatory treatment requirements.

- In addition to costs, there are control issues that compel water supply corporations to continue either operating small WTPs or continue purchasing treated water from a wholesale supplier. For water supply corporations, conveying finished water from a better-equipped, larger facility may involve relinquishing control of operations to an outside entity (a municipality or other water supply corporation). By having sole control over a WTP, a water supply corporation can control operation and maintenance expenditures, and ensure that available capacity exists for future growth within the water supply corporation.

The recommended scenario of consolidating all water treatment to a new regional WTP located in the City of Roma will have its share of challenges for the reasons discussed previously in this section. However, after exhaustive analyses of costs comparisons it is the most cost-effective alternative for the long-term water treatment needs of the Study Area.

This Technical Memorandum (TM) summarizes the findings of Tasks I and II of the City of Roma Regional Water Planning Study (the Study). The focus of Tasks I and II of the Study is the development of descriptions of the Study service area and determination of water system demands for the Study Area.

Activities in Tasks I and II included the following:

- ✓ Delineate service areas;
- ✓ Develop water demand factors;
- ✓ Compile population projections;
- ✓ Compare and discuss differences between population projections, using Texas Commission on Environmental Quality (TCEQ) and local data as compared to Texas Water Development Board (TWDB) data;
- ✓ Develop maps of existing and future development over the 30-year planning horizon;
- ✓ Develop water demand by service areas over the 30-year planning horizon;
- ✓ Examine water rights and potential alternative sources of additional water (discussed briefly in this TM and covered in additional detail in TM No. 2);
- ✓ Develop a map showing existing water distribution and treatment facilities; and
- ✓ Prepare a technical memorandum summarizing the findings.

BACKGROUND

The City of Roma (City) is located at the south end of Starr County, primarily situated along United States (US) Highway 83. Tracing its roots to the Spanish Colonial Colonists in the 1760's, the City contains physical reminders of over two centuries of Texas/México borderlands heritage. The City's early history is rooted in the Spanish colonial period. In 1746, José de Escandón received permission from the Spanish Crown to colonize Nuevo Santander, which extended from the Sierra Madre Oriental to the Gulf of México and from the rainforest of Tamaulipas northward beyond the Rio Grande River. By 1753, Escandón had founded the towns of Camargo, Reynosa, Revilla and Mier south of the Rio Grande River and Dolores on the north bank, followed by Laredo in 1755.

The City is also popularly known as Roma-Los Saenz, since the incorporated City also took in the area known as Los Saenz. The City was founded in 1765 and incorporated in 1936. It serves as a port of entry from Mexico into the U.S. via the Roma-Ciudad Miguel Alemán International Bridge. Prior to Texas's independence from Mexico in 1836, the town was listed as under the jurisdiction of the town of Mier, Mexico and served under Spanish rule.

Roma and Los Saenz are actually two adjoining settlements that have incorporated jointly; Spanish is the primary language. Corrales de Saenz was founded in the mid-1760s by local ranchers Miguel, Gerónimo, and Juan Ángel Saenz, followers of José de Escandón from the Spanish colonial city of Mier, and it is possible that what came to be known as Roma, Los Saenz and Ciudad Miguel Alemán were originally part of the same city, San Pedro de Roma, Tamaulipas. The area was also known as Buena Vista and then Garcia Ranch.

In 1848, when the area became a part of the United States, the City's name was changed from Roma-Los Saenz to Roma, suggested by the Oblates of Mary Immaculate, who founded a mission there in the mid-1850s. The settlement had the only post office in Starr County in 1848.

From 1850 to 1900 Roma was the westernmost port on the Rio Grande for the flatboats and steamers carrying cotton downstream. In 1904 it had a population of 521. During the years of the Mexican Revolution, 1910–1917, many refugees sought haven in the historic "Pink House," now the Knights of Columbus Hall. In 1925 the railroad was extended to Rio Grande City and new roads were built to Roma. The first international bridge, a unique suspension bridge, was constructed in 1927; a new concrete bridge was built in 1979.

In the early 1930s oil and gas were discovered near Roma, and many oil-crew families moved there. In 1931 Roma had a population of 1,000 and thirty businesses. Melon-packing plants and two cattle-auction barns were built in the early 1950s. The completion of Falcon Dam in 1953 assured control of flooding in the area. Father Pierre Keralum designed the first church in 1854, the tower of which forms a part of Our Lady of Refuge Church, dedicated in 1965.

An 1840 structure houses the Roma Historical Museum, organized in 1971, when Roma was designated a national historic district. More than a dozen homes have been restored and marked with Texas state medallions around the main plaza, where the Marlon Brando movie *Viva Zapata* was made. Roma is one of the best remaining Spanish colonial townsites in the lower Rio Grande Valley. Many of the structures, including the Pink House and the Manuel Guerra home, were designed by noted German architect Heinrich Portscheller during the 1880s.

The population in Roma has grown steadily from 2,154 in 1970 to 8,059 in 1990. Since 1979 a new water treatment plant (WTP), a 500,000-gallon elevated water storage tank (EST), a new fire and police building, and a new community center have been constructed. By 1990 dry-land farming to the north, with 100,000 acres of irrigated river bottom around the city, provided a strong agricultural base. In 1990 the new Roma High School was dedicated 1.5 miles west of the city. In 1991 Roma had forty-five businesses. The population was 9,617 in 2000.

The City is a rapidly growing community that encompasses a diverse range of built environments. Quiet cul-de-sacs and a busy arterial transportation corridor exist in close proximity. Originating from the assemblage of multiple development areas and bordering an international boundary, the City gains much of its character from the local political geography. The City was incorporated as a combination of many areas, and this background still produces areas of special character today. Currently, the City is widely known as a community of neighborhoods.

Currently, the City covers approximately 2.9 square miles (sq mi) of land and the extraterritorial jurisdiction (ETJ) covers an additional 3.0 sq mi. The estimated population within the City (incorporated limits) is 9,765 residents (population based on 2010 US Census).

However, approximately only half of the population served by the City is actually located within the incorporated city limits, so the total population served by the City in 2010 was 18,467. As stipulated by Chapter 42 of the Texas Local Government Code, based on the City's population size, the City's ETJ extends 1.0 mile beyond the City limits, as referenced in Exhibit 1-1. However, because of the Rio Grande River boundary and other cities adjacent to Roma, the City's ETJ only exists primarily to the north.

The Study Area also incorporates four water supply corporations (WSC). A WSC is a legally chartered corporation operating under the laws of the State of Texas for the purpose of furnishing potable water (and/or in some cases wastewater) utility service for rural residents as described in its Certificate of Convenience and Necessity (CCN). Each WSC's CCN boundary encompasses its service area and may either surround or be adjacent to nearby cities or other WSCs. A layout of the CCN area for each Study participant is presented in Exhibit 1-2.

PROJECT SCOPE AND GOALS

One of the primary functions of municipalities is to ensure public health and safety through the provision of basic utility services, particularly potable water and sanitary sewer. However, in the case of the Study Area, growth over the last 75 years in the more rural parts of Starr County has been accommodated through development of WSCs in combination with municipal growth. This method of utility service development has resulted in a complex utilities situation.

The Study Area's historical reliance on multiple, individual utilities to provide basic water and wastewater services ensured more local oversight of utility operations and associated taxes and fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall Study Area has grown. For example, there are several water treatment facilities in the Study Area, whereas many similar-sized communities function efficiently and cost-effectively with only one large treatment facility for each type of service.

Such economies of scale in other communities provide benefits such as:

- More unified administration, operations, purchasing;
- Cost sharing for staff training and certification;
- Substantially reduced paperwork, monitoring, reporting and enforcement activity associated with each treatment plant; and
- Typically much lower cost of treatment per gallon.

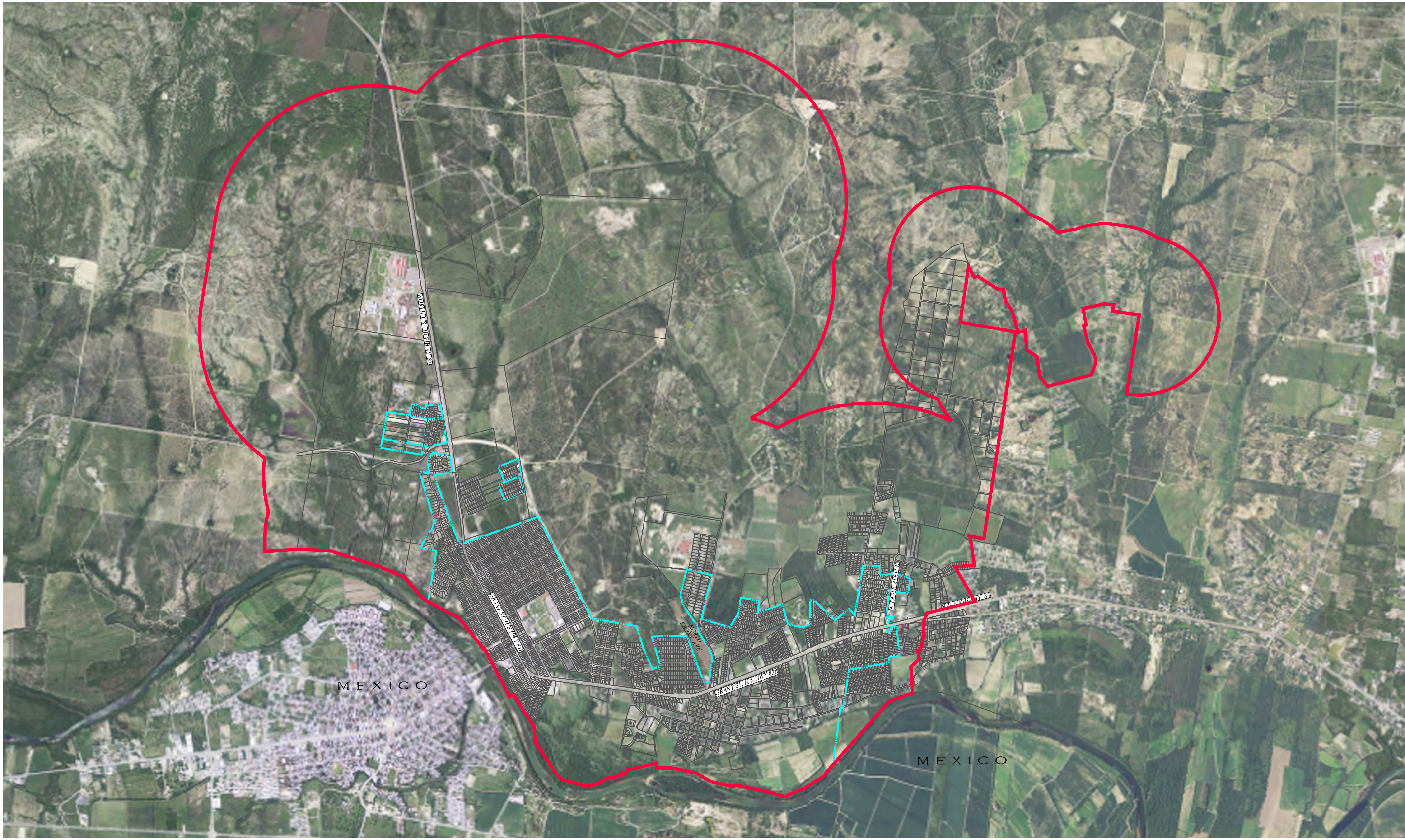


EXHIBIT 1-1
CITY OF ROMA EXISTING CITY LIMITS
AND ETJ BOUNDARY

N
500 0 1500
SCALE IN FEET

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street, Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

11-5287
06/21/2012

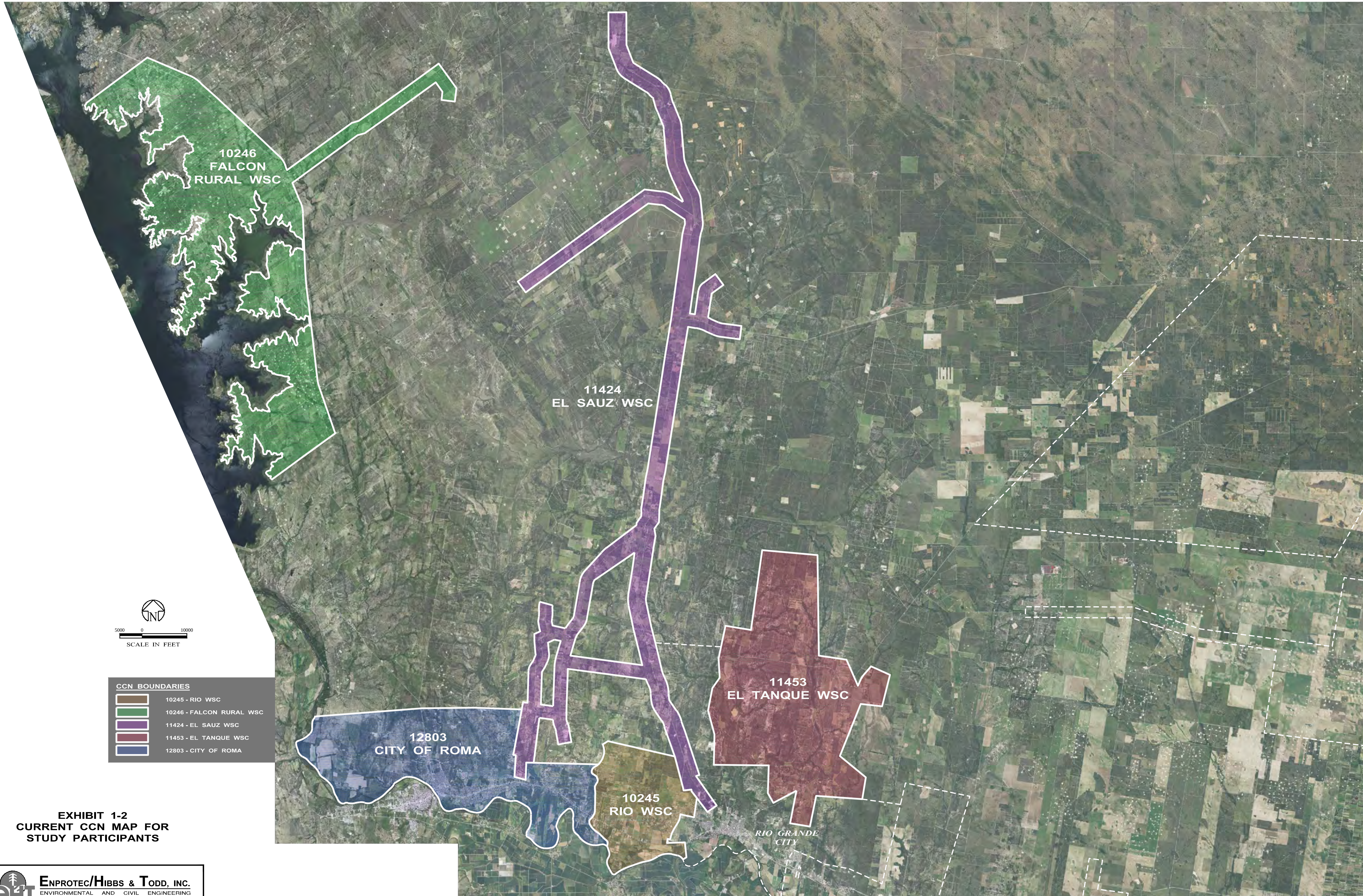


EXHIBIT 1-2
CURRENT CCN MAP FOR
STUDY PARTICIPANTS

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
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Firm Registration No. 1151

11-5287
06/21/2012

Two key issues will significantly impact the course of this Study. First, regional water planning for the entire Lower Rio Grande Valley reflects an anticipated tripling of the area's population over the next 50 years, with an associated doubling of water demand over the same period. This means that existing WTP facilities will have insufficient capacity in the very near future and will require some amount of expansion. Second, water quality in the Rio Grande River is anticipated to continue to degrade in the future and may require additional treatment to meet current or future regulatory requirements.

This Study addresses these key issues and the fundamental questions of how particular regionalization alternatives might be accomplished and whether they would be feasible given the identified technical challenges and cost implications. This should lead to technically sound engineering master plans to guide ongoing water system investments and management activities by the City and others.

The proposed regional planning area in this Study Area includes the City of Roma's incorporated limits and ETJ (refer to Exhibit 1-1) and the CCN areas of the participating WSCs adjacent to the City (refer to Exhibit 1-2).

The tasks included in this Study are as follows in Table 1-1.

Table 1-1
Study Tasks

Task	Description
Task I	Service Area Description
Task II	Determination of Water System Demands
Task III	Prepare Water Treatment System Alternatives
Task IV	Prepare Water Distribution System Alternatives
Task V	Water Operation Alternatives
Task VI	Implementation Schedule
Task VII	Determination of Costs and Recommendations
Task VIII	Evaluation of Funding Options and Alternative District Consolidations/Regional Structure
Task IX	Development of Regional Water Conservation and Drought Management Plans
Task X	Reports
Task XI	Environmental Assessment
Task XII	Meetings

PARTICIPANTS

The Study Area includes five individual entities as planning participants (listed in Table 1-2). Refer to Exhibit 1-2 for a map of the Study Area participants. Rio Grande City (RGC) is not included.

Table 1-2 Regional Planning Participants
City of Roma
Falcon Rural WSC
El Sauz WSC
El Tanque WSC
Rio WSC

SERVICE AREAS

The service areas included in this Study are a mixture of rural residential and urban residential, commercial and industrial areas. In several of the WSCs (including Falcon Rural WSC, El Sauz WSC and El Tanque WSC), growth and development in their respective service areas have occurred almost completely along roadway corridors such as US Highway 83 or various Farm-to-Market (FM) roads. In the City of Roma and Rio WSC, their respective service areas have developed similarly to other small rural communities, with varying areas of residential, commercial and industrial growth not limited by proximity to major roadways.

EXISTING WATER FACILITIES

Study Area residents are supplied water by one of the participants operating within the Study Area. Historically, the source of raw water for the Study Area has been the Rio Grande River. In one case the participants pump and treat Rio Grande River water themselves; in other cases several of the WSCs only have the capability to purchase treated surface water from other utilities. As a result, the basic concepts for regionalization offer unique opportunities for the participants in the Study Area.

The existing water production and distribution facilities vary throughout the Study Area. This is largely because each utility was created and developed at different times, with different growth rates, and with different design criteria. The various ages, technologies, and design methods can be attributed to these reasons. By using information directly from each entity and from the Texas Commission on Environmental Quality (TCEQ) data, a representation of the existing infrastructure was developed. However, more detailed information on the age, condition, and remaining useful life of the individual water plants and various distribution system components was not readily available for all the participating utilities during the development of this Study.

Data that was collected and considered on existing water supplies, WTPs, and the various utility distribution systems is presented in the following sections.

EXISTING WATER SOURCES

Of the five participants in the Study Area, only three of the five participants currently own any water rights at this time: Roma; Falcon Rural WSC; and Rio WSC. Since three of the five participants are currently purchasing water wholesale from Rio Grande City, this situation is not surprising. The breakdown of water rights owned by each participant is listed in Table 1-3.

Table 1-3
Current Participant-Owned Water Rights

Study Participant	Municipal Water Rights (ac-ft)	Class A Irrigation Water Rights (ac-ft)	Class B Irrigation Water Rights (ac-ft)
City of Roma	2,841.18	551.40	588.25
Falcon Rural WSC	249.00	0.00	0.00
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**

Notes
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.

While the City of Roma appears to have sufficient water rights at this time, the actual secure volume of water available annually (firm yield) is less certain. While municipal water rights are guaranteed for each entity, in the Rio Grande Valley, irrigation water rights have historically received the lowest priority for withdrawal of water from the Rio Grande River. Furthermore, Class A irrigation water rights also tend to receive higher priority than Class B irrigation water rights. Therefore, in the case of a drought (based on when Lake Amistad and Lake Falcon are operating at less than 50% level), an entity should be able to count on its municipal water rights for raw water usage, but it is likely that the irrigation water rights will not be available. In essence, each utility that balances a combination of municipal and irrigation water rights is gambling that sufficient water rights will be available in the event of a drought. This situation of municipal rights taking seniority over irrigation rights is unique to this part of the State of Texas, whereas in almost every other area of the State the active rule is “First in time, first in right.” As a result, in the Rio Grande Valley, municipal rights generated in 2012 have the same seniority as municipal rights generated in 1980, which is far different from the rest of the State.

The United States’ share of water stored in Amistad and Falcon Reservoirs and diverted from the lower and middle Rio Grande River for domestic, municipal, industrial, and irrigation purposes is administered by the TCEQ in compliance with the decision of the Thirteenth Court of Civil Appeals in the landmark case styled “State of Texas, et al. vs. Hidalgo County Water Control and Improvement District No. 18, et al." and commonly referred to as the Rio Grande Valley Water Case. The original suit was filed by the State of Texas in 1956 to restrain the diversion of water from the Rio Grande for irrigation when the share of water due the United States from water impounded in Falcon Reservoir was 50,000 acre-feet (ac-ft) or less. The storage amount of 50,000 ac-ft was the quantity of water that the Texas Board of Water Engineers (a predecessor agency to the TCEQ) had determined at that time to be necessary to meet municipal, domestic and livestock demands for a three-month period without additional inflows into Falcon Reservoir. Earlier efforts to apply voluntary restrictions on diversions of water had collapsed due to severe drought conditions and the consequent shortage of water supplies[1].

The original trial of the Valley Water Case lasted from January 1964 to August 1966, and the final judgment of the appellate court was entered in 1969. In 1971, the Texas Water Rights Commission (a predecessor agency to the TCEQ) adopted rules and regulations implementing the court decision. According to the 1969 judgment rendered in this case, a storage reserve in Falcon Reservoir equal to 60,000 ac-ft was established to meet municipal and industrial demands and a total of approximately 155,000 ac-ft of water rights (annual usage) was allocated for domestic, municipal and industrial (DMI) uses. This sets the initial basis for municipal water rights allocation in the Rio Grande Valley. Irrigation water from the Rio Grande was allocated for 742,808.6 acres of agricultural land below Falcon Dam. Of this amount, 641,221 acres were assigned Class A irrigation rights, and the remaining acres were awarded Class B irrigation rights.

Whereas municipal uses, which include uses for domestic, industrial, manufacturing, and steam electric power generation purposes, were granted the highest water supply priority, the result of the Valley Water Case was to establish a weighted priority system along the lower Rio Grande for allocating the remaining surface water supply to irrigation (and mining) uses. The two classes of irrigation water rights that were established, (Class A and Class B) today provide a means for differentiating the rates at which water is credited to individual irrigation storage accounts in Amistad and Falcon Reservoirs. The Class A water right accrues water at a rate 1.7 times greater than the Class B water right. Although this weighted priority system for irrigation water users generally has little significance during years when water is abundant, its effect in water-short years is to distribute the shortage among all users, with the greater shortages occurring on lands with the Class B water rights.

As a result of the Lower Rio Grande Valley Water Case, rules have been adopted by the State's water agency (now the TCEQ) that regulates the operation of lower and middle Rio Grande River system and the allocation of water among all users. The rules applied by the TCEQ in administering mainstream water rights in the Lower and Middle Rio Grande River Basins affect not only the amount of water that can be diverted from the Rio Grande River and its tributaries, but also the operation of the storage pools in Amistad and Falcon Reservoirs. The current rules provide a reserve of 225,000 ac-ft of storage in Amistad and Falcon Reservoirs for domestic, municipal and industrial uses, which is referred to as the "DMI pool," and an operating reserve that fluctuates between 380,000 ac-ft and 150,000 ac-ft, depending on the amount of water in

[1] Discussion on allocation of water rights in Rio Grande Valley from 2011 Region M Regional Water Plan.

conservation storage in the reservoirs. The stated purpose of the operating reserve in the TCEQ rules is to provide for:

1. Loss of water by seepage, evaporation and conveyance;
2. Emergency requirements; and
3. Adjustments of amounts in storage, as may be necessary by finalization of the International Boundary and Water Commission (IBWC) provisional United States-Mexico water ownership computations.

The operating reserve is calculated monthly by multiplying the percentage of total United States conservation storage in the Amistad-Falcon system times the maximum operating reserve of 380,000 ac-ft. The calculated reserve cannot be less than 275,000 ac-ft, unless there is insufficient water stored in the reservoirs, in which case, the balance of the water in storage, after allocations for the DMI pool and irrigation account balances, is assigned to the operating reserve. Under no circumstances can the operating reserve be less than 75,000 ac-ft, unless in emergency situations or as determined by the Watermaster.

Consideration is being given to revising the TCEQ's Rio Grande operating rules by altering the storage amounts for the DMI reserve and the operating reserve. Investigations of the impacts of different reserve amounts on overall water availability and the yield of the Amistad-Falcon reservoir system are being undertaken in the Region M water supply planning study. The Watermaster administers the water allocations to municipal/domestic, industrial, agricultural and other user storage accounts. Such allocations are based on the available water in storage in Falcon and Amistad Reservoirs, as reported by the IBWC on the last Saturday of each month, less dead storage. To determine the amount of water to be allocated to various accounts, the Watermaster makes the following computations at the beginning of each month:

1. From the amount of water in usable storage, 225,000 ac-ft are deducted to re-establish the reserve; i.e., the DMI pool, for domestic, municipal, and industrial uses; hence, these uses are given the highest priority;

2. From the remaining storage, the total end-of-month account balances for all lower and middle Rio Grande irrigation and mining allottees are deducted; and,

3. From the remaining storage, the operating reserve is deducted.

After the above computations are made, the remaining storage, if any, is allocated to the irrigation and mining accounts. The allotment for irrigation and mining uses is divided into the Class A and Class B water rights categories. Class A rights (allottees) receive 1.7 times as much water as that allotted to Class B rights. An irrigation allottee cannot accumulate in storage more than 1.41 times its annual authorized diversion right, and, if an allottee does not use water for two consecutive years, its account is reduced to zero. If there is not sufficient water in storage to fully restore the operating reserve in Step 3 above, then the TCEQ rules authorize the

Watermaster to make negative allocations of water from the irrigation and mining accounts in sufficient amounts to provide the minimum 75,000 ac-ft of operating reserve capacity.

In addition, when considering converting irrigation water rights to municipal water rights, the class of irrigation rights impacts the final amount of municipal water rights created. Class A irrigation water rights typically convert to municipal at a rate of 50%; in other words, 1,000 ac-ft of Class A irrigation water rights would convert to 500 ac-ft of municipal water rights. However, Class B irrigation water rights typically converts to municipal at a rate of 40%; in other words, 1,000 ac-ft of Class B irrigation water rights would convert to 400 ac-ft of municipal water rights. In addition, once the irrigation water rights are converted to municipal use, the seniority of the converted water rights do not take precedence over older municipal water rights owned by other utilities. However, TCEQ now allows for the merging of newly converted municipal water rights into a utility's oldest water rights account, so a utility can take advantage of the age of the older water rights to gain seniority now for the newly converted water rights. Table 1-4 shows potentially available municipal water rights for each Study participant as a result of completing conversion of irrigation water rights to municipal.

Table 1-4
Potential Total Municipal Water Rights

Study Participant	Current Municipal Water Rights (ac-ft)	Converted from Class A Irrigation Water Rights (ac-ft)	Converted from Class B Irrigation Water Rights (ac-ft)	Total Potential Municipal Water Rights (ac-ft)
City of Roma	2,841.18	275.70	235.30	3,352.18
Falcon Rural WSC	249.00	0.00	0.00	249.00
El Sauz WSC	0.00	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00	0.00
Rio WSC	527.11	0.00	197.80	724.91
Total	**3,617.29**	**275.70**	**433.10**	**4,326.09**

Notes
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.
2 - Water right conversion rates per Rio Grande River Watermaster.

It appears that the existing amount of water rights owned by each Study participant will not be sufficient to meet raw water supply requirements over the next thirty years, regardless of the regionalization alternative ultimately recommended at the end of this Study. Therefore, additional water supplies will need to be developed for each utility. A detailed discussion of potential water supply alternatives is included in TM No. 2.

EXISTING WATER PLANTS

There are currently two existing WTPs operating within the Study Area that provide water directly to customers in the service area (Roma and Falcon Rural WSC). The other participants are served by a WTP outside of the Study Area. In addition to these plants, Rio WSC is currently in the design/construction phase of a new WTP. This plant is anticipated to begin operations in 2012 or 2013. An additional discussion for the Rio WSC WTP is included in the WTP Alternatives TM. The physical addresses and representative treatment capacities of the WTPs within the Study Area are shown in Table 1-5.

Table 1-5
Existing Water Treatment Plants

Number	Name	Location	Current Permitted Capacity
1	City of Roma WTP	803 N Portscheller St.	5.15 mgd
2	Falcon Rural WSC WTP	439 River Rd.	1.30 mgd
Total Permitted Capacity = 6.45 mgd			

Both of the existing WTPs (and the proposed new Rio WSC WTP) in the Study Area use conventional treatment technology, which consists of coagulation, flocculation, sedimentation and filtration. Conventional treatment technology is intended to remove suspended particulate matter from the raw water and to reduce total organic carbon (TOC) from the water. While both WTPs currently meet primary drinking water standards (PDWS) using conventional treatment technology, the water quality in the Rio Grande River continues to degrade as more and more WWTP effluent is discharged into the Rio Grande River. As a result, total dissolved solids (TDS), chlorides and sulfates are continuing to increase, which cannot be treated using conventional treatment technology. Additional discussions on future water quality and potential treatment requirements will be included in the Water Treatment Alternatives TM. Additional information on the existing WTPs located in the Study Area is discussed below.

Falcon Rural WSC WTP

The Falcon WTP is approximately 30 years old, though an expansion and upgrade was completed a little over 10 years ago. The WTP processes are based on conventional treatment technology. The WTP consists of one clari-cone sedimentation basin and a package filter system. The WTP is rated for 1.3 million gallons per day (mgd); with the average demand at approximately 0.8 mgd, the WTP is operating at 62% of its rated capacity. While the WTP has additional treatment capacity available, many of the process components at the WTP are approaching the end of their useful life. Also, the utility does not own any adjacent property, so capacity of the existing WTP is limited to the existing treatment capacity at the existing WTP site. In addition, the Falcon WSC operators do not maintain staff onsite at the WTP at all times, so when emergencies occur at the WTP, there is typically some delay before operators can respond to WTP issues.

There are also issues with the raw water system used by the Falcon WTP. Raw water is pumped from the Rio Grande River from a raw water pump station (RWPS) located adjacent to the Rio Grande River. The RWPS is set at an elevation slightly above the normal Rio Grande River water surface elevation, so during times of Rio Grande River flooding, the

RWPS becomes completely submerged, resulting in loss of raw water pumping and therefore loss of finished water production at the WTP.

In addition, the Falcon WTP does not have the use of a raw water storage reservoir (similar situation in Roma). While this does not present a problem for the majority of the year, there are situations when a raw water reservoir would be necessary. For example, from time to time the RWPS equipment must be taken offline for service. During this period, the WTP could remain in operation by withdrawing raw water from the storage reservoir. This capability is extremely critical when the RWPS must undergo emergency service, which may take more than a few hours to complete. Another example is if maintenance is needed at the Falcon and/or Amistad dams, then the WTP could continue to operate for a period of time (typically 1-3 weeks depending on reservoir size) while the dams are being serviced. Since Falcon does not have a reservoir for its WTP, daily WTP operation and therefore finished water production, is limited by the available water in the Rio Grande River.

As discussed previously, Falcon WSC does not own sufficient surface water rights to meet demands through the end of the planning period (2040). In fact, Falcon does not own sufficient water rights to meet its current demands. For the past 20 years, Falcon has had to lease additional water rights on an annual basis from nearby utilities, such as the City of Roma. While this arrangement has worked well in the past, many utilities (including Roma) are approaching the limit of their current water rights themselves.

City of Roma WTP

The City of Roma WTP is approximately 40 years old, though an expansion and upgrade was completed roughly 15 years ago (Refer to Exhibit 1-3). As discussed before, the process is based on conventional treatment technology. The WTP consists of two circular sedimentation basins and a conventional dual-media filter system that uses sand and anthracite coal. The WTP is rated for 5.15 mgd; with the average demand at approximately 2.5 mgd, the WTP is operating at 49% of its rated capacity.

The WTP was designed fifteen years ago to serve approximately 5,900 connections in its design year, which was set for 2015. However, due to higher than anticipated growth in the area, the City reached and exceeded the projected 2015 connection count several years ago. At this time, the City services approximately 6,300 connections. In using TCEQ Chapter 290 design criteria for water systems, at 0.6 gallons per minute (gpm) per connection, a WTP size of 5.45 mgd is required at this time.

Since the City's average demand is less than half of the TCEQ calculated demand, the City requested an alternative capacity requirement (ACR) evaluation, which was granted by the TCEQ. However, an ACR is not permanent, so the City must move forward with conceptual planning for either an expansion (if feasible) or a completely new WTP facility.

EXHIBIT 1-3
CITY OF ROMA
EXISTING WATER TREATMENT PLANT

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151
11-5287
06/21/2012

In addition, while the WTP has additional treatment capacity available, many of the process components at the WTP are approaching the end of their useful life. The existing facility has been upgraded and expanded several times, and it appears that without purchasing additional property adjacent to the WTP site, it may not be feasible to expand the existing WTP further. Therefore, in the following Water Treatment Alternatives TM (TM No. 3), several options will be considered for the City with regard to the ultimate fate of the existing WTP site.

There are also issues with the raw water system used by the City of Roma. Raw water is pumped from the Rio Grande River from a RWPS located adjacent to the Rio Grande River up to the WTP which sits atop the cliffs overlooking the Rio Grande River. While the City's RWPS is set at an elevation similar to that of the Falcon RWPS, the City has implemented electrical and control improvements that allow for operation of the RWPS even when fully submerged in a river flooding event. However, the City has had continual issues with river debris clogging the RWPS creating periods of downtime for both the City's RWPS and WTP.

Similar to Falcon WSC, the City's WTP does not have the use of a raw water storage reservoir. Since the City of Roma does not have a reservoir for its WTP, daily WTP operation and therefore finished water production, is limited by the available water in the Rio Grande River. Depending on the regionalization alternative ultimately recommended in this Study, the need for a raw water storage reservoir becomes exceedingly critical.

The City has sufficient water rights to meet treatment goals at this time and likely through the next 5-10 years. However, similar to Falcon WSC, the City does not own sufficient water rights to meet demands through the end of the planning period (2040).

In the past, the City's water demands have been low enough to allow for leasing extra water rights on an annual basis to nearby utilities, such as Falcon WSC. While this arrangement has worked well in the past, the water demand in Roma has increased to the point that the City must now focus first on storing reserve water for high water demand periods before leasing any additional water. While this change in the City's water rights management strategy helps to protect the City during high water demand periods, it puts an even greater strain on nearby rural WSCs. Regardless of the ultimate regionalization alternative recommended in this Study, the City will need to pursue obtaining additional water rights and/or developing additional water supplies to meet future water demands. Additionally, depending on the recommended regionalization alternative, the City may also need to obtain additional water rights above and beyond their future needs to meet regional demands.

El Sauz WSC

El Sauz WSC does not have an existing WTP facility; instead, El Sauz purchases treated water wholesale from Rio Grande City (RGC). To meet current water demands, RGC is in the process of constructing a new 6.0 mgd WTP at the western end of its CCN area. However, in reviewing population projections from the 2011 Region M Water Plan and from the TCEQ Water Utility Database, it appears that the new WTP may not have sufficient capacity to meet anticipated water demands in this service area for the next thirty years without further expanding the new WTP facility.

While El Sauz has not faced the same O&M issues as Roma and Falcon WSC have, by operating as a wholesale water purchaser, El Sauz has been at the mercy of operational issues faced by RGC. Because El Sauz is located at the far end of RGC's system, when problems occur in the RGC water system, it may take a significant amount of time for El Sauz to be notified of a potential disruption in their water supply. In addition, being located at the far end of the RGC system could lead to high water age, which leads to loss of disinfectant residual in the water and the potential for producing disinfection byproducts (DBP) such as trihalomethanes (THM) at disinfectant booster locations. Furthermore, El Sauz has experienced periods of high demand when RGC could not provide sufficient water.

El Sauz WSC does not have the water rights or the proximity to a surface water source to consider constructing their own WTP. Per the TCEQ Water Rights Database, El Sauz WSC does not own any surface water rights at this time. Since El Sauz does not own any water rights, they must pay a higher cost per 1,000 gallons for wholesale water from RGC.

El Tanque WSC

El Tanque WSC also does not treat water on its own; instead, El Tanque purchases treated water wholesale from RGC. As with the population projection review for El Sauz WSC, it appears that the new RGC WTP may not have sufficient capacity to meet anticipated water demands in the El Tanque WSC service area for the next thirty years without further expanding the new WTP facility.

Since El Tanque is also located at the far end of RGC's system (northeast of RGC, as opposed to El Sauz WSC being located to the northwest of RGC), when problems occur in the RGC water system, it may take a long time for El Tanque to be notified of a potential disruption in their water supply. In addition, being located at the far end of the RGC system could lead to high water age, which leads to loss of disinfectant residual in the water and the potential for producing DBPs such as THMs at disinfectant booster locations. Furthermore, El Tanque has experienced periods of high demand when RGC could not provide sufficient water. While the water demands in the El Tanque WSC service area are lower than TCEQ standards for gpm per connection, additional water is necessary to meet demands.

Similar to El Sauz, El Tanque WSC does not have the water rights or the proximity to a surface water source to consider constructing their own WTP. Per the TCEQ Water Rights Database, El Tanque WSC does not own any surface water rights at this time. Since El Tanque does not own any water rights, they must pay a higher cost per 1,000 gallons for wholesale water from RGC.

Rio WSC

Rio WSC also does not currently treat water on its own; instead, Rio purchases treated water wholesale from RGC. As with the population projection review for El Sauz and El Tanque, it appears that the new RGC WTP may not have sufficient capacity to meet anticipated water demands in the Rio WSC service area for the next thirty years without further expanding the new WTP facility.

Rio WSC is also located at the far west end of RGC's system, which causes the same operational problems that El Sauz and El Tanque have. Furthermore, Rio has also experienced periods of high demand when RGC could not provide sufficient water, as recent as this past summer. While the water demands in the Rio WSC service area are lower than TCEQ standards for gpm per connection, additional water is necessary to meet demands.

In light of these issues, Rio WSC is moving forward with design and construction of its own WTP. Despite multiple requests for information, little design information for the new WTP has been provided to the Study team. However, in comparing TCEQ Water Rights Database data to current demands, it appears that while Rio WSC owns sufficient surface water rights to meet current water demands at this time, it does not appear to own sufficient water rights to meet projected water demands through the end of the planning period of this Study. Therefore, depending on the regionalization alternative recommended in this Study, Rio WSC may need to continue obtaining additional water rights to meet its service area water demands in the future.

EXISTING WATER DISTRIBUTION SYSTEM

The existing water distribution system throughout the Study Area consists of water transmission and distribution piping of various sizes, types and ages. Each utility is responsible for construction and maintenance of its individual distribution system. Age, condition, type and sizing of water lines were evaluated in this Study only to the extent of determining necessary improvements when considering potential regionalization alternatives. Further evaluation of the individual systems would require the development of a combined utility-wide system model, which was not included in the scope of this Study.

Storage was also evaluated throughout the City's water system with regard to other potential improvements in efficiency and/or safety. The TCEQ has specific requirements with regard to minimum provided ground storage and elevated or pressure storage for water systems in Texas. TCEQ has a minimum requirement of 200 gallons of total storage per connection, with half of the storage capacity being provided either as elevated storage (from an elevated storage tank) or as pressure storage (from a hydropneumatic tank). Refer to Table 1-6 for the current storage capacity for each participant in this Study.

Table 1-6 Existing Storage Capacity			
Participant	**Current Elevated / Pressure Capacity (MG)**	**Current Ground Storage Capacity (MG)**	**Current Total Storage Capacity (MG)**
City of Roma	0.800	0.768	1.568
Falcon Rural WSC	0.095	0.318	0.413
El Sauz WSC	0.150	0.000	0.150
El Tanque WSC	0.089	0.210	0.299
Rio WSC	*0.003*	0.598	0.601
TOTAL	**1.137**	**1.894**	**3.031**
Note - Sizes shown in italic reflect storage capacities that appear to be inadequate as compared to TCEQ 290.45 design criteria.			

The distributions systems in the Study Area vary greatly, depending on whether the system is in a rural area or in or near a city. The similarities and differences between each distribution system in the Study Area are discussed below. Additional discussions on potential distribution regionalization alternatives will be included in the Water Distribution System Alternatives TM.

Falcon Rural WSC

The Falcon WSC distribution system is approximately 30 years old, though line upgrades are completed as necessary (Refer to Exhibits 1-4 and 1-5). The transmission/distribution system consists primarily of a trunk line that parallels Highway 83. The trunk line varies between 4-inch and 8-inch pipelines, with smaller lines branching off to individual connections and subdivisions throughout the service area.

Initial storage and system pressure is provided directly from the WTP, with offsite storage being provided by several offsite booster pump stations that include ground storage tanks and standpipes. Due to the small line sizes in multiple locations, pressure losses in the system are likely higher than other similarly-sized municipal systems. Excessive line pressures can also reduce the useful life of piping and can often cause failures at pipe joints resulting in excessive water losses, which has been observed by the Falcon WSC operators.

Current problems with the system include insufficient system pressure and volume at various times of the year, inadequate pipeline sizes, excessive water losses in the distribution system and lack of viable interconnections with nearby utilities. The closest opportunities for potential interconnections are either the City of Roma or the City of Zapata.

SCALE IN FEET (1000 0 3000)

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-4
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM
(1 OF 2)

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EXHIBIT 1-5
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM
(2 OF 2)

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City of Roma

The City of Roma distribution system age varies, from approximately 50 years old to less than 10 years old in areas (Refer to Exhibit 1-6). While the transmission/distribution system does consist primarily of trunk lines that parallel Highway 83, the City's distribution system provides for looping throughout the City. The trunk line varies between 10-inch and 12-inch pipelines, with smaller lines branching off to individual connections and subdivisions throughout the City's service area.

Initial storage and system pressure is provided directly from the WTP, with offsite storage being provided by several booster pump stations that include ground storage tanks and standpipes. The City also has a 0.5 million gallon (MG) elevated storage tank (EST) located at the north end of the city, a small 0.1 MG EST located at the WTP and a new 0.3 MG EST on FM 649. The closest opportunities for potential interconnections are Falcon WSC, Rio WSC or the City of Rio Grande City.

El Sauz WSC

The El Sauz WSC distribution system is also approximately 30 years old, though line upgrades are completed as necessary (Refer to Exhibits 1-7 and 1-8). The transmission/distribution system consists primarily of trunk lines that parallel FM 3167 and FM 649. The trunk line size varies, with smaller lines branching off to individual connections and subdivisions throughout the service area.

Initial storage and system pressure is provided directly from RGC, with offsite storage being provided by several booster pump stations that include ground storage tanks and standpipes. Due to the small line sizes in multiple locations, pressure losses in the system are likely higher than other similarly-sized municipal systems. Excessive line pressures can also reduce the useful life of piping and can often cause failures at pipe joints resulting in excessive water losses.

Current problems with the system include insufficient system pressure and volume at various times of the year, inadequate pipeline sizes and excessive water losses in the distribution system. The closest opportunities for potential interconnections are the City of Roma, El Tanque WSC or Rio WSC.

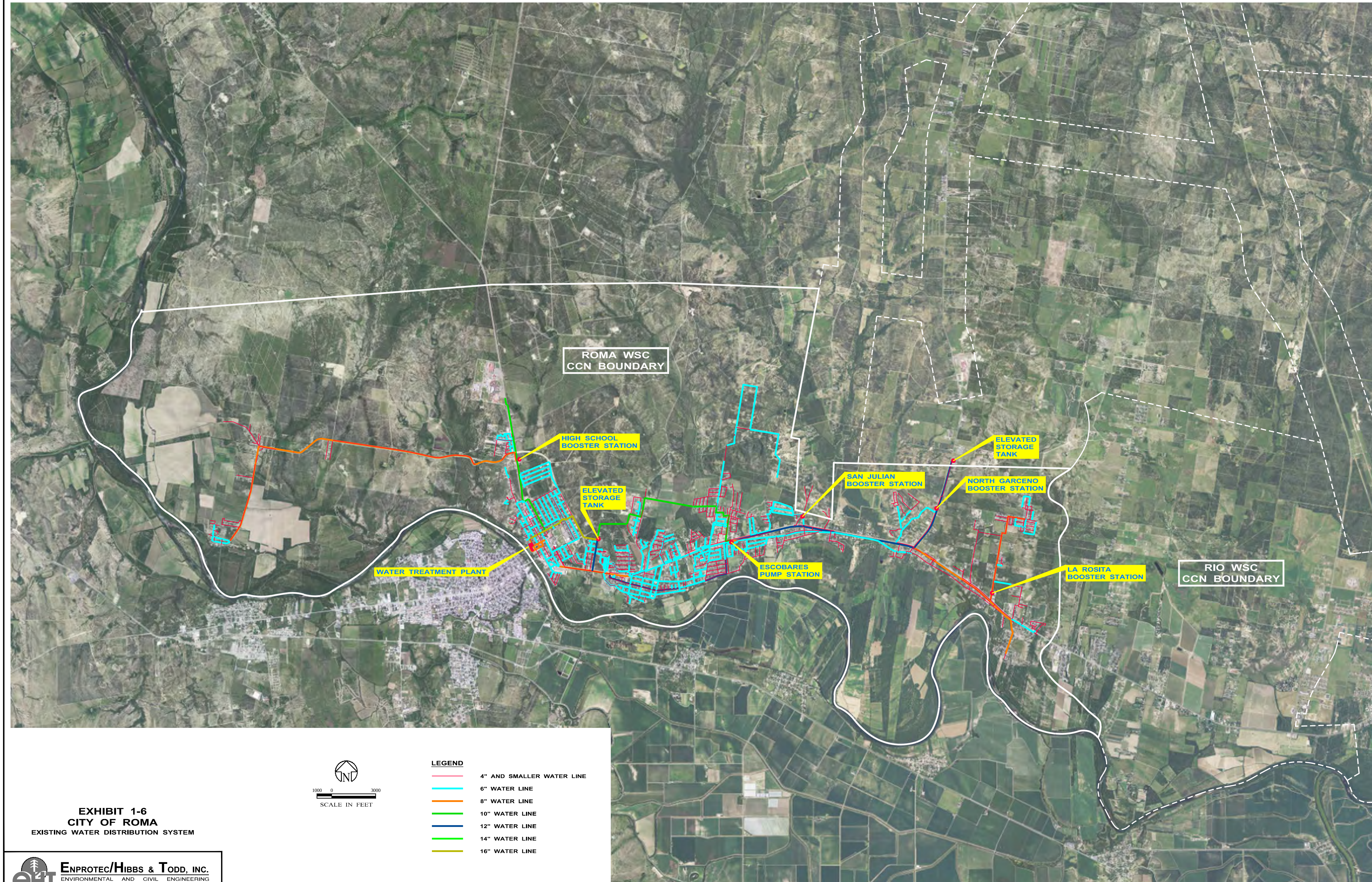

EXHIBIT 1-6
CITY OF ROMA
EXISTING WATER DISTRIBUTION SYSTEM

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1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-7
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM
(1 OF 2)

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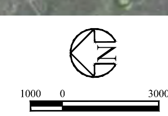

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-8
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM
(2 OF 2)

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El Tanque WSC

The El Tanque WSC distribution system is approximately 20 years old, though line upgrades are completed as necessary (Refer to Exhibit 1-9). The transmission/distribution system consists primarily of trunk lines that parallel FM 755, Old Charco-Blanco Road and La Sagunada Road. The primary trunk line is 6-inch, with smaller lines branching off to individual connections and subdivisions throughout the service area. However, El Tanque is also in the process of completing a United States Department of Agriculture Rural Development (USDA-RD) project to upgrade the majority of its 6-inch trunk lines to 8-inch.

Initial storage and system pressure is provided directly from RGC, with offsite storage being provided by several booster pump stations that include ground storage tanks and standpipes. While the primary trunk line is all 8-inch, the high amount of growth and subsequent water demand is exceeding the capacity of the system, resulting in pressure losses in the system that are likely higher than other similarly-sized municipal systems. Excessive line pressures can also reduce the useful life of piping and can often cause failures at pipe joints resulting in excessive water losses.

Current problems with the system include insufficient system pressure and volume at various times of the year, inadequate pipeline sizes and excessive water losses in the distribution system. The closest opportunities for potential interconnections are either El Sauz WSC or Rio WSC.

Rio WSC

The Rio WSC distribution system is approximately 20 years old, though line upgrades are completed as necessary (Refer to Exhibit 1-10). The transmission system consists primarily of trunk lines that parallel FM 3167 and Highway 83. However, this service area is more similar to the City of Roma’s water system in that the distributions system has looped sections throughout. The primary trunk lines are 6-inch and 8-inch, with smaller lines branching off to individual connections and subdivisions throughout the service area.

Current problems with the system include insufficient system pressure and volume at various times of the year, inadequate pipeline sizes and excessive water losses in the distribution system. The closest opportunities for potential interconnections are the City of Roma, El Sauz WSC or El Tanque WSC.

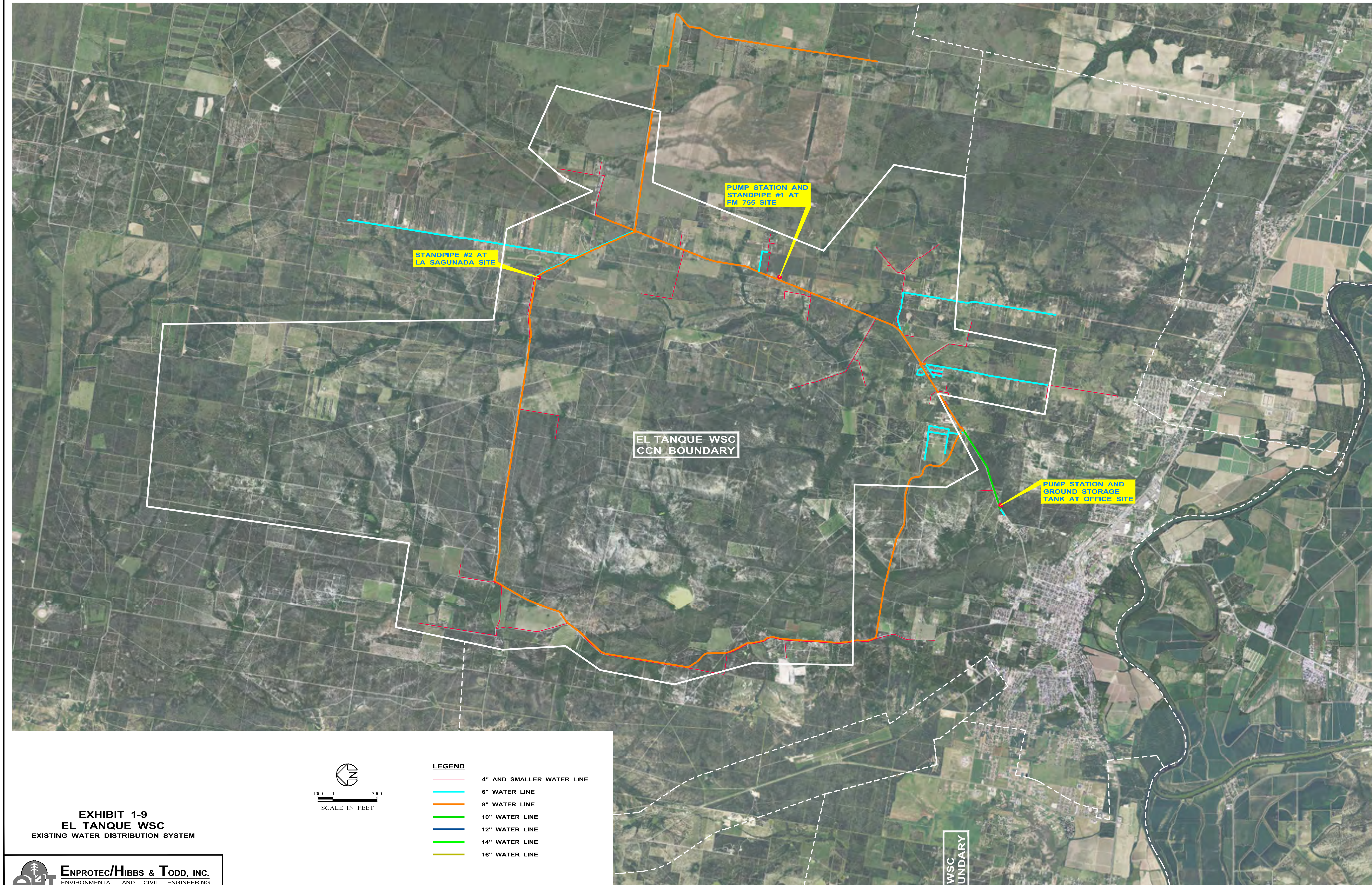

EXHIBIT 1-9
EL TANQUE WSC
EXISTING WATER DISTRIBUTION SYSTEM

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EXHIBIT 1-10
RIO WSC
EXISTING WATER DISTRIBUTION SYSTEM

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CURRENT AND PROJECTED POPULATION

Existing and projected population data was collected from the 2000 and 2010 Census, City and utility historical data, previous planning studies and WTP planning reports, the TCEQ Water Utility Database and the 2011 Region M Water Plan (RWP). While the 2010 Census data provided the most accurate data for the City of Roma, the data was not available for each specific WSC. In addition, the 2000 and 2010 Census data only provided population data for the population residing within the City of Roma's city limits and did not include the population served by the City within its ETJ. It was determined that many of the older planning studies and even the newer 2011 Region M RWP did not accurately match historical growth rates over the past 10-20 years when looking forward to future growth projections. It was also noted that there were some differences between the TWDB regional planning estimates and the current utility population data. A discussion of these differences and the methodology used to develop the planning period growth projections and water demands is included below. Existing and projected population growth projections are included in Table 1-7.

- The 2011 Region M RWP reflected a 2010 population of 11,989 for the City of Roma, which is used as the basis for future growth in the Region M RWP (this matches only the incorporated area). However, both the TCEQ WUD and City data reflect a much larger population (18,467) in 2010, accounting for the population served both within the City limits and in the City's ETJ. The combined City and ETJ population for Roma will be used in this Study.

- The 2011 Region M RWP reflected a 2010 population of 2,942 for the Rio WSC service area. The most recent TCEQ inspection (2008 as shown in the TCEQ WUD data) reflects a current served population of 3,900 so the more accurate population for Rio WSC will be used in this Study.

- The 2011 Region M RWP did not include separate 2010 populations for Falcon WSC, El Sauz WSC and El Tanque WSC. By reviewing historical regional facility plans, specific utility data and TCEQ WUD data, the following 2010 starting populations were developed for this Study: 2,600, 1,510 and 2,462, respectively.

- Growth projections for each area from historical planning studies reflected an annual growth rate of 1.0% or less, though growth in Roma has approached 1.5-2.0% annually over the past 10 years. The 2011 Region M RWP reflected an annual growth rate of 1.25% for Roma, and a rate of 3.0% or greater for the rural areas in Starr County. As the WSC service areas do not currently provide centralized wastewater service, it is not likely that those areas will grow at a rate exceeding cities such as Roma and Rio Grande City. Also, while it appears more conservative to use the projected growth rates from the Region M RWP for each participant in the Study, the City of Roma did not agree with the lower anticipated growth rate for the City, so the recommended respective growth rates are as follows:

- City of Roma Annual Growth Rate – 1.50%
- Falcon WSC Annual Growth Rate – 2.00%
- El Sauz WSC Annual Growth Rate – 2.35%
- El Tanque WSC Annual Growth Rate – 2.35%
- Rio WSC Annual Growth Rate – 2.39%

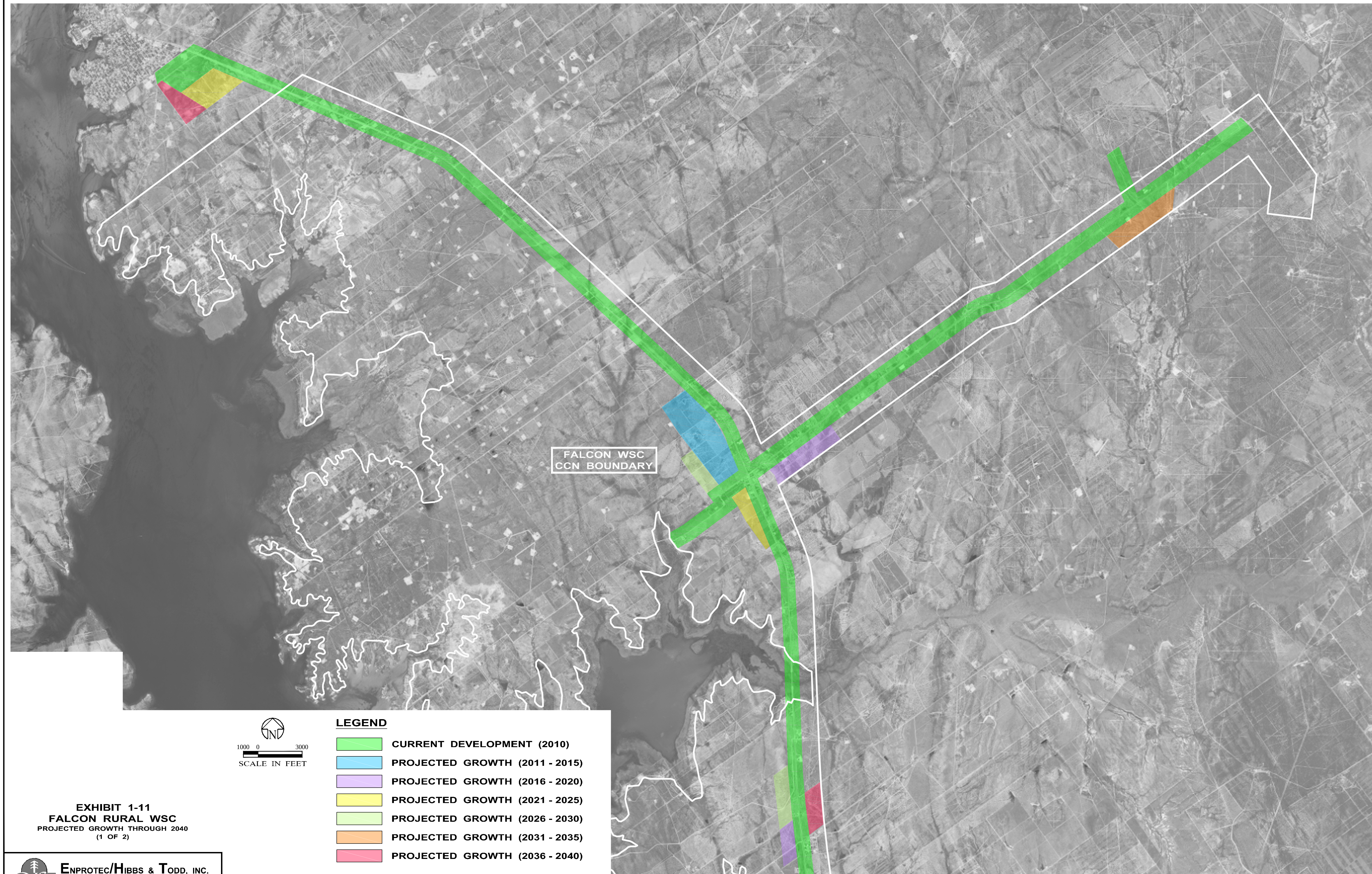
- Household population density factors were developed from utility data for each participant, dividing the population at a given time by the number of connections at that time. The population density ranged from as low as 2.13 people per household for Falcon WSC to as high as 4.08 for El Sauz WSC, with an average of roughly 3.1. Because there is such a large variance in population density, it is recommended that the historical population density factor be applied individually for each utility, as shown below:

  - City of Roma Household Population Density Factor – 2.93
  - Falcon WSC Household Population Density Factor – 2.13
  - El Sauz WSC Household Population Density Factor – 4.08
  - El Tanque WSC Household Population Density Factor – 3.12
  - Rio WSC Household Population Density Factor – 3.00

Table 1-7
Current and Projected Population Counts

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	18,467	19,852	21,341	22,941	24,662	26,512	28,500	37,050
Falcon Rural WSC	2,600	2,860	3,146	3,461	3,807	4,187	4,606	6,448
El Sauz WSC	1,510	1,687	1,886	2,107	2,355	2,632	2,941	4,323
El Tanque WSC	1,950	2,179	2,435	2,721	3,041	3,398	3,798	5,583
Rio WSC	3,900	4,366	4,888	5,472	6,126	6,858	7,677	11,347
Total Projected Population	**28,427**	**30,945**	**33,696**	**36,703**	**39,990**	**43,587**	**47,522**	**64,751**

In this Study, "buildout" is assumed to be 2060, to provide projection data for better comparison with Region M RWP data. While 2060 was set as the anticipated buildout milestone for each area, complete buildout is actually not likely to be completed by 2060. Significant open, undeveloped area is adjacent to each utility and in most cases, additional growth is only limited by the availability of adequate water and wastewater services. Currently, only a small portion of Starr County is developed and therefore, development of the Study Area could continue well past the anticipated buildout year of 2060. Anticipated growth and development within the service areas of the five Study participants are included in Exhibits 1-11 through 1-17.



LEGEND

- CURRENT DEVELOPMENT (2010)
- PROJECTED GROWTH (2011 - 2015)
- PROJECTED GROWTH (2016 - 2020)
- PROJECTED GROWTH (2021 - 2025)
- PROJECTED GROWTH (2026 - 2030)
- PROJECTED GROWTH (2031 - 2035)
- PROJECTED GROWTH (2036 - 2040)

EXHIBIT 1-11
FALCON RURAL WSC
PROJECTED GROWTH THROUGH 2040
(1 OF 2)

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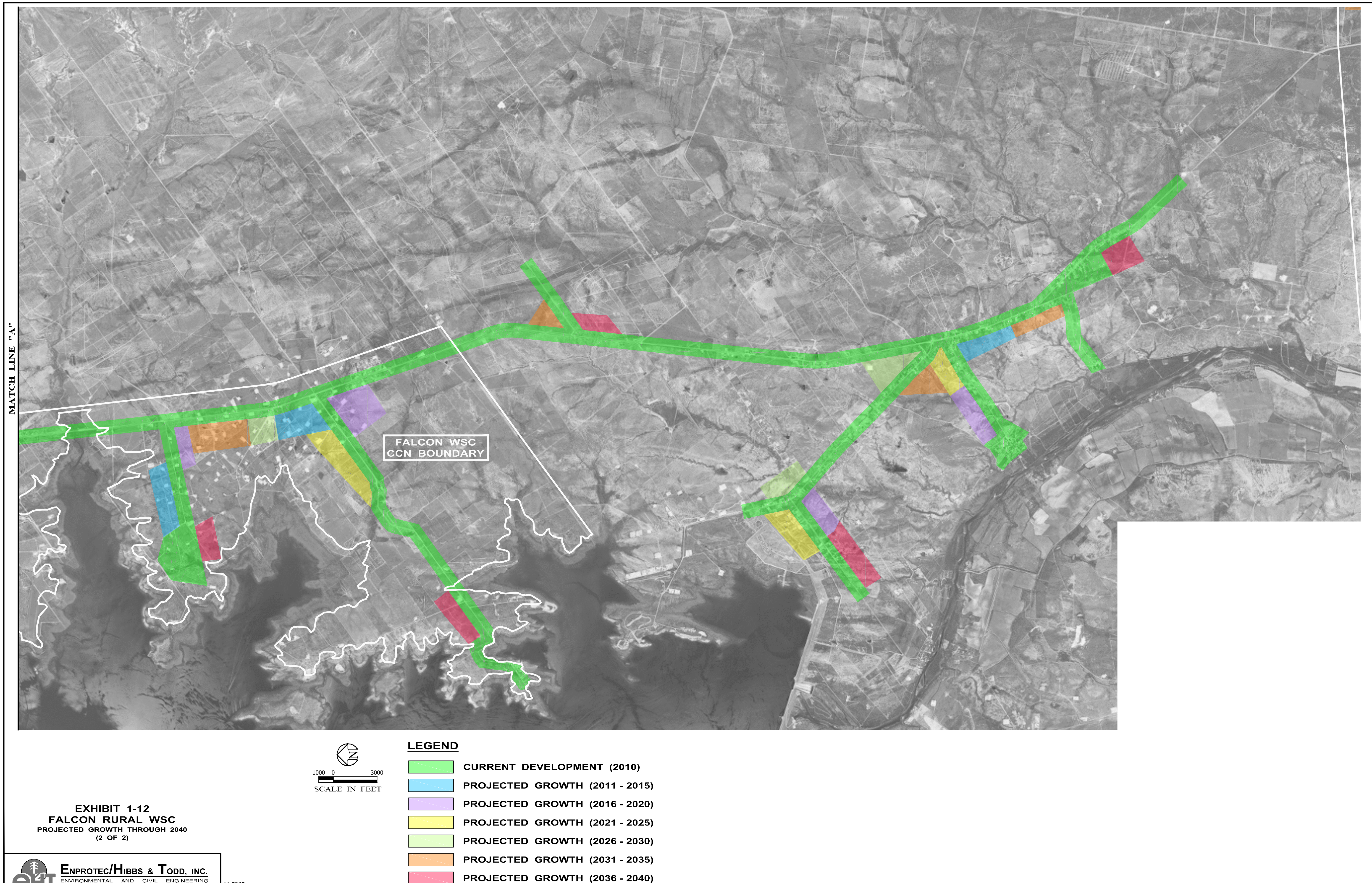

EXHIBIT 1-12
FALCON RURAL WSC
PROJECTED GROWTH THROUGH 2040
(2 OF 2)

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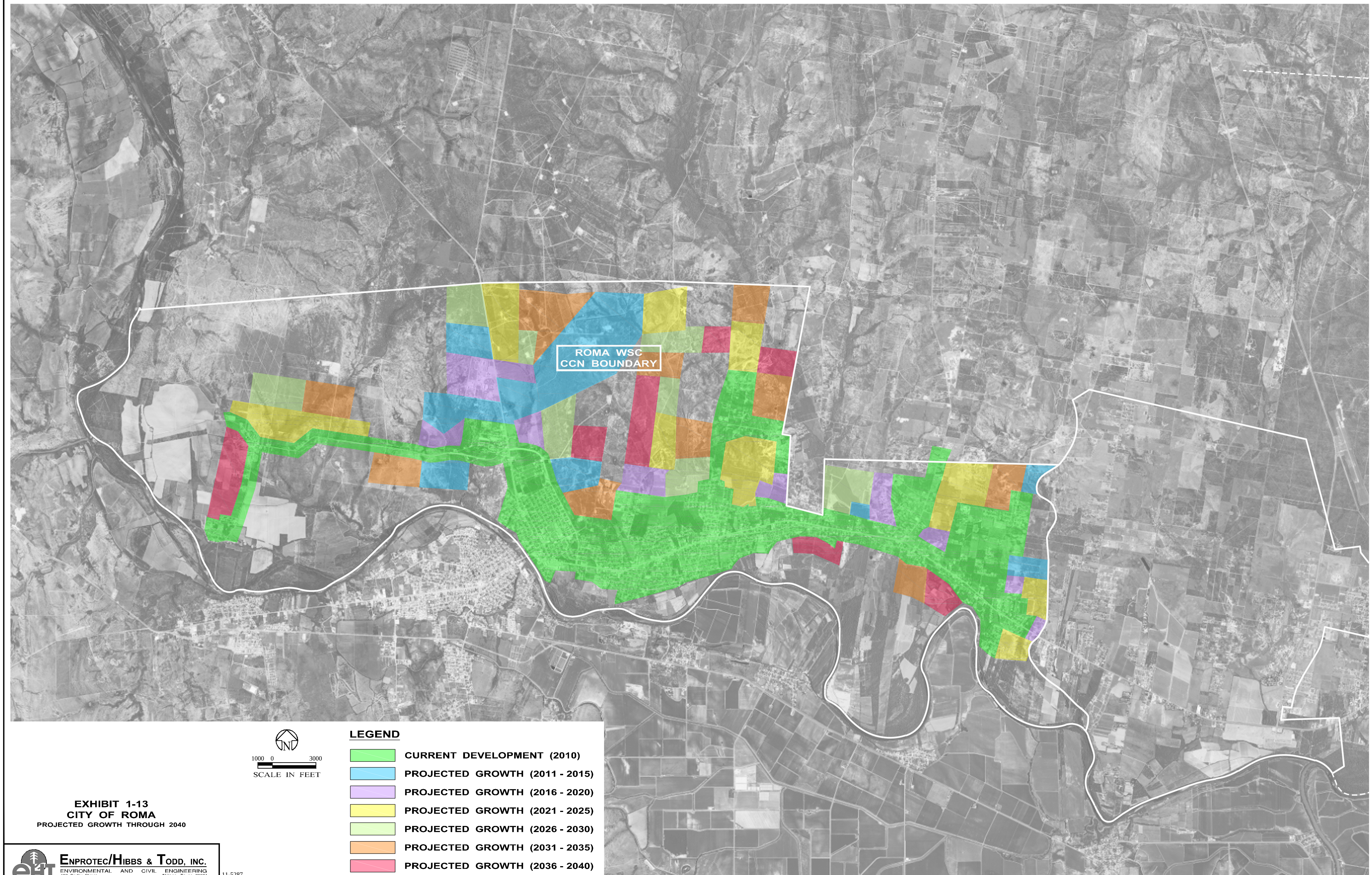

EXHIBIT 1-13
CITY OF ROMA
PROJECTED GROWTH THROUGH 2040

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1000 0 3000
SCALE IN FEET

LEGEND

- CURRENT DEVELOPMENT (2010)
- PROJECTED GROWTH (2011 - 2015)
- PROJECTED GROWTH (2016 - 2020)
- PROJECTED GROWTH (2021 - 2025)
- PROJECTED GROWTH (2026 - 2030)
- PROJECTED GROWTH (2031 - 2035)
- PROJECTED GROWTH (2036 - 2040)

EXHIBIT 1-14
EL SAUZ WSC
PROJECTED GROWTH THROUGH 2040
(1 OF 2)

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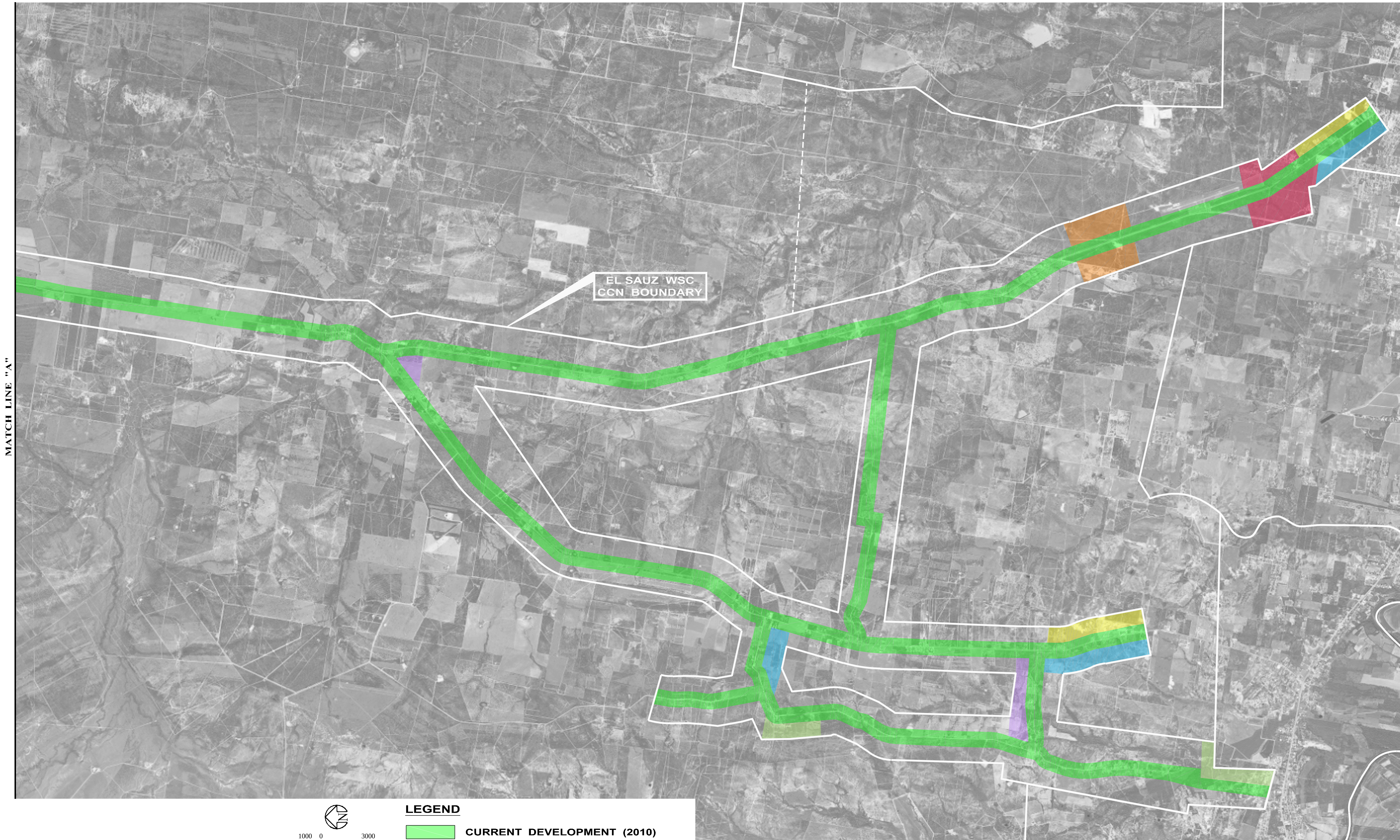

EXHIBIT 1-15
EL SAUZ WSC
PROJECTED GROWTH THROUGH 2040
(2 OF 2)

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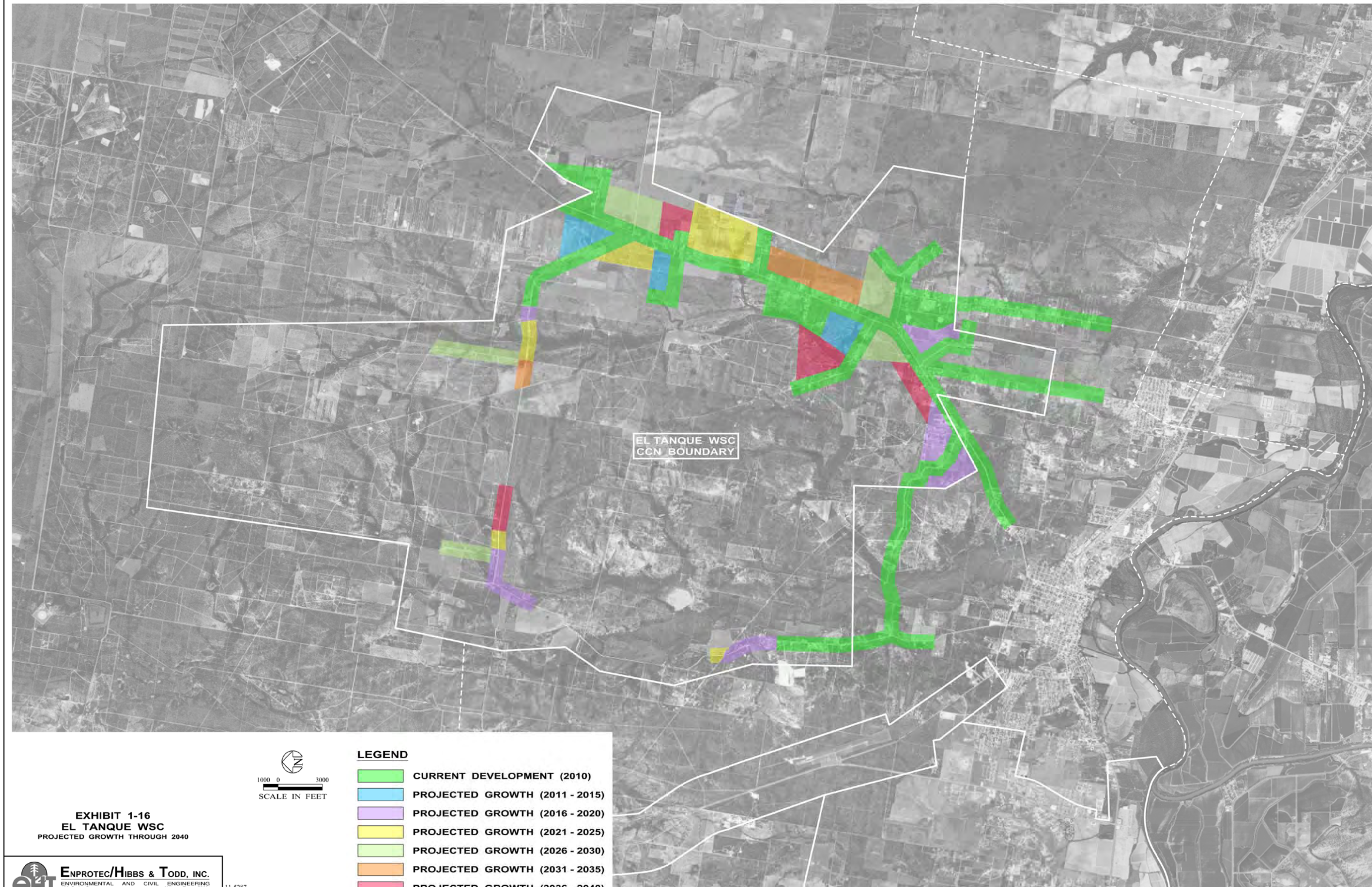

EXHIBIT 1-16
EL TANQUE WSC
PROJECTED GROWTH THROUGH 2040

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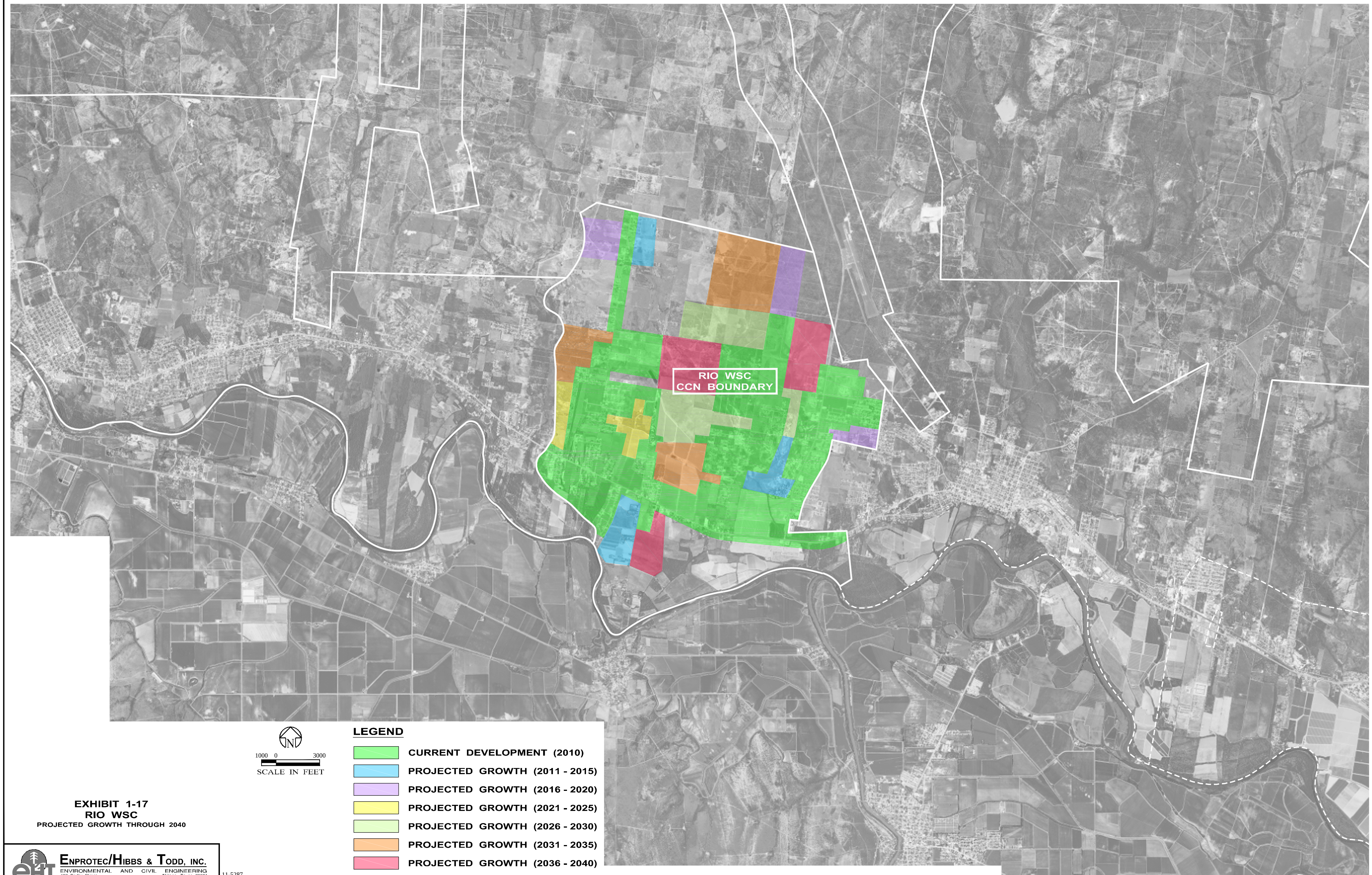

EXHIBIT 1-17
RIO WSC
PROJECTED GROWTH THROUGH 2040

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During the most recent Region M RWP updates, it has been determined that based on the growth observed in the Rio Grande Valley over the past two decades that the population is anticipated to more than triple over the next 50 years (from 2010 to 2060). In observing the growth rates used for Rio WSC and Starr County Other (that include Falcon WSC, El Sauz WSC and El Tanque WSC lumped together), the anticipated tripling of population by 2060 is nearly accomplished. However, the service area population for the City of Roma (using total service area population in 2010, annual growth of 1.5% and household population density factor of 2.93) only appears to roughly double over the next 50 years, which seems low. The prevailing wisdom in the RGV has always been that growth is limited by availability of adequate water and wastewater services. Therefore, it may be more prudent to increase the anticipated annual growth rate for the City of Roma to match anticipated growth in other parts of the RGV.

The comparisons between population numbers from the various sources of population data researched for this Study are presented in Table 1-8. As shown in this table the population estimates vary significantly, as each category looks at different items. For example, the 2010 Census data looks only at populations incorporated areas or block tract areas and therefore does not account for the entire service area for participants such as the City of Roma. In the TWDB Population Estimate (based on the 2011 Region M RWP data), population figures were not identified for individual utilities such as Falcon WSC, El Sauz WSC and El Tanque WSC. Therefore, it appears that the data developed in this Study may be the most accurate for each utility and not only should this data be used as the foundation of this Study, but the population data should also be coordinated with the Region M RWP developers in order to update population data as necessary in the upcoming 2016 Region M RWP update.

Table 1-8
Comparison of Population Estimates

Population Source	2010	2015	2020	2025	2030	2035	2040
TWDB Population Estimate [1]	14,931	N/A	17,659	N/A	20,482	N/A	23,341
Study Population Estimates [2]	28,427	30,945	33,696	36,703	39,990	43,587	47,522
2010 Census Count	19,725						
Notes							
1 - TWDB Population Estimates were taken from the 2011 Regional Water Plan for Region M. Available online at http://www.twdb.state.tx.us/wrpi/rwp/rwp.asp. Population not listed individually for Falcon WSC, El Sauz WSC and El Tanque WSC.							
2 - Population estimates developed from current utility data and TCEQ WUD data.							

CURRENT AND PROJECTED CONNECTIONS

During the initial development of this Study, the current number of connections for each utility district was taken from TCEQ WUD data and utility-specific data. When current connection counts were provided by the utilities, the up-to-date utility connection totals were used in place of the TCEQ WUD data. Table 1-9 shows the projected connection counts for each utility in five-year increments.

Table 1-9 Current and Projected Connection Counts								
Data	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	6,300	6,773	7,280	7,826	8,413	9,044	9,723	12,640
Falcon Rural WSC	1,219	1,341	1,475	1,622	1,785	1,963	2,160	3,023
El Sauz WSC	370	413	462	516	577	645	721	1,059
El Tanque WSC	625	698	781	872	975	1,089	1,217	1,789
Rio WSC	1,300	1,455	1,629	1,824	2,042	2,286	2,559	3,782
Total Estimated Connections	**9,814**	**10,681**	**11,627**	**12,661**	**13,792**	**15,028**	**16,379**	**22,294**

CURRENT AND PROJECTED WATER DEMAND

A key step in this Study is the development of population/water demands projections for each entity in the planning area. Data on existing water usage was collected from several sources to form the basis of the projections for future demand. Data from the TCEQ WUD was used along with additional data acquired from the utilities, to prepare the existing and projected water demands within the Study Area.

The average water demand per connection in each of the utilities has been observed historically to be somewhat less than the TCEQ's standard requirements of 0.6 gpm per connection (or 864 gallons per day per connection for the City). Therefore, to determine actual current and future demand, the current daily water demand was multiplied by 365 to determine the annual demand required for each utility. In addition, the average usage per connection was also calculated based on current connections. The current and projected daily and monthly water demands are included in Tables 1-10 and 1-11, respectively.

Table 1-10 Current and Projected Daily Water Demand										
Participant	**Current Average Daily Usage Per Connection (gallons)**	**Current Peak Daily Usage Per Connection (gallons)**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	437	546	2.75	2.96	3.18	3.42	3.67	3.95	4.24	5.52
Falcon Rural WSC	320	400	0.39	0.53	0.58	0.64	0.7	0.77	0.85	1.19
El Sauz WSC	595	744	0.22	0.25	0.27	0.31	0.34	0.38	0.43	0.63
El Tanque WSC	432	540	0.27	0.3	0.34	0.38	0.42	0.47	0.53	0.77
Rio WSC	431	539	0.56	0.63	0.7	0.79	0.88	0.98	1.1	1.63
TOTAL	**2,214**	**2,769**	**4.19**	**4.66**	**5.07**	**5.52**	**6.02**	**6.56**	**7.15**	**9.74**
Notes										
1 - WTP demand in mgd										
2 - Connections based on historical number of persons per household										
3 - Growth based on utility-specific annual growth										
4 - Demand based on historical usage										

Table 1-11
Current and Projected Monthly Water Demand

Participant	Current Average Monthly Usage Per Connection (gallons)	Current Peak Monthly Usage Per Connection (gallons)	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	13,277	16,596	83.6	89.9	96.7	103.9	111.7	120.1	129.1	167.8
Falcon Rural WSC	9,731	12,164	11.9	16.1	17.7	19.4	21.4	23.5	25.9	36.2
El Sauz WSC	18,086	22,608	6.7	7.5	8.4	9.3	10.4	11.7	13	19.2
El Tanque WSC	13,140	16,425	8.2	9.2	10.3	11.5	12.8	14.3	16	23.5
Rio WSC	13,103	16,379	17	19.1	21.3	23.9	26.8	30	33.5	49.6
TOTAL	**67,337**	**84,171**	**127.4**	**141.7**	**154.3**	**168**	**183.1**	**199.5**	**217.5**	**296.3**
Notes										
1 - WTP demand in million gallons										
2 - Connections based on historical number of persons per household										
3 - Growth based on utility-specific annual growth										
4 - Demand based on historical usage										

While the average water demand per connection in each of the utilities has been observed historically to be somewhat less than the TCEQ's standard requirements of 0.6 gpm per connection, the 0.6 gpm per connection design requirement forms the basis of design for proposed WTPs. Therefore, to determine current and future required treatment capacity, the number of connections for each utility was multiplied by the TCEQ's standard design criteria value of 0.6 gpm per connection. This calculated daily demand was multiplied by 365 to determine the annual demand or treatment capacity required per TCEQ design criteria. The calculated demand based on TCEQ design criteria is include in Table 1-12.

Table 1-12
Current and Projected Minimum Required Water Treatment Plant Capacity

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	5.44	5.85	6.29	6.76	7.27	7.81	8.40	10.92
Falcon Rural WSC	1.05	1.16	1.27	1.40	1.54	1.70	1.87	2.61
El Sauz WSC	0.32	0.36	0.40	0.45	0.50	0.56	0.62	0.92
El Tanque WSC	0.54	0.60	0.67	0.75	0.84	0.94	1.05	1.55
Rio WSC	1.12	1.26	1.41	1.58	1.76	1.98	2.21	3.27
Total Minimum WTP Capacity	**8.48**	**9.23**	**10.05**	**10.94**	**11.92**	**12.98**	**14.15**	**19.26**
Notes								
1 - WTP capacity in mgd.								
2 - Connections based on historical number of persons per household								
3 - Growth based on utility-specific annual growth								
4 - Sizing based on TCEQ criteria of 0.6 gpm per connection.								

However, TCEQ also requires that a water system must operate at no greater than 85% of its treatment and storage capacity at all times. Therefore, at each growth milestone, the required minimum treatment capacity must be increased such that if the actual full demand (0.6 gpm per connection) occurred during the point in time, the total demand would still be less than 85% of available system capacity. The recommended design capacity at each milestone is shown in Table 1-13.

Table 1-13
Current and Projected Recommended Water Treatment Plant Capacity

Data	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	6.40	6.88	7.40	7.96	8.55	9.19	9.88	12.85
Falcon Rural WSC	1.24	1.36	1.50	1.65	1.81	2.00	2.20	3.07
El Sauz WSC	0.38	0.42	0.47	0.52	0.59	0.66	0.73	1.08
El Tanque WSC	0.64	0.71	0.79	0.89	0.99	1.11	1.24	1.82
Rio WSC	1.32	1.48	1.66	1.85	2.08	2.32	2.60	3.84
Total Recommended WTP Capacity	**9.98**	**10.86**	**11.82**	**12.87**	**14.02**	**15.28**	**16.65**	**22.66**

Notes
1 - WTP capacity in mgd.
2 - Connections based on historical number of persons per household
3 - Growth based on utility-specific annual growth
4 - Sizing based on TCEQ criteria of 0.6 gpm per connection, increased so that demand is no greater than 85% of provided treatment capacity.

SOURCE OF EXISTING WATER SUPPLIES

Currently, all of the Study participants utilize water from the Rio Grande River, either directly for treatment for the City of Roma and Falcon WSC, or via an intermediary wholesale water supplier for El Sauz WSC, El Tanque WSC and Rio WSC. Based on the existing water rights data shown in Table 1-3, it appears that roughly 5,251 ac-ft of water rights are currently owned by the Study participants, if counting all Class A and Class B irrigation rights (assuming no drought impacts on Falcon or Amistad). However, according to Table 1-4, if the existing irrigation rights are converted to municipal use (to guarantee availability during droughts), then approximately 4,326 ac-ft are available. While it is obvious that the existing water rights in either case will not meet demands in the future, the real question is how much of a gap in demand vs. supply is there? Anticipated actual water demand for each Study participant (with respect to necessary water rights) through the planning period (based on current average utility water demands) is shown in Table 1-14.

Table 1-14
Current and Projected Required Water Rights Based on Water Demands

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	3,081	3,312	3,560	3,827	4,114	4,423	4,754	6,181
Falcon Rural WSC	437	591	651	716	787	866	953	1,334
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	627	702	786	880	985	1,103	1,235	1,825
Total Estimated Necessary Water Rights	**4,694**	**5,219**	**5,682**	**6,189**	**6,743**	**7,348**	**8,011**	**10,911**
Notes								
1 - Water demand in acre-feet.								
2 - Projected demand based on current water usage per utility.								

Once the total necessary water rights were determined, several additional calculations were completed to determine what additional water rights or water supplies would be needed to "fill the gap" between current available water rights and demands in the future. The first set of calculations involved deducting the total existing volume of water rights available from the demands in the future. The second set of calculations deducted a reduced volume of water rights, based on the option to convert all existing Class A and Class B irrigation rights into municipal water rights. The results from those two sets of calculations are displayed in Tables 1-15 and 1-16, respectively.

Table 1-15
Required Additional Water Rights Using All Existing Water Rights

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	-	-	-	-	133	442	773	2,200
Falcon Rural WSC	188	342	402	467	538	617	704	1,085
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	-	-	-	-	-	81	213	804
Total Estimated Additional Water Rights Needed	**737**	**956**	**1,087**	**1,233**	**1,528**	**2,097**	**2,759**	**5,659**

Notes
1 - Water demand in acre-feet.
2 - Projected demand based on current water usage per utility.
3 - Total additional water rights needed by deducting all existing Municipal, Class A Irrigation and Class B Irrigation water rights.
4 - Cells with a dash signify that existing water rights should be sufficient to meet projected water demands.

Table 1-16
Required Additional Water Rights Using Potentially Converted Water Rights

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	-	-	208	475	762	1,070	1,402	2,828
Falcon Rural WSC	188	342	402	467	538	617	704	1,085
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	-	-	61	155	260	378	510	1,100
Total Estimated Additional Water Rights Needed	**737**	**956**	**1,356**	**1,863**	**2,417**	**3,022**	**3,685**	**6,585**

Notes
1 - Water demand in acre-feet.
2 - Projected demand based on current water usage per utility.
3 - Total additional water rights needed by deducting all existing water rights converted to municipal (M&I) use.
4 - Cells with a dash signify that existing water rights should be sufficient to meet projected water demands.

Based on the data in Table 1-15 and 1-16, it appears that additional water rights or alternative water supplies will be necessary both for the City of Roma and the other Study participants over the next 5-10 years and the demand will likely only increase as time goes on. Therefore, the next critical step in this Study is identify potential additional water supplies, either via continuing the historical tradition of purchasing and/or leasing of surface water rights, or the consideration of potential alternative water sources. The identification and evaluation of potential water supply alternatives are included in TM No. 2.

This Technical Memorandum (TM) summarizes the findings of Task II of the City of Roma Regional Water Planning Study (the Study). The focus of this TM is the identification and discussion of potential alternative water supplies for the Study Area.

Activities in this TM included the following:

- ✓ Review anticipated water demands developed in TM No. 1;
- ✓ Identify alternative water supplies including costs, advantages and disadvantages;
- ✓ Determine the water rights and/or water supplies required for each Study participant; and,
- ✓ Prepare a technical memorandum summarizing the findings.

BACKGROUND

For any operating water system, raw water supply forms the primary building block upon which the remaining components of the water system infrastructure are built. In the case of water systems located in the Rio Grande Valley, the primary water supply source is typically the Rio Grande River. Water systems that provide treatment (not purchasing finished water wholesale) must own or lease a specific amount of Rio Grande River surface water rights. In essence, a utility that treats water must own sufficient water rights that meet or exceed the total maximum water usage in a given year. For example, if a water system's water treatment plant (WTP) operates at an annual average demand of 1 million gallons per day (mgd), or 1,120 acre-feet (ac-ft), that utility must own a minimum of 1,120 ac-ft of water rights. However, the Texas Water Development Board (TWDB) also requires that sufficient water rights be available to match the design period of the project funding; for example, if a project is funded for a 20-year project life, sufficient water rights must be obtained to meet anticipated capacity through the duration of the 20-year project life.

However, if a utility only purchases finished water wholesale from another utility, the wholesale purchasing utility may or may not be required to purchase its own individual water rights. The requirement of purchasing water rights for a wholesale purchasing utility depends solely on the water purchasing contract between the purchasing utility and the selling utility. In some wholesale purchase agreements, the selling utility may require that the purchasing utility provide leased water rights to the selling utility, as long as the purchase agreement is active. This type of agreement allows the selling utility to purchase fewer water rights to serve themselves and the purchasing utility, which can reduce the total cost of water service. Another type of purchase agreement does not require the purchasing utility to provide water rights of any kind to the selling utility, though the overall cost of water service is normally higher as a result.

During the development of the Study, multiple sources of water rights data were consulted to determine both the current total water rights owned by each Study participant and the overall makeup of those water rights. Regardless of the regionalization alternative ultimately recommended later in this Study, development of additional water supplies in the short-term and in the long-term is a critical priority to any utility treating its own water supply.

EXISTING WATER SUPPLIES

Of the five participants in the Study Area, it appears that only three of the five participants currently own any water rights at this time; the City of Roma (City), Falcon Rural WSC and Rio WSC. Since three of the five participants (El Sauz WSC, El Tanque WSC and Rio WSC) are currently purchasing water wholesale from Rio Grande City, this situation is to be expected. The breakdown of water rights owned by each participant is listed in Table 2-1.

Table 2-1
Current Participant-Owned Water Rights

Study Participant	Municipal Water Rights (ac-ft)	Class A Irrigation Water Rights (ac-ft)	Class B Irrigation Water Rights (ac-ft)
City of Roma	2,841.18	551.40	588.25
Falcon Rural WSC	249.00	0.00	0.00
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**

Notes
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.

While entities such as the City of Roma appear to have sufficient water rights at this time, the actual secure volume of water available annually (firm yield) is less certain. While municipal water rights are guaranteed for each entity, in the Rio Grande Valley, irrigation water rights have historically received the lowest priority for withdrawal of water from the Rio Grande River. Furthermore, Class A irrigation water rights tend to receive higher priority than Class B irrigation water rights. Therefore, in the case of a drought (based on when Lake Amistad and Lake Falcon are operating at less than 50% level), an entity should be able to count on its municipal water rights for raw water usage, but it is likely that the irrigation water rights will not be available. In essence, each utility that balances a combination of municipal and irrigation water rights is gambling that sufficient water rights will be available in the event of a drought. The methodology on how water rights are allocated to each owner and the priority of said rights are discussed in the following section. This situation of municipal rights taking seniority over irrigation rights is unique to this part of the State of Texas, whereas in almost every other area of the State the active rule is “First in time, first in right.” As a result, in the Rio Grande Valley, municipal rights generated in 2012 have the same seniority as municipal rights generated in 1980, which is far different from the rest of the State.

Allocation of Water Rights in the Lower Rio Grande Valley

The United States’ share of water stored in Amistad and Falcon Reservoirs and diverted from the lower and middle Rio Grande for domestic, municipal, industrial, and irrigation purposes is administered by the Texas Commission on Environmental Quality (TCEQ) in compliance with the decision of the Thirteenth Court of Civil Appeals in the landmark case styled "State of Texas, et al. vs. Hidalgo County Water Control and Improvement District No. 18, et al." and commonly referred to as the Rio Grande Valley Water Case. The original suit was filed by the State of Texas in 1956 to restrain the diversion of water from the Rio Grande for irrigation when the share of water due the United States from water impounded in Falcon Reservoir was 50,000 ac-ft or less. The storage amount of 50,000 ac-ft was the quantity of water that the Texas Board of Water Engineers [1](a predecessor agency to the TCEQ) had determined at that time to be necessary to meet municipal, domestic and livestock demands for a three-month period without additional inflows into Falcon Reservoir. Earlier efforts to apply voluntary restrictions on diversions of water had collapsed due to severe drought conditions and the shortage of water supplies.

The original trial of the Valley Water Case lasted from January 1964 to August 1966, and the final judgment of the appellate court was entered in 1969. In 1971, the Texas Water Rights Commission (another predecessor agency to the TCEQ) adopted rules and regulations implementing the court decision. According to the judgment rendered in this case, a storage reserve in Falcon Reservoir equal to 60,000 ac-ft was established to meet municipal and industrial demands, and a total of approximately 155,000 ac-ft of water rights (annual usage) was allocated for domestic, municipal and industrial (DMI) uses. Irrigation water from the Rio Grande was allocated for 742,808.6 acres of agricultural land below Falcon Dam. Of this amount, 641,221 acres were assigned Class A irrigation rights, and the remaining acres were awarded Class B irrigation rights.

Whereas municipal uses, which include uses for domestic, industrial, manufacturing, and steam electric power generation purposes, were granted the highest water supply priority, the result of the Valley Water Case was to establish a weighted priority system along the lower Rio Grande for allocating the remaining surface water supply to irrigation (and mining) uses. The two classes of irrigation water rights that were established, (Class A and Class B) today provide a means for differentiating the rates at which water is credited to individual irrigation storage accounts in Amistad and Falcon Reservoirs. The Class A water right accrues water at a rate 1.7 times greater than the Class B water right. Although this weighted priority system for irrigation water generally has little significance during years when water is abundant, its effect in water-short years is to distribute the shortage among all users, with the greater shortages occurring for users with Class B water rights.

As a result of the Lower Rio Grande Valley Water Case, rules have been adopted by the State's water agency (the TCEQ), that regulates the operation of the lower and middle Rio Grande system and the allocation of water among all users. The rules applied by the TCEQ in administering mainstream water rights in the Lower and Middle Rio Grande Basins affect not only the amount of water that can be diverted from the Rio Grande and its tributaries, but also the operation of the storage pools in Amistad and Falcon

[1] 2011 Region M Regional Water Plan

Reservoirs. The current rules provide a reserve of 225,000 ac-ft of storage in Amistad and Falcon Reservoirs for domestic, municipal and industrial (DMI) uses, which is referred to as the "DMI pool," and an operating reserve that fluctuates between 380,000 ac-ft and 150,000 ac-ft, depending on the amount of water in conservation storage in the reservoirs. The stated purpose of the operating reserve in the TCEQ rules is to provide for: (1) loss of water by seepage, evaporation and conveyance; (2) emergency requirements; and, (3) adjustments of amounts in storage, as may be necessary by finalization of the International Boundary and Water Commission (IBWC) provisional United States-Mexico water ownership computations. The operating reserve is calculated monthly by multiplying the percentage of total United States conservation storage in the Amistad-Falcon system times the maximum operating reserve of 380,000 ac-ft. The calculated reserve cannot be less than 275,000 ac-ft, unless there is insufficient water stored in the reservoirs, in which case, the balance of the water in storage, after allocations for the DMI pool and irrigation account balances, is assigned to the operating reserve. The operating reserve can only be less than 75,000 ac-ft in emergency situations or if determined by the Watermaster.

Consideration is being given to revising the TCEQ's Rio Grande operating rules by altering the storage amounts for the DMI reserve and the operating reserve. Investigations of the impacts of different reserve amounts on overall water availability and the yield of the Amistad-Falcon reservoir system are being undertaken in the Region M water supply planning study. The Watermaster administers the water allocations to municipal/domestic, industrial, agricultural and other user storage accounts. Such allocations are based on the available water in storage in Falcon and Amistad Reservoirs, as reported by the IBWC on the last Saturday of each month, less dead (unrecoverable) storage. To determine the amount of water to be allocated to various accounts, the Watermaster makes the following computations at the beginning of each month:

1. From the amount of water in usable storage, 225,000 ac-ft are deducted to re-establish the reserve; i.e., the DMI pool, for domestic, municipal, and industrial uses; hence, these uses are given the highest priority;

2. From the remaining storage, the total end-of-month account balances for all lower and middle Rio Grande irrigation and mining allottees are deducted; and

3. From the remaining storage, the operating reserve is deducted.

After the above computations are made, the remaining storage, if any, is allocated to the irrigation and mining accounts. The allotment for irrigation and mining uses is divided into the Class A and Class B water rights categories. Class A rights (allottees) receive 1.7 times as much water as that allotted to Class B rights. An irrigation allottee cannot accumulate in storage more than 1.41 times its annual authorized diversion right, and, if an allottee does not use water for two consecutive years, its account is reduced to zero. If there is not sufficient water in storage to fully restore the operating reserve in Step 3 above, then the TCEQ rules authorize the Watermaster to make negative allocations of water from the irrigation and mining accounts in sufficient amounts to provide the minimum 75,000 ac-ft of operating reserve capacity.

Conversion of Water Rights

In addition, when considering converting irrigation water rights to municipal water rights, the class of irrigation rights impacts the final amount of municipal water rights created. Class A irrigation water rights typically convert to municipal at a rate of 50%; in other words, 1,000 ac-ft of Class A irrigation water rights would convert to 500 ac-ft of municipal water rights. However, Class B irrigation water rights typically converts to municipal at a rate of 40%; in other words, 1,000 ac-ft of Class B irrigation water rights would convert to 400 ac-ft of municipal water rights. In addition, once the irrigation water rights are converted to municipal use, the seniority of the converted water rights do not take precedence over older municipal water rights owned by other utilities. However, TCEQ now allows for the merging of newly converted municipal water rights into a utility's oldest water rights account, so a utility can take advantage of the age of the older water rights to gain seniority now for the newly converted water rights. Table 2-2 shows what municipal water rights could be available to each Study participant by completing conversion of irrigation water rights to municipal. In addition, Tables 2-3 and 2-4 show the additional water rights needed and when specific water rights are needed for each participating utility through buildout.

Table 2-2
Potential Total Municipal Water Rights

Study Participant	Current Municipal Water Rights (ac-ft)	Converted from Class A Irrigation Water Rights (ac-ft)	Converted from Class B Irrigation Water Rights (ac-ft)	Total Potential Municipal Water Rights (ac-ft)
City of Roma	2,841.18	275.70	235.30	3,352.18
Falcon Rural WSC	249.00	0.00	0.00	249.00
El Sauz WSC	0.00	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00	0.00
Rio WSC	527.11	0.00	197.80	724.91
Total	**3,617.29**	**275.70**	**433.10**	**4,326.09**

Notes
1 - Water rights based on TCEQ Water Rights Database, as of November 2011.
2 - Water right conversion rates per Rio Grande River Watermaster.

Table 2-3
Current and Projected Required Water Rights Based on Water Demands

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	3,081	3,312	3,560	3,827	4,114	4,423	4,754	6,181
Falcon Rural WSC	437	591	651	716	787	866	953	1,334
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	627	702	786	880	985	1,103	1,235	1,825
Total Estimated Necessary Water Rights	**4,694**	**5,219**	**5,682**	**6,189**	**6,743**	**7,348**	**8,011**	**10,911**
Notes								
1 - Water demand in acre-feet.								
2 - Projected demand based on current water usage per utility.								

Table 2-4
Required Additional Water Rights Using All Existing Water Rights (Based on Water Demands)

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	-	-	-	-	133	442	773	2,200
Falcon Rural WSC	188	342	402	467	538	617	704	1,085
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	-	-	-	-	-	81	213	804
Total Estimated Additional Water Rights Needed	**737**	**956**	**1,087**	**1,233**	**1,528**	**2,097**	**2,759**	**5,659**
Notes								
1 - Water demand in acre-feet.								
2 - Projected demand based on current water usage per utility.								
3 - Total additional water rights needed by deducting all existing Municipal, Class A Irrigation and Class B Irrigation water rights.								
4 - Cells with a dash signify that existing water rights should be sufficient to meet projected water demands.								

As discussed in TM No. 1, it appears that the existing amount of water rights owned by each Study participant will not be sufficient to meet raw water supply requirements over the next thirty years, regardless of the regionalization alternative ultimately recommended at the end of the Study. Therefore, additional water supplies will likely need to be developed for each utility.

ALTERNATIVES FOR DEVELOPING NEW WATER SUPPLIES

When considering development of new water supplies, the type and quality of water, availability, cost and overall feasibility to procure those water supplies must be evaluated closely to determine which investment has the lowest risk. With regard to evaluating water supplies over a thirty-year period, the cost frequently is fairly high, so identifying anticipated advantages, disadvantages and potential fatal flaws with each proposed new water supply is critical in identifying projects to implement as a result of this Study. The potential areas for developing additional water supplies are identified below:

- Purchase of new water rights;
- Lease of water rights;
- Acquisition of new water rights via Bed and Banks reuse provision;
- New water supply via indirect potable reuse;
- New water supply via direct potable reuse; and
- New water supply via brackish groundwater.

A brief discussion on how each alternate water supply could be developed, conceptual cost of development, and feasibility is included in the following sections. For the sake of providing a comparable evaluation of feasibility and anticipated capital costs, the water supply goal in the following sections will be based on acquiring 1,000 ac-ft of municipal raw water supply from each supply alternative.

Purchase of New Water Rights

The purchase of additional water rights is a fairly lengthy, though straightforward process. In most cases, water rights available for purchase are posted on various websites, including the TCEQ's Watermaster website and on the Rio Grande River Regional Water Authority (RGRRWA) website. The entity intending to purchase the available water rights can then contact and begin negotiations with the selling entity.

In years past, the RGRRWA set a starting price each year to begin negotiations for purchasing new water rights. The advertised price was intended to be a starting point only, as Class A irrigation rights would be more valuable than Class B irrigation rights and of course, municipal rights would be more valuable than Class A or B irrigation rights. However, there is little likelihood of seeing municipal water rights for sale at this point in time, so typically one would expect to see either Class A or B irrigation rights being advertised for purchase.

The starting price for Class B irrigation water rights in 2000 was roughly $1,000 per ac-ft; in 2010 the average starting price increased to $2,280 per ac-ft, which is annual cost increase of approximately 22.8%. Therefore, it is anticipated that water rights will likely continue to escalate in cost as resources continue to decline. To plan for future increases in water rights costs, a best-case annual increase of 5% (to match typical inflation) and a worst-case annual increase rate of 22.8% provide an anticipated cost range of $5,200-$10,000 per ac-ft during the Study period. For the purposes of this Study, a cost of $2,280 (in 2012 dollars) will be used for water rights acquisitions. In addition, it is likely that Class B irrigation rights will be the most commonly available in the future, so using the 40% conversion rate for Class B irrigation rights, to acquire 1,000 ac-ft of municipal water rights, approximately 2,500 ac-ft of Class B irrigation water rights would need to be purchased, at a cost of $5,700,000 (in 2012 dollars).

While the purchase of additional water rights may appear to be the simplest and most straightforward procurement method reviewed, there are several inherent advantages and disadvantages to this water supply alternative, which are listed in Table 2-5.

Table 2-5
Advantages and Disadvantages for Purchasing New Water Rights

Advantages	Disadvantages
Simpler than other water supply alternatives to accomplish	May not be able to find sufficient water rights to purchase when needed
-	Additional water rights must be purchased to convert to guaranteed municipal rights
-	May not qualify for funding via traditional funding methods
-	Does not provide an improvement in finished water quality

One of the notable issues is that while purchasing additional water rights could increase the total raw water supply for each utility, it will not improve the quality of the raw water. Therefore, potential treatment costs will need to be developed for providing an additional Reverse Osmosis (RO) treatment system as a future option to prepare for the likelihood of TCEQ enforcing Secondary Drinking Water Standards (SDWS) limits for total dissolved solids (TDS), chlorides and sulfates in the future. Costs will therefore need to be compared for both alternatives to maintain existing water quality and alternatives to improve upon existing water quality.

Lease of New Water Rights

The lease of additional water rights can be a straightforward process. In most cases, water rights available for lease are not posted online, and require the leasing party to contact potential water rights owners to determine availability of leasing. The entity intending to lease the available water rights can then contact and begin negotiations with the owning entity.

The price for leasing water rights currently ranges from $50-100 per ac-ft; however, as water demands increase, at an annual inflation rate of 5%, the cost to lease water rights could increase to $200-400 per ac-ft per year by the end of the planning period (2040). The price for leasing water rights is solely based on an owner's excess capacity of water rights however, so depending on availability, the future leasing price per ac-ft could be somewhat less or much higher. Using a current (2012) leasing price of $50-100 per ac-ft, leasing 1,000 ac-ft of municipal water rights could cost roughly $50,000-100,000 per year (in 2012 dollars) or $1,500,000-3,000,000 (in 2012 dollars) over a period of 30 years. However, availability of water to lease depends on a utility's excess water; therefore in the future as water demands continue to increase, water may simply not be available for leasing, except on an emergency basis and for extremely high prices.

While the purchase of additional water rights may appear to be the simplest and most straightforward procurement method reviewed, there are several inherent advantages and disadvantages to this water supply alternative, which are listed in Table 2-6.

Table 2-6
Advantages and Disadvantages for Leasing Water Rights

Advantages	Disadvantages
Simplest of water supply alternatives to accomplish	May not be able to find sufficient water rights to lease when needed
Could provide necessary surface water rights at one of the lowest costs in the evaluated alternatives	The more limited the availability of water rights to lease, the higher the cost of leasing per ac-ft
-	Water rights leased in one year may not be available the following year
-	May not qualify for funding via traditional funding methods
-	Does not provide an improvement in finished water quality

Water Rights from Bed and Banks Permitting

Within the Study Area, there has historically been little use of reclaimed water. This is still fairly common in many municipal areas and even more so in rural areas where there typically is no centralized treatment of wastewater. Therefore, of the average effluent produced each day by the City of Roma (0.6 mgd or 672 ac-ft), roughly 100% of the current effluent produced is discharged to waterways ultimately draining to the Rio Grande River. As growth continues in the Study Area, efficient management of all potential water supply sources is critical. Regardless of the regionalization alternative recommended in this Study, potential reclaimed water use in the Study Area should be researched thoroughly to determine areas of drinking water demand reduction via use of reclaimed water for non-potable uses, such as irrigation and potable uses such as Bed and Banks credits or indirect/direct reuse.

Generally about 60% of all water diverted from Texas' rivers and streams or groundwater pumped for municipal purposes enters the state's watercourses as discharges of treated effluent from wastewater treatment plants (WWTPs). Once considered a threat to surface water supplies, due in part to actual or perceived water quality concerns, the value of this treated effluent is now clearly recognized. This is evidenced by a much heightened interest in reuse projects to meet current and future increased municipal demands. Furthermore, the concept of reuse is included in nearly every Senate Bill 1 regional water plan. Treated wastewater effluent discharged into Texas' rivers also helps meet downstream water needs, including those of the environment and agriculture. [2]

In water rights permitting, reuse is the use of surface water which has already been beneficially used once under a water right, or the use of groundwater which has been used per 30 Texas Administrative Code (TAC) § 297.1(44). There are two types of reuse: indirect reuse and direct reuse. Indirect reuse is the reuse of water, usually effluent, which is placed back into the river or stream (referred to as "return flow"). This generally occurs when a WWTP discharges effluent into a stream and either the discharger or another person or entity diverts the effluent further downstream to use again. A Bed and Banks authorization under the Texas Water Code Section 11.042 is required for the use of the watercourse to transport the water for reuse. In contrast, direct reuse occurs when effluent from a WWTP is piped directly to a place where it is used.

Municipalities have increasingly looked to their effluent as an additional water resource and the participants of this Study should be no exception. Regardless of the regionalization alternative recommended, a Bed and Banks permit should be pursued for any existing effluent discharges. A Bed and Banks permitting process will generally include, but not be limited to the following tasks:

- Preparation of the Bed and Banks Permit Application(s), which includes data collection, financial development and map preparation;
- Submit initial application to the TCEQ;
- Respond to the TCEQ Requests for Information;
- Prepare and Submit Accounting Plan;
- Coordinate with and support the City in response/negotiations with any permit protestants;
- Work with Staff and outside legal counsel in support of the application process; and
- Work with the TCEQ throughout the process to ensure approval to the best extent possible.

One of the biggest benefits to applying for a Bed and Banks permit is that the cost is limited to the engineering, administrative and legal efforts (typically on the range of $100,000 to $200,000 total in 2012 dollars) in coordinating with the TCEQ. For example, with the City of Roma's current average effluent discharge of 0.6 mgd (roughly

[2] *Texas Water Rights and Wastewater Reuse, Prepared by the Reuse Committee of the TWCA*

672 ac-ft), approval of a Bed and Banks permit for the current full volume of the annual effluent discharge could save up to $3,630,000 (in 2012 dollars) in purchased water rights (using Class B conversion ratio, $2,280 (in 2012 dollars) per ac-ft and deducting permitting costs above). Therefore, applying for a Bed and Banks permit should be completed in addition to any of the other water supply alternatives.

Historically there has been substantial resistance from downstream parties, requesting that a Bed and Banks authorization not be approved, in order to maintain existing supply into the Rio Grande River as a continued source of recharge. In many cases, the authorization volume is much less than the original requested amount, frequently 50% or less. Therefore, it is likely that if a Bed and Banks authorization were approved for the City at this time, the anticipated potential water rights authorized would likely be half of the permitted capacity of the existing WWTP. As compared to the example above, if only 50% of the current effluent available could be credited to the City (336 ac-ft), the savings (including cost of permitting) would be roughly $1,920,000, which shows that even at 50% credit, there is still a significant value to the City by obtaining a Bed and Banks authorization. Therefore, to maximize reuse potential, considerations should be made toward maximizing the available treatment capacity of the City's wastewater treatment plant (WWTP) in the future.

As with the other water supply alternatives, there are several inherent advantages and disadvantages to this alternative, which are listed in Table 2-7.

Table 2-7
Advantages and Disadvantages for Obtaining a Bed and Banks Permit

Advantages	Disadvantages
Lowest cost in the evaluated alternatives to provide additional water rights	Bed and Banks authorization may not be approved due to downstream opposition
Water rights should convey as municipal use at 1:1	Does not provide an improvement in finished water quality
If a Bed and Banks authorization is approved, collection and treatment of wastewater from other areas could increase available Bed and Banks water	A Bed and Banks authorization may not grant full amount of water rights in comparison to effluent put back into Rio Grande River
-	May not qualify for funding via traditional funding methods

A review of the City of Roma's current daily potable water demands and daily treated wastewater revealed that the volume of wastewater treated each day does not correspond with the volume of water treated for drinking. The average wastewater production in the Rio Grande Valley is frequently about 50% of the total drinking water produced each day. However, it appears that based on current water and wastewater production in the City of Roma, that the wastewater to water ratio is roughly 25%. Therefore, additional analyses of the City's wastewater system should be completed as soon as possible to determine the source of this discrepancy.

Reuse

There has been very little historical use of reclaimed water in the Study Area. Therefore, of the average effluent produced each day (0.6 mgd), roughly 100% of the current effluent produced is discharged to waterways ultimately draining to the Rio Grande River. As growth continues in the Study Area, efficient management of all potential water supply sources is critical.

WWTP effluent can be reused in a variety of ways. The most common form of reuse is non-potable reuse, where the effluent is piped to various areas for irrigation. However, depending on how widespread the potential use is of reclaimed water, it may be cost-prohibitive to implement a wide-scale non-potable reuse system. The next most common form of reuse is potable reuse, either indirect or direct. Indirect potable reuse is based on using a water reservoir or river to blend the WWTP effluent prior to being pumped to a WTP for treatment. Direct potable reuse is based on sending WWTP effluent directly to a WTP for treatment then sent directly to a water distribution system without blending. These two reuse concepts are discussed in detail in the following sections.

Indirect Potable Reuse

Indirect potable reuse (indirect reuse) is one of the water recycling applications that has developed, largely as a result of advances in treatment technology that enables the production of high quality recycled water at increasingly reasonable costs and reduced energy inputs. In indirect reuse, municipal wastewater is highly treated and discharged directly into groundwater or surface water sources with the intent of augmenting drinking water supplies. Unplanned use of wastewater for drinking purposes has taken place for a long time. This occurs where wastewater is discharged from a WWTP to a river and is subsequently used as a raw water source for a downstream WTP.

In contrast, this water supply alternative focuses on planned indirect reuse. The use of environmental buffers such as rivers, dams, lakes or aquifers is considered a safe practice given that the natural systems have a high capacity to further purify water. Retention time of the recycled water in the raw water supply (the amount of time the recycled water stays in the raw water supply to blend) allows any remaining contaminants to be degraded by physical processes (such as ultraviolet light from sunlight) or biological processes (such as 'native' microorganisms). Storage of the recycled water for a period of time before consumption provides an interval of time in which to either stop delivery of water or to apply corrective actions in the event of a treatment failure. Dilution of recycled water in the environmental buffer also minimizes any potential risk by decreasing the concentration of contaminants that may be present.

More and more cities with limited water resources are considering indirect reuse as a feasible option for the sustainable management of water because it is a water supply alternative not dependent on rainfall and it is possible to achieve high quality recycled water in compliance with state and federal drinking water standards and guidelines. Indirect reuse has the potential to make a significant contribution to municipal water resources needs, but a cautious approach is required to manage the health risk associated with recycled water for drinking.

The number and concentration of chemical and biological hazards in wastewater is typically higher than the potential hazards that could be found in pristine waters. Contaminants (such as personal care products) have been detected at low concentrations in highly treated recycled water and any potential health impacts need to be evaluated. Moreover, there are currently no health values for most of these contaminants and usually limited toxicological information is available. Therefore, an analysis of potential human and environmental risks and the involvement of the community before any implementation proceeds need to be carefully undertaken on a case-by-case basis.

Indirect reuse is not new and has been successfully implemented in the United States (US), Europe and Singapore. In the US, California is the leading state with the highest number of indirect reuse projects and more than 40 years experience; other states with demonstration or full-scale indirect reuse projects include Arizona, Colorado, Texas, Florida and Virginia. In California, Water Factory 21, in the Orange County Water District (OCWD), is the oldest project, with a production capacity of 5 mgd. Water Factory 21 was closed in 2004 and the OCWD's upgraded Groundwater Replenishment System (GRS) plant was completed in 2007. The GRS facility has been constructed in Phase I to produce 70 mgd with an ultimate capacity of 130 mgd. In addition, the City of Big Spring, Texas is currently under construction of a 1.5 mgd indirect reuse system, which the TCEQ has referred to as a Raw Water Production Facility (RWPF).

To ensure significant reduction of bacteria, viruses and chemical compounds usually found in wastewater effluent, indirect reuse now typically utilizes membrane filtration (MF), which is the recommended pretreatment technology upstream of reverse osmosis (RO) systems, followed by an RO system, further followed by an advanced ultraviolet oxidation (UVO) treatment.

Secondary effluent (water that is already considered safe for discharging back into the Rio Grande River) from a conventional WWTP should first be treated by an MF system. An MF system is a low-pressure membrane with a pore size of 0.01

micrometer (µm). An MF system can remove most of the fine suspended solids (more than 99% rejection), colloidal solids, bacteria and protozoa.

After the MF system, the membrane-filtered water (at this point the water is considered high quality reuse water by the TCEQ) passes through an RO system, a high-pressure process that forces water across a specialized membrane. An RO system can reject high molecular weight organic matter, and total organic carbon (TOC) rejection is normally higher than 96%, which reduces the risk of creating disinfection byproducts in the blended water during downstream water treatment. Removal of biochemical oxygen demand (BOD) and chemical oxygen demand (COD) has been reported as high as 98% and 96% respectively, which reduces likelihood of algae growth in the blended water supply. RO systems also separate out minerals and other contaminants, including heavy metals, viruses, pesticides and some personal care products (PCP), such as birth control products.

In the studies conducted so far on potable reuse treatment systems, high percentages of organic contaminant removal are commonly reported. An RO system can remove up to 99% of hormones and more than 95% of all tested analytes, including 16 pharmaceuticals and three PCPs. In general, RO membranes are able to reject most endocrine disrupters, pharmaceuticals and PCPs, with the exception of low molecular weight compounds.

However, incomplete rejection of certain disinfection byproducts, and some micropollutants of low molecular weight has been reported during full and pilot scale high-pressure RO membrane applications. Organic chemicals of high molecular weight are effectively rejected by MF/RO treatment, but those of low molecular weight (less than 500 Daltons) are less effectively rejected and have been detected in the RO permeate (RO treated water) at low concentrations. While the low molecular weight compounds detected in product water are present in trace concentrations well below health significance, a UVO system is now typically used to destroy the low molecular weight compounds so they are no longer found in the recycled water blended for potable reuse.

Although communities have accepted reclaimed or recycled water for non-drinking purposes such as irrigation of parks, they have historically been less likely to accept the use of recycled water as a drinking water source. The perceived decrease in temporal and geographical distance between wastewater and recycled water in potable reuse raises reservations amongst the community about the safety and quality of the recycled water. Emotions, or the “yuck” factor, play a major part in people’s lack of acceptance. Nevertheless, increased community support has occurred in the last decade and important progress has occurred in identifying factors of success or failure in the implementation of indirect reuse projects. Five aspects have been identified by the Water

Environment Foundation (WEF) for building and maintaining community support in potable reuse projects:

- Managing information for all stakeholders;
- Maintaining individual motivation and demonstrating organizational commitment;
- Promoting communication and public dialogue;
- Ensuring a fair and sound decision-making process and outcome; and
- Building and maintaining trust.

Effective communication between the community, key stakeholders and the project team is crucial to achieve community support. All potable reuse projects need to be accompanied by community education to demonstrate that the current technology is adequate to protect human health. A timely and active communication program to discuss the treatment processes, the risks, the measures in place to control risks and the safety of the water, may help to increase trust in the project. The experience in the US has indicated that community understanding and acceptance may take several years, but that a broad community communication approach is fundamental for the successful implementation of indirect reuse projects. There are many examples where local communities have rejected indirect potable reuse proposals because they were poorly informed or insufficiently confident in the process. Some examples include the Dublin San Ramon Services District in California and the Water Futures Toowoomba in Queensland, where there was a lack of coordination between the authorities involved in planning, health, water supply and environment, and/or inadequate community consultation on the issue.

To produce raw water via an indirect reuse system, additional water must be treated through the membrane system to allow for water recovery losses. For example, a membrane filtration system is generally about 90% efficient, while an RO system is only 75% efficient. So to produce 1,000 ac-ft (0.9 mgd), 1.3 mgd of effluent must be sent to a membrane treatment system. The anticipated capital cost to construct a 0.9 mgd indirect reuse system is approximately $7,000,000 (in 2012 dollars). However, as with the other water supply alternatives, there are several inherent advantages and disadvantages to this alternative, which are listed in Table 2-8.

Table 2-8 **Advantages and Disadvantages for Implementing Indirect Potable Reuse**	
Advantages	**Disadvantages**
Provides an improvement in finished water quality	Community opposition due to "yuck" factor
Provide additional raw water without purchasing additional water rights	Disposal of membrane treatment system wastewater (RO concentrate)
Can reduce salt concentrations in blended raw water, improving finished water quality from WTP	Requires additional training to operate advanced treatment systems
Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality	Increased treatment costs above normal WWTP operations and discharge of effluent

Another major benefit of indirect reuse water being added to a raw water supply is in the nature of the blending results. RO permeate has almost no mineral content following RO treatment and as a result tends to be highly aggressive. When RO permeate is mixed with a raw water supply source (such as river water), the RO permeate withdraws minerals from the original raw water supply to stabilize itself. When the RO permeate withdraws minerals from the original raw surface water, the overall blended water is observed to have lower mineral concentrations as a result. Therefore, the overall blended quality of the water tends to improve. Using the City of Roma current water demand (2.5 mgd) with a 0.9 mgd (1,000 ac-ft) indirect reuse system, two examples were developed to display the impacts of an indirect reuse system on a water supply. In the first example (Table 2-9), the total current City demand of 2.5 mgd is used and the 0.9 mgd indirect reuse supply is added to the normal demand, resulting in a total flow of 3.4 mgd.

Table 2-9
Indirect Potable Reuse Blending Example No. 1

Data	Typical River Water	Typical RO Permeate	Anticipated Blended Water Quality
Flow (mgd)	2.5	0.9	3.4
TDS (mg/L)	1100	50	822
Chlorides (mg/L)	500	10	370
Sulfate (mg/L)	500	10	370
Hardness (mg/L as $CaCO_3$)	250	5	185
Turbidity (NTU)	10	0	7.4
TOC (mg/L)	3	0.1	2.2

In the second example (Table 2-10), the total current City demand of 2.5 mgd is used and the 0.9 mgd indirect reuse supply is incorporated into the normal demand, resulting in a total flow of 2.5 mgd. This example is intended to show the impact on blended water quality by having the recycled water make up a larger percentage of the total raw water supply used.

Table 2-10 Indirect Potable Reuse Blending Example No. 2			
Data	**Typical River Water**	**Typical RO Permeate**	**Anticipated Blended Water Quality**
Flow (mgd)	1.6	0.9	2.5
TDS (mg/L)	1100	50	722
Chlorides (mg/L)	500	10	324
Sulfate (mg/L)	500	10	324
Hardness (mg/L as CaCO3)	250	5	162
Turbidity (NTU)	10	0	6.4
TOC (mg/L)	3	0.1	2.0

With the two examples shown above, it should be apparent that the greater the percentage of the recycled water in the blended water supply, the greater the benefits of blending to improving raw water quality. By utilizing an indirect potable reuse system, additional water supply could be obtained and the overall raw water quality could be improved to the point that the new WTP may never require adding RO treatment of its own.

However, the benefits of utilizing an indirect potable reuse system must be tempered by the potential risks also involved. It is absolutely critical to maintain an effective public education campaign when developing potable reuse projects to ensure that the public feels that they are being kept well informed from start to finish.

Direct Potable Reuse

Direct potable reuse (direct reuse) refers to the introduction of highly-treated recycled water directly into a municipal water supply system. The obvious advantages of direct reuse are the opportunity to reduce the distance that recycled water would need to be pumped and eliminating the need to re-treat the water, potentially significantly reducing operating costs. Direct reuse has the potential to allow for full reuse of available recycled water in municipal areas, using the existing water distribution infrastructure. However, the biggest problem with direct reuse is community acceptance. The distinction that natural surface water is pure and better is no longer valid in many areas, mostly due to discharges of wastewater effluent and agricultural and urban runoff into raw water supplies.

A preference for indirect potable reuse has been evident in the past, since a reliable source of water of a particular quality is required. Indirect reuse systems normally make use of a natural storage buffer (reservoir or river), which provides a safety net in that the need for any further treatment can be detected before distribution. However, indirect reuse systems have their own problems in that any recycled water may be exposed to environmental contaminants. Key issues with direct reuse are listed below.

- Direct reuse is technically demanding because wastewater requires more extensive treatment prior to re-introduction to a WTP. In indirect reuse, recycled water is discharged to receiving bodies of water such as lakes and rivers; directly cycling the reclaimed water back into a drinking water system requires physical and chemical treatment surpassing that necessary for surface water discharge.

- Direct reuse has historically been contentious in society because of the negative associations of wastewater. Although many communities already practice indirect reuse because their drinking water intake lies downstream of another municipality's WWTP, the idea of direct reuse is often more upsetting. Citizen group reactions in areas where direct reuse has been proposed tend to be strongly negative.

- While some of the initial upset over direct reuse can be attributed to a lack of education of the realities of water treatment, direct reuse does suffer some serious questions regarding health and hygiene. The dilution of pollutants by receiving bodies of water in traditional indirect reuse plays a significant role in cleaning the water. A system that loops back a large quantity of its water volume creates the risk of concentrating pollutants over time. While EPA-limited pollutants and pathogens are closely monitored, there are other potential problem chemicals whose effects are unknown. For example, many medications are excreted from the body and are detectable in wastewater. Such chemicals are not on the list of monitored pollutants, but would likely be present in recycled water.

To produce treated water via a direct reuse system, a similarly-sized MF/RO and UV oxidation system must be designed. The anticipated capital cost to construct a 0.9 mgd (1,000 ac-ft) potable reuse system is approximately $9,000,000 (in 2012 dollars). Note that the recommended treatment system for a direct potable reuse system will be identical to an indirect potable reuse system. While this type of treatment system must be used for direct reuse, it is not actually required for most uses of indirect reuse. However, while a direct reuse system has not been formally approved yet by the TCEQ, planned indirect potable reuse has been utilized throughout the state, especially when using advanced membrane treatment processes to treat the recycled water prior to blending with the raw water supply. As with the other water supply alternatives, there are several inherent advantages and disadvantages to this alternative, which are listed in Table 2-11.

Table 2-11 Advantages and Disadvantages for Implementing Direct Potable Reuse	
Advantages	**Disadvantages**
Provides an improvement in finished water quality	Community opposition due to "yuck" factor
Provide additional water without purchasing additional water rights	Disposal of membrane treatment system wastewater (RO concentrate)
Can reduce salt concentrations in blended finished water, improving finished water quality in distribution system	Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints
Provide additional treated water without re-treating at the WTP	Requires additional training to operate advanced treatment systems
Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality	No official approval of direct reuse in the state as yet by the TCEQ

If long-term implementation of reuse is recommended in the course of this Study, it is likely that indirect reuse will be recommended rather than direct reuse.

Development of Brackish Groundwater

Throughout the Study Area, groundwater has provided water supplies that range from sustainable municipal supplies to quantities of water suitable for irrigation, livestock, and industrial supplies. The major aquifers that exist within the region include the Gulf Coast aquifer, which underlies the entire coastal region of Texas, and the Carrizo-Wilcox aquifer that exists in a broad band that sweeps across the state beginning at the Rio Grande north of Laredo, then continuing northeasterly in an arc south and then east of San Antonio before continuing on to the northeastern corner of Texas and into Louisiana. These aquifers are delineated on the map in Figure 2-1 ("major and minor aquifers" in the Rio Grande Water Planning Region).

In 2002, the TWDB designated the Yegua-Jackson aquifer as a minor aquifer in the State of Texas. The primary rationale for this designation is that water use from the Yegua-Jackson aquifer ranks in the upper half of annual water use for the minor aquifers, with more than 11,000 ac-ft of water produced in 1997 across the State of Texas. In the Rio Grande Valley, the Yegua-Jackson aquifer extends in a narrow band from the Rio Grande through Starr, Zapata, and Webb counties (Figure 2-1).

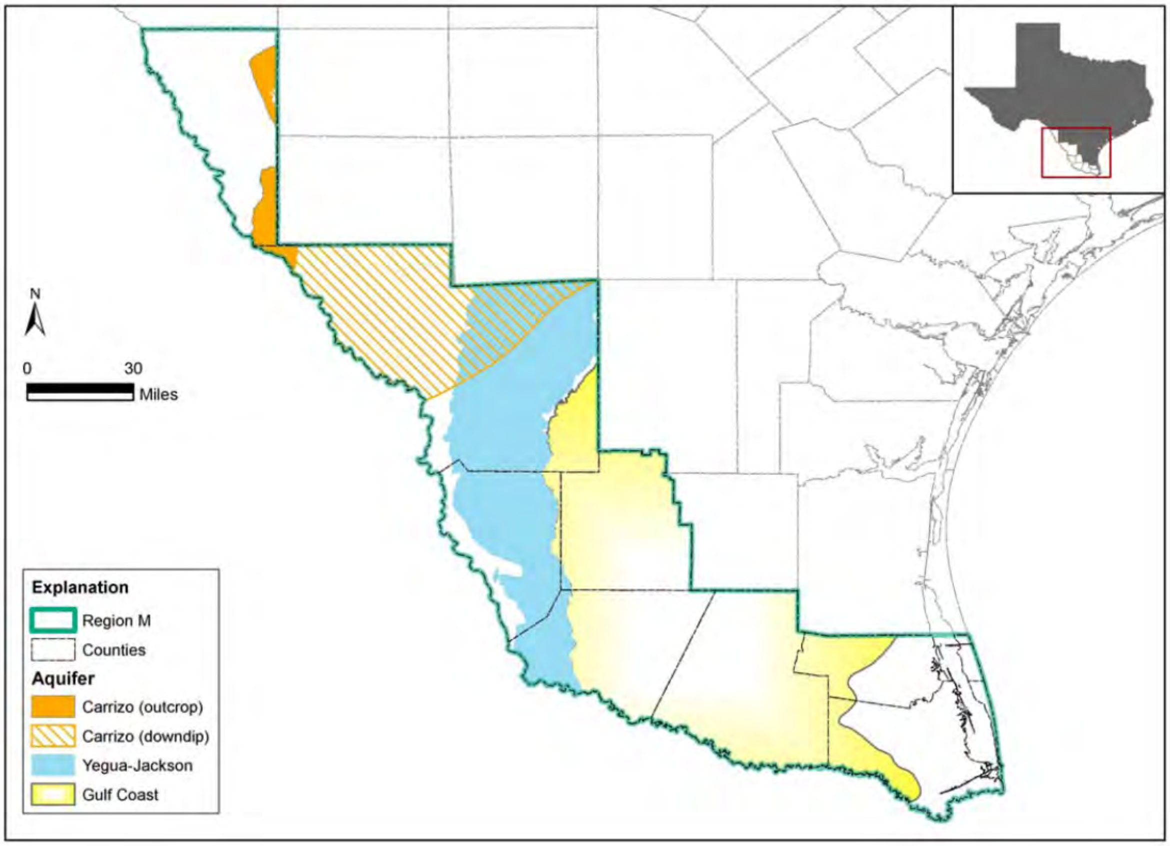

Figure 2-1
Major and Minor Aquifers in the Region M Water Planning Region

Less significant aquifers that exist within the region have not been designated by the TWDB as "minor aquifers," but they provide important water supplies for smaller areas. In the Rio Grande Valley, other aquifers include the Rio Grande Alluvium, which is also called the Rio Grande aquifer, and the Laredo Formation.

The concepts of groundwater availability and aquifer sustainability have been debated significantly in recent years. For groundwater source availability, TWDB planning guidelines require that regional planning groups "Calculate the largest annual amount of water that can be pumped from a given aquifer without violating the most restrictive physical or regulatory or policy conditions limiting withdrawals, under drought-of-record conditions. Regulatory conditions refer specifically to any limitations on pumping withdrawals imposed by groundwater conservation districts through their rules and permitting programs." This guideline requires that planning groups make a policy decision as to the interpretation of the term "most restrictive" as it relates to long-term groundwater availability.

TWDB further requires that "Once Groundwater Availability Model (GAM) information is accessible for an area within a region, the Planning Group shall incorporate this information in its next planning cycle unless better site-specific information is developed." The Rio Grande planning group (in the latest Region M Planning Study) concluded that the two available GAMs are the most appropriate tool for analyzing regional groundwater availability in the Region for the two major aquifers, the Carrizo-Wilcox and Gulf Coast aquifers.

A GAM has not been completed for the Yegua-Jackson aquifer. Therefore, the groundwater availability assessment for the Yegua-Jackson and other small aquifers are based on published information, historical water use data from these aquifers, available well and water level records, and the knowledge base of the consultant team. The Region M planning group determined that it is in the best interest of the Region to maintain an acceptable level of aquifer sustainability during the 50-year planning window, as well as for future generations beyond the 50-year planning period. Thus, for the two major aquifers for which GAMs exist, the groundwater availability for the planning period was defined as the amount of groundwater that could be withdrawn from aquifers over the next 50 years that would not cause more than 100 feet of water level decline in the aquifers as compared to water levels in 2010. These criteria were used to guide the development of the ground-water availability assessment and to determine groundwater supply for each aquifer in each county. As noted above, water supply for the Yegua-Jackson and other small aquifers was estimated from other information. The planning group acknowledges that additional water does occur in storage within the aquifers and that a portion of that water (above than the estimated supply) could be pumped if there is not a groundwater conservation district in place to prevent such withdrawals.

Water contains a varying amount of TDS. Freshwater has a TDS content of less than 1,000 parts per million (ppm) and seawater normally has a TDS of 30,000 to 40,000 ppm. Brackish water falls in between the two, with a TDS ranging between 1,000 to 10,000 ppm. Brackish water occurs along coastal areas where seawater meets freshwater discharges and in areas of high salt occurrence in rocks and soils, where brackish groundwater results, especially if rainfall is low and evaporation rates are high.

Much of the groundwater in the region is brackish (i.e., above 1000 ppm or mg/L of total dissolved solids). In order to be used for municipal supply, the brackish groundwater requires treatment. The portion of groundwater that is brackish has been estimated by looking at the overall water quality in each county on an aquifer-by-aquifer basis. The groundwater quality information is discussed in more detail in the following sections.

Gulf Coast Aquifer

The Gulf Coast aquifer exists in an irregular band along the Texas coast from the Texas-Louisiana border to Mexico. Historically the Gulf Coast aquifer has been used to supply varying quantities of water in Cameron, Hidalgo, Jim Hogg, eastern Starr, southeastern Webb, and southern Willacy counties as shown in Figure 2-2 (Approximate Areas of Groundwater Aquifers in the Lower Rio Grande Valley).

Total groundwater pumpage was approximately 22,770 ac-ft in 1997. In 1997, municipal pumpage accounted for 11,665 ac-ft, irrigation for 6,550 ac-ft, manufacturing use for 850 ac-ft, electric power generation for 720 ac-ft, mining for 2,410 ac-ft, and livestock use for 575 ac-ft.

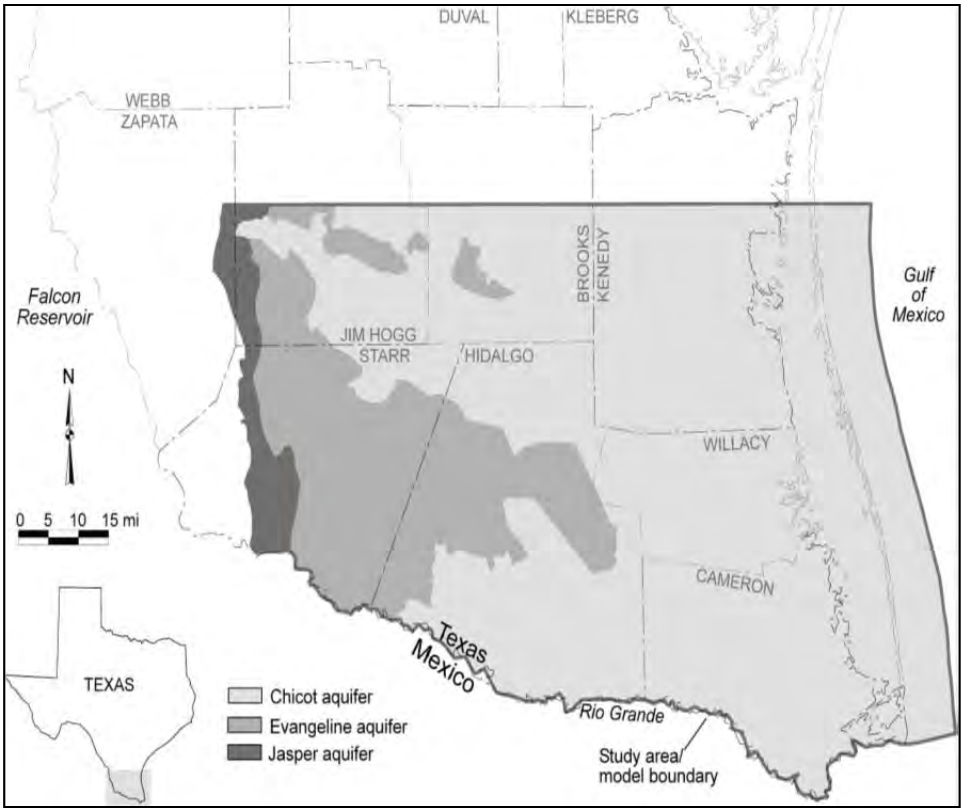

Figure 2-2
Approximate Areas of Groundwater Aquifers in the Lower Rio Grande Valley

The greatest total groundwater use in recent years was estimated at 37,990 ac-ft in 1991, primarily driven by irrigation demands of 26,540 ac-ft. The largest volume of groundwater used to meet municipal demands was 11,685 ac-ft in 1996. Because groundwater is usually considered as a secondary source, the higher demand for groundwater has usually coincided with times when there was less surface water available.

The Gulf Coast aquifer consists of interbedded clays, silts, sands, and gravels, which are hydrologically connected to form a leaky aquifer system. In general, there are four components of this system: the deepest zone is the Catahoulla; above the Catahoulla is the Jasper aquifer located within the Oakville Sandstone; the Evangeline aquifer contained within the Fleming and Goliad sands is separated from the Jasper by the Burkeville confining layer; and the uppermost aquifer—the Chicot—consists of the Lissie, Willis, Bentley, Montgomery, Beaumont, and overlying alluvial deposits. In the Rio Grande Valley, these overlying alluvial deposits include portions of the Rio Grande alluvium. These zones extend into Zapata and Webb counties, but produce smaller quantities of water in these areas.

The primary water-producing zone varies from one area of the region to another. The Chicot aquifer is the primary water-producing zone in western Cameron and eastern Hidalgo counties. The Evangeline aquifer produces significant quantities of water in Cameron, Hidalgo, and Willacy counties. The Oakville Sandstone produces significant quantities of water in northeastern Starr County, northwestern Hidalgo County, and a portion of Jim Hogg County. The Catahoula formation produces small to moderate quantities of water in Webb County.

Recharge to the Gulf Coast aquifer occurs primarily through percolation of excess precipitation, which is precipitation that does not run off of the land surface or is not lost through evapotranspiration. This may be supplemented in some areas by the addition of irrigation water from the Rio Grande. In some areas recharge may be limited by shallow subsurface drainage systems designed to control the buildup of salts resulting from continued irrigation operations.

Although there are significant quantities of groundwater available, groundwater has not been heavily used and water levels have remained relatively stable over the years. The Gulf Coast aquifer is basically considered to be full. Well yields can vary significantly. In the Oakville Sandstone, average production is about 120 gallons per minute (gpm), while in the Chicot aquifer the average well yield is about 10 times this rate, or 1,200 gpm. In the Catahoula formation, yields range from 30 to 150 gpm.

The Region M Planning Study estimated volumes of groundwater available for development from the Gulf Coast Aquifer are provided in Table 2-12. As discussed previously, these groundwater availability estimates for the Gulf Coast aquifer were based on simulations with the Southern Gulf Coast GAM.

Table 2-12 Projected Groundwater Availability (in acre-ft) from the Gulf Coast Aquifer						
County	**River Basin**	**2010**	**2020**	**2030**	**2040**	**Buildout (2060)**
Starr	Nueces-Rio Grande	3,040	3,040	3,040	3,040	3,040
Starr	Rio Grande	4,560	4,560	4,560	4,560	4,560
Total for Starr County		**7,600**	**7,600**	**7,600**	**7,600**	**7,600**

Carrizo-Wilcox Aquifer

The Carrizo Sand outcrops in a very small area in northwest Webb County, approximately 60 miles to the north-northwest of Laredo. The formation continues north into Dimmit, Zavala, and Maverick counties, roughly parallel in orientation to those formations occurring to the east and south.

The Carrizo Sand is a coarse to fine grained, massive, loosely cemented, cross-bedded sandstone with some interbedded thinner sandstones and shales. It yields moderate to large quantities of groundwater, but the yield decreases with distance from the outcrop as the formation dips southeastward. Recharge occurs primarily through exposure of the Carrizo Sand to precipitation at the outcrop and where the outcrop is incised by creeks or streams. A groundwater model has recently been developed for the Carrizo aquifer and further study is underway by the TWDB to fully assess the recharge and potential yield of this aquifer.

Minor Aquifers

Other aquifers included in the Rio Grande Valley that are known to supply groundwater include the Yegua-Jackson aquifer, Rio Grande Alluvium and the Laredo Formation. Although the Rio Grande Alluvium exists in the northern portion of the Rio Grande Valley, most of the production from this formation occurs in the three most southern counties - Cameron, Hidalgo, and Starr. The Laredo Formation is primarily utilized in Webb County.

The Yegua-Jackson aquifer extends in a narrow band from the Rio Grande and Mexico across the State to the Sabine River and Louisiana. In the Rio Grande Valley, the Yegua-Jackson aquifer extends in a narrow band from the Rio Grande through Starr, Zapata, and Webb counties. The amount and type of use from the Yegua-Jackson aquifer vary across the region.

The Rio Grande Alluvium primarily provides water in Hidalgo and Starr counties within about five miles of the Rio Grande River. The quantities of water produced from this formation are probably included in the estimates of pumpage from the Gulf Coast aquifer by the TWDB because it is difficult to separate the surface deposits of the Rio Grande Alluvium from those of the Gulf Coast aquifer. The main differentiating characteristic is that the Rio Grande Alluvium is considered to be more permeable. The Laredo Formation is located in southeastern Webb County and northern Zapata County.

The estimates of past groundwater use from "other aquifers" in the Region M Planning Study includes four counties: Maverick, Webb, Zapata, and Starr. The aquifers that may be included in these estimates of use are the Rio Grande Alluvium, Laredo Formation, and the Catahoula Formation in Webb County. The total estimated groundwater use for each year is 1,172 ac-ft.

The Yegua-Jackson aquifer consists of complex associations of sand, silt, and clay deposited during the Tertiary Period. Net sand thickness is generally less than 200 feet at any location within the aquifer. Water quality varies greatly within the aquifer, and shallow occurrences of poor-quality water are not uncommon. In general, however, small to moderate amounts of usable quality water can be found within shallow sands (less than 300 feet deep) over much of the Yegua-Jackson aquifer. Although the occurrence, quality, and quantity of water from this aquifer are erratic, domestic and livestock supplies are available from shallow wells over most of its extent. Locally, water for municipal, industrial, and irrigation purposes is available. Yields of most wells are small, less than 50 gallons per minute (gpm), but in some areas, yields of adequately constructed wells may be as high as 500 gpm.

The Rio Grande Alluvium exists in Hidalgo County as a river alluvium, but transitions in Cameron County to a more deltaic type of deposit. The material composing the alluvium is highly variable from one location to another. The alluvium has generally been divided into three layers: shallow (less than 75 feet), middle (75 to 150 feet), and deep (150 to 225 feet).

Yields are generally higher in the deeper zone and closer to the Rio Grande River. Recharge is primarily through interaction with the Rio Grande River, with some surface recharge. Water levels have generally been stable. There is currently additional research being done by the TWDB to further identify the thickness and properties of this groundwater source.

The TWDB has not tracked water usage in the Yegua-Jackson aquifer because it was designated a minor aquifer in 2002. There will be a GAM available for the Yegua-Jackson aquifer in the future. Therefore, estimates of groundwater availability for the Yegua-Jackson aquifer (Table 2-13) were based in part on the historical TWDB estimate of groundwater from the "other" aquifers in the region.

Table 2-13 Projected Groundwater Availability (in acre-ft) from the Yegua-Jackson Aquifer					
County	**2010**	**2020**	**2030**	**2040**	**Buildout (2060)**
Starr	2,000	2,000	2,000	2,000	2,000
Total	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**

Historically, the TWDB has arbitrarily set a limit of 10,000 ac-ft per year for "Other Aquifers" in select counties (Table 2-14). This may exceed what can actually be produced in many cases, and in some cases may be much less than actual production. It is beneficial to note that the total historical use for all "other aquifers" in all counties has not exceeded 5,000 ac-ft per year. The existing TWDB estimates of water availability have been adopted.

Table 2-14 Projected Groundwater Availability (in acre-ft) from "Other Aquifers"						
County	**River Basin**	**2010**	**2020**	**2030**	**2040**	**Buildout (2060)**
Starr	Nueces-Rio Grande	2,291	2,291	2,291	2,291	2,291
Starr	Rio Grande	7,709	7,709	7,709	7,709	7,709
Total for Starr County		**10,000**	**10,000**	**10,000**	**10,000**	**10,000**

On September 1, 2005, the Texas Legislature passed House Bill (HB) 1763 that presented changes in how groundwater availability is determined in Texas. In its more important changes, HB1763:

1) Regionalizes decisions on groundwater availability;

2) Requires regional water planning groups to use groundwater availability numbers from the groundwater conservation districts; and

3) Defines a permitting target/cap for groundwater production.

These changes affect the rules and plans of groundwater conservation districts, various groundwater supply projects planned around the state, and the regional and state water plans. It also affects the ability of political subdivisions to get state loans for groundwater projects, even if those projects are in areas with no groundwater conservation districts.

Groundwater Management Areas have been around for more than 50 years. Until September 2001, the main purpose was the creation of groundwater conservation districts. After 2001, the primary purpose has been joint planning. However, in

2005, HB1763 required joint planning among groundwater conservation districts within groundwater management areas. The most important part of the joint planning is to determine desired future conditions and calculate managed available groundwater values.

Before HB1763, regional water planning groups were only required to consider the information from the groundwater management plans. This in turn allowed the planning group to determine planning values for groundwater availability without being required to use those values submitted in the groundwater management plans. With the passage of HB1763, regional water planning groups are now required to use managed available groundwater for their groundwater availability estimates. The TWDB recommends that regional water planning groups consider broadening their strategies in terms of both quantity and source to take into consideration changes in groundwater availability for planning purposes.

The process begins with the development of desired future conditions. These are defined as the desired, quantified conditions of groundwater resources (i.e. water levels, water quality, spring flows, or volumes) at a specified time or times in the future or in perpetuity. Groundwater Conservation Districts must go through the process of joint planning to define these desired future conditions. GAMs must be used in this analysis. When submitting desired future conditions, the TWDB requires the following:

1) Physically compatible conditions;

2) Copies of the groundwater management area meeting postings and minutes, with the complete voting record by member, of the groundwater management area's public meetings at which the desired future conditions were adopted;

3) A resolution signed by the groundwater management area member district representatives adopting the desired future conditions;

4) The name of a designated representative of the groundwater management area for TWDB staff to contact as necessary; and

5) Any other information the Executive Administrator of the TWDB or designee may require.

After this information is submitted, the TWDB provides each district and regional water planning group in the groundwater management area with the values of managed available groundwater based on the desired future conditions.

State law allows for the filing of a petition with the TWDB appealing the reasonableness of a desired future condition. A person with a legally defined interest in groundwater in the groundwater management area, a groundwater conservation district in or adjacent to the groundwater management area, or a regional water planning group for a region in the groundwater management area may file a petition with the TWDB appealing the approval of a desired future condition. The petition must be filed within one calendar year of the adoption of the desired future conditions. The complete petition must first be provided to the groundwater conservation districts 30 days before a petition is filed with the TWDB.

After a series of notices and hearings, the Executive Administrator will prepare a list of findings based on the evidence and may provide a summary, an analysis, and recommendations relating to the groundwater conservation districts' groundwater management plans and desired future condition. If the TWDB finds that the desired future condition is reasonable, the Executive Administrator will send a letter to the petitioner and the groundwater conservation districts noting the TWDB's decision. If the TWDB finds that the desired future condition is not reasonable, then the TWDB will prepare a report that includes a list of findings and recommended revisions to the desired future condition. The groundwater conservation districts are then required to revise their desired future condition in accordance with the TWDB's recommendations and submit the revised desired future condition to the TWDB.

Currently four groundwater conservation districts exist in the region, Brush Country, Kenedy County, Red Sands, and Starr County. Starr County Groundwater Conservation District (District) is located in Starr County. They just completed appointing its board of directors for the district and have been working closely with TWDB and other local districts to help construct their Groundwater Conservation Management Plan. The District is currently in the process of registering all wells and receiving the required permits for the wells.

To produce raw water via a brackish groundwater system, two key components are required, a well supply system and an advanced treatment system. Since the majority of groundwater historically utilized in the Rio Grande Valley for municipal use is brackish, RO treatment is required. To produce 1,000 ac-ft (0.9 mgd), 1.3 mgd of groundwater must be pumped from the ground and sent to an RO membrane treatment system. As discussed above, groundwater wells drilled into the Gulf Coast Aquifer, Carrizo-Wilcox Aquifer and Rio Grande River fed alluviums have historically not produced large flow rates on a per-well basis. Therefore, it is likely that a well field would need to be constructed, with a minimum of 5 wells (with one redundant), sized at approximately 250 gpm each. With a typical cost of $500,000 (in 2012 dollars) for a shallow well (less than 1,000 feet deep), the anticipated capital cost to construct a 0.9 mgd brackish groundwater well and RO treatment system is approximately $7,500,000 (in 2012 dollars). However, as with the other water supply alternatives, there are several inherent advantages and disadvantages to this alternative, which are listed in Table 2-15.

Table 2-15
Advantages and Disadvantages for Developing a Brackish Groundwater Supply

Advantages	Disadvantages
Provides an improvement in either raw or finished water quality	Disposal of membrane treatment system wastewater (RO concentrate)
Provide additional water without purchasing additional water rights	Requires additional training to operate advanced treatment systems
Can reduce salt concentrations in blended raw and/or finished water, improving raw and/or finished water quality	Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints
Provide additional treated water without re-treating at the WTP or can blend RO permeate with raw water to improve raw water quality	Based on historical groundwater usage in Starr County, there appears to limited availability of groundwater in the Study Area
Cost to provide additional water is lower than some of the other alternatives, especially when accounting for improved water quality	-

A key benefit from this alternative is that while increasing the total water supply for each utility, it can also improve the quality of the raw water (if the RO permeate is blended with raw water).

FUTURE REGULATIONS AND IMPACT ON SUPPLY AND TREATMENT

Of the key issues evaluated in identifying future water supplies, the concern over future water quality should take highest priority. The quality of the water coming from the Rio Grande River has deteriorated over the past several decades and will likely continue to deteriorate over the next thirty years. The primary water quality changes have occurred with dissolved constituents such as TDS, dissolved chlorides and dissolved sulfates. TDS consists of salts that can leach into the river from rock formations and from the discharge of WWTP effluent into the river.

A hundred years ago the Rio Grande River was a wide, deep, fast-moving river that sent a substantial volume of water along the Rio Grande Valley to discharge into the ocean. Over the past hundred years, more and more of the daily river water flow has been diverted, initially for agricultural use and now with an ever-increasing change toward municipal use. As more water was diverted from the Rio Grande River over the years, the river became shallower in areas allowing for greater evaporation, which results in greater concentration of salts in the river water. Over the past thirty years, an increasing number of WWTPs have been placed online, with many of the WWTPs discharging either directly or ultimately into the river. Between the evaporation and WWTP effluent discharges, the salinity of the river has increased substantially over the past thirty years. As a result, the increasing salinity is and will continue to impact treatment performance of WTPs.

The WTPs in the Study Area are of a conventional type. Conventional WTPs consist of coagulation, flocculation, sedimentation and dual-media filtration. The primary goal of conventional treatment WTPs is to remove most suspended solids, which can contain suspended organics, bacteria and viruses. However, a conventional WTP cannot remove fine particles of suspended solids and dissolved solids. Over the past 10 years utilities using conventional WTP processes have been seeing increasing difficulty in maintaining the same quality of finished water as the raw water quality has deteriorated, especially during the summer time when the river water temperature is higher, organic content is higher, and evaporation is at its highest, resulting in the highest concentration of salts in the water.

While the TCEQ has not yet begun widespread enforcement of its secondary drinking water standard (SDWS) limits, many utilities over the past five years have begun to invest in alternative and innovative treatment technologies to improve the quality of their drinking water. One example of this is utilizing membrane filtration in lieu of granular media filtration, which is still used in most conventional WTPs. Membrane filtration, such as microfiltration (MF) or ultrafiltration (UF) provide significantly improved performance in removing smaller suspended particles in the finished water, making it much easier for utilities to maintain compliance with the recent, more stringent Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

In addition, utilities using water supplies that are high in TDS, which is considered by the EPA to be above 500 milligrams per liter (mg/L), are starting to also invest in desalination (removal of dissolved salts) technologies such as RO, electrodialysis (ED) and electrodialysis reversal (EDR). With these technologies, a utility can substantially reduce TDS, chlorides, sulfates and hardness, providing a much higher quality of finished water than conventional WTPs can provide. An additional discussion on membrane filtration and RO treatment is included in the TM discussing water treatment, distribution and O&M alternatives. As alternative water supplies are evaluated in this Study, the potential increased treatment requirements of the water supply will be determined and how it impacts the feasibility of each potential water supply.

ALTERNATIVE RECOMMENDATIONS AND COSTS

When considering development of new water supplies, the cost frequently is fairly high, so identifying anticipated advantages, disadvantages and potential fatal flaws with each proposed new water supply is critical in identifying projects to implement as a result of this Study. The potential advantages and disadvantages for water supply alternatives are identified below in Table 2-16.

A brief discussion on how each alternate water supply could be developed, conceptual cost of development, and feasibility was included in the previous sections of this TM. For the sake of providing a comparable evaluation of feasibility and anticipated capital costs, the water supply goal in the previous sections was based on acquiring 1,000 ac-ft of municipal raw water supply from each supply alternative.

In addition, a key issue observed with several of the alternatives is that obtaining additional water rights via purchasing more water rights, leasing more water rights or obtaining a Bed and Banks permit could increase the total raw water supply, but will not improve the quality of the raw/finished water. For the other evaluated alternatives (indirect potable reuse, direct potable reuse and brackish groundwater development) in this TM, an overall improvement in water quality can be obtained along with the development of addition water supplies. In order to provide a more fair comparison of benefits versus costs for each alternative, potential treatment costs were developed for providing an additional RO treatment system as a future option to prepare for the likelihood of TCEQ enforcing SDWS limits for TDS, chlorides and sulfates in the future.

Table 2-16
Advantages and Disadvantages for Water Supply Alternatives

Water Supply Alternative	Advantages	Disadvantages
Purchasing water rights	Simpler than other water supply alternatives to accomplish.	May not be able to find sufficient water rights to purchase when needed. Additional water rights must be purchased to convert to guaranteed municipal rights. May not qualify for funding via traditional funding methods. Does not provide an improvement in finished water quality.
Leasing water rights	Simplest of water supply alternatives to accomplish. Could provide necessary surface water rights at one of the lowest costs in the evaluated alternatives.	Sufficient water rights to lease may not be available when needed. The more limited the availability of water rights to lease, the higher the cost of leasing per ac-ft. Water rights leased in one year may not be available the following year. May not qualify for funding via traditional funding methods. Does not provide an improvement in finished water quality.
Obtain water rights via Bed and Banks authorization	Lowest cost in the evaluated alternatives to provide additional water rights. Water rights should convey as municipal use at 1:1. If a Bed and Banks authorization is approved, collection and treatment of wastewater from other areas could increase available Bed and Banks water.	Bed and Banks authorization may not be approved due to downstream opposition. A Bed and Banks authorization may not grant full amount of water rights in comparison to effluent put back into river. May not qualify for funding via traditional funding methods.
Develop new raw water supply via indirect potable reuse	Provides an improvement in finished water quality. Provides additional raw water without purchasing additional water rights. Can reduce salt concentrations in blended raw water, improving finished water quality from WTP. Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality.	Community opposition due to "yuck" factor. Disposal of membrane treatment system wastewater (RO concentrate). Requires additional training to operate advanced treatment systems. No official approval of direct potable reuse in Texas by the TCEQ.
Develop new finished water supply via direct potable reuse	Provides an improvement in finished water quality. Provides additional water without purchasing additional water rights. Can reduce salt concentrations in blended finished water, improving finished water quality in distribution system. Provide additional treated water without re-treating at the WTP. Cost to provide additional water is lower than most of the other alternatives, especially when accounting for improved water quality.	Community opposition due to "yuck" factor. Disposal of membrane treatment system wastewater (RO concentrate). Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints. Requires additional training to operate advanced treatment systems.
Develop new raw/finished water supply via brackish groundwater	Provides an improvement in either raw or finished water quality. Provides additional water without purchasing additional water rights. Can reduce salt concentrations in blended raw and/or finished water, improving raw and/or finished water quality. Provide additional treated water without re-treating at the WTP or can blend RO permeate with raw water to improve raw water quality. Cost to provide additional water is lower than some of the other alternatives, especially when accounting for improved water quality.	Disposal of membrane treatment system wastewater (RO concentrate). Requires additional training to operate advanced treatment systems. Direct input to the distribution system can create areas of varying water quality in the distribution system, leading to resident complaints. Based on historical groundwater usage in Starr County, there appears to limited availability of groundwater in the Study Area.

For the sake of comparison, RO treatment systems for the first three water supply alternatives are also based on developing 1,000 ac-ft of municipal water, with the associated RO benefits of treating that water volume daily. The associated capital cost comparison for each alternative is included in Table 2-17.

Table 2-17
Capital Cost Comparison for Water Supply Alternatives

Water Supply Alternative	Conceptual Capital Cost (in 2012 Dollars)
Purchasing water rights	$5,700,000
Leasing water rights	$50,000 - $100,000 per year
Obtain water rights via Bed and Banks authorization	$100,000 - $200,000
Develop new raw water supply via indirect potable reuse	$7,000,000
Develop new finished water supply via direct potable reuse	$9,000,000
Develop new raw/finished water supply via brackish groundwater	$7,500,000

Based on the review of advantages, disadvantages and conceptual capital costs for each water supply alternative, several recommendations have been developed for the path forward. The recommendations with respect to each evaluated water supply alternative are discussed in further detail below.

- **Bed and Banks Authorization** – The City of Roma should begin discussions with its City Attorney regarding development of a Bed and Banks authorization application. eHT can assist the City in discussing the potential for obtaining a Bed and Banks authorization with the TCEQ to determine the likelihood both of obtaining an authorization and the potential amount of water rights that could be developed. These efforts should begin prior to consideration of any other alternatives due to the extremely low cost to develop additional water rights.

- **Indirect Potable Reuse** – Pending the outcome of the Bed and Banks review with the TCEQ and attorneys, the City of Roma should consider the development of an indirect potable reuse program. If little to no water rights credits can be obtained via a Bed and Banks authorization, consideration should be given to developing an advanced treatment system to allow for augmenting the City's existing raw water supplies via indirect potable reuse. The early planning stages for this alternative could also be completed in conjunction with early development of groundwater.

- **Brackish Groundwater** – Efforts during the early planning stages of this alternative could be accomplished in parallel to any other water supply alternative development efforts. More specifically, efforts to develop potential test well sites could be accomplished in conjunction with planning efforts to develop an indirect potable reuse system.

- **Leasing of Water Rights** – Since the City still has sufficient water rights to meet its own needs, little effort may be required to lease additional water rights at this time. However, it may be worthwhile for the City to identify potential leasing options for the future to be prepared to meet short-term needs.

- **Purchase of Water Rights** - Since the City still has sufficient water rights to meet its own needs, little effort may be required to purchase additional water rights at this time. However, it may be worthwhile for the City to identify potential purchasing options for the future to be prepared to meet near future needs.

- **Direct Potable Reuse** – Direct potable reuse should be only considered as a last resort. If little to no water rights credits can be obtained via a Bed and Banks authorization, consideration should be given to developing an indirect potable reuse prior to considering direct reuse.

This Technical Memorandum (TM) summarizes the findings of Task III of the City of Roma Regional Water Planning Study (the Study). The focus of Task III of the Study is the preparation of water treatment system alternatives for the Study Area.

Activities in Task III included the following:

- ✓ Determine useful life of each facility;
- ✓ Determine treatment capacity;
- ✓ Determine available capacity;
- ✓ Evaluate potential for regional water treatment;
- ✓ Determine anticipated treatment requirements over the 30-year planning horizon;
- ✓ Develop water demand by service areas over the 30-year planning horizon;
- ✓ Develop anticipated opinions of probable cost for treatment; and
- ✓ Prepare a technical memorandum summarizing the findings.

BACKGROUND

The historical reliance on individual utilities to provide basic water services in the Study Area has ensured more local oversight of utility operations and associated fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall area has grown. For example, there are currently three (including City of Rio Grande City) water treatment plants (WTPs) operating in and around the Study Area, whereas many similar-sized areas can function efficiently and cost-effectively with only one large treatment facility for each type of service.

Such economies of scale in other communities provide benefits such as:

- More unified administration, operations, purchasing;
- Cost sharing for staff training and certification;
- Reduced number of State discharge permits and points of effluent discharge into area waterways;
- Reduced paperwork, monitoring, reporting and enforcement activity associated with each treatment plant; and
- Typically much lower cost of treatment per gallon.

The potential benefits of "regionalization" or "consolidation" of utility providers are important enough that unique opportunities should be identified and pursued where they make sense and have a good chance to benefit all parties. Such opportunities will gradually come about as the overall region approaches build-out, as debt assumption becomes less of a factor, and through attrition as older systems face difficulties in meeting maintenance and rehabilitation needs, and further State and Federal regulatory mandates come along.

This TM addresses the fundamental questions of how particular consolidations might be accomplished with respect to meeting treatment goals. Incorporation of the results of this TM, along with results from the water distribution system alternatives TM (TM No. 4) and the operation and maintenance (O&M) alternatives TM (TM No. 5) should lead to technically sound engineering master plans to guide ongoing water system investments and management activities by the City of Roma and the other participating utilities. The goals of this TM are to:

- Identify and discuss future WTP sizing requirements for each utility;
- Identify and discuss current and future regulatory impacts on water treatment requirements;
- Identify and discuss current and future water quality needs and how it can impact water treatment requirements; and
- Develop potential WTP regionalization scenarios.

FUTURE REGULATIONS AND IMPACT ON SUPPLY AND TREATMENT

When identifying potential WTP regionalization alternatives, the concern over future water quality should take high priority. The quality of the water coming from the Rio Grande River has deteriorated over the past several decades and will likely continue to deteriorate over the next thirty years. Changes in water quality have occurred with respect to increasing levels of dissolved contaminants such as total dissolved solids (TDS), chlorides and sulfates. TDS consists of salts that can leach into the river from rock formations, evaporation (and resulting concentration of existing salts in the water) and from the discharge of wastewater treatment plant (WWTP) effluent into the river. The salinity of the river has increased substantially over the past thirty years and as a result, water quality will likely become one of the predominant issues (if not the most predominant) impacting treatment requirements for WTPs in the Rio Grande Valley.

Within the United States, regulatory agencies such as the Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ) are starting to push utilities that rely on water supplies high in TDS (which is considered to be above 500 milligrams per liter [mg/L]) to start investing in desalination (removal of dissolved salts) technologies such as reverse osmosis (RO), electrodialysis (ED) and electrodialysis reversal (EDR). With these technologies, a utility can significantly reduce TDS, chlorides, sulfates and in most cases hardness, providing a substantially higher quality of finished water than conventional WTPs can provide.

While the TCEQ has not yet begun widespread enforcement of its secondary drinking water standards (SDWS), many utilities in Texas over the past ten years have begun to invest in alternative and innovative treatment technologies to improve drinking water quality. One example of this is in utilizing membrane filtration in lieu of granular media filtration (which is still used in most conventional WTPs). Membrane filtration such as microfiltration (MF) or ultrafiltration (UF) provides significantly improved performance in removing smaller suspended particles in the finished water, making it much easier for utilities to maintain compliance with the recent, more stringent Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

In addition, some utilities have also begun to incorporate desalination technologies into their treatment facilities. In most cases, the addition of desalination technology is a direct result of the treatment requirements to develop a new water supply source, such as brackish groundwater or potable reuse of reclaimed wastewater treatment plant (WWTP) effluent. In other cases, the only available water supply to a utility may have such a high salinity that desalination is the only feasible method for utilizing that water supply.

As various regionalization alternatives are evaluated in this Study, potential increased treatment requirements of the water supply and how those treatment requirements impact the feasibility of each regionalization alternative will be determined.

DESIGN GUIDELINES FOR A NEW WATER TREATMENT PLANT

The goals of this section are to discuss the various water treatment technologies currently available, and the treatment requirements that would likely need to be met with a new WTP, regardless of the regionalization alternative ultimately recommended. Historically, most WTPs have used conventional treatment processes.

Conventional Treatment Technology

Conventional WTPs consist of coagulation, flocculation, sedimentation and dual-media filtration. The primary goal of conventional treatment WTPs is to remove most suspended solids, which can contain suspended organics, bacteria and viruses.

Coagulation can successfully remove a large amount of organic compounds, including some dissolved organic material, which is referred to as natural organic matter (NOM) or dissolved organic carbon (DOC). Coagulation can also remove suspended particles, including inorganic precipitates, such as iron and manganese. A large amount of DOC can give water an unpleasant taste and odor, as well as an orange or brown discoloration. While coagulation can remove particles and some dissolved matter, the water may still contain pathogens. In previous studies, it was found that coagulation and sedimentation can only remove roughly 25-80 percent of viruses and 30-85 percent of bacteria. When the pathogens are removed from the water, they are removed mainly because they are attached to the dissolved substances that are removed by coagulation. In Exhibit 3-1, the coagulants have been added to the water, and the particles are starting to bind together and settle to the bottom.

Exhibit 3-1
Coagulation Effects in Jar Testing

The coagulation process involves adding iron or aluminum salts, such as aluminum sulfate (alum), aluminum chlorohydrate (ACH), ferric sulfate, ferric chloride or polymers, to the water. These chemicals are called coagulants, and have a positive charge. The positive charge of the coagulant neutralizes the negative charge of dissolved and suspended particles in the water. When this reaction occurs, the particles bind together, or coagulate, into a floc (this process is also called flocculation). The larger particles, or floc, are heavy and quickly settle to the bottom of the basin. This settling process is called sedimentation. Exhibit 3-2 illustrates the basic reactions and processes that occur during coagulation, flocculation and sedimentation.

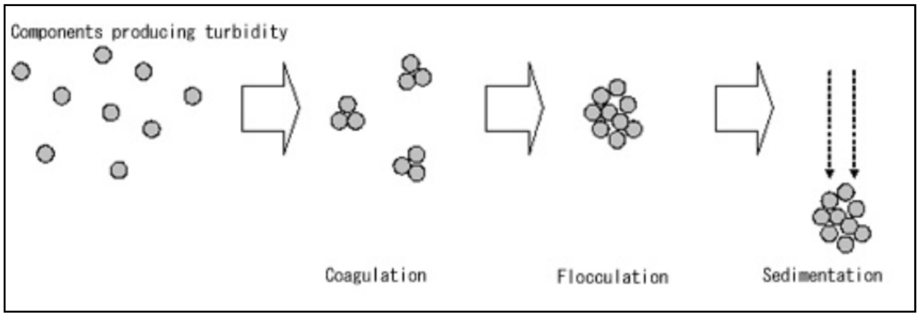

Exhibit 3-2
Conventional Coagulation, Flocculation and Sedimentation Processes

As coagulation and sedimentation cannot remove all of the viruses and bacteria in the water, it cannot produce safe drinking water via these processes alone. It is, however, an important primary step in the water treatment process, because coagulation and sedimentation removes many of the particles, such as DOC, that make water difficult to disinfect. Because coagulation and sedimentation remove some of the dissolved substances, less chlorine must be added to disinfect the water. While using less chlorine can reduce O&M costs, the primary benefit to reducing DOC is that a reduced amount of dangerous disinfection by-products (DBPs) such as trihalomethanes (THMs) and haloacetic acids (HAA5) are formed when the water comes into contact with chlorine.

The second major process in a conventional WTP is filtration, which removes particulate matter from water by forcing the water to pass through porous media. A WTP filtration system consists of filters with varying sizes of pores, and is designed to operate as either a single-media (sand), dual-media (sand and anthracite) or tri-media (sand, anthracite and garnet) granular media filter.

There are two basic types of conventional filtration; slow filtration and rapid filtration. Slow filtration is a biological process, because it uses bacteria to treat the water. The bacteria establish a community on the top layer of sand and clean the water as it passes through, by digesting the contaminants in the water. The layer of microbes is called a schmutzdecke (or biofilm), and requires cleaning every couple of months, when it gets too thick and the flow rate declines. After the schmutzdecke is removed, the bacteria must be allowed several days to reestablish a community before filtering can resume. Slow filtration systems have been used for many years, with the earliest systems operating in London in the 19th century.[1] However, slow filtration systems require large areas of land to operate, because the flow rate of the water ranges from 0.5-1.3 gallons per minute per square foot (gpm/ft^2). Due to the land area required and the downtime for cleaning, rapid filters (developed in the early 20th century) have become much more prevalent today than slow filters.

Rapid filtration is a physical process that removes suspended solids from the water in the same manner as slow filters, but at a much higher rate. Rapid filtration is much more common than slow filtration, because rapid filters have fairly high flow rates and require relatively little space to operate. In fact, during rapid filtration, water can be filtered up to a rate of 6.5 gpm/ft^2. Rapid filters require periodic cleaning, called backwashing, where filtered (clean) water is pumped back into the filter structure from the clean side of the filter and flushes the trapped solids out of the filter. Backwashing typically requires the use of 10-20 percent of the daily production of filtered water to be diverted for cleaning.

Advanced Treatment Technologies

A conventional WTP cannot remove fine particles of suspended solids and dissolved solids. Over the past 10 years utilities using conventional WTP processes have been seeing increasing difficulty in maintaining the same quality of finished water if the raw water quality deteriorates.

The ability of conventional treatment, such as sedimentation and granular media filtration, is compared below (refer to Exhibit 3-3) with different types of membrane filtration, including microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO). Particles with a diameter greater than one millimeter, such as gravel and sand, are removed through the sedimentation process. Particles with a diameter greater than 100 microns (or 0.1 millimeter), can be removed through granular media filtration. As the pore size decreases, a greater proportion of material is retained as the water passes through the filter.

[1] Safewater.org, Conventional Water Filtration

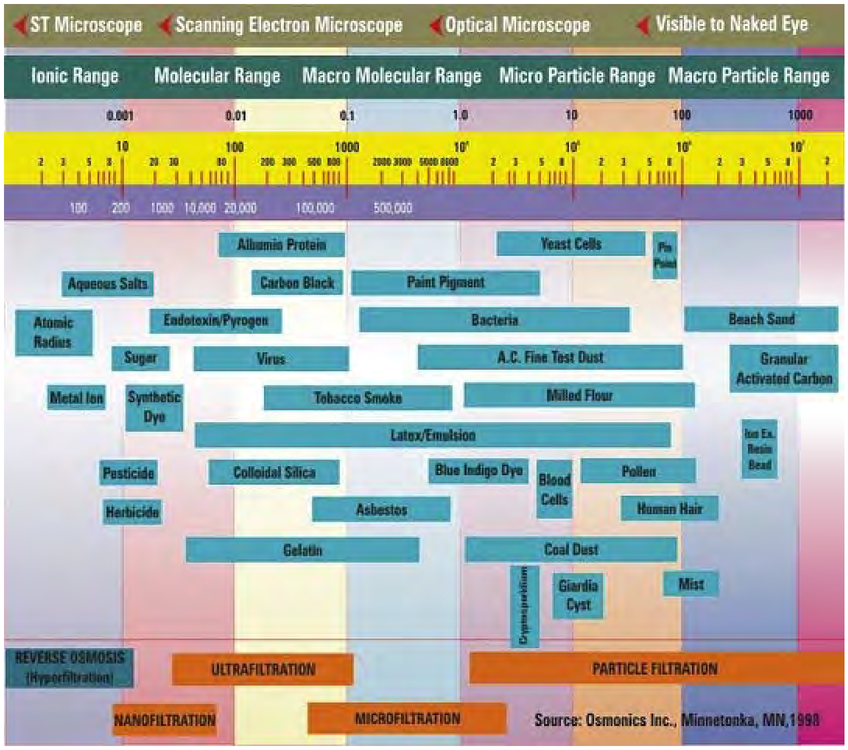

Exhibit 3-3
Comparison of Filtration Technologies

MF and UF filtration systems have a wider spectrum of particle removal capabilities than conventional media filtration. Conventional single-, dual-, or tri-media filters usually have lesser removal efficiency in terms of raw water organics in suspended form, DBP precursors, fine particles, silt and pathogens. Membrane filtration technologies are also less prone to upsets caused by seasonal changes in source water temperature, pH, turbidity, color, pathogen contamination and size and type of water particles, because their primary treatment mechanism is a mechanical particle removal through fine-pore membranes. Therefore, for applications where raw water quality experiences significant seasonal variations, and presents a challenge in terms of high pathogen, fine particles, and elevated particulate organics contamination, membrane filtration technologies are likely to offer performance benefits.

Membrane Treatment Technology

Membrane technology uses selectively permeable membranes to remove impurities from water. There are four general classes of membranes, including:

- Microfiltration (MF)
- Ultrafiltration (UF)
- Nanofiltration (NF)
- Reverse Osmosis (RO)

MF and UF membranes are classified as low-pressure membranes, or less than 100 pounds per square inch (psi) operating pressure, while NF and RO are classified as high-pressure (greater than 100 psi operating pressure), diffusion-controlled membranes. The type of membrane dictates the selectivity of the process. MF and UF membranes are usually considered as an alternative to more conventional filtration technologies such as single-, dual- or tri-media granular media filters.

MF has a pore size range of 0.1 to 5.0 microns and is capable of removing most bacteria and both Giardia and Cryptosporidium cysts, but is generally incapable of removing viruses and colloids (including many color forming compounds, or dissolved solids). UF has a pore size range of 0.002 to 0.1 microns and is capable of removing some colloids, including some color contributing colloidal particles, bacteria, most viruses and some organic compounds.

Membrane Filtration – Required Pretreatment

MF/UF pretreatment normally consists of chemical addition with mixing (coagulation), flocculation and settling. A coagulant and pre-disinfectant would need to be added to the raw water upstream of a static mixer which can mix the coagulating chemicals in the pipeline. Coagulation is then followed by a two-stage flocculation (allowing for buildup of “floc” particles) system, which is then followed by enhanced settling (sedimentation) in a clarifier. To connect a pretreatment system with a MF/UF filter system, an equalization basin is needed downstream of the pretreatment (and upstream of the MF/UF system) to absorb flow variations in the required settled water flow rate, due to backwashing of membranes.

Circular “reactor” clarifiers are a common approach that combines flocculation and enhanced settling in one basin. However, a more footprint-efficient configuration is recommended for pretreatment processes. It is recommended that the flocculation, sedimentation, and equalization basins be rectangular in configuration with common-wall construction to minimize the footprint of the pretreatment system. To further minimize the footprint of basin areas, vertical flocculators tend to be used more than horizontal, and use of inclined settling plates in the clarifier can also reduce the footprint. Vertical turbine pumps with variable speed control can be installed on top of the equalization basins to feed the MF/UF membrane filtration trains.

Other common advantages with using membrane technology are typically smaller plant footprints, modularity of design, simple operation, and a higher degree of automation. These advantages contribute to both lower land (and potentially total capital) and O&M costs and facilitate easier treatment plant expansions. While membrane technologies have many advantages, they also have potential problems. The problems that must be addressed in applying membrane technology to WTPs include membrane fouling, disinfection byproduct potential formation, management and disposal of a concentrated liquid waste stream, potentially higher capital costs than conventional treatment, and membrane integrity monitoring.

Treatment Technology Cost Comparison

One final comparison between conventional and membrane filtration is with regard to anticipated capital and O&M costs. While conventional filtration WTPs are still much more common than membrane filtration WTPs, the construction of new membrane filtration WTPs is rapidly becoming the standard for most new WTPs. Before 2000, membrane filter WTP capital cost was at least 2 times the cost of conventional filtration WTPs (and roughly 4 times conventional cost before 1990), though the treatment performance for membrane filtration was significantly better.

Since 2000, the cost difference has disappeared and in many cases, has reversed. Recent membrane filtration WTPs have been constructed at $2.50-3.50 per gallon (within the past two years), with the most recent being a 10 mgd membrane filtration WTP constructed at a total construction cost of $30 million ($3.00 per gallon). Because membrane filtration WTPs are becoming more common, reduced demand for conventional treatment plants has resulted in an increase in cost for most conventional treatment equipment. In comparison, a recent conventional WTP constructed was a 6 mgd WTP at a total construction cost of $25 million ($4.00 per gallon). However, it is anticipated that in using advancements in conventional technology, it should be feasible to construct either a membrane filtration or conventional WTP at a construction cost of approximately $3.00 per gallon, though that cost does not include necessary offsite improvements; therefore, including the additional offsite raw water pumping, storage and transmission system improvements, a construction cost of $3.50 per gallon is used in this Study until such time as final treatment process selections can be completed.

O&M costs vary for different types of conventional and membrane filtration systems, though the key cost components for conventional WTPs are normally water usage for cleaning and chemical usage for solids removal, whereas the main cost component for a membrane filtration WTP is energy usage. While membrane filters use more energy than conventional filters, the reductions in chemical and water usage for cleaning tend to result in a lower O&M cost than operation of conventional filters.

To summarize, both conventional treatment and membrane filtration treatment are viable treatment technologies with respect to current state and federal treatment requirements. However, when considering capital and O&M cost, current treatment performance and capability to meet future regulatory and treatment requirements, membrane filtration is recommended for any new surface WTP. In addition, to ensure consistent feed water to the membranes and to minimize membrane fouling while maximizing membrane life, conventional pretreatment ahead of the new membrane filtration system is also recommended for the new WTP.

DESALINATION TREATMENT ALTERNATIVES AND REQUIREMENTS

NF and RO membranes are usually considered to be secondary treatment processes in order to provide 2- to 4-log removal (99.0% - 99.99%) of contaminants (such as TDS, chloride, sulfate, heavy metals, radionuclides and most personal care products) from the water stream. However, NF does not remove TDS as well as RO, so NF membranes are generally used more often than not for water softening applications rather than for TDS removal. RO has the smallest pore size of membrane technology (approximately 0.001 microns and less) and is therefore capable of removing 90 to 99 percent of most TDS and other dissolved materials from the potable water stream. Therefore, RO membranes would be a better choice for a secondary treatment process if maximizing efficiency of reduction of TDS is desired.

RO is based on the process of osmosis. Osmosis involves the selective movement of water from one side of a membrane (a plastic film that looks similar to cellophane) to the other. Pressure is applied to the contaminated water, forcing water through the membrane. Since contaminants do not move with the water as it moves across the membrane, purified water collects on the other side of the membrane. The purified water that accumulates on the permeate (clean) side of the membrane can then be used. The remaining volume of water on the feed side is called concentrate or reject (waste stream) and is diverted to ultimate disposal. A specific amount of pressure is necessary to overcome the osmotic pressure (pressure required to overcome forward osmosis and start reverse osmosis) and separate purified water from the original feed stream. This required pressure is based on the type and concentration of contaminants in the water; brackish water (commonly found in groundwater or in reclaimed effluent) typically requires a feed pressure of 200-400 pounds per square inch (psi) whereas seawater frequently requires a feed pressure upwards of 1,000 psi. Supplying feed pressure in excess of the original osmotic pressure also typically provides better separation and a higher production rate of finished water.

RO requires a high quality feed (source) water, hence the need for MF or UF ahead of an RO system. In general, low quality raw water (high suspended solids or turbidity) applied to MF or UF should be pretreated to remove the majority of the suspended solids. Such reductions in the raw water solids content reduces the likelihood that the membranes will clog and can reduce the disinfection chemical demand of the treated water. Depending on the source water, pretreatment may include pre-filtration, pH adjustment, pre-oxidation, and/or coagulation / flocculation / sedimentation (CFS). Pretreatment for membrane technologies generally requires fewer treatment chemicals and smaller doses of those chemicals when compared to traditional WTPs. As a result, the product water from a traditional WTP typically contains higher levels of treatment chemicals than does the product water from membrane WTPs. Also, since fewer chemicals are applied to membrane processes as compared to conventional processes, the quantity of solids to be processed in the waste streams is generally significantly reduced.

ADDITIONAL REQUIREMENTS FOR A NEW WATER TREATMENT PLANT

The goal of this section is to discuss the various additional issues impacting the construction of a new WTP.

Raw Water Storage and Transmission

Currently, none of the existing WTPs in the Study Area utilize raw water storage reservoirs. Consequently, during emergency situations on the Rio Grande River, utilities are normally forced to shut down WTP operations while the primary raw water pump station (RWPS) is being serviced. Therefore, a new off-channel raw water storage reservoir is recommended for any of the regionalization alternatives evaluated.

Potential Site for New WTP

Regardless of the type of new WTP recommended in this Study, a site will need to be selected for construction of the new WTP. Based on projected water demands, it appears that a new regional WTP will provide water primarily to the City of Roma, which will cause the City to carry the largest share of the WTP cost. Therefore, it is logical that a new regional WTP be located somewhere within the City's certificate of convenience and necessity (CCN) area. Projected WTP and distribution system improvement costs discussed in this TM and in the Water Distribution System Alternatives TM will reflect the first-ranked potential WTP site (refer to Exhibit 3-4). Costs for the second-ranked site will be included as an appendix to the final Study report.

To construct a new WTP at a new site elsewhere in the City of Roma, several key factors need to be identified and incorporated into site selection and approval, including proximity to existing thoroughfares, proximity to nearby wastewater collection systems and availability for future needed expansions beyond 2040. The currently first-ranked WTP site is located west of one of the City's school campuses and north of the one of the City's elevated storage tanks (EST). Refer to Exhibit 3-4 below for a layout of the existing property proposed for a new WTP site.

Exhibit 3-4
Potential New WTP Site in North Roma

While the City already owns the defined property in Exhibit 3-4, there is still a section of property between the City property and the school campus that is still privately owned (highlighted in yellow). Because the City property has such an oblong shape, construction of long-term WTP improvements at this site may not be feasible. Therefore, if this site is ultimately utilized for a new City or Regional WTP, it is recommended that the additional private property (highlighted in yellow) be purchased to ensure sufficient space for constructing future WTP expansions at this site. At current land prices, purchase of the additional private property could cost upwards of $250,000-300,000, which will need to be budgeted in the anticipated capital costs for the new WTP.

Potential Hurdles for Expanding the WTP in North Roma

While there are many potential benefits to expanding the City's WTP in north Roma, there are several hurdles that could be fatal flaws to this WTP site alternative, including land acquisition, environmental clearance, complexity and redundancy, and public sentiment. The intent of this section is to identify any potential hurdles to utilizing this site for future WTP expansions. If the City wishes to pursue development of this site for water treatment, a Phase I environmental assessment would be completed in the preliminary design phase prior to completing any construction plans or specifications. Each of the hurdles identified below would need to be addressed to the satisfaction of the City before proceeding with actual final design, in order to minimize any risk on the City's behalf in pursuing development of this site.

Land Acquisition

The first critical hurdle is in acquiring the necessary property to provide expanded treatment capacity in this location. According to City staff, while the City owns the property circled in black in Exhibit 3-4, the property between the proposed WTP site and the school is owned privately. Therefore, if the City and other Study participants prefer to move forward with expanding the City's WTP at this location, efforts to determine feasibility of acquiring the east property would need to begin immediately following completion of this Study, in order to determine whether or not this WTP site alternative is viable.

Environmental Clearance

Funding agencies that distribute loan and grant funds from the federal government all require some form of environmental impact assessment. Funding from the United State Department of Agriculture (USDA) requires the completion and approval of an environmental assessment and the Texas Water Development Board (TWDB) requires the completion and approval of an environmental information document (EID). In either case, all potential environmental issues have to be addressed in order to receive a Finding of No Significant Impact (FNSI), which must be received in order to receive grant funding.

Complexity and Redundancy

If the City pursues development of the proposed north Roma site for a new WTP, certain processes and support facilities must be duplicated at the new WTP (which are not fully used at this time at the existing WTP). This adds cost to the initial phases of the WTP that is an investment that cannot be recouped until later phases of the WTP when the City would need to transition completely to the newer WTP. In addition, operation of a new WTP at a location some distance from the existing WTP requires additional staff to operate both WTPs unless additional funds are used to retrofit the existing WTP for remote operation to allow a single operating staff to operate and maintain both facilities.

Public Sentiment

The proposed north Roma site for a new WTP is located just west of the Roel and Celia Saenz Elementary School. Care must be taken to ensure adequate protection for children from exposure to water treatment chemicals and plant processes. While these issues can easily be factored into the design of the WTP, the City may get pushback from City residents adjacent to the proposed site or residents whose children attend the Roel and Celia Saenz Elementary School just east of the proposed WTP site.

In addition to the evaluation of the potential new north WTP site, an expansion analysis was completed to determine the feasibility of upgrading and expanding the existing City of Roma WTP site. Based on the existing processes and structures at the existing WTP site (Refer to Exhibit 3-5), it is likely that little expansion of the existing WTP can occur without drastically overhauling the plant site and transitioning to more advanced treatment technologies (which require a significantly less footprint for construction than the existing conventional treatment technologies).

Exhibit 3-5
Existing and Potential WTP Sites in Downtown Roma

Expanding the City of Roma's WTP at its current location (while planning for additional future necessary expansions) will require the acquisition of additional adjacent property. Since the existing WTP is bordered on the west by the Roma Bluff, and on the north and east sides by existing residential property, it appears that the only potential avenue for expansion would be via acquisition of all or part of the block just south of the WTP, as defined by Lincoln Ave., Convent Ave., North Water St. and Portscheller St.

The south block is currently owned and used by several owners, including the City of Roma, Central Power & Light (CP&L) and several private property owners. CP&L currently leases and operates a building (from the City) for billing and customer support services on the northwest corner of the block, while the City's WTP clearwell and high service pump station (HSPS) are located on the west end of the block. In addition, the City also owns the John Vale / Noah Cox House (Refer to Exhibit 3-6), which is located just across the street from Roma City Hall.

Exhibit 3-6
John Vale / Noah Cox House Across from Roma City Hall

Two additional buildings are located on the block, which include an old cantina located on the southeast corner (Refer to Exhibit 3-7) and another historical building located on the northeast corner of the block. Both buildings are believed to be constructed by Enrique Portscheller in the late 1800's. In the original construction, stone and brick walls lined the outer boundaries of each property, portions of which are still standing.

Exhibit 3-7
Portscheller Cantina Across from Roma City Hall

In November 1993, the 9-square block area around Roma Plaza was designated a National Historic Landmark District, the highest designation for historic properties in the United States.[2] Tracing its roots to the Spanish Colonial Colonists in the 1760's, Roma contains physical

[2] City of Roma public information

reminders of over two centuries of Texas/México borderlands heritage. Because of the cultural history of this area, the consideration of any improvements in this area would need to maintain or enhance the existing history of the Landmark District. However, reuse or recycling of the existing historical buildings may be accomplished via a concept called adaptive reuse.

Adaptive reuse refers to the process of reusing an old site or building for a purpose other than foe which it was built or designed. Adaptive reuse is seen by many as a key factor in land conservation and the reduction of urban sprawl. However adaptive reuse can become controversial as there is sometimes a blurred line between renovation, façadism (the practice of demolishing a building but leaving its facade intact for the purposes of building new structures in it or around it) and adaptive reuse. It is usually regarded as a compromise between historic preservation and demolition.

The key difference between adaptive reuse and façadism is how the WTP improvements could be conceptually designed with respect to incorporating the existing structures. In Exhibit 3-8 below, several key areas have been identified for improvements, including areas needed for electrical improvements, administration, lab and office areas, pretreatment processes and a new filtration system.

In the south City block area identified in Exhibit 3-8, the Vale/Cox House could be renovated (pending THC review and approval) and converted into a new Motor Control Center for the new WTP facility and needed transformers and backup generators could be installed at the southwest corner of the block. The original wall that surrounded the Vale/Cox property could be restored, which would re-enclose that property, along with shielding the outdoor electrical equipment from view.

The courtyard area between the Vale/Cox House and the old Portscheller Cantina could house a new pretreatment system for the WTP, and the original wall that surrounded the courtyard could also be restored, which would shield the pretreatment system from view.

The center of the block is large enough to provide space for roughly 10 mgd of conventional filter capacity, or 15-20 mgd of membrane filter capacity. While a conventional filtration system can remain outdoors, a membrane filtration system should be enclosed, and sufficient space is available to enclose a membrane filtration system while still providing upwards of 20 mgd of capacity.

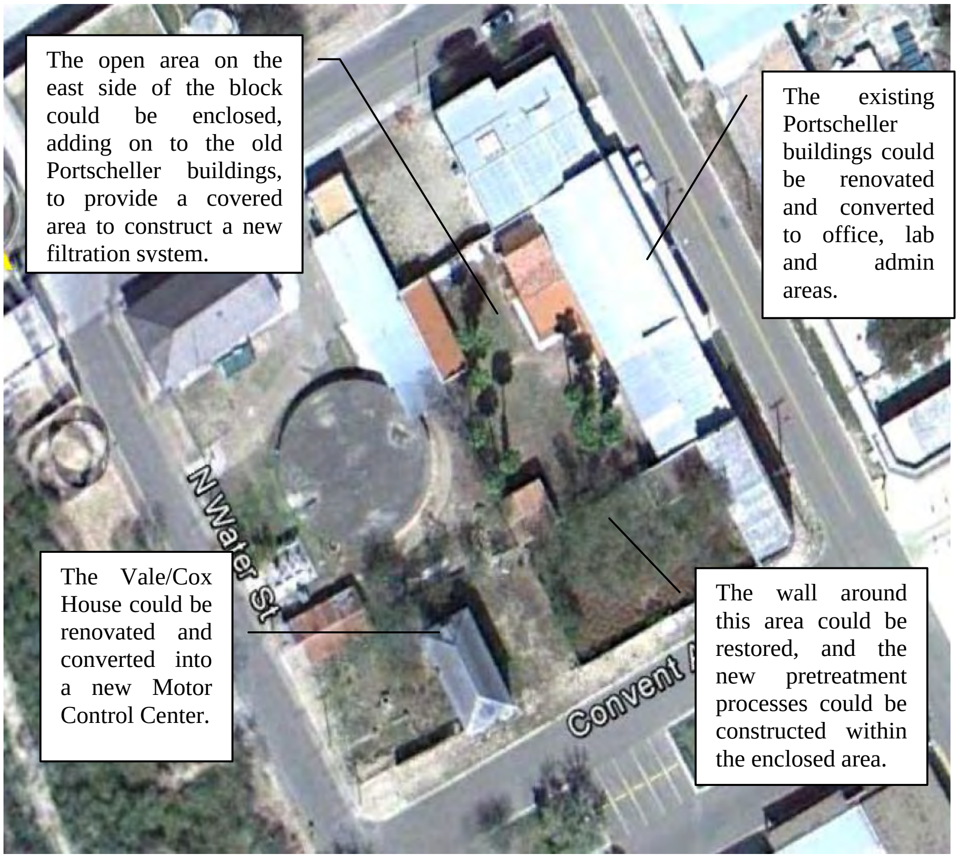

Exhibit 3-8
Conceptual WTP Improvements in Downtown Roma

The Portscheller buildings along the east side of the City block could be renovated (pending THC review and approval) and converted to administration space, operator office space, lab space for the WTP operator staff. In addition, if windows are installed on the west side of each building, a walkthrough hallway could be created, connecting all the buildings, to allow for an uninterrupted view of the WTP processes to allow for better operational management, training and providing educational tours of the WTP.

Potential Hurdles for Expanding the WTP in Downtown Roma

While there are many potential benefits to expanding the City's WTP in downtown Roma, there are several hurdles that could be fatal flaws to this WTP site alternative, including land acquisition, historical renovation requirements and limitations, renovation costs and public sentiment. The intent of this section is to identify any potential hurdles to utilizing this site for future WTP expansions. If the City wishes to pursue development of this site for water treatment, a Phase I environmental assessment would be completed in the preliminary design phase prior to completing any construction plans or specifications. Each of the hurdles identified below would need to be addressed to the satisfaction of the City before proceeding with actual final design, in order to minimize any risk on the City's behalf in pursuing development of this site.

Land Acquisition

The first critical hurdle is in acquiring the necessary property to provide expanded treatment capacity in this location. According to City staff, while the majority of the buildings along the west side of the City block are owned already by the City, the old Portscheller buildings along the east side of the block are owned by City residents, and in some cases, property may be owned jointly by multiple people. Therefore, if the City and other Study participants preferred to move forward with expanding the City's WTP to the adjacent south City block, efforts to determine feasibility, if any, of acquiring the eastern properties would need to begin immediately following completion of this Study, in order to determine whether or not this WTP site alternative is viable.

Historical Renovation Regulations

The next hurdle is determining the level of improvements that could be completed at each site, as the entire City block is located within the City of Roma's Historical Landmark District that was identified in 1993. The level of improvements allowed depends on the designation, such as whether the designation is for the National Register of Historic Places (NRHP), designated as a Recorded Texas Historic Landmark (RTHL) or designated as a State Archeological Landmark (SAL).

NRHP is a federal program administered in Texas by the Texas Historical Commission (THC) in coordination with the National Park Service (NPS). Listing in the National Register provides national recognition of a property's historical or architectural significance and denotes that it is worthy of preservation[3].

The RTHL designation can be awarded to buildings at least 50 years old that are judged worthy of preservation for their architectural and historical associations. Because of this, it is important for the exterior of the building to retain its historic integrity. If exterior architectural or structural changes, including the relocation of the building, are proposed, the owner must consult with the THC's Architecture Division 60 days in advance of any changes to be certain that the proposed work does not result in a loss of historic integrity.

SALs are buildings, structures or archeological sites designated by the THC that receive protection under the Antiquities Code of Texas. SALs cannot be

[3] Texas Historical Commission, Historical Designations

removed, altered, damaged, salvaged or excavated without a permit from the THC.

In coordination with NPS, it was determined that the Roma Historical Landmark District is currently identified as a collection of NRHP properties under the NPS National Register of Historic Places.[4] While this is the highest historical designation for the property, there is no review process for changes. However, any conceptual improvements to the site will need to be coordinated with THC as soon as possible to determine feasibility of completing the conceptual improvements.

Renovation Costs

Renovation costs for historical buildings are normally site-specific, in that in some examples, renovating a historical building is much more cost-effective than constructing a new building, and in some cases, renovation costs much more than constructing a new building. With the exception of the Vale/Cox House, the anticipated use for the other existing historical buildings would not change significantly, so the costs to renovate the majority of the historical buildings (and land acquisition) could be less than the anticipated land acquisition required for a new WTP site north of the City, along with the costs for constructing the required "human spaces", such as administration, office and lab space.

Public Sentiment

The City of Roma has a rich, diverse cultural history, dating back to the 1760's. As a result, City residents may not feel that adaptive reuse of the existing historical buildings is the best solution for extending the life of the existing buildings. To ensure a successful implementation of adaptive reuse (if this site alternative is ultimately selected for future WTP expansions), it will be critical to incorporate City resident input in the early planning stages, to gain buy-in from residents on the recommended building improvements.

REGIONALIZATION ALTERNATIVES

The goal of this section of the TM is to evaluate potential alternatives of consolidating water systems where feasible to increase operational efficiency and cost-effectiveness throughout the Study Area. For the area and number of connections served by the five Study participants, it is common to only have one or two water treatment facilities. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WTPs (refer to O&M Alternatives TM [TM No. 5] for additional discussion of potential O&M savings).

[4] National Park Service, National Register of Historic Places

Each WTP was evaluated in this Study for potential consolidation by being reviewed with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities and observed level of annual O&M efforts. There are 2 existing WTPs within the Study Area (City of Roma and Falcon WSC), with two existing WTPs located east of the Study Area in Rio Grande City. In addition, Rio WSC is in the process of designing and constructing a new WTP to provide part of its' service area water demands. Based on the evaluation of each WTP, alternatives have been developed for potential consolidation of WTPs and water systems to a minimum number of operating facilities.

Since the goal of this section is to determine the needs of all the water systems in the Study Area, several additional in-depth analyses were completed for each existing service area with the goal of developing additional potential consolidation alternatives. In general, there are five potential basic treatment alternatives for the Study participants which include serving from a minimum of one to all five of the Study participants from a new regional WTP. However, depending on which specific utilities would be served by a new regional WTP, there are sixteen potential alternatives for regionalization, which will ultimately take into account anticipated distribution and O&M costs as well as treatment. The regionalization scenarios evaluated in this Study are included in Table 3-1.

Table 3-1
Regionalization Scenarios

Scenario	City of Roma	Falcon Rural WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

Notes
1 - Implementation of any of the scenarios would likely require the construction of a new regional WTP.
2 - Existing WTPs would likely remain online for their respective remaining useful life to serve as a backup to a regional WTP.

A description of the proposed scenario, projected WTP opinion of probable construction costs (OPCC) and advantages and disadvantages are included on the following pages for each scenario identified in Table 3-1. Table 3-2 reflects the basic advantages and disadvantages for each scenario.

Table 3-2
Advantages and Disadvantages for Each Scenario

Scenario	Advantages	Disadvantages
Scenario 1	Lowest capital cost of the scenarios.	No benefits to the other Study participants.
Scenario 2	Provides improved treatment at reduced cost for Roma and Falcon Rural WSC. Provides another supply of water to Falcon Rural WSC.	No benefits to the other three Study participants.
Scenario 3	Lowest capital cost for distribution system improvements. Provides improved treatment at reduced cost for Roma and El Sauz WSC. Provides another supply of water to El Sauz WSC.	No benefits to the other three Study participants.
Scenario 4	Provides improved treatment at reduced cost for Roma and El Tanque WSC. Provides another supply of water to El Tanque WSC.	No benefits to the other three Study participants.
Scenario 5	Provides improved treatment at reduced cost for Roma and Rio WSC. Provides another supply of water to Rio WSC.	No benefits to the other three Study participants.
Scenario 6	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and El Sauz WSC. Provides another supply of water to Falcon Rural WSC and El Sauz WSC.	No benefits to the other two Study participants.
Scenario 7	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and El Tanque WSC. Provides another supply of water to Falcon Rural WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 8	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 9	Provides improved treatment at reduced cost for Roma, El Sauz WSC and El Tanque WSC. Provides another supply of water to El Sauz WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 10	Provides improved treatment at reduced cost for Roma, El Sauz WSC and Rio WSC. Provides another supply of water to El Sauz WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 11	Provides improved treatment at reduced cost for Roma, El Tanque WSC and Rio WSC. Provides another supply of water to El Tanque WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 12	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Sauz WSC and El Tanque WSC. Provides another supply of water to Falcon Rural WSC, El Sauz WSC and El Tanque WSC.	No benefits to one of the Study participants.
Scenario 13	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Sauz WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC, El Sauz WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 14	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Tanque WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 15	Provides improved treatment at reduced cost for Roma, El Sauz WSC, El Tanque WSC and Rio WSC. Provides another supply of water to El Sauz WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 16	Can provide water to all the Study participants.	Highest cost of all the scenarios.

A description of the distribution improvements required, distribution OPCC and advantages and disadvantages for each scenario is included in the Water Distribution System Alternatives TM (TM No. 4). A description of the anticipated O&M costs and operational advantages and disadvantages for each scenario is included in the Water System Operations Alternatives TM (TM No. 5).

A brief discussion for the potential regionalization scenarios is included in the following pages. The anticipated WTP capacity required per TCEQ design criteria (using 0.6 gpm per connection as minimum WTP sizing criteria) has been developed for each scenario, identifying required capacity at each five-year milestone through the course of the Study planning period. In addition, to ensure reserve capacity is available at each milestone to maintain compliance with the TCEQ's 85% Rule, the minimum WTP capacity identified for each scenario has been increased so that the anticipated water demand never exceeds 85% of the rated WTP capacity. An example of how the WTP sizing was accomplished for each scenario is shown below, followed by summary tables of required scenario WTP capacities and recommended design capacities to provide a comparison of the various scenarios. Following the discussion of WTP sizing, an anticipated OPCC will be provided for each potential regionalization scenario, along with a summary of costs for capital cost comparison between the various scenarios.

Regionalization Scenario 16 Example

In this scenario, the City of Roma, Falcon Rural WSC, El Sauz WSC, El Tanque WSC and Rio WSC all join together to develop a new regional WTP to serve all the utilities. The projected water demands for each utility are based on the number of projected connections identified for each utility in TM No. 1. Based on Table 3-3, the minimum required Scenario 16 WTP capacity (based on TCEQ 290 design criteria) at the end of the planning Study horizon (2040) would be approximately 14.2 mgd.

Table 3-3
Projected Water Capacity Requirements for Scenario 16

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	5.44	5.85	6.29	6.76	7.27	7.81	8.40	10.92
Falcon Rural WSC	1.05	1.16	1.27	1.40	1.54	1.70	1.87	2.61
El Sauz WSC	0.32	0.36	0.40	0.45	0.50	0.56	0.62	0.92
El Tanque WSC	0.54	0.60	0.67	0.75	0.84	0.94	1.05	1.55
Rio WSC	1.12	1.26	1.41	1.58	1.76	1.98	2.21	3.27
TOTAL	**8.48**	**9.23**	**10.05**	**10.94**	**11.92**	**12.98**	**14.15**	**19.26**
Notes								
1 - WTP capacity size in mgd								
2 - Connections based on historical number of persons per household								
3 - Growth based on utility-specific annual growth								
4 - WTP capacity based on TCEQ standard 0.6 gpm per connection								

To ensure that the City would be in compliance with the TCEQ's 85% Capacity Rule, the required capacity at each milestone is divided by 0.85 so that at each milestone, the water demand will not exceed the 85% Capacity Rule. Per Table 3-4, the recommended Scenario 16 WTP capacity at the end of the planning Study horizon (2040) is 16.7 mgd.

Table 3-4
Recommended Water Capacity Requirements for Scenario 16

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	6.40	6.88	7.40	7.96	8.55	9.19	9.88	12.85
Falcon Rural WSC	1.24	1.36	1.50	1.65	1.81	2.00	2.20	3.07
El Sauz WSC	0.38	0.42	0.47	0.52	0.59	0.66	0.73	1.08
El Tanque WSC	0.64	0.71	0.79	0.89	0.99	1.11	1.24	1.82
Rio WSC	1.32	1.48	1.66	1.85	2.08	2.32	2.60	3.84
TOTAL	**9.98**	**10.86**	**11.82**	**12.87**	**14.02**	**15.28**	**16.65**	**22.66**

Notes
1 - WTP capacity size in mgd
2 - Connections based on historical number of persons per household
3 - Growth based on utility-specific annual growth
4 - WTP capacity based on TCEQ standard 0.6 gpm per connection, divided by 0.85 for compliance with TCEQ's 85% capacity rule.

Each additional potential regionalization scenario was developed using the same methodology as Scenario 16. The anticipated minimum required WTP capacity for each scenario is summarized in Table 3-5.

Table 3-5
Summary of Projected Water Capacity Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
Scenario 1	5.44	5.85	6.29	6.76	7.27	7.81	8.40	10.92
Scenario 2	6.50	7.01	7.56	8.16	8.81	9.51	10.27	13.53
Scenario 3	5.76	6.21	6.69	7.21	7.77	8.37	9.02	11.84
Scenario 4	5.98	6.45	6.96	7.52	8.11	8.76	9.45	12.47
Scenario 5	6.57	7.11	7.70	8.34	9.03	9.79	10.61	14.19
Scenario 6	6.82	7.37	7.96	8.61	9.31	10.07	10.89	14.45
Scenario 7	7.04	7.61	8.24	8.92	9.65	10.45	11.32	15.08
Scenario 8	7.62	8.27	8.97	9.74	10.58	11.49	12.48	16.80
Scenario 9	6.30	6.81	7.36	7.96	8.61	9.31	10.07	13.38
Scenario 10	6.89	7.47	8.10	8.78	9.53	10.35	11.23	15.10
Scenario 11	7.11	7.71	8.37	9.09	9.88	10.73	11.66	15.73
Scenario 12	7.36	7.97	8.64	9.36	10.15	11.01	11.94	15.99
Scenario 13	7.94	8.62	9.37	10.19	11.07	12.04	13.10	17.72
Scenario 14	8.16	8.87	9.65	10.49	11.42	12.43	13.53	18.35
Scenario 15	7.43	8.07	8.77	9.54	10.37	11.29	12.29	16.65
Scenario 16	8.48	9.23	10.05	10.94	11.92	12.98	14.15	19.26

Notes
1 - WTP capacity size in mgd
2 - Connections based on historical number of persons per household
3 - Growth based on utility-specific annual growth
4 - WTP capacity based on TCEQ standard 0.6 gpm per connection

As discussed in the example for Scenario 16, the required capacity (identified in Table 3-5) at each milestone is divided by 0.85 so that the water demand will not exceed the 85% Capacity Rule at each 5-year milestone. The anticipated recommended WTP capacity (incorporating compliance with the 85% Capacity Rule) for each scenario is summarized in Table 3-6.

Table 3-6
Summary of Projected Water Capacity Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
Scenario 1	6.40	6.88	7.40	7.96	8.55	9.19	9.88	12.85
Scenario 2	7.64	8.25	8.90	9.60	10.37	11.19	12.08	15.92
Scenario 3	6.78	7.30	7.87	8.48	9.14	9.85	10.62	13.92
Scenario 4	7.04	7.59	8.19	8.84	9.54	10.30	11.12	14.67
Scenario 5	7.73	8.36	9.06	9.81	10.63	11.52	12.48	16.69
Scenario 6	8.02	8.67	9.37	10.13	10.95	11.84	12.81	17.00
Scenario 7	8.28	8.96	9.69	10.49	11.36	12.30	13.32	17.74
Scenario 8	8.96	9.73	10.56	11.46	12.44	13.51	14.68	19.77
Scenario 9	7.42	8.01	8.66	9.37	10.13	10.96	11.85	15.74
Scenario 10	8.10	8.78	9.53	10.33	11.21	12.17	13.22	17.77
Scenario 11	8.36	9.07	9.85	10.70	11.62	12.62	13.72	18.51
Scenario 12	8.65	9.38	10.16	11.02	11.94	12.95	14.05	18.82
Scenario 13	9.34	10.15	11.03	11.98	13.03	14.17	15.41	20.84
Scenario 14	9.60	10.44	11.35	12.35	13.43	14.62	15.92	21.58
Scenario 15	8.74	9.49	10.32	11.22	12.20	13.28	14.45	19.59
Scenario 16	9.98	10.86	11.82	12.87	14.02	15.28	16.65	22.66

Notes
1 - WTP capacity size in mgd
2 - Connections based on historical number of persons per household
3 - Growth based on utility-specific annual growth
4 - WTP capacity based on TCEQ standard 0.6 gpm per connection, divided by 0.85 for compliance with TCEQ's 85% capacity rule.

REGIONALIZATION COSTS

A brief discussion on anticipated treatment capital costs for the potential regionalization scenarios is included in the following pages. Design components common to each scenario include requirements for raw water pumping and storage, pretreatment, filtration (membrane or conventional), disinfection, finished water storage and high service pumping. Therefore, the anticipated construction cost for both Scenario 1 and 16 are well-defined, whereas the utility combination scenarios (Scenario 2 to 15) are proportional to Scenario 1 and 16 based on increased/reduced treatment capacity.

Examples of how the anticipated WTP OPCC is developed for Scenario 1 and 16 are shown below, followed by a summary table of anticipated WTP OPCCs for comparison of the various scenarios.

Regionalization Scenario 1 Example

In Scenario 1, the City of Roma builds a new WTP to serve the City, while the remaining participating utilities in this Study continue to operate by either treating raw water or purchasing treated water wholesale from another utility. For Scenario 1, the recommended 2040 WTP capacity for the City of Roma is approximately 9.9 mgd. Since a final filtration process has not yet been selected, it is recommended that a construction cost of $3.50 per gallon be used for development of conceptual construction costs. Using an average construction cost per gallon of $3.50, the WTP construction cost at a capacity of 9.9 mgd, is roughly $34,650,000.

This construction cost normally includes all typical WTP processes, from raw water pumping all the way to high service pumping; normally a WTP is located as close as possible to its source of water to minimize pumping energy costs. However, raw water system improvements are separated from the primary WTP construction cost in this Study to allow for differences in WTP location and sizing requirements, as there will be an additional cost for pumping raw water to the new WTP (north WTP site) beyond typical costs. Based on Table 3-7, the anticipated total project cost (including construction, contingency and engineering) for Scenario 1 is approximately $43,881,400 (in 2012 dollars).

Table 3-7
Projected Total Cost for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,607,100	$5,607,100
2	Construct new 30-inch raw water transmission main	LF	9,100	$218	$1,983,800
3	Construct new 109 MG reservoir adjacent to Rio Grande River	LS	1	$3,598,700	$3,598,700
4	Construct new 9.9 MGD WTP	LS	1	$19,800,000	$19,800,000
				subtotal	$30,989,600
				Contingencies (20%)	$6,198,000
				TOTAL ESTIMATED CONSTRUCTION COST	$37,187,600
				Engineering & Testing (18%)	$6,693,800
				TOTAL ESTIMATED CAPITAL COST	**$43,881,400**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2040 requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.

Note that since the projected capital cost for Scenario 1 would likely be too excessive to fund at one time, the most logical approach would be to construct this facility in multiple phases, with the goal of reducing treatment costs to approximately $20 million or less per construction phase. Phasing of construction would allow for a greater opportunity to fund the majority of each construction phase via grant and/or low interest loan funding, which will make the project significantly more viable.

Regionalization Scenario 16 Example

At the other end of the potential regionalization scenario spectrum, in Scenario 16, the City of Roma, Falcon Rural WSC, El Sauz WSC, El Tanque WSC and Rio WSC all join together to build a new regional WTP to serve all the utilities. For Scenario 16, the recommended 2040 WTP capacity is approximately 16.7 mgd. Using an average construction cost per gallon of $3.50, the WTP construction cost at a capacity of 16.7 mgd, is roughly $58,450,000.

This construction cost normally includes all typical WTP processes, from raw water pumping all the way to high service pumping; normally a WTP is located as close as possible to its source of water to minimize pumping energy costs. However, raw water system improvements are separated from the primary WTP construction cost in this Study to allow for differences in WTP location and sizing requirements, as there will be an additional cost for pumping raw water to the new WTP (north WTP site) beyond typical costs. Based on Table 3-8, the anticipated OPCC for Scenario 16 is approximately $65,814,900 (in 2012 dollars).

Table 3-8
Projected Treatment OPCC for Scenario 16

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$6,052,300	$6,052,300
2	Construct new 36-inch RW transmission main	LF	9,100	$293	$2,666,300
3	Construct new 184 MG reservoir adjacent to Rio Grande River	LS	1	$4,360,800	$4,360,800
4	Construct new 16.7 MGD WTP	LS	1	$33,400,000	$33,400,000
				subtotal	$46,479,400
				Contingencies (20%)	$9,295,900
				TOTAL ESTIMATED CONSTRUCTION COST	$55,775,300
				Engineering & Testing (18%)	$10,039,600
				TOTAL ESTIMATED CAPITAL COST	**$65,814,900**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2040 requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.

Costs for each additional potential regionalization scenario were developed using the same methodology as Scenario 1 and 16. The anticipated WTP capital cost for each scenario is summarized in Table 3-9.

Table 3-9
Summary of Projected Treatment OPCCs for Regionalization Scenarios

DESCRIPTION	TOTAL CONSTRUCTION COST	ENGINEERING & TESTING	TOTAL CAPITAL COST
Scenario 1	$37,187,600	$6,693,800	$43,881,400
Scenario 2	$43,834,100	$7,890,200	$51,724,300
Scenario 3	$39,340,500	$7,081,300	$46,421,800
Scenario 4	$41,537,400	$7,476,800	$49,014,200
Scenario 5	$44,877,300	$8,078,000	$52,955,300
Scenario 6	$46,021,600	$8,283,900	$54,305,500
Scenario 7	$46,874,800	$8,437,500	$55,312,300
Scenario 8	$50,374,400	$9,067,400	$59,441,800
Scenario 9	$43,065,400	$7,751,800	$50,817,200
Scenario 10	$46,620,800	$8,391,800	$55,012,600
Scenario 11	$47,947,600	$8,630,600	$56,578,200
Scenario 12	$48,756,500	$8,776,200	$57,532,700
Scenario 13	$52,531,400	$9,455,700	$61,987,100
Scenario 14	$53,879,700	$9,698,400	$63,578,100
Scenario 15	$49,835,000	$8,970,300	$58,805,300
Scenario 16	$55,775,300	$10,039,600	$65,814,900
Notes			
1 – Costs in 2012 dollars.			

As discussed for Scenario 1, the most logical approach would be to construct a new WTP facility in multiple phases, with the goal of reducing treatment costs to approximately $20 million or less per construction phase. Phasing of construction would allow for a greater opportunity to fund the majority of each construction phase via grant and/or low interest loan funding, which will make the project significantly more viable.

One of the benefits of regionalization is that by providing water to multiple utilities, the average cost per volume of water treated (normally in terms of cost per 1,000 gallons treated) typically reduces as the number of connections served increases. This concept is known as “economies of scale.”

For example, under Scenario 1, the City of Roma would need a WTP capacity of approximately 9.9 mgd by the year 2040 (planning horizon of this Study). The projected total project cost for a 9.9 mgd WTP (if constructed all at once) is approximately $43,881,400 (using 2012 dollars), including construction cost, contingency and engineering and testing services. In a worst-case funding scenario, no grant or low-interest loan funds would be available, so that scenario is used as the starting point for determining potential cost of service. Therefore, for the projected Scenario 1 OPCC of $43,881,400, the projected annual debt service is developed using an interest rate of 5.0% (assuming no low-interest rate at this point) at a term of 30 years. Using the Scenario 1 OPCC, an interest rate of 5.0% and a term of 30 years, an annual debt service of $2,646,700 is determined. The same methodology is used to determine the projected worst-case annual debt service for each potential regionalization scenario and the respective debt service for each scenario is shown in Table 3-10.

While the Scenario 1 WTP 2040 design capacity is anticipated to be 9.9 mgd, based on current demands, it is anticipated that the average water demand would actually be roughly half of the capacity 2040 WTP, or 4.95 mgd. Therefore, in determining projected cost per volume (a common method for utilities is to evaluate cost per thousand gallons treated), the debt service (worst-case for this example) for Scenario 1 ($2,646,700) is divided by the anticipated water demand (4.95 mgd in 2040), converted to a per 1,000 gallon basis. Example cost equations are shown below.

Cost = debt service / demand
= ($2,646,700) / (4.95 mgd x 1,000,000 gal/million gallons x 365.25 days/year)
= $0.00146 per gallon x 1,000 = $1.46 per 1,000 gallons

The same methodology was used to determine the projected cost per volume treated for each potential regionalization scenario and the respective cost for each scenario is also shown in Table 3-10. As the Distribution System Alternatives TM (TM No. 4) and the O&M Alternatives TM (TM No. 5) are completed, the projected cost per 1,000 gallons treated will be combined from each TM to generate a total cost per 1,000 gallons treated, which would ultimately become the basis for setting rates for treatment in the future.

Table 3-10
Impacts of Regionalization on Cost of Service

DESCRIPTION	WORST-CASE ANNUAL DEBT SERVICE (100% LOAN)	COST PER THOUSAND GALLONS TREATED
Scenario 1	$2,646,700	$1.46
Scenario 2	$3,115,300	$1.41
Scenario 3	$2,798,700	$1.43
Scenario 4	$2,953,500	$1.44
Scenario 5	$3,188,900	$1.40
Scenario 6	$3,269,500	$1.39
Scenario 7	$3,329,600	$1.36
Scenario 8	$3,576,200	$1.33
Scenario 9	$3,061,200	$1.41
Scenario 10	$3,311,700	$1.36
Scenario 11	$3,405,200	$1.35
Scenario 12	$3,462,200	$1.35
Scenario 13	$3,728,300	$1.32
Scenario 14	$3,823,300	$1.31
Scenario 15	$3,538,200	$1.34
Scenario 16	$3,956,300	$1.30

As discussed previously, without any grant or low-interest loan funding, development of a regional WTP may not be feasible due to the high cost of infrastructure. Therefore, the obvious fatal flaw in this Study is the availability of grant and low-interest funding for the final recommended improvements. To show the impact of this type of funding, two additional examples were developed for varying levels of grant and/or low-interest loan funding. While worst-case (100% loan, typical open market interest rate) debt service costs were developed for each scenario in Table 3-10, additional cost examples using a 50% grant/loan combination and a 75% grant/loan combination are developed and displayed in Tables 3-11 and 3-12.

The two additional funding opportunities are identified as grant/loan combinations, as similar benefits can be attained depending on the funding methodology. For example, using Scenario 1 once again, the anticipated annual debt service (assuming open market, 5.0% interest, 30-year term) is $2,646,700. On some projects, a utility may qualify for either grants or low-interest loans, but not both. Therefore, in a 50% grant/loan combination example, it is assumed that either the 50% reduction in debt service is accomplished either directly via grant or loan forgiveness, along with the remaining loan component still including a typical interest rate. However, the same reduction in debt service can be accomplished with no grant being applied, as long as the interest rate on the loan is reduced to less than 1.0%, which can be obtained by utilities defined by funding agencies as "disadvantaged." Cost impacts to each potential regionalization scenario via a 50% grant/loan funding program is included in Table 3-11.

Table 3-11
Impacts of Regionalization and Grant Opportunities on Cost of Service
50% Grant/Loan

DESCRIPTION	MEDIUM-CASE ANNUAL DEBT SERVICE (50% GRANT)	COST PER THOUSAND GALLONS TREATED
Scenario 1	$1,323,350	$0.73
Scenario 2	$1,557,650	$0.71
Scenario 3	$1,399,350	$0.72
Scenario 4	$1,476,750	$0.72
Scenario 5	$1,594,450	$0.70
Scenario 6	$1,634,750	$0.69
Scenario 7	$1,664,800	$0.68
Scenario 8	$1,788,100	$0.67
Scenario 9	$1,530,600	$0.70
Scenario 10	$1,655,850	$0.68
Scenario 11	$1,702,600	$0.68
Scenario 12	$1,731,100	$0.67
Scenario 13	$1,864,150	$0.66
Scenario 14	$1,911,650	$0.65
Scenario 15	$1,769,100	$0.67
Scenario 16	$1,978,150	$0.65

A similar methodology is applied for the 75% grant/loan combination example (refer to Table 3-12), except that even if the loan component was offered at 0.0% interest, the debt service would only be reduced by roughly 50%. Therefore, grant funding would still need to be applied to reach a total debt service reduction of 75%.

Table 3-12
Impacts of Regionalization and Grant Opportunities on Cost of Service
75% Grant/Loan

DESCRIPTION	BEST-CASE ANNUAL DEBT SERVICE (75% GRANT)	COST PER THOUSAND GALLONS TREATED
Scenario 1	$661,675	$0.37
Scenario 2	$778,825	$0.35
Scenario 3	$699,675	$0.36
Scenario 4	$738,375	$0.36
Scenario 5	$797,225	$0.35
Scenario 6	$817,375	$0.35
Scenario 7	$832,400	$0.34
Scenario 8	$894,050	$0.33
Scenario 9	$765,300	$0.35
Scenario 10	$827,925	$0.34
Scenario 11	$851,300	$0.34
Scenario 12	$865,550	$0.34
Scenario 13	$932,075	$0.33
Scenario 14	$955,825	$0.33
Scenario 15	$884,550	$0.33
Scenario 16	$989,075	$0.32

In the case of this Study, all of the Study participants are considered to be significantly "economically disadvantaged" and therefore it is anticipated that projects identified in this Study should qualify for either 50% or 75% grant/loan combination funding.

RECOMMENDED ALTERNATIVE

Based on the anticipated construction and capital costs and treatment debt service cost per 1,000 gallons treated, it appears that the most cost-effective regionalization scenario with respect to treatment debt service cost is Scenario 16, which will serve all five Study participants.

However, the proposed WTP debt service component is only one component of the overall cost evaluation required for each regionalization scenario. Once projected distribution system costs (from TM No. 4) and projected WTP and distribution system O&M costs (from TM No. 5) are developed for each scenario, the cost components will be combined and total costs will be compared from scenario to scenario. Total cost comparisons for the potential regionalization scenarios are included in TM No. 6.

This Technical Memorandum (TM) summarizes the findings of Task IV of the City of Roma Regional Water Planning Study (the Study). The focus of Task IV of the Study is the preparation of Water Distribution System Alternatives for the Study Area.

Activities in Task IV included the following:

- ✓ Determine existing and future storage needs in the Study Area;
- ✓ Evaluate potential for regional water distribution; and
- ✓ Develop a technical memorandum summarizing the water distribution system alternatives through the year 2040 to serve existing and future growth.

BACKGROUND

The historical reliance on individual utilities to provide basic water services in the Study Area has ensured more local oversight of utility operations and associated fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall area has grown. For example, each utility in the Study Area operates its own distribution system and does not utilize a continual or emergency interconnect with other nearby utilities, whereas many other similar-sized areas can function efficiently and cost-effectively with only one large distribution system. While the goal of this Study is not to encourage consolidation of the multiple distribution systems into a single system, there are potential benefits to focusing on more of a regional approach for the communities in this Study rather than maintaining the current mode of operation. Regionalization in other communities has provided benefits such as:

- Potential cost sharing for staff training and certification;
- Reduced enforcement activity associated with each distribution system by providing sufficient storage for all systems; and
- Typically a much lower transmission and distribution cost per thousand gallons.

The potential benefits of "regionalization" or "consolidation" of utility providers are important enough that unique opportunities should be identified and pursued where they make sense and have a good chance to benefit all parties. Such opportunities will gradually come about as the overall region approaches build-out, as debt assumption becomes less of a factor, and through attrition as older systems face difficulties in meeting maintenance and rehabilitation needs, and further State and Federal regulatory mandates come along.

This TM addresses the fundamental questions of how particular consolidations might be accomplished with respect to meeting transmission, storage and distribution goals. Incorporation of the results of this TM, along with others included in the Study should lead to technically sound engineering master plans to guide ongoing water system investments and management activities by the City of Roma and the other participating utilities in this Study. The following goals of this TM are to identify and discuss:

- Future water demands and distribution system impacts for each utility;
- Alternatives for volume and pressure maintenance within the transmission and distribution systems;
- Impacts of growth and water demands on distribution system storage components;
- Impacts of growth and development on planning for distribution system improvements;
- Water transmission and distribution system design requirements; and
- Various methods of regionalization including potential distribution system regionalization scenarios.

ANTICIPATED FUTURE WATER DEMANDS

This section of the TM discusses anticipated future water demands for each utility in the Study and how those demands impact distribution system infrastructure. The projected growth in connections for each participating utility is used to determine the anticipated water demand through the Study planning period. Refer to Table 4-1 for a summary of the projected growth in connections for each utility through the end of the 2040 planning horizon (data referenced from TM No. 1, Table 1-9).

Table 4-1
Current and Projected Connection Counts

Data	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	6,300	6,773	7,280	7,826	8,413	9,044	9,723	12,640
Falcon Rural WSC	1,219	1,341	1,475	1,622	1,785	1,963	2,160	3,023
El Sauz WSC	370	413	462	516	577	645	721	1,059
El Tanque WSC	625	698	781	872	975	1,089	1,217	1,789
Rio WSC	1,300	1,455	1,629	1,824	2,042	2,286	2,559	3,782
Total Estimated Connections	**9,814**	**10,681**	**11,627**	**12,661**	**13,792**	**15,028**	**16,379**	**22,294**

The anticipated water demand developed for each utility (for each five-year milestone through the course of the Study planning period) is based on water treatment plant (WTP) design criteria required per the Texas Commission on Environmental Quality (TCEQ) regulations, which use 0.6 gallons per minute (gpm) per connection as a minimum for sizing a WTP. Refer to Table 4-2 for a summary of the anticipated water demands for each utility through the planning horizon of 2040 (data referenced from TM No. 3, Table 3-3).

Table 4-2
Projected Water Demands

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	5.44	5.85	6.29	6.76	7.27	7.81	8.40	10.92
Falcon Rural WSC	1.05	1.16	1.27	1.40	1.54	1.70	1.87	2.61
El Sauz WSC	0.32	0.36	0.40	0.45	0.50	0.56	0.62	0.92
El Tanque WSC	0.54	0.60	0.67	0.75	0.84	0.94	1.05	1.55
Rio WSC	1.12	1.26	1.41	1.58	1.76	1.98	2.21	3.27
TOTAL	**8.48**	**9.23**	**10.05**	**10.94**	**11.92**	**12.98**	**14.15**	**19.26**
Notes								
1 – Water demand in mgd.								
2 - Connections based on historical number of persons per household.								
3 - Growth based on utility-specific annual growth.								
4 – Water demand based on TCEQ standard 0.6 gpm per connection.								

Sizing for storage, transmission and distribution systems also requires the use of a peaking factor; the water demand peaking factor for municipal utilities is typically 1.25. Therefore, each water demand shown in Table 4-1 is multiplied by 1.25 to determine the anticipated peaking demand (based on average demand calculated using TCEQ design criteria) for each participating utility at each 5-year milestone through the planning horizon of 2040. Refer to Table 4-3 for a summary of the anticipated peak water demands for each utility through the planning horizon of 2040.

Table 4-3
Projected Peak Water Demands

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	6.80	7.31	7.86	8.45	9.09	9.76	10.50	13.65
Falcon Rural WSC	1.31	1.45	1.59	1.75	1.93	2.13	2.34	3.26
El Sauz WSC	0.40	0.45	0.50	0.56	0.63	0.70	0.78	1.15
El Tanque WSC	0.68	0.75	0.84	0.94	1.05	1.18	1.31	1.94
Rio WSC	1.40	1.58	1.76	1.98	2.20	2.48	2.76	4.09
TOTAL	**10.59**	**11.54**	**12.55**	**13.68**	**14.89**	**16.24**	**17.69**	**24.09**
Notes								
1 – Water demand in mgd.								
2 - Growth based on utility-specific annual growth.								
3 – Water demand based on TCEQ standard 0.6 gpm per connection, times 1.25 peaking factor.								

In addition, the TCEQ also requires that distribution systems have reserve capacity available to maintain compliance with the TCEQ's 85% Rule; consequently, the minimum WTP capacity identified for each scenario has been increased so that the anticipated water demand never exceeds 85% of the rated WTP capacity. To develop the recommended distribution system capacity for each system, the peak water demands displayed in Table 4-3 are divided by 85%, which provides a capacity sufficient to be in compliance with the TCEQ's 85% Rule at each 5-year milestone in the Study planning period. Refer to Table 4-4 for a summary of the recommended distribution system capacity for each utility through the planning horizon of 2040.

Table 4-4 Recommended Capacity for Distribution System Improvements								
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	8.00	8.60	9.25	9.94	10.69	11.49	12.35	16.06
Falcon Rural WSC	1.54	1.71	1.87	2.06	2.26	2.50	2.75	3.84
El Sauz WSC	0.47	0.53	0.59	0.66	0.74	0.82	0.91	1.35
El Tanque WSC	0.79	0.88	0.99	1.10	1.24	1.38	1.54	2.28
Rio WSC	1.65	1.85	2.07	2.32	2.59	2.91	3.25	4.81
TOTAL	**12.46**	**13.57**	**14.76**	**16.09**	**17.51**	**19.10**	**20.81**	**28.34**
Notes								
1 – Water demand in mgd.								
2 - Growth based on utility-specific annual growth.								
3 – Recommended capacity based on TCEQ standard 0.6 gpm per connection, times 1.25 peaking factor, with additional capacity to be compliant with TCEQ 85% Rule.								

The recommended distribution system capacities displayed in Table 4-4 are used to define the pumping and transmission capacity requirements for the various regionalization alternatives identified later in this TM.

VOLUME AND PRESSURE MAINTENANCE

The goal of this section is to identify and discuss methods for maintenance volume and/or pressure in the distribution system. There are several methods for maintaining adequate volume and pressure in the distribution system and the TCEQ has design and operational criteria for each type of system.

Pressure Maintenance

Regarding pressure maintenance, the TCEQ requires a minimum distribution system pressure of 35 pounds per square inch (psi) during normal operation and a minimum emergency pressure of 20 psi during emergencies in the area, such as fire flow demands. Distribution system pressure can be maintained either via elevated storage or pressure storage (in conjunction with the use of pumps to supplement pressure). The two primary methods of elevated storage are discussed below.

Elevated Storage - EST

Elevated storage can be accomplished either via elevated storage tanks (ESTs) or standpipes. An EST is an elevated structure supporting a water tank, constructed at a height sufficient to maintain a constant pressure from the EST to a water distribution system. Constant pressure is maintained via hydrostatic pressure of the elevation of the water in the tank. For example, every 2.31 feet (ft) of elevation provides roughly 1 psi of pressure. While the TCEQ only requires a minimum pressure of 35 psi, the minimum pressure must be met throughout the distribution system; accounting for losses due to topography, frictional pipe losses and minor losses through bends and pipe fittings, the initial pressure supplied by an EST must be high enough to allow for losses throughout the system while maintaining the minimum 35 psi pressure during normal conditions. The typical pressure (required to maintain minimum pressure throughout the distribution system) applied by an EST is 60 psi (reflecting a standard height of 140 ft).

A variety of materials can be used to construct a typical EST; steel and reinforced pre-stressed concrete are most often used, incorporating an interior coating to protect the tank from potential corrosion damage. The reservoir (actual water tank) in an EST can be spherical, cylindrical, an ellipsoid, square or rectangle, with a typical minimum height of approximately 20 ft and a minimum of 5 ft in diameter. Examples of common types of ESTs are shown in Exhibit 4-1 and 4-2.

Exhibit 4-1
Typical Steel ESTs

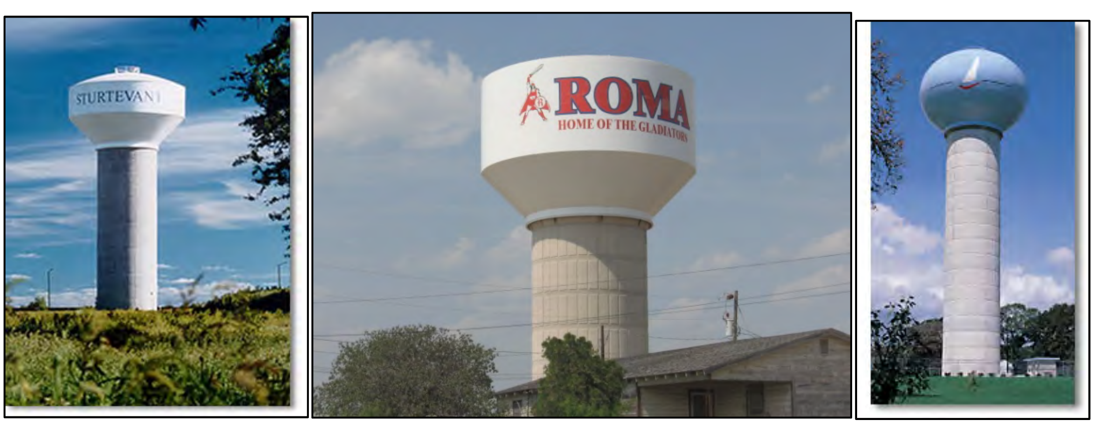

Exhibit 4-2
Typical Composite ESTs

A common complaint from residents located near an EST is the lack of aesthetics associated with most conventional and composite ESTs; therefore, it sometimes is in the best interests of a utility to consider additional architectural components in a new EST design to provide a better blending of the tank infrastructure with nearby surroundings. In addition to standard construction, ESTs can be surrounded by ornate coverings including fancy brickwork, large ivy-covered trellis or simply painted. Examples of ESTs that include additional architectural features to blend into the nearby landscape are shown in Exhibit 4-3.

Exhibit 4-3
Examples of Architecturally Enhanced ESTs

Elevated Storage - Standpipes

Elevated storage can also be accomplished via use of standpipes. A standpipe is a cylindrical, elevated structure where the structure itself is the water storage tank. Constant pressure is also maintained via hydrostatic pressure of the elevation of the water in the tank, though the available pressure is less than what is consistently available in an

EST. For example, TCEQ only counts water stored and provided at a minimum pressure of 35 psi as “elevated water”. Therefore, when a typical standpipe height of 140 ft is used (to match other standpipes and/or ESTs connected to the distribution system), only the top 59 ft (140 ft – 35 psi x 2.31 ft/psi) can count toward the TCEQ’s requirements for elevated or pressure storage.

Due its inherent limitations in capacity, standpipes are typically better-suited to small utilities that supply less than 1,000 connections. A variety of materials can also be used to construct a standpipe, with steel and reinforced pre-stressed concrete most often used. Some newer steel standpipes are also being constructed with an interior glass lining, which eliminates corrosion issues and coating requirements, albeit at a higher initial capital cost. Standpipes can be constructed with a diameter as small as 4 ft to as large as 20 ft. Examples of conventional types of standpipes are shown in Exhibit 4-4.

Exhibit 4-4
Typical Steel Standpipes

Similar to complaints on the lack of aesthetics associated with most conventional and composite ESTs, standpipes also frequently get aesthetics complaints. As with ESTs, it is also feasible (though frequently significantly more expensive as compared to a conventional standpipe) to add architectural components in a new standpipe design, to provide a better blending of the tank infrastructure with nearby surroundings. Examples of standpipes that include additional architectural features to blend into the nearby landscape are shown in Exhibit 4-5.


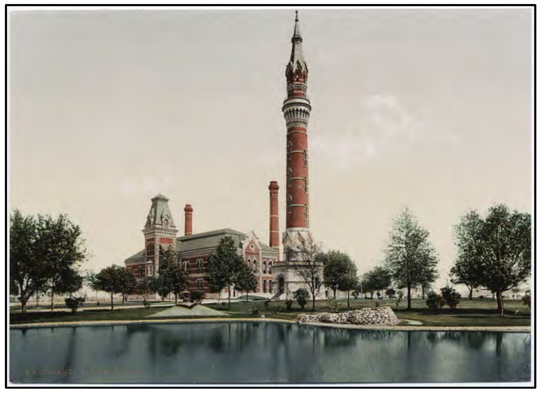


Exhibit 4-5
Examples of Architecturally Enhanced Standpipes

Pressure Storage - HPT

The TCEQ's elevated/pressure storage requirement can also be met via the use of hydropneumatic pressure tanks (HPTs). A typical HPT system consists of an outer metal shell, inner bladder and an air compressor system; larger HPT tanks do not require an inner bladder and instead rely on the pressure strength of the outer tank shell itself. When an HPT needs to be filled, nearby pumps fill the tank with water. Air compressors are used to maintain a specific tank pressure which provides a specific discharge pressure when the HPT lets water out into the distribution system.

Similar to an EST system, an HPT requires water from a nearby source. For an HPT though, TCEQ requires a backup power source for the pumps supplying water to the HPT. In addition, TCEQ requires backup power to maintain operation of the air compressors necessary to maintain tank pressure in the HPT. While the TCEQ only requires a minimum pressure of 35 psi, the minimum pressure must be met throughout the distribution system; therefore, the standard pressure applied by an HPT is 60 psi, though depending on the size of the distribution, an HPT can be designed for discharge pressures upwards of 100 psi.

TCEQ design criteria requires that if using an HPT tank system to maintain distribution system pressure, a minimum of 20 gallons of pressure tank capacity be provided per connection. For example, a utility supporting 100 connections only requires a 2,000 gallon HPT (and supporting pump and backup power system), which is likely a lower capital cost than an EST.

However, as the number of connections increases, the capital cost for larger supply pumps to support an HPT tank system (which must be sized for 2.0 gpm per connection for an HPT system) and emergency backup power system rapidly overtake the capital cost for a similarly-sized standpipe or EST. In addition, the TCEQ requires that utilities that provide service to more than 2,500 connections must utilize elevated storage rather than pressure storage. Therefore, anticipated storage costs in this TM are based on the use of elevated storage using ESTs.

IMPACTS TO STORAGE REQUIREMENTS

The goal of this section of the TM is to discuss the impacts of growth and regionalization on treated water storage needs for each utility. The anticipated future elevated storage needs are determined using TCEQ design criteria of 100 gallons per connection for elevated storage; since the utilities currently use either ESTs or standpipes, only criteria for elevated storage is provided in this section. In addition, the TCEQ regulations also include design criteria for total required storage, which is based on 200 gallons per connection. Refer to Table 4-5 for a summary of the existing elevated and total storage capacity for each utility (data from TM No. 1, Table 1-6).

Table 4-5
Existing Storage Capacity

Participant	Current Elevated / Pressure Capacity (MG)	Current Ground Storage Capacity (MG)	Current Total Storage Capacity (MG)
City of Roma	0.800	0.768	1.568
Falcon Rural WSC	0.095	0.318	0.413
El Sauz WSC	0.150	0.000	0.150
El Tanque WSC	0.089	0.210	0.299
Rio WSC	*0.003*	0.598	0.601
TOTAL	**1.137**	**1.894**	**3.031**

Notes
1 - Sizes shown in italics reflect storage capacities that appear to be inadequate as compared to 30 TAC 290.45 design criteria.

The minimum elevated storage required for each utility (for each five-year milestone through the course of the Study planning period) is based on TCEQ design criteria requiring a minimum of 100 gallons of elevated storage per connection. Refer to Table 4-6 for a summary of the minimum elevated storage capacities needed for each utility through the planning horizon of 2040.

Table 4-6
Minimum Elevated Storage Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	0.630	0.677	0.728	0.783	0.841	0.904	0.972	1.264
Falcon Rural WSC	0.122	0.134	0.148	0.162	0.179	0.196	0.216	0.302
El Sauz WSC	0.037	0.041	0.046	0.052	0.058	0.065	0.072	0.106
El Tanque WSC	0.063	0.070	0.078	0.087	0.098	0.109	0.122	0.179
Rio WSC	0.130	0.146	0.163	0.182	0.204	0.229	0.256	0.378
TOTAL	**0.981**	**1.068**	**1.163**	**1.266**	**1.379**	**1.503**	**1.638**	**2.229**

Notes
1 – Elevated water storage capacity in million gallons (MG).
2 - Capacity based on TCEQ minimum requirement of 100 gallons per connection.
3 - Number of connections based on growth projections completed in TM No. 1.

Similar to treatment and transmission systems, the TCEQ also requires that utilities ensure reserve storage capacity is available at each milestone to maintain compliance with the TCEQ's 85% Rule; therefore, the minimum elevated storage capacity identified for each scenario has been increased so that the required storage (as defined by TCEQ based on the current number of connections) does not exceed 85% of the rated storage capacity. To develop the recommended elevated storage capacity for each system, the minimum required elevated storage capacities displayed in Table 4-6 are divided by 85%, which provides a storage capacity sufficient to be in compliance with the TCEQ's 85% Rule at each 5-year milestone in the Study planning period. Refer to Table 4-7 for a summary of the recommended elevated storage capacity for each utility through the planning horizon of 2040.

Table 4-7
Recommended Elevated Storage Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	0.741	0.797	0.856	0.921	0.990	1.064	1.144	1.487
Falcon Rural WSC	0.143	0.158	0.174	0.191	0.210	0.231	0.254	0.356
El Sauz WSC	0.044	0.049	0.054	0.061	0.068	0.076	0.085	0.125
El Tanque WSC	0.074	0.082	0.092	0.103	0.115	0.128	0.143	0.210
Rio WSC	0.153	0.171	0.192	0.215	0.240	0.269	0.301	0.445
TOTAL	**1.155**	**1.256**	**1.368**	**1.489**	**1.623**	**1.768**	**1.927**	**2.623**

Notes
1 – Elevated water storage capacity in million gallons (MG).
2 - Capacity based on TCEQ minimum requirement of 100 gallons per connection, with increased capacity for compliance with the TCEQ's 85% Rule.
3 - Number of connections based on growth projections completed in TM No. 1.

As discussed previously, the TCEQ also has a minimum total storage requirement for each utility (for each five-year milestone through the course of the Study planning period), which is based on TCEQ design criteria of 200 gallons of total storage per connection. Refer to Table 4-8 for a summary of the minimum total storage capacities needed for each utility through the planning horizon of 2040.

Table 4-8
Minimum Total Storage Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	1.260	1.355	1.456	1.565	1.683	1.809	1.945	2.528
Falcon Rural WSC	0.244	0.268	0.295	0.324	0.357	0.393	0.432	0.605
El Sauz WSC	0.074	0.083	0.092	0.103	0.115	0.129	0.144	0.212
El Tanque WSC	0.125	0.140	0.156	0.174	0.195	0.218	0.243	0.358
Rio WSC	0.260	0.291	0.326	0.365	0.408	0.457	0.512	0.756
TOTAL	**1.963**	**2.136**	**2.325**	**2.532**	**2.758**	**3.005**	**3.276**	**4.459**

Notes
1 – Total water storage capacity in million gallons (MG).
2 - Capacity based on TCEQ minimum total water storage requirement of 200 gallons per connection.
3 - Number of connections based on growth projections completed in TM No. 1.

Similar to the recommended elevated storage capacities, the minimum total storage capacity identified for each scenario is increased so that the required storage (as defined by TCEQ based on the current number of connections) never exceeds 85% of the rated storage capacity in the future. To develop the recommended elevated storage capacity for each system, the minimum required total storage capacities displayed in Table 4-8 are divided by 85%, which provides a storage capacity sufficient to be in compliance with the TCEQ's 85% Rule at each 5-year milestone in the Study planning period. Refer to Table 4-9 for a summary of the recommended total storage capacities for each utility through the planning horizon of 2040.

Table 4-9
Recommended Total Storage Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	1.482	1.594	1.713	1.841	1.980	2.128	2.288	2.974
Falcon Rural WSC	0.287	0.316	0.347	0.382	0.420	0.462	0.508	0.711
El Sauz WSC	0.087	0.097	0.109	0.121	0.136	0.152	0.170	0.249
El Tanque WSC	0.147	0.164	0.184	0.205	0.229	0.256	0.286	0.421
Rio WSC	0.306	0.342	0.383	0.429	0.480	0.538	0.602	0.890
TOTAL	**2.309**	**2.513**	**2.736**	**2.979**	**3.245**	**3.536**	**3.854**	**5.245**

Notes
1 – Total water storage capacity in million gallons (MG).
2 - Capacity based on TCEQ minimum requirement of 200 gallons per connection, with increased capacity for compliance with the TCEQ's 85% Rule.
3 - Number of connections based on growth projections completed in TM No. 1.

When developing improvements for storage, pumping and pipeline systems, the size and type of storage is critical in defining the type of pumping system necessary to match the storage improvements. Determining the type and size of storage is critical as TCEQ design criteria includes various pumping requirements depending on the amount of elevated storage provided. For example, distribution systems that only meet the minimum requirement for elevated storage (100 gallons per connection) must provide high service and transfer pump stations (at pressure or volume booster points in the distribution system) sized at 2.0 gallons per minute (gpm) per connection or a firm capacity equaling the peak hourly demand. In comparison, utilities that provide sufficient elevated storage to meet the TCEQ's minimum requirements for total storage (at least 200 gallons per connection) are only required to provide high service and transfer pump stations sized at 0.6 gpm per connection, using total capacity.

Therefore from a capital cost standpoint, the reduction in pump equipment sizing and reduction in ground storage tank (GST) sizing may provide an offset of most, if not all, of the additional cost to provide sufficient EST storage to meet total storage requirements. In addition, there are also O&M cost savings inherent to meeting total storage requirements via EST storage. A detailed life cycle cost analysis (which includes both capital and O&M costs) for the abovementioned example is included in TM No. 5. Based on the potential capital cost savings and the benefits of providing primarily elevated storage, the recommended storage improvements in the various regionalization scenarios are based on meeting total storage requirements via elevated storage.

DEVELOPMENT IMPACTS TO REGIONALIZATION ALTERNATIVES

The goal of this section is to discuss the impacts of growth and development in the Study Area that can or will impact the conceptual design of new transmission and distribution system improvements included in the regionalization alternatives. The main point of discussion in this section will cover the impacts to potential transmission pipeline alignments from an arterial highway bypass within the Study Area that the Texas Department of Transportation (TxDOT) is proposing.

TxDOT is proposing a 4-lane toll way bypass of United States (US) Highway 83 (US 83) in Starr County that will bypass the City of Roma and Rio Grande City by looping US 83 where it connects to Farm-to-Market (FM) 650 over to where FM 1430 connects to US 83 (refer to Exhibit 4-6). The proposed bypass is but one piece of an overall Valley transportation loop planned for the Rio Grande Valley area, which will ultimately provide a transportation loop between US 83, US 281 and US 77, which pass through Starr, Hidalgo, Cameron and Willacy County.

Based on the proposed alignment, it appears that the proposed bypass will pass directly through the center of the Study Area. Therefore, it is prudent to develop a conceptual regional pipeline alignment in conjunction with the proposed bypass alignment. Pending proper timing of road and water infrastructure improvements, the typical engineering, environmental and legal efforts to acquire necessary property and clear it for pipeline improvements will likely have already been completed in the clearance required to approve TxDOT funding for the road improvements. As a result, by developing utility improvements along the typical right-of-way (ROW) corridor that will parallel the bypass alignment, substantial cost savings to the distribution system improvements can be obtained. Therefore, the various distribution system regionalization alternatives discussed later in this TM are based on the assumption that the proposed TxDOT bypass will move forward into construction and that adequate ROW space will be available for installation of necessary distribution system improvements.

DESIGN GUIDELINES FOR TRANSMISSION/DISTRIBUTION IMPROVEMENTS

The goal of this section is to discuss the design guidelines and regulatory requirements that will be utilized in the design of new transmission and distribution system improvements, regardless of the regionalization alternative ultimately recommended. These design guidelines will form the basis of design for the proposed distribution system alternatives recommended in this TM.

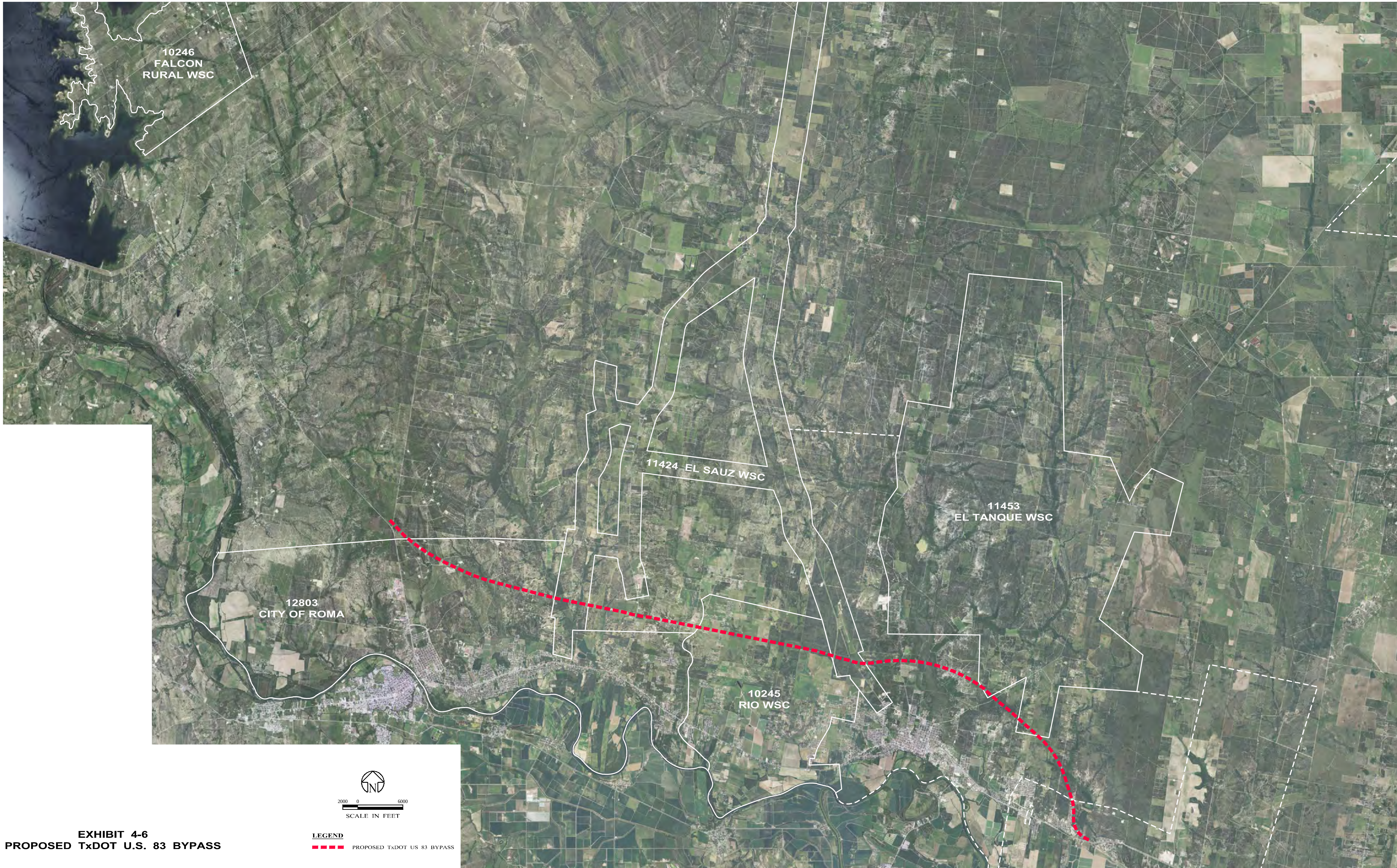

EXHIBIT 4-6
PROPOSED TxDOT U.S. 83 BYPASS

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Pipeline Design

It is anticipated that the proposed transmission pipelines (identified in the regionalization alternatives discussed later in this TM) will primarily be used as trunk mains, transporting potable water from one utility area to another; therefore, only one or two connections in each utility area will be made to the transmission pipelines. However, as each utility area develops, additional connections to the transmission pipeline will likely be necessary, which can impact operation of the overall transmission system. To prepare for this operational situation, the pipelines in the following regionalization alternatives are designed using a maximum pipeline velocity of 3.5 feet per second (ft/s).

Multiple piping materials can be used for the transmission piping, including reinforced concrete cylinder pressure pipe (RCCP), steel, polyvinyl chloride (PVC) and high-density polyethylene (HDPE). Each type of pipe material has its own inherent advantages and disadvantages, including capital cost, ease of installation, ease of maintenance and pipe friction. Of these issues, friction is the most critical as it directly impacts the maximum flow capacity per pipe size and the anticipated O&M cost to pump water through the pipeline. Available flow capacity per pipe size is designed in direct proportion to the inner pipe diameter and the dynamic head loss per foot of pipeline. Dynamic head loss can be calculated via several equations, the most common being the Hazen-Williams equation, which utilizes a dimensionless (the number has no units) number that relates typical friction loss to a specific type of pipe material; this number is known as the Hazen-Williams c-factor. The higher the c-factor, the lower the actual friction loss, so materials such as PVC and HDPE provide the lowest dynamic friction losses in pipelines. Since PVC has one of the lowest capital costs per foot of pipe installed and it also has one of the highest friction factors of the available pipe materials, PVC is used as the pipeline basis of design in the following regionalization alternatives. The unit cost (per linear foot) of PVC pipeline is based on the recommended pipe diameter and the type of material within the pipeline trench (such as sand, clay, gravel or rock).

Storage Tank Design

While capital cost must always be a primary consideration during the conceptual planning and design of storage tank systems, the overall life cycle cost should also be considered to provide the lowest overall cost of ownership without sacrificing needed operations. As discussed previously in this TM, it is recommended that volume and pressure maintenance be provided via elevated storage tanks. In addition, it is recommended that each EST be designed on a total storage basis to allow for reductions in the size and operating cost of the booster pump stations. It is also recommended that each EST be constructed at a standard height of 140 ft, which will provide a consistent tank discharge pressure of roughly 60 psi. A cost of $2.50 per gallon of elevated storage allows for either conventional or composite EST construction; construction of an EST with additional architectural aesthetic-friendly features can also be completed, though the cost per gallon is closer to $3.00-$4.00. The $2.50 cost per gallon for elevated storage is used in the regionalization alternatives discussed later in this TM and will be used in the full project cost analysis in TM No. 6.

Booster Pump Station Design

Booster pump stations are anticipated to be constructed (along with an EST) at various locations along the transmission main to maintain adequate pressure and volume of potable water from one utility to another; a booster pump station will also be constructed at the main point of connection to each utility to provide maximum pressure at each finished water take point. In addition to pressure and volume maintenance, some of the booster pump stations are designed to provide a boost to the disinfection residual, which in the case of surface water is usually chloramine. While a chloramines boosting system is not necessary at each booster pump station, it is recommended for the primary connection points to each utility, to ensure that safe, disinfected potable water is delivered into each utility's distribution system. Since many rural water systems still boost only with free chlorine, budget for allowing boosting of both chlorine and liquid ammonium sulfate (LAS) is included for each booster pump station, in case a boosting of chloramine residual is required.

Each booster pump station consists of a small ground storage tank (GST) designed to provide a discharge point for the upstream transmission main and a pumping feed reservoir for the booster pumps; it is anticipated that the transfer GST at each booster pump station will be roughly 25,000-50,000 gallons in capacity. The booster pump station is designed as a triplex pump station, which provides firm capacity via two of three pumps (with each pump sized for half of the firm capacity), with the third pump providing redundancy. As discussed previously, some booster pump stations will also need to include a disinfection boosting system.

While the majority of the booster pump stations will utilize an EST to satisfy storage requirements, one or more of the booster pump stations may not require an EST. The ground topography increases significantly throughout the Study Area, creating several high points in the transmission main. As a result, it is likely that an EST constructed at standard height (140 ft) cannot provide sufficient pressure to reach the high points in the transmission pipeline system while maintaining the TCEQ required minimum 35 psi system pressure. Therefore, either a booster pump station may be required to actually pump the water "up the hill" to reach the high point, where another booster pump station will be located (including an EST), or some of the recommended ESTs can be constructed at a greater height (such as 160 ft, 180 ft or 200 ft) albeit at a higher cost per gallon. The decision ultimately becomes a comparison of higher upfront capital cost (if constructing a non-standard height EST) versus increased annual O&M cost (if utilizing larger booster pumps). Since higher capital costs can be offset with grant and low-interest loan funding while higher O&M costs cannot be offset by funding, it appears logical to minimize O&M costs wherever possible and therefore construct a non-standard height EST where necessary rather than utilize a large booster pump station.

The remaining locations of the necessary booster pump stations are based on the requirement of maintaining 35 psi through the entire distribution system at all times (except during fire flow demands). The goal of locating booster pump stations along the remaining sections of the transmission main alignment is based on the assumption that the starting pressure at the discharge of each EST is 60 psi and the minimum discharge pressure into the transfer GST at the next downstream is no less than 35 psi under normal conditions and 20 psi under emergency conditions.

REGIONALIZATION ALTERNATIVES

The goal of this section of the TM is to evaluate potential alternatives of consolidating water systems where feasible to increase operational efficiency and cost-effectiveness throughout the Study Area. For the area and number of connections served by the five Study participants, it is common to only have one or two water treatment facilities, frequently with a combined transmission and distribution system. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WTPs (refer to O&M Alternatives TM [TM No. 5] for additional discussion of potential O&M savings).

Since the goal of this section is to determine the needs of all the water systems in the Study Area, several additional in-depth analyses were completed for each existing service area with the goal of developing additional potential consolidation alternatives. In general, there are five potential basic regionalization alternatives for the Study participants which include serving from a minimum of one to all five of the Study participants from a new regional WTP (refer to Exhibit 4-7 through 4-13 for layouts of existing distribution systems for each Study participant). Depending on which specific utilities would be served by a new regional WTP, there are sixteen potential alternatives for regionalization, which will ultimately take into account anticipated treatment, distribution and O&M costs. The regionalization scenarios evaluated in this Study are included in Table 4-10 (data referenced from Table 3-1).

Table 4-10
Regionalization Scenarios

Scenario	City of Roma	Falcon WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

A description of the proposed scenario, projected distribution system opinion of probable construction costs (OPCC) and advantages and disadvantages are included on the following pages for each scenario identified in Table 4-10. Costs have been developed for each individual scenario in order to determine the top three scenarios; costs are also developed for each scenario in order to provide the necessary distribution system cost components to incorporate with treatment and O&M costs in TM No. 6, which will identify total life cycle costs per scenario. Table 4-11 reflects the basic advantages and disadvantages for each scenario (information referenced from Table 3-2).

A description of the treatment improvements required, treatment OPCC and advantages and disadvantages for each scenario is included in the Water Treatment System Alternatives TM (TM No. 3). A description of the anticipated O&M costs and operational advantages and disadvantages for each scenario is included in the Water System Operations Alternatives TM (TM No. 5).

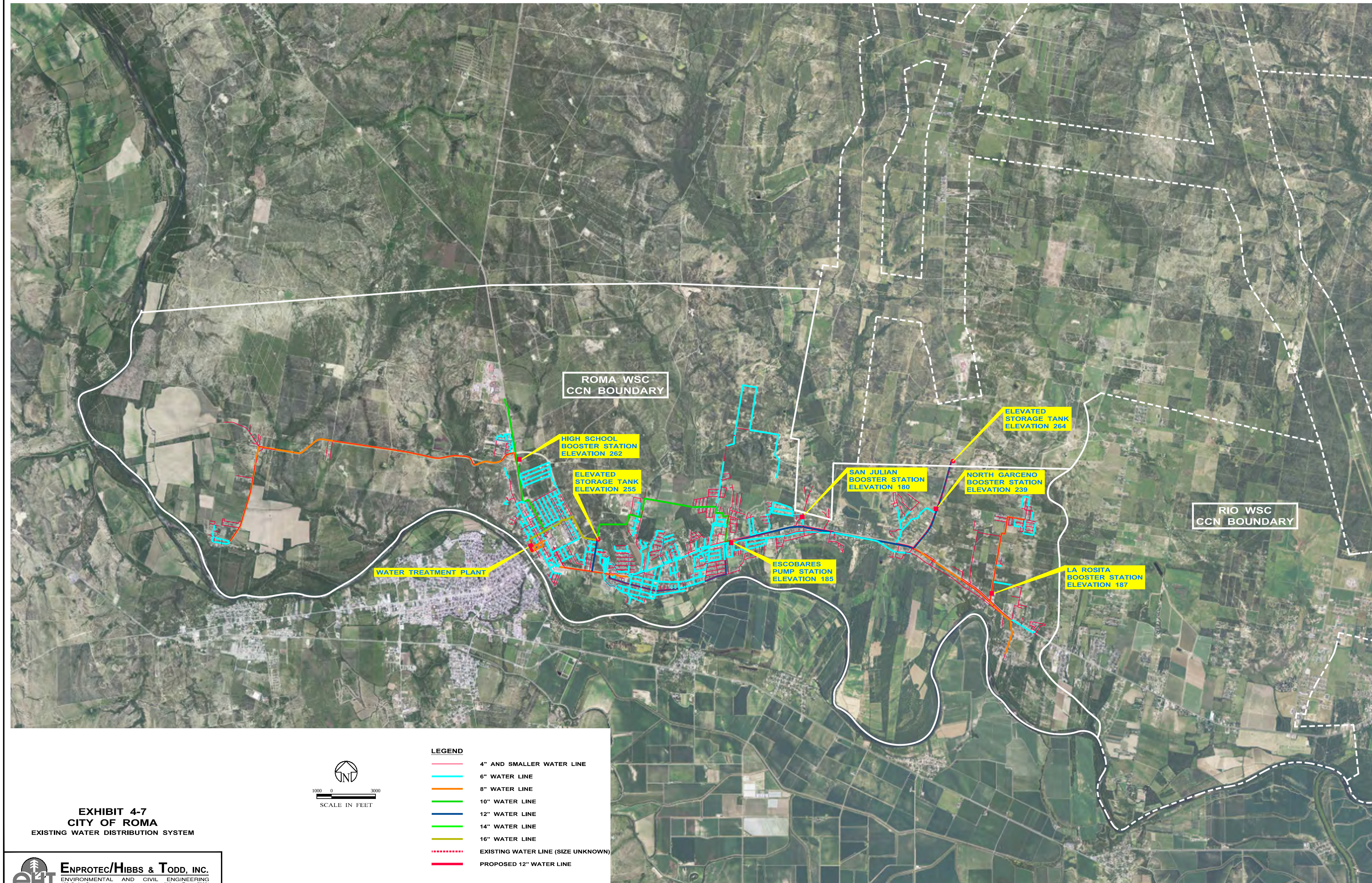

EXHIBIT 4-7
CITY OF ROMA
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
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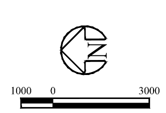

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE

EXHIBIT 4-8
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

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EXHIBIT 4-9
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

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MATCH LINE "A"

1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE

EXHIBIT 4-10
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM

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Firm Registration No. 1151

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MATCH LINE "A"

1000 0 3000
SCALE IN FEET

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE

EXHIBIT 4-11
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM

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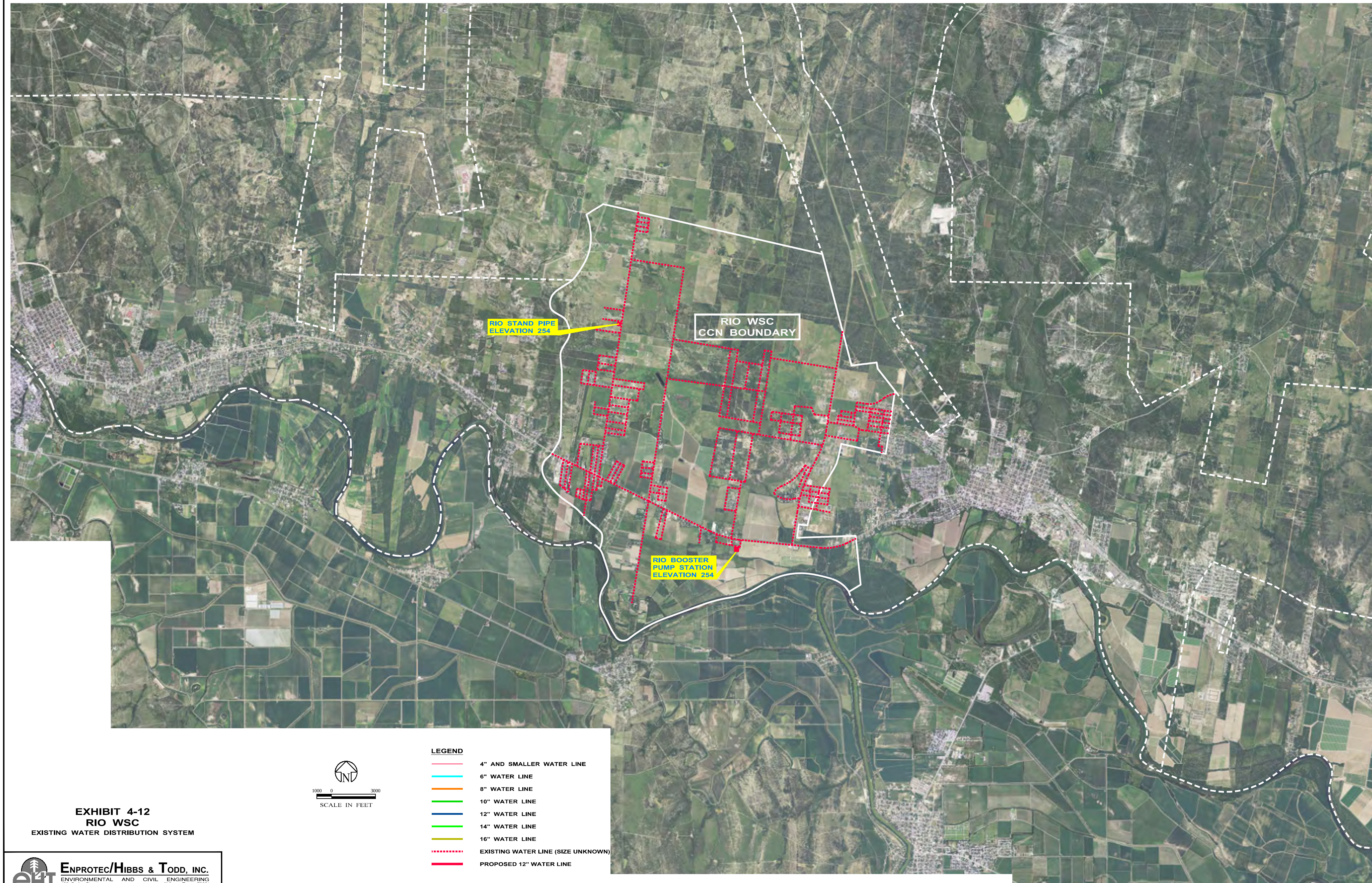

EXHIBIT 4-12
RIO WSC
EXISTING WATER DISTRIBUTION SYSTEM

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Firm Registration No. 1151

11-5287
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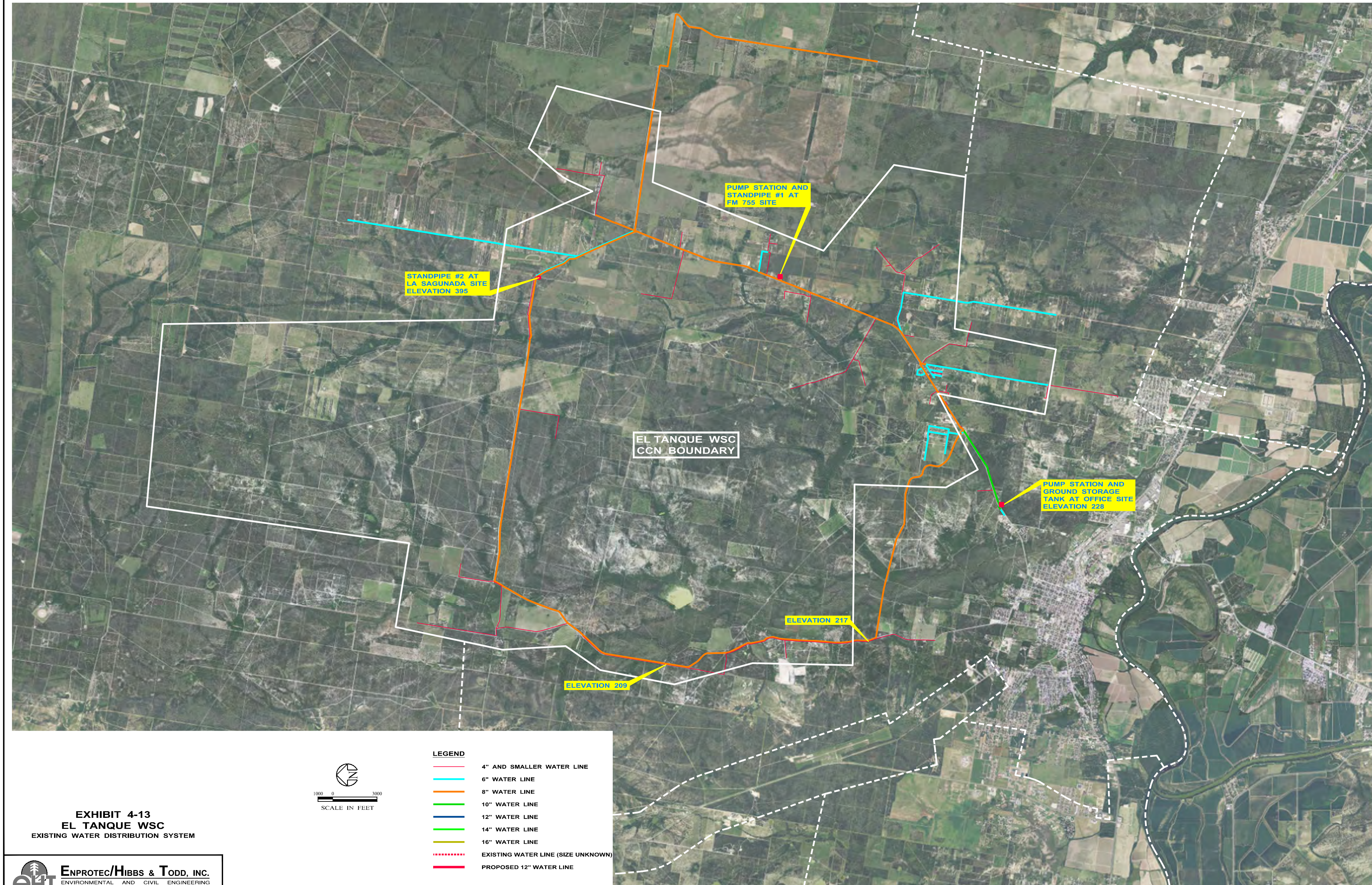

EXHIBIT 4-13
EL TANQUE WSC
EXISTING WATER DISTRIBUTION SYSTEM

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Table 4-11
Advantages and Disadvantages for Each Scenario

Scenario	Advantages	Disadvantages
Scenario 1	Lowest capital cost of the scenarios.	No benefits to the other Study participants.
Scenario 2	Provides improved distribution at reduced cost for Roma and Falcon WSC. Provides another supply of water to Falcon WSC.	No benefits to the other three Study participants.
Scenario 3	Lowest capital cost for distribution system improvements. Provides improved distribution at reduced cost for Roma and El Sauz WSC. Provides another supply of water to El Sauz WSC.	No benefits to the other three Study participants.
Scenario 4	Provides improved distribution at reduced cost for Roma and El Tanque WSC. Provides another supply of water to El Tanque WSC.	No benefits to the other three Study participants.
Scenario 5	Provides improved distribution at reduced cost for Roma and Rio WSC. Provides another supply of water to Rio WSC.	No benefits to the other three Study participants.
Scenario 6	Provides improved distribution at reduced cost for Roma, Falcon WSC and El Sauz WSC. Provides another supply of water to Falcon WSC and El Sauz WSC.	No benefits to the other two Study participants.
Scenario 7	Provides improved distribution at reduced cost for Roma, Falcon WSC and El Tanque WSC. Provides another supply of water to Falcon WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 8	Provides improved distribution at reduced cost for Roma, Falcon WSC and Rio WSC. Provides another supply of water to Falcon WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 9	Provides improved distribution at reduced cost for Roma, El Sauz WSC and El Tanque WSC. Provides another supply of water to El Sauz WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 10	Provides improved distribution at reduced cost for Roma, El Sauz WSC and Rio WSC. Provides another supply of water to El Sauz WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 11	Provides improved distribution at reduced cost for Roma, El Tanque WSC and Rio WSC. Provides another supply of water to El Tanque WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 12	Provides improved distribution at reduced cost for Roma, Falcon WSC, El Sauz WSC and El Tanque WSC. Provides another supply of water to Falcon WSC, El Sauz WSC and El Tanque WSC.	No benefits to one of the Study participants.
Scenario 13	Provides improved distribution at reduced cost for Roma, Falcon WSC, El Sauz WSC and Rio WSC. Provides another supply of water to Falcon WSC, El Sauz WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 14	Provides improved distribution at reduced cost for Roma, Falcon WSC, El Tanque WSC and Rio WSC. Provides another supply of water to Falcon WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 15	Provides improved distribution at reduced cost for Roma, El Sauz WSC, El Tanque WSC and Rio WSC. Provides another supply of water to El Sauz WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 16	Can provide water to all the Study participants.	Highest cost of all the scenarios.

A brief discussion on the potential regionalization scenarios is included in the following pages. The anticipated capacity required per TCEQ design criteria has been developed for each scenario using the criteria discussed earlier in this TM, including required capacity at each five-year milestone through the course of the Study planning period. In addition, to ensure reserve capacity is available at each milestone to maintain compliance with the TCEQ's 85% Rule, the minimum distribution system capacity identified for each scenario has been increased so that the anticipated water demand never exceeds 85% of the rated system capacity. An example of how the system capacity sizing was accomplished for each scenario is shown below, followed by summary tables of required scenario minimum distribution system capacities and recommended design capacities to provide a comparison of the various scenarios. Following the discussion of distribution system sizing, an anticipated OPCC is provided for each potential regionalization scenario, along with a summary of costs for capital cost comparison between the various scenarios.

Regionalization Scenario 16 Example

In Scenario 16, the City of Roma, Falcon Rural WSC, El Sauz WSC, El Tanque WSC and Rio WSC all join together to construct a new regional WTP and a regional water transmission/distribution system to serve all the utilities. The projected water demands for each utility in this TM are based on the number of projected connections identified for each utility in TM No. 1 and include a peaking factor of 1.25 to allow for peak daily demand on the transmission/distribution system. Based on Table 4-12, the minimum required Scenario 16 distribution system capacity (based on TCEQ 290 design criteria and a peaking factor of 1.25) at the end of the planning Study horizon (2040) should be approximately 17.7 mgd.

Table 4-12
Projected Minimum Distribution System Capacity Requirements for Scenario 16

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	6.80	7.31	7.86	8.45	9.09	9.76	10.50	13.65
Falcon Rural WSC	1.31	1.45	1.59	1.75	1.93	2.13	2.34	3.26
El Sauz WSC	0.40	0.45	0.50	0.56	0.63	0.70	0.78	1.15
El Tanque WSC	0.68	0.75	0.84	0.94	1.05	1.18	1.31	1.94
Rio WSC	1.40	1.58	1.76	1.98	2.20	2.48	2.76	4.09
TOTAL	**10.59**	**11.54**	**12.55**	**13.68**	**14.89**	**16.24**	**17.69**	**24.09**

Notes
1 - Distribution system capacity size in mgd.
2 - Connections based on historical number of persons per household.
3 - Growth based on utility-specific annual growth.
4 - Minimum distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand.

Similar to capacity requirements for WTPs, the TCEQ also applies the 85% Rule to distribution system infrastructure; therefore the required minimum capacity (at each milestone in Table 4-12) is divided by 0.85 so that at each milestone, the water demand will not exceed 85% of the rated capacity of the system. Per Table 4-13, the recommended distribution system capacity for Scenario 16 at the end of the planning Study horizon (2040) is 20.9 mgd.

Table 4-13
Projected Recommended Distribution System Capacity Requirements for Scenario 16

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	8.00	8.60	9.25	9.94	10.69	11.49	12.35	16.06
Falcon Rural WSC	1.54	1.71	1.87	2.06	2.26	2.50	2.75	3.84
El Sauz WSC	0.47	0.53	0.59	0.66	0.74	0.82	0.91	1.35
El Tanque WSC	0.79	0.88	0.99	1.10	1.24	1.38	1.54	2.28
Rio WSC	1.65	1.85	2.07	2.32	2.59	2.91	3.25	4.81
TOTAL	**12.46**	**13.57**	**14.76**	**16.09**	**17.51**	**19.10**	**20.81**	**28.34**

Notes
1 - Distribution system capacity size in mgd.
2 - Connections based on historical number of persons per household.
3 - Growth based on utility-specific annual growth.
4 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.

As discussed in the example for Scenario 16, the required minimum distribution system capacity (identified in Table 4-14) at each milestone is divided by 0.85 so that the water demand will not exceed 85% of the rated system capacity at each 5-year milestone. The anticipated recommended distribution system capacity (incorporating compliance with the 85% Rule) for each scenario is summarized in Table 4-14.

Table 4-14
Summary of Projected Recommended Distribution System Capacity Requirements

	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
Scenario 1	8.00	8.60	9.25	9.94	10.69	11.49	12.35	16.06
Scenario 2	9.54	10.31	11.12	12.00	12.96	13.99	15.10	19.90
Scenario 3	8.47	9.13	9.84	10.60	11.43	12.31	13.26	17.41
Scenario 4	8.79	9.49	10.24	11.04	11.93	12.87	13.90	18.34
Scenario 5	9.65	10.46	11.32	12.26	13.28	14.40	15.60	20.87
Scenario 6	10.01	10.84	11.71	12.66	13.69	14.81	16.01	21.25
Scenario 7	10.34	11.19	12.10	13.10	14.19	15.37	16.65	22.18
Scenario 8	11.19	12.16	13.19	14.32	15.54	16.90	18.35	24.71
Scenario 9	9.26	10.01	10.82	11.71	12.66	13.69	14.81	19.69
Scenario 10	10.12	10.99	11.91	12.93	14.01	15.22	16.51	22.22
Scenario 11	10.44	11.34	12.31	13.37	14.51	15.78	17.15	23.15
Scenario 12	10.81	11.72	12.69	13.76	14.93	16.19	17.56	23.53
Scenario 13	11.66	12.69	13.78	14.99	16.28	17.72	19.26	26.06
Scenario 14	11.99	13.04	14.18	15.43	16.78	18.28	19.90	26.99
Scenario 15	10.91	11.87	12.90	14.03	15.25	16.60	18.06	24.50
Scenario 16	12.46	13.57	14.76	16.09	17.51	19.10	20.81	28.34

Notes
1 - Distribution system capacity size in mgd.

REGIONALIZATION COSTS

A brief discussion on anticipated distribution system capital costs for the potential regionalization scenarios is included in this section of the TM. Design components common to each scenario include transmission piping, booster pump stations and potable water storage. It is anticipated that not all of the participating utilities in this Study may immediately decide to join into a regional system; however, as the regional system infrastructure is completed and operational, some of the utilities may decide to join the proposed regional system in the future or at the very least, purchase wholesale water from the regional system as opposed to purchasing from their current wholesale water supplier. Therefore, the recommended distribution improvements are based on the premise that over time, most if not all of the participating utilities in this Study will choose to utilize some volume of water from the regional system to either supplement or replace their current source of potable water.

The anticipated construction costs for Scenario 1 and 2 are fairly different than all the other regionalization scenarios, as Scenario 1 is intended to only supply the City of Roma and as a result only consists of additional storage improvements while Scenario 2 adds only piping improvements to pump potable water up to the Falcon WSC distribution system. Scenarios 3 through 16 incorporate varying amounts of pipeline improvements (along with storage and booster pump station improvements), and are proportional to Scenario 16 based on increased/reduced recommended distribution system capacity. While the projected capital costs for Scenarios 3 through 16 will be very similar to one another, the true comparison will occur with respect to differences in annual O&M costs which are included in TM No. 5. TM No. 5 will also combine capital and O&M costs to develop projected life cycle costs for each regionalization scenario.

Examples of how the anticipated distribution system OPCC is developed for Scenario 1, 2 and 16 are shown below followed by a summary table of anticipated distribution system OPCCs for comparison of the various scenarios.

Regionalization Scenario 1 Example

In Scenario 1, the City of Roma builds a new WTP to serve the City, while the remaining participating utilities in this Study continue to operate by either treating raw water or purchasing treated water wholesale from another utility; as a result, no major transmission pipeline improvements are required for the City, only the provision of additional elevated storage to comply with total storage requirements (refer to Exhibit 4-7 for a layout of the City of Roma's existing distribution system). For Scenario 1, the 2040 recommended distribution system capacity (per Table 4-14) for the City of Roma is approximately 12.4 million gallons per day (mgd). Per Table 4-9, the recommended 2040 total storage capacity for the City of Roma is roughly 2.3 MG. Assuming that the total storage requirement is met via elevated storage only, an additional 1.5 MG of elevated storage is required to supplement the existing 0.8 MG of elevated storage capacity.

While 1.5 MG of additional elevated capacity is needed by 2040 if the City decides to meet its total storage requirement via elevated storage, it is not recommended to construct the entire additional storage in one tank. Rather, providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the City's distribution system. For that reason, Scenario 1 includes the construction of three 0.5 MG ESTs to provide the recommended additional storage needed by 2040 (refer to Exhibit 4-14 for recommended tank improvements for the City of Roma under Scenario 1).

As discussed previously, it is recommended that a construction cost of $2.50 per gallon be used for development of conceptual construction costs of ESTs. Using an average construction cost per gallon of $2.50, the EST construction cost at a capacity of 1.5 MG, is roughly $3,750,000. This construction cost does not include site improvements and the booster pump stations required to lift water into the ESTs. Based on Table 4-15, including additional construction cost items and non-construction costs, the anticipated project cost for Scenario 1 is approximately $6,372,000 (in 2012 dollars).

Table 4-15
Anticipated Distribution System Project Cost for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct three new 0.5 MG standard ESTs	EA	3	$1,250,000.00	$3,750,000.00
2	Site improvements for new ESTs	EA	3	$250,000.00	$750,000.00
				subtotal	$4,500,000
				Contingencies (20%)	$900,000
				TOTAL ESTIMATED CONSTRUCTION COST	$5,400,000
				Engineering & Testing (18%)	$972,000
				TOTAL ESTIMATED CAPITAL COST	**$6,372,000**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank.

Note that while the projected capital cost for Scenario 1 is small enough to be funded at one time, a more logical approach is to construct the recommended distribution system improvements in multiple phases, to complement anticipated phasing of the WTP improvements. Phasing of construction will allow for a greater opportunity to fund the majority of each construction phase via grant and/or low interest loan funding, which will make the project significantly more viable.

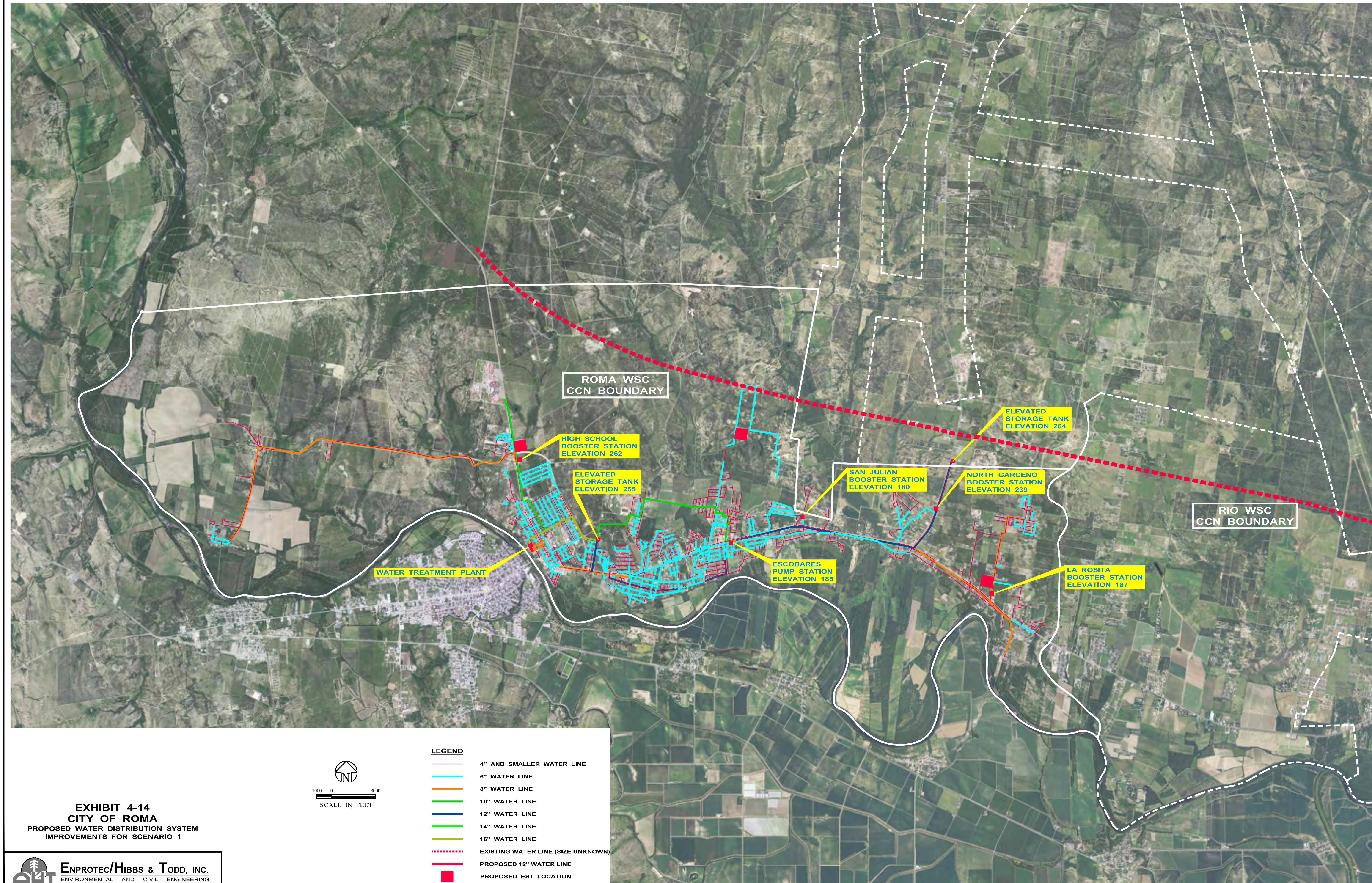

EXHIBIT 4-14
CITY OF ROMA
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 1

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Regionalization Scenario 2 Example

In Scenario 2, the City of Roma and Falcon WSC join together to build a new WTP to serve both the City of Roma and Falcon WSC, while the remaining participating utilities in this Study continue to operate by purchasing treated water wholesale from another utility (refer to Exhibit 4-15 for a layout of proposed improvements for the City of Roma and Falcon WSC); as a result, the only major transmission pipeline improvements are required for Falcon WSC.

For Scenario 2, the 2040 recommended distribution system capacity (per Table 4-14) for the City of Roma and Falcon WSC is approximately 15.1 mgd, though the pipeline system is designed only for sending flow to Falcon WSC, which is projected to require a distribution capacity of 2.75 mgd in 2040. Per Table 4-9, the recommended 2040 total storage capacity for the City of Roma and Falcon WSC is roughly 2.8 MG; assuming that the total storage requirement is met via elevated storage only, an additional 1.9 MG of elevated storage is required to supplement the existing 0.9 MG of elevated storage capacity.

Similar to the example for Scenario 1, it is not recommended to construct the entire additional recommended elevated storage in one tank. Rather, providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the regional distribution system. It is recommended that three 0.5 MG ESTs be constructed in the City of Roma main distribution system (to meet the City's 2040 total storage goals) with two 0.1 MG ESTs being located along the transmission main to Falcon WSC and one 0.2 MG EST located at the connection point to the Falcon WSC distribution system.

As discussed previously, it is recommended that a construction cost of $2.50 per gallon be used for development of conceptual construction costs of ESTs. However, due to the significant changes in elevation (roughly 150 ft increase in elevation from the City of Roma to the west tie-in point of the proposed TxDOT US 83 bypass) along the proposed pipeline alignment (US 83 northwest of the City of Roma), taller ESTs are required to send water from the City to Falcon WSC. For this reason, a cost of $3.00 per gallon is used to allow for taller EST structures, which increases structural wall thickness and foundation requirements.

Using an average construction cost per gallon of $3.00, the EST construction cost at a capacity of 1.9 MG, is roughly $5,700,000. This construction cost does not include site improvements and the booster pump stations required to lift water into the ESTs. Based on Table 4-16, including additional construction cost items and non-construction costs, the anticipated project cost for Scenario 2 is approximately $15,431,500 (in 2012 dollars).

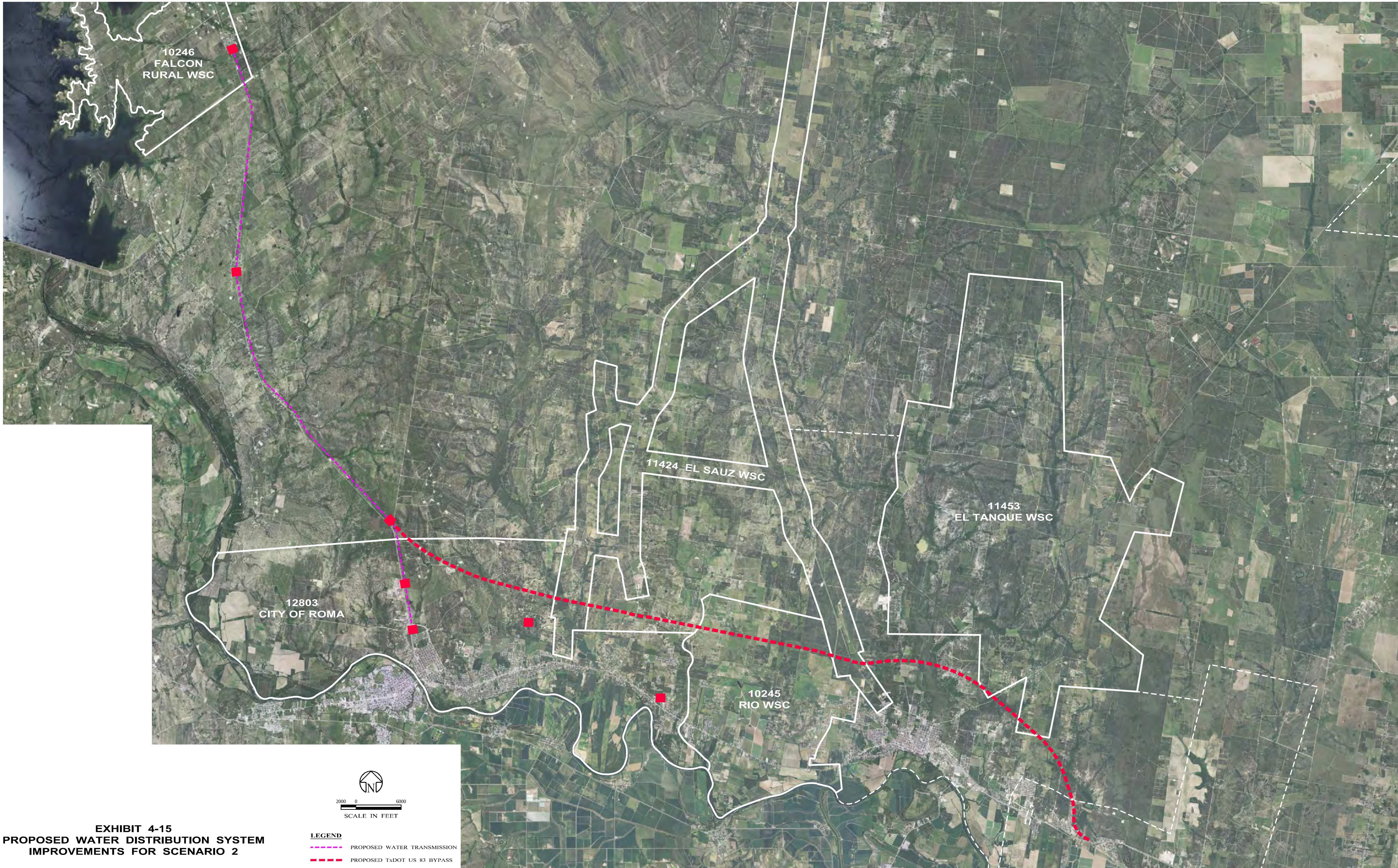

EXHIBIT 4-15
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 2

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Table 4-16 Anticipated Distribution System Project Cost for Scenario 2					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.1 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$300,000	$300,000
4	Construct one new 0.1 MG standard EST at TxDOT Bypass	EA	1	$250,000	$250,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
7	Site improvements for new ESTs	EA	7	$250,000	$1,750,000
8	20-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$100	$1,398,500
9	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	26,277	$75	$1,970,800
10	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
				subtotal	$10,897,900
				Contingencies (20%)	$2,179,600
				TOTAL ESTIMATED CONSTRUCTION COST	$13,077,500
				Engineering & Testing (18%)	$2,354,000
				TOTAL ESTIMATED CAPITAL COST	**$15,431,500**
Notes					
1 - Distribution system capacity size based on 2040 requirements.					
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.					
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.					

Note that while the projected capital cost for Scenario 2 includes storage improvements for the City of Roma, it is likely that the project will need to be constructed in multiple phases, to complement anticipated phasing of the WTP improvements.

Regionalization Scenario 16 Example

At the other end of the potential regionalization scenario spectrum (Scenario 16), the City of Roma, Falcon Rural WSC, El Sauz WSC, El Tanque WSC and Rio WSC all join together to build a new regional WTP to serve all the utilities (refer to Exhibit 4-16 for a layout of the proposed transmission/distribution improvements for Scenario 16). For Scenario 16, the 2040 recommended distribution system capacity (per Table 4-14) for all five utilities is approximately 20.9 mgd.

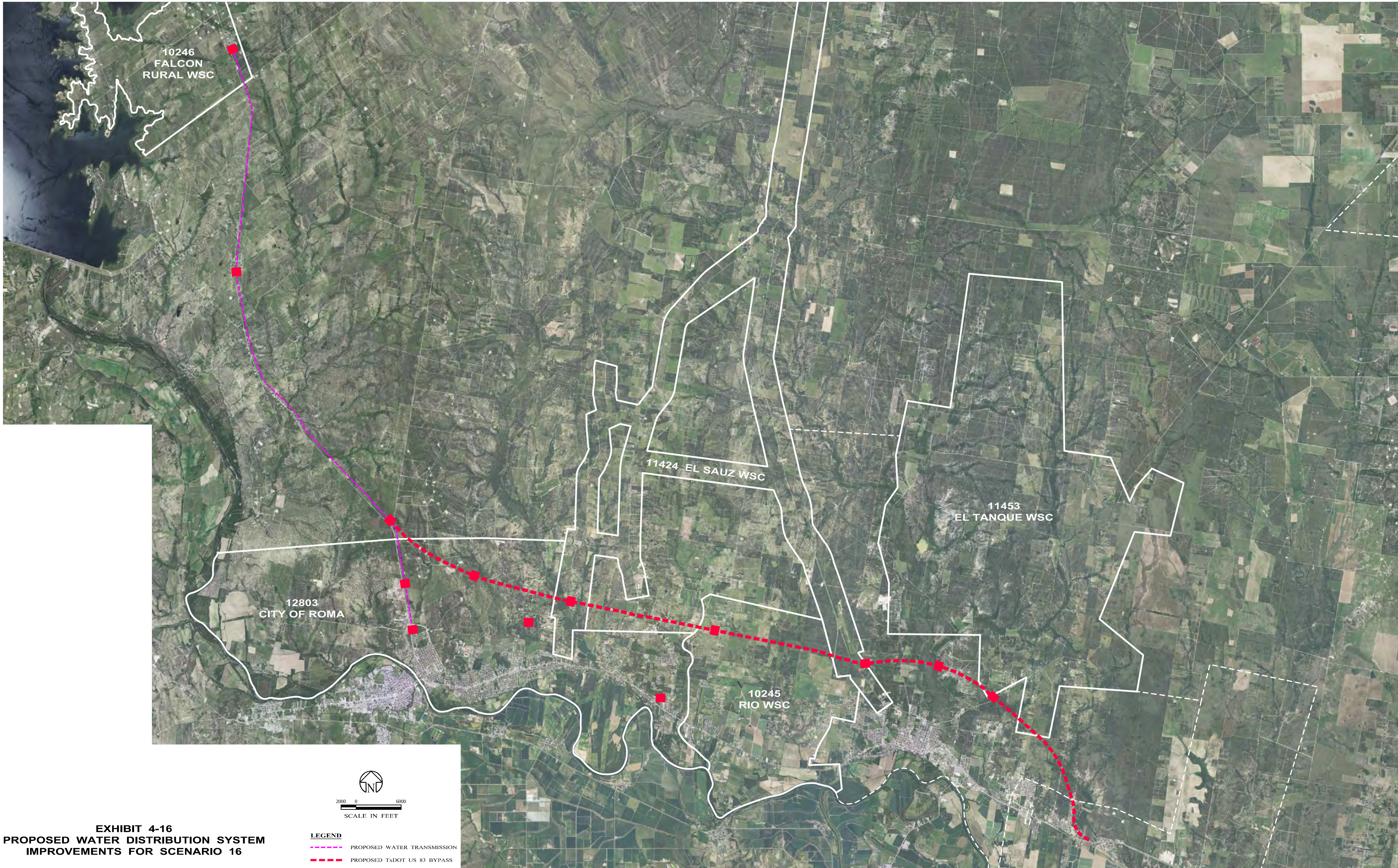

EXHIBIT 4-16
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 16

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Per Table 4-9, the recommended 2040 total storage capacity for all five utilities is roughly 3.9 MG; assuming that the total storage requirement is met via elevated storage only, an additional 2.8 MG of elevated storage is required to supplement the existing 1.1 MG of elevated storage capacity.

Similar to the example for Scenarios 1 and 2, it is not recommended to construct the entire additional recommended elevated storage in one tank. Rather, providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the regional distribution system. It is recommended that three 0.5 MG ESTs be constructed in the City of Roma main distribution system (to meet the City's 2040 total storage goals) with the remaining elevated storage being located along the transmission main to each utility.

As discussed previously, it is recommended that a construction cost of $2.50 per gallon be used for development of conceptual construction costs of ESTs. Using an average construction cost per gallon of $2.50, the EST construction cost at a capacity of 2.8 MG, is roughly $7,000,000. This construction cost does not include site improvements and the booster pump stations required to lift water into the ESTs. Based on Table 4-17, including additional construction cost items and non-construction costs, the anticipated project cost for Scenario 16 is approximately $39,009,000 (in 2012 dollars).

Table 4-17
Anticipated Distribution System Project Cost for Scenario 16

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$750,000	$750,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
7	Construct one new 0.25 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$625,000	$625,000
8	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
9	Construct one new 0.25 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$750,000	$750,000
10	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
11	Construct one new 0.25 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC service connection	EA	1	$625,000	$625,000
12	Construct one new 0.25 MG standard EST at El Tanque WSC service connection	EA	1	$625,000	$625,000
13	Site improvements for new ESTs	EA	13	$250,000	$3,250,000
14	30-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$150	$2,097,800
15	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	26,277	$75	$1,970,800
16	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
17	20-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$100	$2,632,900
18	24-inch transmission main from El Sauz WSC service connection to Rio WSC service connection	LF	38,074	$125	$4,759,300
19	20-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	12,250	$100	$1,225,000
20	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	6,789	$75	$509,200
				subtotal	$27,548,600
				Contingencies (20%)	$5,509,800
				TOTAL ESTIMATED CONSTRUCTION COST	$33,058,400
				Engineering & Testing (18%)	$5,950,600
				TOTAL ESTIMATED CAPITAL COST	**$39,009,000**

Notes

1 - Distribution system capacity size based on 2040 requirements.

2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.

3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

Costs for each additional potential regionalization scenario were developed using the same methodology as Scenarios 1, 2 and 16. The anticipated distribution system capital cost for each scenario is summarized in Table 4-18.

Table 4-18
Summary of Projected Distribution System Costs for Regionalization Scenarios

DESCRIPTION	TOTAL CONSTRUCTION COST	ENGINEERING & TESTING	TOTAL CAPITAL COST
Scenario 1	$5,400,000	$972,000	$6,372,000
Scenario 2	$13,077,500	$2,354,000	$15,431,500
Scenario 3	$10,505,000	$1,890,900	$12,395,900
Scenario 4	$21,012,800	$3,782,400	$24,795,200
Scenario 5	$19,332,900	$3,480,000	$22,812,900
Scenario 6	$16,599,400	$2,987,900	$19,587,300
Scenario 7	$25,541,200	$4,597,500	$30,138,700
Scenario 8	$25,415,200	$4,574,800	$29,990,000
Scenario 9	$20,998,200	$3,779,700	$24,777,900
Scenario 10	$20,556,400	$3,700,200	$24,256,600
Scenario 11	$26,219,600	$4,719,600	$30,939,200
Scenario 12	$28,498,600	$5,129,800	$33,628,400
Scenario 13	$26,945,200	$4,850,200	$31,795,400
Scenario 14	$32,608,400	$5,869,600	$38,478,000
Scenario 15	$28,199,600	$5,076,000	$33,275,600
Scenario 16	$33,058,400	$5,950,600	$39,009,000

Notes
1 – Costs in 2012 dollars.

As discussed previously, the most logical approach would be to construct new distribution improvements in multiple phases, with the goal of reducing distribution capital costs to approximately $20 million or less per construction phase. Phasing of construction allows for a greater opportunity to fund the majority of each construction phase via grant and/or low interest loan funding, which will make the project significantly more viable.

One of the benefits of regionalization is that by providing water to multiple utilities, the average cost per volume of water treated and distributed (normally in terms of cost per 1,000 gallons) typically reduces as the number of connections served increases. This concept is known as "economies of scale."

For example, under Scenario 16, the projected 2040 project cost for the proposed distribution system improvements (if constructed all at once) is approximately $39,009,000 (using 2012 dollars), including construction cost, contingency and engineering and testing services. In a worst-case funding scenario, no grant or low-interest loan funds are available, so that scenario is used as the starting point for determining potential cost of service. Therefore, for the projected Scenario 16 OPCC of $39,009,000, the projected annual debt service is developed using an interest rate of 5.0% (assuming no low-interest rate at this point) at a term of 30 years. Using the projected Scenario 16 project cost, an interest rate of 5.0% and a term of 30 years, an annual debt service of $2,537,591 is determined. The same methodology is used to determine the projected worst-case annual debt service for each potential regionalization scenario, and the respective debt service for each scenario is shown in Table 4-19.

While the WTP and the distribution system must be designed for compliance with the TCEQ's standard design criteria of 0.6 gpm per connection and the 85% Capacity Rule, the actual average daily demand is approximately half of the TCEQ-required design capacity of 0.6 gpm per connection; this is why the City of Roma can still meet daily water demands from its existing WTP under its current ACR rating, whereas under TCEQ standard design criteria, the WTP does not currently have sufficient capacity. Therefore, while the Scenario 16 2040 minimum required distribution design capacity is anticipated to be 16.7 mgd, based on the ratio of current demand to required capacity (approximately 50%), it is anticipated that the average water demand will continue to be roughly half of the 2040 WTP capacity, or 8.85 mgd. Therefore, in determining projected cost per volume (a common method for utilities is to evaluate cost per thousand gallons treated), the debt service (worst-case for this example) for Scenario 16 ($2,537,591) is divided by the anticipated peaking water demand (8.85 mgd in 2040), converted to a per 1,000 gallon basis. Example cost equations are shown below.

Cost = debt service / demand
= ($2,537,591) / (8.85 mgd x 1,000,000 gal/million gallons x 365.25 days/year)
= $0.00083 per gallon x 1,000
= $0.83 per 1,000 gallons

The same methodology was used to determine the projected cost per volume treated for each potential regionalization scenario and the respective cost for each scenario is also shown in Table 4-19. Cost data from the Treatment System Alternatives TM (TM No. 3) and the O&M Alternatives TM (TM No. 5) will be combined to generate a total cost per 1,000 gallons treated.

Table 4-19
Impacts of Regionalization on Cost of Service

DESCRIPTION	WORST-CASE ANNUAL DEBT SERVICE (100% LOAN)	COST PER THOUSAND GALLONS
Scenario 1	$414,508	$0.23
Scenario 2	$1,003,841	$0.46
Scenario 3	$806,371	$0.42
Scenario 4	$1,612,963	$0.79
Scenario 5	$1,484,012	$0.65
Scenario 6	$1,274,182	$0.54
Scenario 7	$1,960,566	$0.81
Scenario 8	$1,950,893	$0.73
Scenario 9	$1,611,838	$0.74
Scenario 10	$1,577,927	$0.65
Scenario 11	$2,012,639	$0.80
Scenario 12	$2,187,576	$0.85
Scenario 13	$2,068,336	$0.73
Scenario 14	$2,503,049	$0.86
Scenario 15	$2,164,626	$0.82
Scenario 16	$2,537,591	$0.83

As discussed previously, without any grant or low-interest loan funding, development of a regional WTP may not be feasible due to the high cost of infrastructure. Therefore, the obvious fatal flaw in this Study is the availability of grant and low-interest funding for the final recommended improvements. To show the impact of this type of funding, two additional examples were developed for varying levels of grant and/or low-interest loan funding. While worst-case (100% loan, typical open market interest rate) debt service costs were developed for each scenario in Table 4-19, additional cost examples using a 50% grant/loan combination and a 75% grant/loan combination are developed and displayed in Tables 4-20 and 4-21.

The two additional funding opportunities are identified as grant/loan combinations, as similar benefits can be attained depending on the funding methodology. For example, using Scenario 1 once again, the anticipated annual debt service (assuming open market, 5.0% interest and a 30-year term) is $2,537,591. On some projects, a utility may qualify for either grants or low-interest loans, but not both. Therefore, in a 50% grant/loan combination example, it is assumed that a 50% reduction in debt service is accomplished either directly via grant or loan forgiveness, along with the remaining loan component still including a typical interest rate. However, the same reduction in debt service can be accomplished with no grant being applied, as long as the interest rate on the loan is reduced to less than 1.0%, which can be obtained by utilities defined by funding agencies as “disadvantaged.” Cost impacts to each potential regionalization scenario via a 50% grant/loan funding program are included in Table 4-20.

Table 4-20
Impacts of Regionalization and Grant Opportunities on Cost of Service
50% Grant/Loan

DESCRIPTION	MEDIUM-CASE ANNUAL DEBT SERVICE (50% GRANT)	COST PER THOUSAND GALLONS
Scenario 1	$207,254	$0.11
Scenario 2	$501,921	$0.23
Scenario 3	$403,186	$0.21
Scenario 4	$806,482	$0.40
Scenario 5	$742,006	$0.33
Scenario 6	$637,091	$0.27
Scenario 7	$980,283	$0.40
Scenario 8	$975,446	$0.36
Scenario 9	$805,919	$0.37
Scenario 10	$788,963	$0.33
Scenario 11	$1,006,320	$0.40
Scenario 12	$1,093,788	$0.43
Scenario 13	$1,034,168	$0.37
Scenario 14	$1,251,525	$0.43
Scenario 15	$1,082,313	$0.41
Scenario 16	$1,268,796	$0.42

A similar methodology is applied for the 75% grant/loan combination example (refer to Table 4-21), except that even if the loan component was offered at 0.0% interest, the debt service would only be reduced by roughly 50%. Therefore, grant funding would still need to be applied to reach a total debt service reduction of 75%.

Table 4-21 Impacts of Regionalization and Grant Opportunities on Cost of Service 75% Grant/Loan		
DESCRIPTION	**BEST-CASE ANNUAL DEBT SERVICE (75% GRANT)**	**COST PER THOUSAND GALLONS TREATED**
Scenario 1	$103,627	$0.06
Scenario 2	$250,960	$0.11
Scenario 3	$201,593	$0.10
Scenario 4	$403,241	$0.20
Scenario 5	$371,003	$0.16
Scenario 6	$318,545	$0.14
Scenario 7	$490,141	$0.20
Scenario 8	$487,723	$0.18
Scenario 9	$402,959	$0.19
Scenario 10	$394,482	$0.16
Scenario 11	$503,160	$0.20
Scenario 12	$546,894	$0.21
Scenario 13	$517,084	$0.18
Scenario 14	$625,762	$0.22
Scenario 15	$541,156	$0.21
Scenario 16	$634,398	$0.21

In the case of this Study, all of the Study participants are considered to be significantly "economically disadvantaged" and therefore it is anticipated that projects identified in this Study should qualify for either 50% or 75% grant/loan combination funding.

RECOMMENDED ALTERNATIVE

Based on the anticipated construction and capital costs and distribution debt service cost per 1,000 gallons, it appears that the most cost-effective regionalization scenario with respect to distribution system debt service cost is Scenario 1, which will serve only the City of Roma. This is logical as Scenario 1 requires the least amount of distribution infrastructure improvements of the evaluated scenarios; however, this scenario provides no regionalization benefits to the other Study participants.

The proposed distribution system debt service component is only one component of the overall cost evaluation required for each regionalization scenario. Once projected WTP and distribution system O&M costs (from TM No. 5) are developed for each scenario, the cost components from TM No. 3, TM No. 4 and TM No. 5 will be combined and total costs will be compared from scenario to scenario. Total cost discussion and final cost comparisons for the potential regionalization scenarios are included in TM No. 6.

This Technical Memorandum (TM) summarizes the findings of Task V of the City of Roma Regional Water Planning Study (the Study). The focus of Task V of the Study is the preparation of water operation alternatives and costs for the Study Area.

Activities in Task V included the following:

- ✓ Determine potential operational scenarios for a single large water treatment plant (WTP) as compared to multiple smaller WTPs;
- ✓ Comparison of operational costs for different types of treatment technologies;
- ✓ Determine anticipated operational costs for each potential regionalization scenario; and
- ✓ Prepare a technical memorandum summarizing the findings.

BACKGROUND

The historical reliance on individual utilities to provide basic water services in the Study Area has ensured more local oversight of utility operations and associated fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall area has grown. For example, each utility in the Study Area operates its own distribution system and does not utilize a continual or emergency interconnect with other nearby utilities, whereas many other similar-sized areas can function efficiently and cost-effectively with only one large distribution system. Regionalization in other communities has provided benefits such as:

- More unified administration, operations and purchasing;
- Cost sharing for staff training and certification;
- Reduced paperwork, monitoring, reporting and enforcement activity associated with each distribution system; and
- Typically a much lower total cost (including treatment, transmission, distribution and system operations) in cost per thousand gallons.

The potential benefits of “regionalization” or “consolidation” of utility providers are important enough that unique opportunities should be identified and pursued where they make sense and have a good chance to benefit all parties. Such opportunities will gradually come about as the overall region approaches build-out, as debt assumption becomes less of a factor, as through attrition as older systems face difficulties in meeting maintenance and rehabilitation needs, and further State and Federal regulatory mandates come along.

This Technical Memorandum (TM) addresses the fundamental questions of how particular consolidations might be accomplished with respect to meeting transmission and distribution goals. Incorporation of the results of this TM, along with results from the other TMs should lead to technically sound engineering master plans to guide ongoing water system investments and management activities by the City of Roma and the other participating utilities in this Study. The goals of this TM are to identify and discuss:

- Comparisons of anticipated annual treatment cost for similarly-sized WTPs, using either conventional or membrane filtration;
- Comparisons of anticipated annual treatment cost for small WTPs versus larger, regional WTPs and how regionalization impacts operation; and
- Comparisons of anticipated annual distribution cost for booster pump stations utilizing either hydropneumatic pressure tanks (HPTs), standpipes or elevated storage tanks (ESTs).

COMPARISON OF ANTICIPATED ANNUAL TREATMENT COST FOR CONVENTIONAL WTPs VERSUS MEMBRANE WTPs

Membrane filtration system capital costs, on a basis of dollars per volume of installed treatment capacity, do not escalate rapidly as plant size decreases, unlike conventional treatment systems. This factor makes membranes quite attractive for small systems. Membrane processes have also become more attractive for potable water production in recent years due to the increased stringency of drinking water regulations. Membrane processes have excellent separation capabilities and show promise for meeting many of the existing and anticipated drinking water standards. The newest version of the Surface Water Treatment Rule (SWTR), the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and the new Disinfectants/Disinfection Byproduct Rule (DBP2) have increased interest in microfiltration (MF) and ultrafiltration (UF) membranes for turbidity, bacteria, virus and disinfection byproducts (DBP) precursor removal.

In addition to differences in capital costs, membrane WTPs also frequently gain benefits in reduced operating costs when compared to conventional WTPs. For example, the basic treatment concept of a conventional WTP is to apply coagulating chemicals to create large collections of suspended solids (flocs) in order to settle out the majority of suspended solids prior to filtration; the conventional pretreatment steps of coagulation, flocculation and sedimentation are required as conventional filtration performance is significantly impacted by the amount of suspended solids or turbidity, that reaches the filtration system. The conventional pretreatment requirement for adequate filtration results in typically a substantially higher chemical usage for coagulation and higher water usage when wasting settled sludge and backwashing filters. Since the chemical usage is typically much higher for a conventional treatment system, the daily solids production is also much higher, resulting in additional solids dewatering, transport and disposal costs.

The basic treatment concept of a membrane WTP is similar, though settled water turbidity has little effect on membrane filtration performance. As a result, chemical usage is normally much lower for membrane systems and membrane filters require a small backwashing volume so chemical and water usage is very low. Since coagulant chemical usage is much lower for membrane filtration systems, the daily solids production is likewise much lower and results in further operational savings. Membrane filtration WTPs also normally require a much smaller operating staff than what is normally needed for conventional WTPs, as the focus of effort shifts away from daily operations (conventional) to primarily preventative maintenance (membrane) as the majority of the plant processes becomes more automated in more advanced WTPs. However, due to the pressure applied to a membrane filter (on the order of 10-35 pounds per square inch [psi]), energy usage is usually higher in a membrane filtration WTP than a conventional filtration WTP. Despite a higher energy usage, the reductions in chemical and water usage and normal reductions in labor typically result in a lower annual operations and maintenance (O&M) cost for a similar-sized membrane WTP as opposed to the cost to operate and maintain a conventional WTP.

Development of O&M Costs

The Environmental Protection Agency (EPA) has developed cost curves for various types of WTPs, including accounting for type of process, whether a treatment facility was based on treating groundwater or surface water, and flow loading. The O&M cost models used in this Study were developed using EPA cost curves as a basis, with revisions completed to account for newer treatment technologies such as membrane filtration and improvements in efficiency-enhancing technologies such as variable frequency drives and automated control systems.

To compare O&M costs between membrane and conventional treatment WTPs, the recommended 2040 basis of design (for Regionalization Scenario 16) of 16.7 million gallons per day (mgd) treatment capacity is used; an O&M cost comparison can be completed at any plant size, though the larger the WTP, the more noticeable the difference in operating costs. Conceptual O&M costs for a new 16.7 mgd (operated at 100% capacity) conventional treatment WTP as compared to a new membrane filtration WTP are listed in Table 5-1.

Table 5-1
O&M Costs Comparison for Conventional and Membrane Filtration

Project Description	Flow Capacity (MGD)	Conceptual Annual O&M Cost
Conventional Filtration WTP	16.7	$7,008,600
Membrane Filtration WTP	16.7	$4,570,800

Note that the costs shown above are based on operating each facility at full capacity. Since the anticipated actual water demand will be roughly half of the plant capacity, it is logical to expect that the operational cost will also be roughly half of the anticipated annual cost shown above. The only exception is in the O&M cost in the form of a membrane replacement fund established for replacement of membranes in a membrane filtration WTP roughly every 10 years (somewhat more expensive than filtration equipment and media replacement required for conventional WTPs every 10-15 years).

Utilizing an average membrane replacement cost of $250,000 per MGD of capacity, a total replacement cost for 16.7 mgd of membranes is approximately $4,175,000, or roughly $420,000 a year if establishing a replacement fund over a 10-year period. While the typical O&M costs could be reduced by half if operating at 50% demand (such as chemical, electricity and labor usage), the annual membrane replacement cost would likely remain the same. However, based on the savings in operational costs (still lower than O&M costs for a conventional WTP) along with superior treatment performance (as discussed in TM No. 3) and lower capital costs, it is recommended that future WTP improvements utilize membrane filtration technology rather than conventional treatment technology.

COMPARISON OF ANTICIPATED ANNUAL TREATMENT COST FOR MULTIPLE SMALL WTPs VERSUS ONE LARGE REGIONAL WTP

This section of the TM discusses various methods for regionalization and how each style may or may not impact operation of treatment and distribution systems. There are three basic methods of regionalization, including:

- Operation of multiple independent facilities;
- Operation of multiple small regional facilities; and
- The development of a single, large regional system.

In considering small WTPs compared to large WTPs, the projected annual O&M cost for a brand new, 0.1 mgd membrane filtration WTP is roughly $98,000, while a 1.0 mgd facility is about $560,000 and a 10.0 mgd facility is roughly $4,156,000. As the size of a WTP increases, economies of scale impact the O&M cost, and the O&M cost per gallon continues to drop with an increasingly larger WTP.

To compare O&M costs for one large regional WTP as compared to multiple, small WTPs, conceptual O&M costs were developed for similarly-sized membrane filtration WTPs that would be required to provide treatment of surface water for the participants in this Study. However, since two of the Study participants (El Sauz WSC and El Tanque WSC) are not located close to a surface water source, there is an additional cost associated with those utilities, as shown below. Conceptual O&M costs for a proposed regional WTP (16.7 mgd) as compared to multiple, small WTPs are listed in Table 5-2.

Table 5-2
O&M Costs Comparison for Small vs. Large WTPs

Project Description	2040 Flow Capacity (MGD)	Conceptual Annual Treatment O&M Cost	Conceptual Annual Raw Water Transmission O&M Cost	Conceptual Total Annual WTP O&M Cost
City of Roma	9.9	$2,691,800	$110,000	$2,801,800
Falcon Rural WSC	2.2	$885,500	$36,000	$921,500
El Sauz WSC	0.7	$417,900	$45,000	$462,900
El Tanque WSC	1.2	$654,100	$80,000	$734,100
Rio WSC	2.6	$963,600	$40,000	$1,003,600
Total	**16.7**	**$5,612,900**	**$311,000**	**$5,923,900**
Regional WTP	**16.7**	**$4,370,800**	**$200,000**	**$4,570,800**

In reviewing O&M cost comparisons of small WTPs compared to a new regional WTP, the cost difference between the two options does not appear to be that significant. However, the 30-year O&M cost difference is roughly $40,000,000. In conclusion, since greater economies of scale can be obtained with larger facilities, it stands to reason that a regional WTP approach can be accomplished at a substantially reduced life cycle cost as compared to constructing multiple, small WTPs.

COMPARISON OF ANTICIPATED ANNUAL DISTRIBUTION COST FOR VARIOUS TYPES OF BOOSTER PUMP STATIONS

Booster pump stations are anticipated to be constructed at various locations along the transmission main to maintain adequate pressure and volume of potable water from one utility to another; a booster pump station will also be constructed at the main point of connection to each utility to provide maximum pressure at each finished water take point. In addition to pressure and volume maintenance, some of the booster pump stations are designed to provide a boost to the disinfection residual, which in the case of surface water is usually chloramine. While a chloramines boosting system is not necessary at each booster pump station, it is recommended for the primary connection points to each utility, to ensure safe, disinfected potable water is delivered into each utility's distribution system.

In order to compare operational costs for a pressure storage system (HPT) versus that for an elevated storage system (ESTs and standpipes), the operating process of each system and the components required for each system is discussed. An EST or standpipe requires only the feed pressure from the incoming water to lift water into the tank. Therefore, during an emergency if a nearby WTP has backup power, then an EST or standpipe will be filled and will continue operation.

A typical HPT system consists of an outer metal shell (with or without inner bladder) and an air compressor system. When an HPT tank needs to be filled, nearby pumps fill the tank with water.

Air compressors are used to maintain a specific tank pressure which keeps the water inside the tank (or the inner bladder) in compression to provide a specific discharge pressure when the HPT lets water out into the distribution system. Similar to the elevated storage system, an HPT still requires water from a nearby source, which would require backup power at the water source. However, backup power is also needed for an HPT system to maintain operation of the air compressors necessary to sustain tank pressure.

In addition, the typical useful life is fairly different for the two tank systems. Older types of ESTs (such as legged tank, ellipsoid, etc.) were traditionally constructed of welded steel and typically had a useful life of 20-30 years, without completing a major rehabilitation of the interior and exterior of the tank. Standpipes are still typically constructed in the same manner as older ESTs and as such require major rehabilitation every 10-20 years to maintain operations. Newer elevated tanks frequently use a composite tank design, which normally consists of a concrete ring structure for the tower, and a welded steel bowl for the tank. The useful life of composite tanks is frequently 30-50 years. The concrete structure typically lasts 50 years without major rehabilitative work and the bowl normally requires major rehabilitation every 30 years.

On the other hand, HPT systems commonly last between 10-20 years, depending mainly on the potential for corrosion in a non-bladder HPT tank (or mainly on quality of the inner bladder in a bladder style HPT tank). Due to the low cost of HPT tanks, it is common to see a complete HPT tank replacement rather than cutting open an HPT tank to rehabilitate or replace internal components and then re-weld together.

Along with cost impacts from material, the type and size of storage used also impacts the size of pumping systems for each booster pump station. Standard TCEQ design criteria for high service and booster pump stations uses a design requirement of 2.0 gallons per minute (gpm) per connection to meet firm pumping capacity (with one pump supplied for redundancy); this pumping requirement is in place as the pumps are needed to supply both volume and pressure to a distribution system. However, TCEQ also has an alternative pumping requirement that can be used for design of a booster pump station if all the required storage (total storage) is provided via elevated storage, either using an EST or a standpipe sized such that the tank is large enough to meet the total storage requirement from the elevated volume alone (above 80 feet, or roughly 35 psi). Under the alternative pumping requirement, the pumps can be sized to meet a total (not firm) pumping capacity of 0.6 gpm per connection, since in the alternative pumping situation, the pumps are only required to transfer water into the elevated storage, which provides its own pressure to the distribution system.

To compare O&M costs, a design example using 1,000 connections is used; the larger the system, the less likely use of an HPT system will remain feasible, and for systems serving connections equal to or greater than 2,500, HPT systems can no longer be used altogether. In developing the costs for a new booster pump station, the sizing for each system was determined based on TCEQ Chapter 290 design criteria for water systems, including 100 gallons per connection for a standard EST or standpipe tank, 200 gallons per connection for an alternative design EST tank, and 20 gallons per connection for an HPT tank. The number of connections served in this example is 1,000. Therefore, several design options are considered, including:

- Option 1 - A 100,000 gallon (0.1 million gallon [MG]) standard EST, a 100,000 gallon ground storage tank (GST) to meet total storage requirements and a firm pumping capacity of 2,000 gpm (total capacity of 3,000 gpm);
- Option 2 - A 200,000 gallon (0.2 MG) alternative design EST or standpipe, a 25,000 gallon transfer GST and a total pumping capacity of 600 gpm; and
- Option 3 - A 20,000 gallon HPT tank, a 100,000 gallon GST to meet total storage requirements and a firm pumping capacity of 2,000 gpm (total capacity of 3,000 gpm).

O&M costs have been developed to assist in comparing the various booster pump station and storage options discussed above, as shown in Table 5-3.

Table 5-3
O&M Costs Comparison for Booster Pump Stations

Booster Pump Station Option	Elevated Storage (MG)	Pressure Storage (MG)	Ground Storage (MG)	Pumping Capacity (gpm)	Conceptual Annual O&M Cost
Option 1 - Use EST/Standpipe w/ GST	0.1	-	0.1	2,000	$44,400
Option 2 - Use EST/Standpipe Only	0.2	-	-	600	$28,100
Option 1 - Use HPT w/ GST	-	0.02	0.1	2,000	$54,800

Based on the costs shown in Table 5-3, construction of new booster pump stations utilizing only ESTs or standpipes as necessary to sustain needed volume and pressure within a regional distribution system, should provide a reduction in annual operation costs within the distribution system.

SUMMARY

Based on the anticipated operations costs discussed previously in this TM, it appears that the key design alternatives with respect to the treatment and distribution systems are as follows:

- A single regional WTP is more cost effective to operate than multiple, smaller facilities;
- A new membrane filtration WTP is more cost effective to operate than a new conventional filtration WTP; and
- Construction of booster pump stations should incorporate construction of elevated storage only, to minimize booster pump sizing and energy usage, therefore reducing operating cost.

The conceptual operational cost component is only one component of the overall cost evaluation required for each regionalization scenario. The cost components from TM No. 3, TM No. 4 and TM No. 5 will be combined and total costs will be compared from scenario to scenario in TM No. 6. Total cost discussion and final cost comparisons for the potential regionalization scenarios and final project recommendations are included in TM No. 6.

This Technical Memorandum (TM) summarizes the findings of Task VII of the City of Roma Regional Water Planning Study (the Study). The focus of Task VII of the Study is the development of complete project costs and life cycle costs for the various regionalization alternatives identified for the Study Area and determination of recommendations for regionalization improvements for the Study Area.

Activities in Task VII included the following:

- ✓ Develop total (treatment and distribution) capital costs for each regionalization alternative;
- ✓ Develop total (treatment and distribution) operation and maintenance (O&M) costs for each regionalization alternative;
- ✓ Develop present worth life cycle costs for each regionalization alternative;
- ✓ Compare life cycle costs for regionalization alternatives to continued independent operation; and
- ✓ Prepare a technical memorandum summarizing the findings.

BACKGROUND

The historical reliance on individual utilities to provide basic water services in the Study Area has ensured more local oversight of utility operations and associated fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall area has grown. The potential benefits of "regionalization" or "consolidation" of utility providers are important enough that unique opportunities should be identified and pursued where they make sense and have a good chance to benefit all parties. Such opportunities will gradually come about as the region approaches build-out, debt assumption becomes less of a factor, older systems face difficulties in meeting maintenance and rehabilitation needs, and stricter State and Federal regulatory mandates are enacted in the future.

This Technical Memorandum (TM) addresses the issue of developing projected total life cycle costs for each of the identified regionalization alternatives discussed in TM No.'s 3, 4 and 5. Incorporation of the results of the previous TMs and development of an overall recommended regionalization alternative should lead to a technically sound engineering master plan to guide ongoing water system investments and management activities by the City of Roma and the other participating utilities in this Study. The goals of this TM are to identify and discuss:

- The proposed methodology for developing 30-year life cycle costs in this Study;
- Anticipated 30-year life cycle costs for each individual Study participant;
- A summary of anticipated 30-year life cycle costs for each of the previously discussed regionalization alternatives;

- Funding impacts for each of the previously discussed regionalization alternatives;
- Recommendations for selection of a regionalization alternative as a project path forward; and
- A potential methodology for phasing necessary treatment and distribution components of an ultimate regional system.

METHODOLOGY FOR DEVELOPING LIFE CYCLE COSTS

Conceptual capital and operation and maintenance (O&M) costs have been developed for each regionalization alternative and are included in the latter sections of this TM. With regard to developing a recommended regionalization alternative, multiple regionalization scenarios have been developed and evaluated for each Study participant, depending on overall makeup of regionalization (such as which participants would regionalize in a given regionalization scenario), sizing of each proposed WTP and distribution system with respect to a 30-year planning horizon and design requirements based on Texas Commission of Environmental Quality (TCEQ) design criteria. Costs have been developed to determine improvements needed for the Study Area, which reflect a total required treatment capacity (by 2040) of 16.7 million gallons per day (mgd). However, it should be noted that additional cost factors such as cost for easements and land acquisition, fluctuations in fuel, chemical and power costs, increases in inflation rates and future condition of structures (if regionalizations or consolidations are completed later in the future) have not been incorporated into the costs developed in this section.

Developing life cycle costs for a proposed project utilize three main components including capital cost, annual O&M cost and an anticipated annual inflation or interest rate. Anticipated capital costs have been developed previously for each of the regionalization scenarios in TM No. 3 and 4, including costs for both treatment and distribution. Anticipated treatment costs are based on the incorporation of either membrane or conventional water treatment, though it is likely that due to future regulatory requirements, membrane treatment will be required.

Typical annual O&M costs have been developed for treatment and distribution options in TM No. 5 and are included in more detail for each regionalization alternative later in this TM. For the sake of this Study, it is assumed that an operational goal for all of the Study participants is to minimize annual operating costs where possible. For that reason, proposed improvements for storage and pumping within the distribution system are based on TCEQ alternative design criteria, which is used to meet storage requirements via elevated storage only, which significantly reduces pumping requirements and therefore, annual O&M costs to operate each booster pump station.

The final component to develop life cycle cost is to determine the anticipated annual inflation rate to be used. Many municipalities throughout Texas use a typical annual interest rate of 3.5% to allow for expected inflation in costs. Consequently, an annual inflation rate of 3.5% is being used to allow for inflation in fuel, labor and other miscellaneous costs for this Study.

ANTICIPATED LIFE CYCLE COSTS FOR EACH STUDY PARTICIPANT

The goal of this section is to determine anticipated life cycle costs of all the water systems in the Study Area, and in-depth analyses were completed for each existing service area with the goal of developing potential regionalization alternatives. Given the five participating entities, there are sixteen potential alternatives for regionalization, which will ultimately take into account anticipated treatment and distribution capital and O&M costs. The regionalization scenarios evaluated in this Study are included in Table 6-1.

Table 6-1
Regionalization Scenarios

Scenario	City of Roma	Falcon WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

Notes
1 - Implementation of any of the scenarios would likely require the construction of a new regional WTP.
2 - Existing WTPs would likely remain online for their respective remaining useful life to serve as a backup to a regional WTP.

A description of the proposed regionalization scenario, projected life cycle costs and advantages and disadvantages are included on the following pages for each scenario identified in Table 6-1. Table 6-2 reflects the advantages and disadvantages for each scenario.

It should be noted that while some of the scenarios identified in Table 6-1 include meeting complete water demands for Rio WSC, it is understood that Rio WSC is in the process of creating its own WTP. Therefore, it is likely that if Rio WSC joins into a regional effort with the other Study participants, the demand from Rio WSC may more likely be an intermittent demand rather than continual. This concept will be discussed further in this TM and in TM No. 8, which discusses funding and regionalization methodologies.

Table 6-2
Advantages and Disadvantages for Each Scenario

Scenario	Advantages	Disadvantages
Scenario 1	Lowest capital cost of the scenarios.	No benefits to the other Study participants. Limited economies of scale.
Scenario 2	Provides improved treatment at reduced cost for Roma and Falcon Rural WSC. Provides another supply of water to Falcon Rural WSC.	No benefits to the other three Study participants. Limited economies of scale.
Scenario 3	Lowest capital cost for distribution system improvements. Provides improved treatment at reduced cost for Roma and El Sauz WSC. Provides another supply of water to El Sauz WSC.	No benefits to the other three Study participants. Limited economies of scale.
Scenario 4	Provides improved treatment at reduced cost for Roma and El Tanque WSC. Provides another supply of water to El Tanque WSC.	No benefits to the other three Study participants. Limited economies of scale.
Scenario 5	Provides improved treatment at reduced cost for Roma and Rio WSC. Provides another supply of water to Rio WSC.	No benefits to the other three Study participants. Limited economies of scale.
Scenario 6	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and El Sauz WSC. Provides another supply of water to Falcon Rural WSC and El Sauz WSC.	No benefits to the other two Study participants.
Scenario 7	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and El Tanque WSC. Provides another supply of water to Falcon Rural WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 8	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 9	Provides improved treatment at reduced cost for Roma, El Sauz WSC and El Tanque WSC. Provides another supply of water to El Sauz WSC and El Tanque WSC.	No benefits to the other two Study participants.
Scenario 10	Provides improved treatment at reduced cost for Roma, El Sauz WSC and Rio WSC. Provides another supply of water to El Sauz WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 11	Provides improved treatment at reduced cost for Roma, El Tanque WSC and Rio WSC. Provides another supply of water to El Tanque WSC and Rio WSC.	No benefits to the other two Study participants.
Scenario 12	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Sauz WSC and El Tanque WSC. Provides another supply of water to Falcon Rural WSC, El Sauz WSC and El Tanque WSC.	No benefits to one of the Study participants.
Scenario 13	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Sauz WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC, El Sauz WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 14	Provides improved treatment at reduced cost for Roma, Falcon Rural WSC, El Tanque WSC and Rio WSC. Provides another supply of water to Falcon Rural WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 15	Provides improved treatment at reduced cost for Roma, El Sauz WSC, El Tanque WSC and Rio WSC. Provides another supply of water to El Sauz WSC, El Tanque WSC and Rio WSC.	No benefits to one of the Study participants.
Scenario 16	Can provide water to all the Study participants.	Highest capital cost of all the scenarios.

Regionalization Scenario 1 Life Cycle Costs

In Scenario 1, the City of Roma builds a new WTP to serve the City, while the remaining participating utilities in this Study continue to operate by either treating raw water or purchasing treated water wholesale from another utility. The recommended 2040 WTP capacity for the City of Roma is approximately 9.9 mgd, at an anticipated (refer to Table 6-3) opinion of projected construction cost (OPCC) of approximately $44,362,300 (in 2012 dollars).

Table 6-3
Projected Total OPCC for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,610,500	$5,610,500
2	Construct new 30-inch raw water transmission main	LF	9,100	$217.75	$1,983,800
3	Construct new 109 MG reservoir adjacent to Rio Grande River	LS	1	$3,934,900	$3,934,900
4	Construct new 9.9 MGD WTP	LS	1	$19,800,000	$19,800,000
				subtotal	$31,329,200
				Contingencies (20%)	$6,265,900
				TOTAL ESTIMATED CONSTRUCTION COST	$37,595,100
				Engineering & Testing (18%)	$6,767,200
				TOTAL ESTIMATED CAPITAL COST	**$44,362,300**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2060 buildout requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.

In addition, the 2040 recommended distribution system capacity under this scenario is approximately 12.4 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 2.3 million gallons (MG). Assuming that the total storage requirement is met via elevated storage only, an additional 1.5 MG of elevated storage is required to supplement the existing 0.8 MG of elevated storage capacity. However, while the majority of the existing elevated storage capacity has recently been rehabilitated, one or more of the existing ESTs may also require replacement during the next thirty years.

While 1.5 MG of additional elevated capacity is needed by 2040 if the City decides to meet its total storage requirement via elevated storage, it is not recommended to construct the entire additional storage in one tank. Rather, providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the City's distribution system. For that reason, Scenario 1 includes the construction of three 0.5 MG ESTs to provide the recommended additional storage needed by 2040 (refer to Exhibit 6-1 for recommended tank improvements for the City of Roma under Scenario 1). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 1 (refer to Table 6-4) is approximately $6,372,000 (in 2012 dollars).

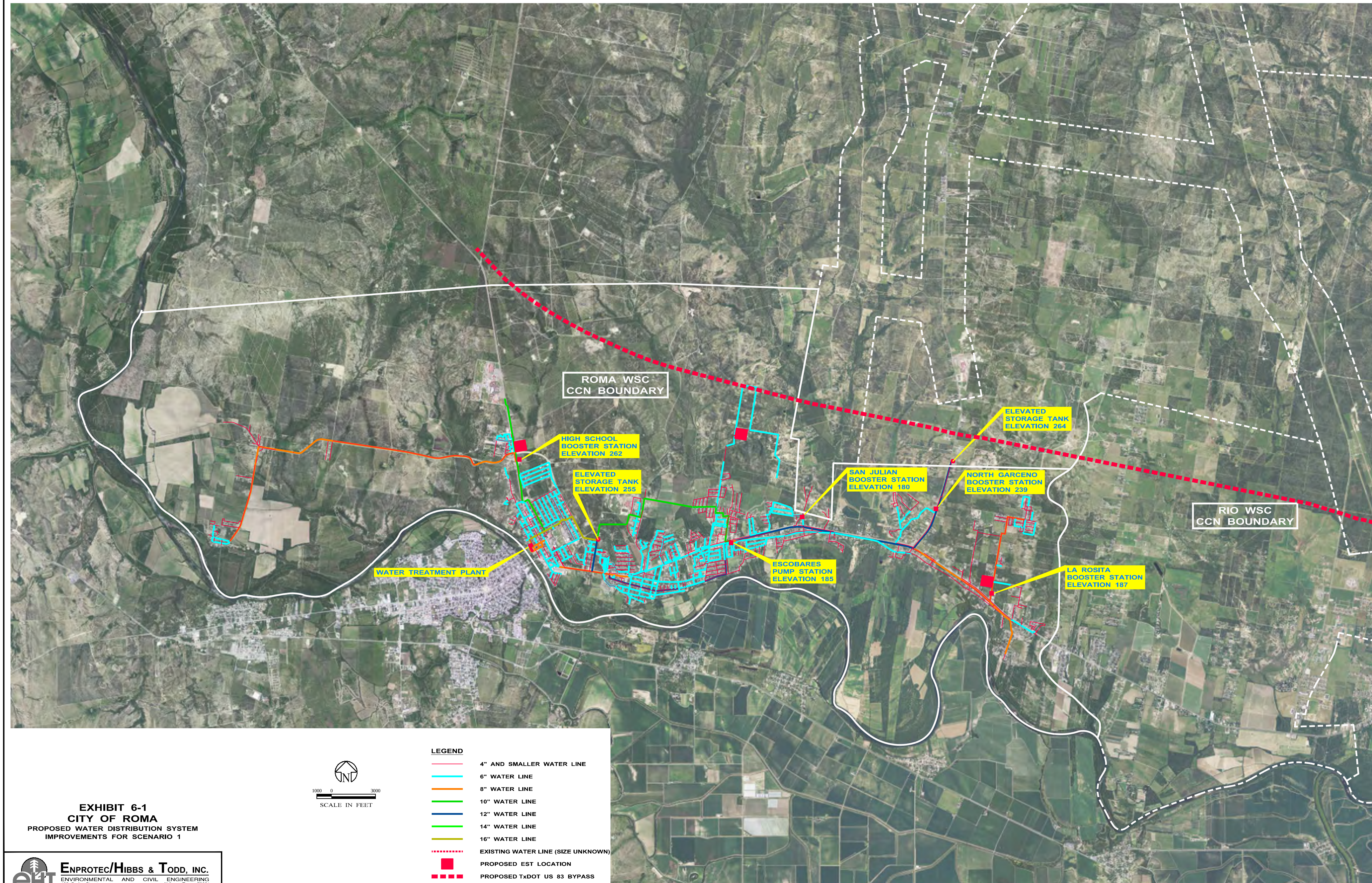

EXHIBIT 6-1
CITY OF ROMA
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 1

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Firm Registration No. 1151

11-5287
06/04/2012

Table 6-4
Anticipated Distribution System Project Cost for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct three new 0.5 MG standard ESTs	EA	3	$1,250,000	$3,750,000
2	Site improvements for new ESTs	EA	3	$250,000	$750,000
				subtotal	$4,500,000
				Contingencies (20%)	$900,000
				TOTAL ESTIMATED CONSTRUCTION COST	$5,400,000
				Engineering & Testing (18%)	$972,000
				TOTAL ESTIMATED CAPITAL COST	**$6,372,000**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank.

For each regionalization scenario, anticipated annual O&M costs for both treatment and distribution have been developed. Under Scenario 1, the anticipated annual treatment O&M cost discussed in TM No. 5 was determined to be approximately $2,801,800 (in 2012 dollars) for a WTP operating at 9.9 mgd. However, historical data has shown that the typical daily water demand is roughly 50% of the TCEQ-expected demand of 0.6 gallons per minute (gpm) per connection. For that reason, it is reasonable to assume that if a 9.9 mgd WTP only needs to operate for roughly 50% of the time, then the annual operating cost should also be half of the anticipated operating cost when running at a full 9.9 mgd flow rate, or $1,400,900 (in 2012 dollars).

While there are variations on how a WTP could be operated to further reduce operating costs, for the sake of developing conceptual planning-level operating costs, it is assumed in this Study that the WTP sized for a given regionalization scenario will likely be operated at an annual rate of 50% of its rated capacity, and therefore the anticipated annual operating cost for treatment will be approximately 50% of the anticipated operating cost for full capacity. To examine operating costs in more detail, consider the proposed plant capacity discussed above. For a total annual treatment O&M cost of $2,801,800, roughly 50-70% (depending on the specific design of a WTP) of the cost comes from energy and chemical usage and replacement equipment and materials, with the remaining 30-50% (depending on the specific WTP design and utility preferences for staffing) of the cost coming from operational staffing. If a 9.9 mgd WTP only needs to operate at 50% of its capacity, then equipment and chemical feed systems are also only operating half the time, leading to a direct reduction of energy and chemical costs by half. Furthermore, staffing requirements (especially if using a membrane filtration WTP) reduce in proportion to the actual runtime of a WTP; for example, the time between cyclical required cleaning and preventative maintenance increases also in proportion to runtime. For that reason, staffing required to operate a WTP at 4.45 mgd rather than at a full capacity of 9.9 mgd is expected to be substantially less, resulting in an overall reduction of O&M cost by roughly 50%, if running at 50% of rated plant capacity.

The current actual usage is approximately 50% of the existing treatment capacity, which is why the City of Roma currently has an approved ACR with TCEQ, which allows for a reduced treatment capacity that is less than the 0.6 gpm per connection standard design requirement. While the anticipated usage in the future is still expect to be roughly 50% of the proposed treatment capacity, construction of necessary WTP capacity may result in a loss of the existing ACR; however, if the proposed WTP improvements are not completed, and water demands increase beyond those allowed for in the ACR, the ACR is invalidated and the City would become noncompliant, resulting in violations and fines. Therefore, while only half of the proposed treatment capacity should need to be utilized on a daily basis, the total capacity is required to minimize risk of noncompliance as a result of peaking water demands.

Under Scenario 1, the primary distribution system improvements are based on meeting anticipated 2040 storage requirements throughout the City of Roma's distribution system. In TM No. 5, the anticipated annual O&M cost to operate one 0.2 MG EST (total storage requirement based on 1,000 connections) and booster pump station was determined to be approximately $28,100 per year (in 2012 dollars). However, the proposed ESTs and booster pump stations recommended under Scenario 1 are each sized for 0.5 MG, resulting in an increase of volume by 2.5. Pumping energy is directly related to both pressure and flow rate (volume); therefore, the annual operating cost of an EST and booster pump station sized 2.5 times larger than the cost example from TM No. 5 (0.2 MG) is expected to also increase by 2.5. For that reason, the anticipated annual O&M cost for one 0.5 MG EST and booster pump station should increase from $28,100 to $70,250; however, similar to the cost adjustment made for treatment, the expected annual operating cost is half of the total capacity cost, so the anticipated actual annual operating cost for a 0.5 MG EST and booster pump station is approximately $35,125 (in 2012 dollars).

Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 1 (refer to Table 6-5) is approximately $1,506,275 (in 2012 dollars).

Table 6-5
Anticipated Annual O&M Cost for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$1,400,900	$1,400,900
2	Annual O&M Cost for Distribution System	EA	3	$35,125	$105,375
				TOTAL ESTIMATED ANNUAL O&M COST	$1,506,275

Notes

1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.

2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $50,734,300 (in 2012 dollars), an anticipated annual O&M cost of $1,506,275 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $78,438,000 is developed for Scenario 1 (refer to Table 6-6). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-6
Anticipated 30-yr Life Cycle Cost for Scenario 1

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	WTP OPCC	EA	1	$44,362,300	$44,362,300
2	Distribution System OPCC	EA	1	$6,372,000	$6,372,000
3	Annual Treatment Cost	EA	1	$1,400,900	$1,400,900
4	Annual O&M Cost for Distribution System	EA	3	$35,125	$105,375
				TOTAL ESTIMATED CAPITAL COST	$50,734,300
				TOTAL ESTIMATED ANNUAL O&M COST	$1,506,275
				ESTIMATED 30-YR LIFE CYCLE COST	$78,438,000

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.
3 - Annual inflation calculation based on an annual interest rate of 3.5%.

Regionalization Scenario 2 Life Cycle Costs

In Scenario 2, the City of Roma and Falcon Rural WSC join together to build a new regional WTP and distribution system, while the remaining participating utilities in this Study continue to operate either by purchasing treated water wholesale from another utility or by treating its own surface water. The recommended 2040 WTP capacity for Scenario 2 is approximately 12.1 mgd, at an anticipated (refer to Table 6-7) OPCC of approximately $51,730,500 (in 2012 dollars).

Table 6-7
Projected Total OPCC for Scenario 2

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,828,100	$5,828,100.00
2	Construct new 36-inch raw water transmission main	LF	9,100	$292.24	$2,659,400.00
3	Construct new 133 MG reservoir adjacent to Rio Grande River	LS	1	$3,845,300	$3,845,300.00
4	Construct new 12.1 MGD WTP	LS	1	$24,200,000.00	$24,200,000.00
				subtotal	$36,532,800
				Contingencies (20%)	$7,306,600
				TOTAL ESTIMATED CONSTRUCTION COST	$43,839,400
				Engineering & Testing (18%)	$7,891,100
				TOTAL ESTIMATED CAPITAL COST	**$51,730,500**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2060 buildout requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP capacity is based on the assumption that by 2040, the existing WTPs will no longer be operational.

The 2040 recommended distribution system capacity for Scenario 2 is approximately 15.1 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 2.8 MG. The recommended storage is to be met via multiple ESTs, some located within the City of Roma's service area and some located along the proposed transmission pipeline between the City of Roma and Falcon Rural WSC. Providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the regionalized distribution system. For that reason, Scenario 2 includes the construction of three 0.5 MG ESTs within the City of Roma and four 0.1 MG ESTs to provide the recommended additional storage needed by 2040 (refer to Exhibit 6-2 for recommended improvements under Scenario 2). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 2 (refer to Table 6-8) is approximately $15,431,500 (in 2012 dollars).

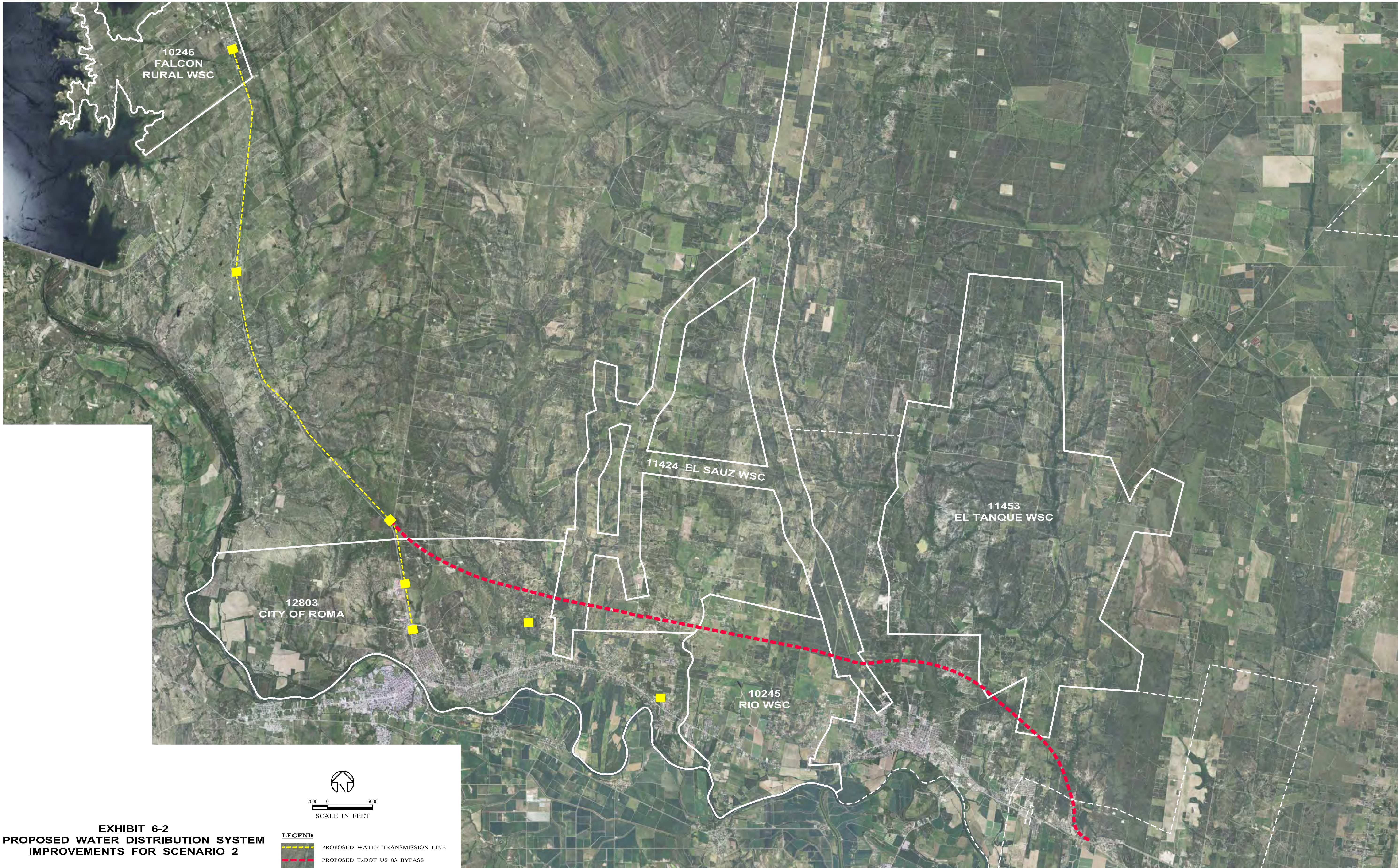

EXHIBIT 6-2
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 2

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Firm Registration No. 1151

11-5287
06/04/2012

Table 6-8
Anticipated Distribution System Project Cost for Scenario 2

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.1 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$300,000	$300,000
4	Construct one new 0.1 MG standard EST at TxDOT Bypass	EA	1	$250,000	$250,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
7	Site improvements for new ESTs	EA	7	$250,000	$1,750,000
8	20-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$100	$1,398,500
9	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	26,277	$75	$1,970,800
10	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
				subtotal	$10,897,900
				Contingencies (20%)	$2,179,600
				TOTAL ESTIMATED CONSTRUCTION COST	$13,077,500
				Engineering & Testing (18%)	$2,354,000
				TOTAL ESTIMATED CAPITAL COST	**$15,431,500**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

For Scenario 2, the anticipated annual treatment O&M cost is determined to be approximately $1,688,555 (in 2012 dollars) for a 12.1 mgd WTP operating at 50% capacity (50% of $3,377,110 in 2012 dollars). Likewise for Scenario 2, distribution system improvements are based on meeting anticipated 2040 storage requirements for both the City of Roma and Falcon Rural WSC. Similar to Scenario 1, the proposed ESTs and booster pump stations recommended under Scenario 2 are each sized differently than 0.2 MG, in several cases sized up for 0.5 MG and in some cases sized down for 0.1 MG.

In addition, several of the ESTs recommended in Scenario 2 will need to be constructed at a higher than standard elevation to allow for significant topographical changes along the distribution pipeline alignment. Pumping energy is directly related to both pressure and flow rate (volume); therefore, the annual operating cost of an EST and booster pump station either sized larger or smaller (relating to volume) or taller (relating to pressure) than the cost example from TM No. 5 (0.2 MG) is expected to increase or decrease proportionally. To account for varying volume, the annual operating cost is also expected to vary in direct proportion to the comparison of the new tank volume with the cost example from TM No. 5 (based on 0.2 MG). However, to account for a non-standard EST height, the proposed height divided by standard height (140-feet) will be used as a cost increase factor; for example, a non-standard EST height of 180-feet (ft) results in an O&M cost increase of 1.3 (180-ft / 140-ft).

Using this methodology, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however, the cost for a 0.5 MG non-standard EST and booster pump station increases from $35,125 to approximately $45,663 (in 2012 dollars). Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 2 (refer to Table 6-9) is approximately $1,834,073 (in 2012 dollars).

Table 6-9
Anticipated Annual O&M Cost for Scenario 2

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$1,688,555	$1,688,555
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	2	$35,125	$70,250
3	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	3	$7,025	$21,075
4	Annual O&M Cost for Distribution System - Non-standard 0.5 MG ESTs and Booster Pump Stations	EA	1	$45,161	$45,161
5	Annual O&M Cost for Distribution System - Non-standard 0.1 ESTs and Booster Pump Stations	EA	1	$9,032	$9,032
				TOTAL ESTIMATED ANNUAL O&M COST	$1,834,073

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $67,162,000 (in 2012 dollars), an anticipated annual O&M cost of $1,834,073 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $100,895,000 is developed for Scenario 2 (refer to Table 6-10). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-10
Anticipated 30-yr Life Cycle Cost for Scenario 2

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	WTP OPCC	EA	1	$51,730,500	$51,730,500
2	Distribution System OPCC	EA	1	$15,431,500	$15,431,500
3	Annual Treatment Cost	EA	1	$1,688,555	$1,688,555
4	Annual O&M Cost for Distribution System	EA	1	$145,518	$145,518
TOTAL ESTIMATED CAPITAL COST					$67,162,000
TOTAL ESTIMATED ANNUAL O&M COST					$1,834,073
ESTIMATED 30-YR LIFE CYCLE COST					$100,895,000
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					

Regionalization Scenario 3 Life Cycle Costs

In Scenario 3, the City of Roma and El Sauz WSC join together to build a new regional WTP and distribution system, while the remaining participating utilities in this Study continue to operate by either continuing to treat surface water or by purchasing treated water wholesale from another utility. The recommended 2040 WTP capacity for Scenario 3 is approximately 10.7 mgd, at an anticipated OPCC (Table 6-11) of approximately $46,421,800 (in 2012 dollars).

Table 6-11
Projected Treatment OPCC for Scenario 3

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,713,800	$5,713,800
2	Construct new 30-inch raw water transmission main	LF	9,100	$217.75	$1,981,500
3	Construct new 154 MG reservoir adjacent to Rio Grande River	LS	1	$3,688,400	$3,688,400
4	Construct new 10.7 MGD WTP	LS	1	$21,400,000	$21,400,000
subtotal					$32,783,700
Contingencies (20%)					$6,556,800
TOTAL ESTIMATED CONSTRUCTION COST					$39,340,500
Engineering & Testing (18%)					$7,081,300
TOTAL ESTIMATED CAPITAL COST					**$46,421,800**
Notes					
1 - WTP, RWPS and RW Pipeline capacity size based on 2060 buildout requirements.					
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.					
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.					

The 2040 recommended distribution system capacity for Scenario 3 is approximately 13.3 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 2.5 MG. The recommended storage is to be met via multiple ESTs, some located within the City of Roma's service area and some located along the proposed distribution pipeline between the City of Roma and El Sauz WSC. Providing the additional storage via several smaller-sized ESTs will provide more flexible operation and better coverage of volume and pressure maintenance throughout the regionalized distribution system. For that reason, Scenario 3 includes the construction of three 0.5 MG ESTs within the City of Roma and four 0.1 MG ESTs to provide the recommended additional storage needed by 2040 (refer to Exhibit 6-3 for recommended improvements under Scenario 3). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 3 (refer to Table 6-12) is approximately $12,395,900 (in 2012 dollars).

Table 6-12
Anticipated Distribution System Project Cost for Scenario 3

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.1 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$300,000	$300,000
4	Construct one new 0.1 MG standard EST at TxDOT Bypass	EA	1	$250,000	$250,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.1 MG standard EST at El Sauz WSC service connection	EA	1	$250,000	$250,000
7	Site improvements for new ESTs	EA	7	$250,000	$1,750,000
8	12-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$55	$769,200
9	10-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$45	$1,184,900
				subtotal	$8,754,100
				Contingencies (20%)	$1,750,900
				TOTAL ESTIMATED CONSTRUCTION COST	$10,505,000
				Engineering & Testing (18%)	$1,890,900
				TOTAL ESTIMATED CAPITAL COST	**$12,395,900**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

EXHIBIT 6-3
PROPOSED WATER DISTRIBUTION SYSTEM
IMPROVEMENTS FOR SCENARIO 3

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Firm Registration No. 1151

11-5287
06/04/2012

For Scenario 3, the anticipated annual treatment O&M cost is determined to be approximately $1,496,272 (in 2012 dollars) for a 10.7 mgd WTP operating at 50% capacity (50% of $2,992,544 in 2012 dollars). Likewise for Scenario 3, distribution system improvements are based on meeting anticipated 2040 storage requirements for both the City of Roma and El Sauz WSC. Similar to Scenario 1 and 2, the proposed ESTs and booster pump stations recommended under Scenario 3 are each sized differently than 0.2 MG, in several cases sized up for 0.5 MG and in some cases sized down for 0.1 MG.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however, the cost for a 0.5 MG non-standard EST and booster pump station increases from $35,125 to approximately $ 45,663 (in 2012 dollars). Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 3 (refer to Table 6-13) is approximately $1,641,790 (in 2012 dollars).

Table 6-13
Anticipated Annual O&M Cost for Scenario 3

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$1,496,272	$1,496,272
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	2	$35,125	$70,250
3	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	3	$7,025	$21,075
4	Annual O&M Cost for Distribution System - Non-standard 0.5 MG ESTs and Booster Pump Stations	EA	1	$45,161	$45,161
5	Annual O&M Cost for Distribution System - Non-standard 0.1 ESTs and Booster Pump Stations	EA	1	$9,032	$9,032
	TOTAL ESTIMATED ANNUAL O&M COST				$1,641,790

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $58,817,700 (in 2012 dollars), an anticipated annual O&M cost of $1,641,790 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $89,014,000 is developed for Scenario 3 (refer to Table 6-14). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-14 Anticipated 30-yr Life Cycle Cost for Scenario 3					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	WTP OPCC	EA	1	$46,421,800	$46,421,800
2	Distribution System OPCC	EA	1	$12,395,900	$12,395,900
3	Annual Treatment Cost	EA	1	$1,496,272	$1,496,272
4	Annual O&M Cost for Distribution System	EA	1	$145,518	$145,518
				TOTAL ESTIMATED CAPITAL COST	$58,817,700
				TOTAL ESTIMATED ANNUAL O&M COST	$1,641,790
				ESTIMATED 30-YR LIFE CYCLE COST	$89,014,000
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					

Regionalization Scenario 4 Life Cycle Costs

In Scenario 4, the City of Roma and El Tanque WSC join together to build a new regional WTP and distribution system, while the remaining participating utilities in this Study continue to operate by either continuing to treat surface water or by purchasing treated water wholesale from another utility. The recommended 2040 WTP capacity for Scenario 4 is approximately 11.2 mgd, at an anticipated OPCC (Table 6-15) of approximately $49,014,200 (in 2012 dollars).

Table 6-15 Projected Treatment OPCC for Scenario 4					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,810,700	$5,810,700
2	Construct new 36-inch raw water transmission main	LF	9,100	$292.24	$2,659,400
3	Construct new 123 MG reservoir adjacent to Rio Grande River	LS	1	$3,744,400	$3,744,400
4	Construct new 11.2 MGD WTP	LS	1	$22,400,000	$22,400,000
				subtotal	$34,614,500
				Contingencies (20%)	$6,922,900
				TOTAL ESTIMATED CONSTRUCTION COST	$41,537,400
				Engineering & Testing (18%)	$7,476,800
				TOTAL ESTIMATED CAPITAL COST	**$49,014,200**
Notes					
1 - WTP, RWPS and RW Pipeline capacity size based on 2060 buildout requirements.					
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.					
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.					

The 2040 recommended distribution system capacity for Scenario 4 is approximately 13.9 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 2.6 MG. Due to the distance between the City of Roma and El Tanque WSC, additional ESTs will be necessary to maintain adequate pressure along the distribution pipeline alignment, while sending water to El Tanque WSC (refer to Exhibit 6-4 for recommended improvements under Scenario 4). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 4 (refer to Table 6-16) is approximately $12,395,900 (in 2012 dollars).

Table 6-16
Anticipated Distribution System Project Cost for Scenario 4

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.1 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$300,000	$300,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC connection	EA	1	$250,000	$250,000
6	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
7	Construct one new 0.1 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$300,000	$300,000
8	Construct one new 0.25 MG standard EST at Rio WSC service connection	EA	1	$625,000	$625,000
9	Construct one new 0.1 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC	EA	1	$250,000	$250,000
10	Construct one new 0.5 MG standard EST at El Tanque WSC service connection	EA	1	$1,250,000	$1,250,000
11	Site improvements for new ESTs	EA	11	$250,000	$2,750,000
12	16-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$75	$1,048,900
13	12-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$55	$1,448,100
14	16-inch transmission main from El Sauz WSC service connection to Rio WSC service connection	LF	38,074	$75	$2,855,600
15	12-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	12,250	$55	$673,800
16	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	6,789	$75	$509,200
				subtotal	$17,510,600
				Contingencies (20%)	$3,502,200
				TOTAL ESTIMATED CONSTRUCTION COST	$21,012,800
				Engineering & Testing (18%)	$3,782,400
				TOTAL ESTIMATED CAPITAL COST	**$24,795,200**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

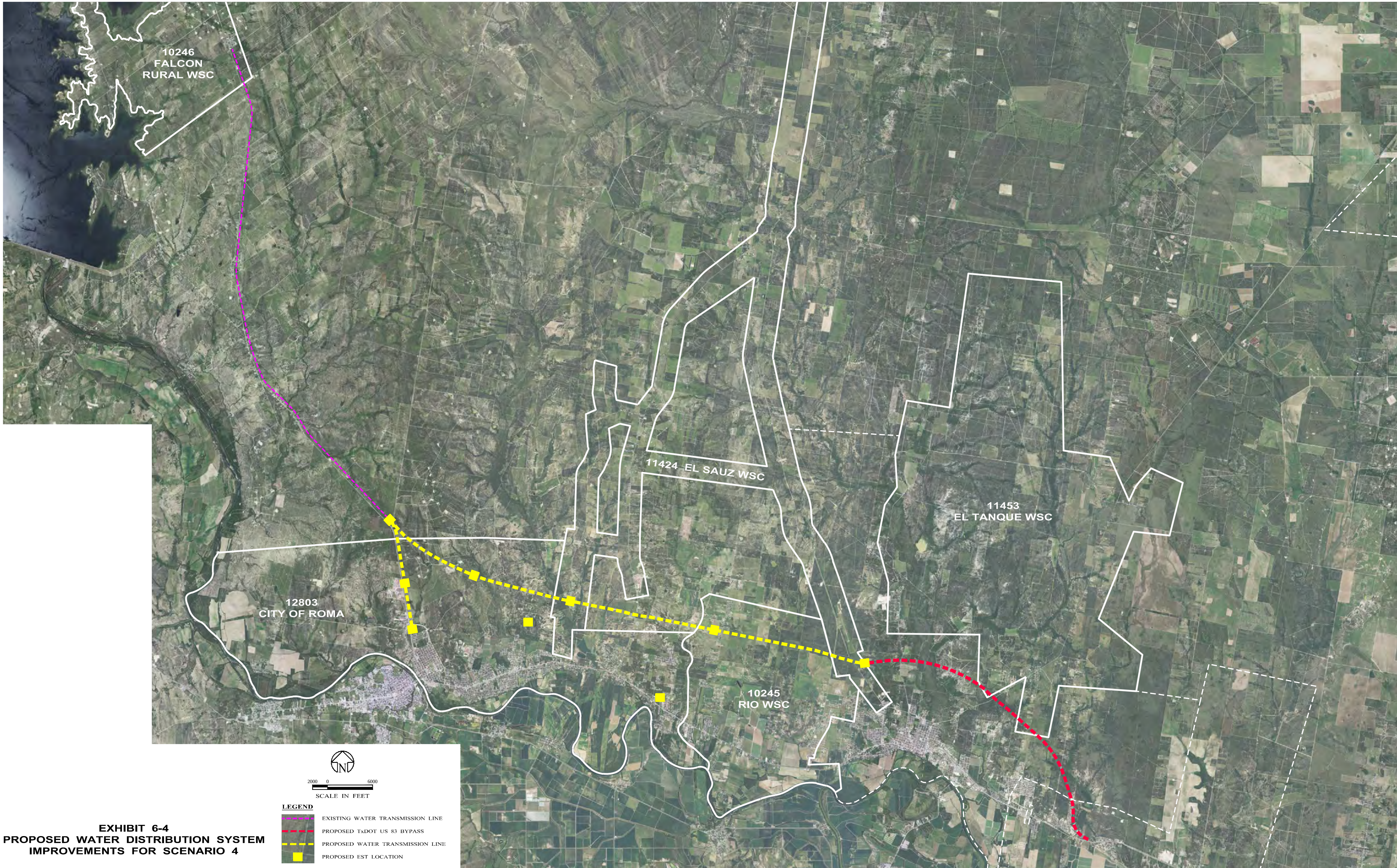

EXHIBIT 6-4
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 4

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11-5287
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For Scenario 4, the anticipated annual treatment O&M cost is determined to be approximately $1,562,417 (in 2012 dollars) for an 11.2 mgd WTP operating at 50% capacity (50% of $3,124,834 in 2012 dollars). Likewise for Scenario 4, distribution system improvements are based on meeting anticipated 2040 storage requirements for both the City of Roma and El Tanque WSC. Similar to the previously discussed scenarios, the proposed ESTs and booster pump stations recommended under Scenario 4 are each sized differently than 0.2 MG.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however, the cost for a 0.5 MG non-standard EST and booster pump station increases from $35,125 to approximately $ 45,663 (in 2012 dollars). Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). In addition, the annual O&M cost for a 0.25 MG standard EST and booster pump station is anticipated to be roughly $17,563 (in 2012 dollars).

Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 4 (refer to Table 6-17) is approximately $1,787,217 (in 2012 dollars).

Table 6-17
Anticipated Annual O&M Cost for Scenario 4

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$1,562,417	$1,562,417
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	3	$35,125	$105,375
3	Annual O&M Cost for Distribution System - Standard 0.25 MG ESTs and Booster Pump Stations	EA	2	$17,563	$35,125
4	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	3	$7,025	$21,075
5	Annual O&M Cost for Distribution System - Non-standard 0.5 MG ESTs and Booster Pump Stations	EA	1	$45,161	$45,161
6	Annual O&M Cost for Distribution System - Non-standard 0.1 ESTs and Booster Pump Stations	EA	2	$9,032	$18,064
	TOTAL ESTIMATED ANNUAL O&M COST				$1,787,217

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $73,809,400 (in 2012 dollars), an anticipated annual O&M cost of $1,787,217 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $106,680,000 is developed for Scenario 4 (refer to Table 6-18). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-18
Anticipated 30-yr Life Cycle Cost for Scenario 4

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	WTP OPCC	EA	1	$49,014,200	$49,014,200
2	Distribution System OPCC	EA	1	$24,795,200	$24,795,200
3	Annual Treatment Cost	EA	1	$1,562,417	$1,562,417
4	Annual O&M Cost for Distribution System	EA	1	$224,800	$224,800
				TOTAL ESTIMATED CAPITAL COST	$73,809,400
				TOTAL ESTIMATED ANNUAL O&M COST	$1,787,217
				ESTIMATED 30-YR LIFE CYCLE COST	$106,680,000
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					

Regionalization Scenario 5 Life Cycle Costs

In Scenario 5, the City of Roma and Rio WSC join together to build a new regional WTP and distribution system, while the remaining participating utilities in this Study continue to operate by either continuing to treat surface water or by purchasing treated water wholesale from another utility. The recommended 2040 WTP capacity for Scenario 5 is approximately 12.5 mgd, at an anticipated OPCC (Table 6-19) of approximately $52,955,300 (in 2012 dollars).

Table 6-19
Projected Treatment OPCC for Scenario 5

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$5,848,200	$5,848,200
2	Construct new 36-inch raw water transmission main	LF	9,100	$292.24	$2,659,400
3	Construct new 138 MG reservoir adjacent to Rio Grande River	LS	1	$3,890,100	$3,890,100
4	Construct new 12.5 MGD WTP	LS	1	$25,000,000	$25,000,000
				subtotal	$37,397,700
				Contingencies (20%)	$7,479,600
				TOTAL ESTIMATED CONSTRUCTION COST	$44,877,300
				Engineering & Testing (18%)	$8,078,000
				TOTAL ESTIMATED CAPITAL COST	**$52,955,300**
Notes					
1 - WTP, RWPS and RW Pipeline capacity size based on 2060 buildout requirements.					
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.					
3 - WTP capacity is based on the assumption that by 2040, the existing WTP will no longer be operational.					

The 2040 recommended distribution system capacity for Scenario 5 is approximately 15.6 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 2.9 MG. Due to the distance between the City of Roma and Rio WSC, additional ESTs will be necessary to maintain adequate pressure along the distribution pipeline alignment, while sending water to Rio WSC (refer to Exhibit 6-5 for recommended improvements under Scenario 5). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 5 (refer to Table 6-20) is approximately $22,812,900 (in 2012 dollars).

Table 6-20
Anticipated Distribution System Project Cost for Scenario 5

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.1 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$300,000	$300,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
7	Construct one new 0.1 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$300,000	$300,000
8	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
9	Site improvements for new ESTs	EA	9	$250,000	$2,250,000
10	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
11	16-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$75	$1,974,700
12	20-inch transmission main from El Sauz WSC service connection to Rio WSC	LF	38,074	$100	$3,807,400
				subtotal	$16,110,700
				Contingencies (20%)	$3,222,200
				TOTAL ESTIMATED CONSTRUCTION COST	$19,332,900
				Engineering & Testing (18%)	$3,480,000
				TOTAL ESTIMATED CAPITAL COST	**$22,812,900**

Notes
1 - Distribution system capacity size based on 2040 requirements.
2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.
3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

EXHIBIT 6-5
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 5

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11-5287
06/04/2012

For Scenario 5, the anticipated annual treatment O&M cost is determined to be approximately $1,740,856 (in 2012 dollars) for a 12.5 mgd WTP operating at 50% capacity (50% of $3,481,712 in 2012 dollars). Likewise for Scenario 5, distribution system improvements are based on meeting anticipated 2040 storage requirements for both the City of Roma and Rio WSC. Similar to the previously discussed scenarios, the proposed ESTs and booster pump stations recommended under Scenario 5 are each sized different than 0.2 MG.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however, the cost for a 0.5 MG non-standard EST and booster pump station increases from $35,125 to approximately $ 45,663 (in 2012 dollars). Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). In addition, the annual O&M cost for a 0.25 MG standard EST and booster pump station is anticipated to be roughly $17,563 (in 2012 dollars).

Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 5 (refer to Table 6-21) is approximately $1,951,606 (in 2012 dollars).

Table 6-21
Anticipated Annual O&M Cost for Scenario 5

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$1,740,856	$1,740,856
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	3	$35,125	$105,375
3	Annual O&M Cost for Distribution System - Standard 0.25 MG ESTs and Booster Pump Stations	EA	2	$17,563	$35,125
4	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	1	$7,025	$7,025
5	Annual O&M Cost for Distribution System - Non-standard 0.5 MG ESTs and Booster Pump Stations	EA	1	$45,161	$45,161
6	Annual O&M Cost for Distribution System - Non-standard 0.1 ESTs and Booster Pump Stations	EA	2	$9,032	$18,064
	TOTAL ESTIMATED ANNUAL O&M COST				$1,951,606

Notes

1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.

2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $75,768,200 (in 2012 dollars), an anticipated annual O&M cost of $1,951,606 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $111,663,000 is developed for Scenario 5 (refer to Table 6-22). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-22
Anticipated 30-yr Life Cycle Cost for Scenario 5

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	WTP OPCC	EA	1	$52,955,300	$52,955,300
2	Distribution System OPCC	EA	1	$22,812,900	$22,812,900
3	Annual Treatment Cost	EA	1	$1,740,856	$1,740,856
4	Annual O&M Cost for Distribution System	EA	1	$210,750	$210,750
				TOTAL ESTIMATED CAPITAL COST	$75,768,200
				TOTAL ESTIMATED ANNUAL O&M COST	$1,951,606
				ESTIMATED 30-YR LIFE CYCLE COST	$111,663,000

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.
3 - Annual inflation calculation based on an annual interest rate of 3.5%.

Regionalization Scenario 16 Life Cycle Costs

In Scenario 16, all of the Study participants will join together to build a new regional WTP and distribution system. The recommended 2040 WTP capacity for Scenario 16 is approximately 16.7 mgd, at an anticipated OPCC (Table 6-23) of approximately $65,814,900 (in 2012 dollars).

Table 6-23
Projected Treatment OPCC for Scenario 16

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$6,052,300	$6,052,300
2	Construct new 36-inch RW transmission main	LF	9,100	$292.24	$2,666,300
3	Construct new 184 MG reservoir adjacent to Rio Grande River	LS	1	$4,360,800	$4,360,800
4	Construct new 16.7 MGD WTP	LS	1	$33,400,000	$33,400,000
				subtotal	$46,479,400
				Contingencies (20%)	$9,295,900
				TOTAL ESTIMATED CONSTRUCTION COST	$55,775,300
				Engineering & Testing (18%)	$10,039,600
				TOTAL ESTIMATED CAPITAL COST	**$65,814,900**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2040 requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP cost based on $3.00 per gallon to allow for primary WTP construction, using either conventional or membrane filtration. The remainder of the $3.50 per gallon covers the raw water system improvements.
4 - WTP capacity is based on the assumption that at buildout, the existing WTP will no longer be operational.

The 2040 recommended distribution system capacity for Scenario 16 is approximately 20.9 mgd (allowing for peaking capacity) and the recommended 2040 total storage capacity under this scenario is roughly 3.9 MG. Due to the distance between the City of Roma and the Study participants, additional ESTs will be necessary to maintain adequate pressure along the distribution pipeline alignment, while sending water to each of the WSCs (refer to Exhibit 6-6 for recommended improvements under Scenario 16). Including additional construction cost items and non-construction costs, the anticipated distribution system improvements cost for Scenario 16 (refer to Table 6-24) is approximately $12,395,900 (in 2012 dollars).

It should also be noted that in developing the highest system capacity scenarios (such as Scenario 16), there is a significant difference in piping unit cost when comparing the raw water transmission line cost against distribution system transmission piping. For example, in Scenario 16, the unit cost for 30-inch distribution piping is roughly $150 per linear foot, whereas the unit cost for the proposed 36-inch raw water transmission line is approximately $293 per linear foot. It is anticipated in the project that additional property acquisition will be required for the pipe alignment; in addition, since there is no clear, undisturbed pathway from the Rio Grande River (raw water supply) to the proposed WTP site, it is anticipated that the majority of the piping will need to be installed via either boring or directional drilling to cross US Highway 83 and to minimize utility conflicts throughout the developed sections of the City of Roma. However, the cost for distribution piping is reduced, as the proposed alignment of the piping is intended to parallel US Highway 83, and the piping is anticipated to be installed via typical open-cut trenching within TxDOT ROW outside of the road, which will significantly reduce the unit cost for installation of the distribution piping.

For Scenario 16, the anticipated annual treatment O&M cost is determined to be approximately $2,285,400 (in 2012 dollars) for a 16.7 mgd WTP operating at 50% capacity (50% of $4,570,800 in 2012 dollars). Likewise for Scenario 16, distribution system improvements are based on meeting anticipated 2040 storage requirements for all of the Study participants. Similar to the previously discussed scenarios, the proposed ESTs and booster pump stations recommended under Scenario 16 are each sized differently than 0.2 MG.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the annual O&M cost for a 0.25 MG standard EST and booster pump station is anticipated to be roughly $17,563 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.25 MG non-standard EST and booster pump station is approximately $22,580 (in 2012 dollars). Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under Scenario 16 (refer to Table 6-25) is approximately $2,582,959 (in 2012 dollars).

EXHIBIT 6-6
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 16

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Table 6-24
Anticipated Distribution System Project Cost for Scenario 16

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct two new 0.5 MG standard ESTs in Roma	EA	2	$1,250,000	$2,500,000
2	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$750,000	$750,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
6	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
7	Construct one new 0.25 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$625,000	$625,000
8	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
9	Construct one new 0.25 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$750,000	$750,000
10	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
11	Construct one new 0.25 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC service connection	EA	1	$625,000	$625,000
12	Construct one new 0.25 MG standard EST at El Tanque WSC service connection	EA	1	$625,000	$625,000
13	Site improvements for new ESTs	EA	13	$250,000	$3,250,000
14	30-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$150	$2,097,800
15	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	26,277	$75	$1,970,800
16	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
17	20-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$100	$2,632,900
18	24-inch transmission main from El Sauz WSC service connection to Rio WSC service connection	LF	38,074	$125	$4,759,300
19	20-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	12,250	$100	$1,225,000
20	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	6,789	$75	$509,200
				subtotal	$27,548,600
				Contingencies (20%)	$5,509,800
				TOTAL ESTIMATED CONSTRUCTION COST	$33,058,400
				Engineering & Testing (18%)	$5,950,600
				TOTAL ESTIMATED CAPITAL COST	**$39,009,000**

Notes

1 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.

2 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

Table 6-25 Anticipated Annual O&M Cost for Scenario 16					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	Annual Treatment Cost	EA	1	$2,285,400	$2,285,400
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	3	$35,125	$105,375
3	Annual O&M Cost for Distribution System - Standard 0.25 MG ESTs and Booster Pump Stations	EA	5	$17,563	$87,813
4	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	2	$7,025	$14,050
5	Annual O&M Cost for Distribution System - Non-standard 0.5 MG ESTs and Booster Pump Stations	EA	1	$45,161	$45,161
6	Annual O&M Cost for Distribution System - Non-standard 0.25 MG ESTs and Booster Pump Stations	EA	2	$22,580	$45,161
				TOTAL ESTIMATED ANNUAL O&M COST	$2,582,959
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					

Using a projected total capital cost of $104,823,900 (in 2012 dollars), an anticipated annual O&M cost of $2,582,959 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $152,330,000 is developed for Scenario 16 (refer to Table 6-26). However, this cost does not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-26 Anticipated 30-yr Life Cycle Cost for Scenario 16					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT COST**	**TOTAL COST**
1	WTP OPCC	EA	1	$65,814,900	$65,814,900
2	Distribution System OPCC	EA	1	$39,009,000	$39,009,000
3	Annual Treatment Cost	EA	1	$2,285,400	$2,285,400
4	Annual O&M Cost for Distribution System	EA	1	$297,559	$297,559
				TOTAL ESTIMATED CAPITAL COST	$104,823,900
				TOTAL ESTIMATED ANNUAL O&M COST	$2,582,959
				ESTIMATED 30-YR LIFE CYCLE COST	$152,330,000
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					

Life Cycle Costs Considering No Regionalization

In addition to consideration of providing regionalized water services to all of the Study participants, the impact of each Study participant meeting their own water needs separately through the 30-year Study horizon should also be evaluated in detail similarly to the regionalization scenarios. The goal of identifying anticipated costs for a non-regionalization scenario is to determine the actual anticipated cost savings of regionalization. In this scenario, each of the Study participants will construct a new WTP to meet anticipated 30-year water demands. This scenario was developed with the assumption that the current wholesale finished water provider for El Sauz WSC, El Tanque WSC and Rio WSC may not be able to maintain continual service to these water supply corporations, similar to historical water supply deficit situations that have occurred over the past several years. In the non-regionalization scenario, each of the Study participants will separately build a new WTP and distribution system improvements necessary to meet storage requirements through 2040. The recommended 2040 WTP capacity for this scenario is still approximately 16.7 mgd, divided between the five Study participants. The anticipated OPCC (Table 6-27) to construct five new WTPs and associated distribution system improvements in this scenario is approximately $131,644,700 (in 2012 dollars).

The anticipated annual treatment O&M cost (from TM No. 5) is determined to be approximately $2,956,200 (in 2012 dollars) for multiple WTPs operating at 50% capacity (50% of $5,912,400 in 2012 dollars). Likewise for this scenario, distribution system improvements are based on meeting anticipated 2040 storage requirements for each of the Study participants. Similar to the previously discussed scenarios, the proposed ESTs and booster pump stations recommended under this scenario are each sized differently than 0.2 MG.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however. Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). In addition, the annual O&M cost for a 0.25 MG standard EST and booster pump station is anticipated to be roughly $17,563 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.25 MG non-standard EST and booster pump station is approximately $22,580 (in 2012 dollars). In addition, the annual O&M cost for a 0.05 MG standard EST and booster pump station is anticipated to be roughly $3,000 (in 2012 dollars).

Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution under this scenario (refer to Table 6-28) is approximately $3,252,713 (in 2012 dollars).

Table 6-27
Projected OPCC for Non-Regionalization Scenario

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	**Roma**				
2	Construct new raw water pump stations	LS	1	$5,610,500	$5,610,500
3	Construct new 30-inch RW main	LF	9,100	$217.75	$1,983,800
4	Construct new 109 MG reservoir	LS	1	$3,934,900	$3,934,900
5	Construct new 9.9 MGD WTP	LS	1	$19,800,000	$19,800,000
6	Construct five 0.5 MG standard ESTs	EA	5	$1,250,000	$6,250,000
7	Site improvements for new ESTs	EA	5	$250,000	$1,250,000
8	**Falcon WSC**				
9	Construct new raw water pump stations	LS	1	$2,498,600	$2,498,600
10	Construct new 14-inch RW main	LF	1,000	$65	$65,000
11	Construct new 24 MG reservoir	LS	1	$1,752,400	$1,752,400
12	Construct new 2.2 MGD WTP	LS	1	$8,250,000	$8,250,000
13	Construct two 0.25 MG standard ESTs	EA	2	$625,000	$1,250,000
14	Site improvements for new ESTs	EA	1	$250,000	$250,000
15	Replacement of existing main to 8-inch	LF	90,000	$35	$3,150,000
16	**El Sauz WSC**				
17	Construct new raw water pump stations	LS	1	$1,243,600	$1,243,600
18	Construct new 8-inch RW main	LF	60,000	$35	$2,100,000
19	Construct new 8 MG reservoir	LS	1	$581,500	$581,500
20	Construct new 0.7 MGD WTP	LS	1	$3,150,000	$3,150,000
21	Construct four 0.05 MG standard ESTs	EA	4	$125,000	$500,000
22	Site improvements for new ESTs	EA	4	$250,000	$1,000,000
23	**El Tanque WSC**				
24	Construct new raw water pump stations	LS	1	$2,112,500	$2,112,500
25	Construct new 12-inch RW main	LF	20,000	$55	$1,100,000
26	Construct new 14 MG reservoir	LS	1	$987,700	$987,700
27	Construct new 1.2 MGD WTP	LS	1	$4,500,000	$4,500,000
28	Construct three 0.1 MG standard ESTs	EA	3	$250,000	$750,000
29	Site improvements for new ESTs	EA	3	$250,000	$750,000
30	**Rio WSC**				
31	Construct new raw water pump stations	LS	1	$2,952,900	$2,952,900
32	Construct new 16-inch RW main	LF	10,000	$75	$750,000
33	Construct new 29 MG reservoir	LS	1	$2,071,000	$2,071,000
34	Construct new 2.6 MGD WTP	LS	1	$9,750,000	$9,750,000
35	Construct three 0.25 MG standard ESTs	EA	3	$625,000	$1,875,000
36	Site improvements for new ESTs	EA	3	$250,000	$750,000
				subtotal	$92,969,400
				Contingencies (20%)	$18,593,900
				TOTAL ESTIMATED CONSTRUCTION COST	$111,563,300
				Engineering & Testing (18%)	$20,081,400
				TOTAL ESTIMATED CAPITAL COST	**$131,644,700**

Notes
1 - WTP, RWPS and RW Pipeline capacity size based on 2040 requirements.
2 - Reservoir capacity based on 10 days of raw water storage at full WTP capacity, plus 10% for losses.
3 - WTP cost based on $3.00 per gallon to allow for primary WTP construction, using either conventional or membrane filtration. The remainder of the $3.50 per gallon covers the raw water system improvements.
4 - WTP capacity is based on the assumption that at buildout, each existing WTP will no longer be operational.

Table 6-28
Anticipated Annual O&M Cost for Non-Regionalization Scenario

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Annual Treatment Cost	EA	1	$2,956,200	$2,956,200
2	Annual O&M Cost for Distribution System - Standard 0.5 MG ESTs and Booster Pump Stations	EA	5	$35,125	$175,625
3	Annual O&M Cost for Distribution System - Standard 0.25 MG ESTs and Booster Pump Stations	EA	5	$17,563	$87,813
4	Annual O&M Cost for Distribution System - Standard 0.1 MG ESTs and Booster Pump Stations	EA	3	$7,025	$21,075
5	Annual O&M Cost for Distribution System - Standard 0.05 MG ESTs and Booster Pump Stations	EA	4	$3,000	$12,000
				TOTAL ESTIMATED ANNUAL O&M COST	$3,252,713

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.

Using a projected total capital cost of $131,644,700 (in 2012 dollars), an anticipated annual O&M cost of $3,252,713 (also in 2012 dollars) and an annual inflation rate of 3.5%, an estimated 30-year life cycle cost of $191,469,000 is developed for Scenario 16 (refer to Table 6-29). Based on the comparison of capital, O&M and life cycle costs, it appears to be more cost effective to regionalize to one WTP facility instead of constructing five separate WTP facilities.

Table 6-29
Anticipated 30-yr Life Cycle Cost for Non-Regionalization Scenario

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	WTP and Distribution System OPCC	EA	1	$131,644,700	$131,644,700
2	Annual Treatment Cost	EA	1	$2,956,200	$2,956,200
3	Annual O&M Cost for Distribution System	EA	1	$296,513	$296,513
				TOTAL ESTIMATED CAPITAL COST	$131,644,700
				TOTAL ESTIMATED ANNUAL O&M COST	$3,252,713
				ESTIMATED 30-YR LIFE CYCLE COST	$191,469,000

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.
3 - Annual inflation calculation based on an annual interest rate of 3.5%.

ANTICIPATED LIFE CYCLE COSTS FOR THE REMAINING STUDY ALTERNATIVES

In the remaining potential regionalization scenarios, varying combinations of Study participants were evaluated to build a new regional WTP and distribution system. A projected WTP OPCC has been developed for each regionalization scenario and is shown in Table 6-30.

Table 6-30
Projected Treatment OPCC for Each Scenario

SCENARIO	WTP CAPACITY (mgd)	CONSTRUCTION COST	CONTINGENCY	NON-CONSTRUCTION COST	OPCC
1	9.90	$31,329,200	$6,265,900	$6,767,200	$44,362,300
2	12.10	$36,528,400	$7,305,700	$7,890,200	$51,724,300
3	10.70	$32,783,700	$6,556,800	$7,081,300	$46,421,800
4	11.20	$34,614,500	$6,922,900	$7,476,800	$49,014,200
5	12.50	$37,397,700	$7,479,600	$8,078,000	$52,955,300
6	12.90	$38,351,300	$7,670,300	$8,283,900	$54,305,500
7	13.40	$39,062,300	$7,812,500	$8,437,500	$55,312,300
8	14.70	$41,978,600	$8,395,800	$9,067,400	$59,441,800
9	11.90	$35,887,800	$7,177,600	$7,751,800	$50,817,200
10	13.30	$38,850,600	$7,770,200	$8,391,800	$55,012,600
11	13.80	$39,956,300	$7,991,300	$8,630,600	$56,578,200
12	14.10	$40,630,400	$8,126,100	$8,776,200	$57,532,700
13	15.50	$43,776,100	$8,755,300	$9,455,700	$61,987,100
14	16.00	$44,899,700	$8,980,000	$9,698,400	$63,578,100
15	14.50	$41,529,100	$8,305,900	$8,970,300	$58,805,300
16	16.70	$46,479,400	$9,295,900	$10,039,600	$65,814,900

Notes

1 - WTP, RWPS and RW Pipeline capacity size based on 2040 requirements.

2 - WTP cost based on $3.00 per gallon to allow for primary WTP construction, using either conventional or membrane filtration. The remainder of the $3.50 per gallon covers the raw water system improvements.

3 - WTP capacity is based on the assumption that at buildout, the existing WTP will no longer be operational.

4 - Costs in 2012 dollars.

A projected distribution system improvements OPCC has also been developed for each regionalization scenario and is shown in Table 6-31.

Table 6-31
Projected Distribution System OPCC for Each Scenario

SCENARIO	DISTRIBUTION SYSTEM CAPACITY (mgd)	CONSTRUCTION COST	CONTINGENCY	NON-CONSTRUCTION COST	OPCC
1	12.40	$4,500,000	$900,000	$972,000	$6,372,000
2	15.20	$10,897,900	$2,179,600	$2,354,000	$15,431,500
3	13.30	$8,754,100	$1,750,900	$1,890,900	$12,395,900
4	13.90	$17,510,600	$3,502,200	$3,782,400	$24,795,200
5	15.70	$16,110,700	$3,222,200	$3,480,000	$22,812,900
6	16.10	$13,832,800	$2,766,600	$2,987,900	$19,587,300
7	16.70	$21,284,300	$4,256,900	$4,597,500	$30,138,700
8	18.40	$21,179,300	$4,235,900	$4,574,800	$29,990,000
9	14.90	$17,498,500	$3,499,700	$3,779,700	$24,777,900
10	16.60	$17,130,300	$3,426,100	$3,700,200	$24,256,600
11	17.20	$21,849,600	$4,370,000	$4,719,600	$30,939,200
12	17.60	$23,748,800	$4,749,800	$5,129,800	$33,628,400
13	19.30	$22,454,300	$4,490,900	$4,850,200	$31,795,400
14	19.90	$27,173,600	$5,434,800	$5,869,600	$38,478,000
15	18.10	$23,499,600	$4,700,000	$5,076,000	$33,275,600
16	20.90	$27,548,600	$5,509,800	$5,950,600	$39,009,000

Notes

1 - Distribution system capacity size based on 2040 requirements.

2 - Recommended distribution system capacity based on TCEQ standard 0.6 gpm per connection, plus a 1.25 peaking factor for peak daily demand, and an additional increase for compliance with the TCEQ's 85% Capacity Rule.

3 - EST cost based on $2.50 per gallon to allow for construction of EST, using either conventional or a composite tank. Cost for a 180-ft EST is increased to $3.00 per gallon to allow for additional structural requirements.

4 - Costs in 2012 dollars.

Using the previously discussed methodology for larger/smaller ESTs and non-standard height ESTs, the anticipated annual O&M cost for one standard height 0.5 MG EST and booster pump station (in 2012 dollars) is approximately $35,125 (matching the cost adjustment from Scenario 1 above); however, the cost for a 0.5 MG non-standard EST and booster pump station increases from $35,125 to approximately $ 45,663 (in 2012 dollars). Likewise, the annual O&M cost for a 0.1 MG standard EST and booster pump station is anticipated to be roughly $7,025 (in 2012 dollars), whereas the anticipated annual O&M cost for a 0.1 MG non-standard EST and booster pump station is approximately $9,032 (in 2012 dollars). In addition, the annual O&M cost for a 0.25 MG standard EST and booster pump station is anticipated to be roughly $17,563 (in 2012 dollars).

Based on the cost calculations discussed above, the anticipated annual O&M cost for treatment and distribution for each scenario is identified in Table 6-32.

Table 6-32
Projected O&M Cost for Each Scenario

SCENARIO	WTP CAPACITY (mgd)	DISTRIBUTION SYSTEM CAPACITY (mgd)	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	TOTAL ANNUAL COST
1	9.90	12.40	$1,400,900	$105,375	$1,506,275
2	12.10	15.20	$1,688,555	$145,518	$1,834,073
3	10.70	13.30	$1,496,272	$145,518	$1,641,790
4	11.20	13.90	$1,562,417	$224,800	$1,787,217
5	12.50	15.70	$1,740,856	$210,750	$1,951,606
6	12.90	16.10	$1,783,927	$180,643	$1,964,570
7	13.40	16.70	$1,850,072	$231,825	$2,081,897
8	14.70	18.40	$2,028,510	$224,800	$2,253,310
9	11.90	14.90	$1,657,790	$217,775	$1,875,565
10	13.30	16.60	$1,836,228	$210,750	$2,046,978
11	13.80	17.20	$1,902,373	$235,338	$2,137,711
12	14.10	17.60	$1,945,444	$279,996	$2,225,441
13	15.50	19.30	$2,123,883	$262,434	$2,386,317
14	16.00	19.90	$2,190,028	$287,021	$2,477,049
15	14.50	18.10	$1,997,745	$283,509	$2,281,254
16	16.70	20.90	$2,285,400	$297,559	$2,582,959
Notes					
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.					
3 - Costs in 2012 dollars.					

With both capital and O&M costs developed for each regionalization scenario, a projected 30-year life cycle cost has been developed and is identified in Table 6-33. However, these life cycle costs do not take into account any potential phasing of treatment and/or distribution system improvements or any potential grant funding opportunities; impacts from these issues on anticipated cost of service will be discussed later in this TM and in subsequent TMs.

Table 6-33
30-Year Life Cycle Cost for Each Scenario

SCENARIO	WTP CAPITAL COST	DISTRIBUTION CAPITAL COST	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	30-YR LIFE CYCLE COST
1	$44,362,300	$6,372,000	$1,400,900	$105,375	$78,438,000
2	$51,724,300	$15,431,500	$1,688,555	$145,518	$100,889,000
3	$46,421,800	$12,395,900	$1,496,272	$145,518	$89,014,000
4	$49,014,200	$24,795,200	$1,562,417	$224,800	$106,680,000
5	$52,955,300	$22,812,900	$1,740,856	$210,750	$111,663,000
6	$54,305,500	$19,587,300	$1,783,927	$180,643	$110,026,000
7	$55,312,300	$30,138,700	$1,850,072	$231,825	$123,742,000
8	$59,441,800	$29,990,000	$2,028,510	$224,800	$130,875,000
9	$50,817,200	$24,777,900	$1,657,790	$217,775	$110,091,000
10	$55,012,600	$24,256,600	$1,836,228	$210,750	$116,918,000
11	$56,578,200	$30,939,200	$1,902,373	$235,338	$126,835,000
12	$57,532,700	$33,628,400	$1,945,444	$279,996	$132,092,000
13	$61,987,100	$31,795,400	$2,123,883	$262,434	$137,672,000
14	$63,578,100	$38,478,000	$2,190,028	$287,021	$147,615,000
15	$58,805,300	$33,275,600	$1,997,745	$283,509	$134,038,000
16	$65,814,900	$39,009,000	$2,285,400	$297,559	$152,330,000

Notes
1 - Anticipated annual treatment cost based on historical demand, which is typically 50% of the expected TCEQ design demand of 0.6 gpm per connection.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements, also assuming 50% of TCEQ design demand.
3 - Annual inflation calculation based on an annual interest rate of 3.5%.
4 - Costs in 2012 dollars.

FUNDING IMPACTS ON REGIONALIZATION ALTERNATIVES

One of the benefits of regionalization is that by providing water to multiple utilities, the average cost per volume of water treated (normally in terms of cost per 1,000 gallons treated) typically reduces as the number of connections served increases. This concept is known as “economies of scale.”

For example, under Scenario 1, the City of Roma would need a WTP capacity of approximately 9.9 mgd by the year 2040 (Study planning horizon). The projected total project cost for a 9.9 mgd WTP (if constructed all at once) is approximately $43,881,400 (using 2012 dollars), including construction cost, contingency and engineering and testing services. In a worst-case funding scenario, no grant or low-interest loan funds would be available, so that scenario is used as the starting point for determining potential cost of service. Therefore, for the projected Scenario 1 OPCC of $44,362,300, the projected annual debt service is developed using an interest rate of 5.0% (assuming no low-interest rate at this point) at a term of 30 years. Using the Scenario 1 OPCC, an interest rate of 5.0% and a term of 30 years, an annual debt service of $2,646,700 is determined. The same methodology is used to determine the projected worst-case annual debt service for each potential regionalization scenario and the respective debt service for each scenario is shown in Table 3-10.

While the Scenario 1 WTP 2040 design capacity is anticipated to be 9.9 mgd, based on current demands, it is anticipated that the average water demand would actually be roughly half of the capacity 2040 WTP, or 4.95 mgd. Therefore, in determining projected cost per volume (a common method for utilities is to evaluate cost per thousand gallons treated), the debt service (worst-case for this example) for Scenario 1 ($3,061,208) plus the anticipated annual O&M cost for Scenario 1 ($1,506,275) is divided by the anticipated water demand (4.95 mgd in 2040), converted to a per 1,000 gallon basis. Example cost equations are shown below.

Cost = (debt service + O&M cost) / demand
= ($4,567,483) / (4.95 mgd x 1,000,000 gal/million gallons x 365.25 days/year)
= $0.00253 per gallon x 1,000 or $2.53 per 1,000 gallons

The same methodology was used to determine the projected cost per volume in treatment and distribution for each potential regionalization scenario and the respective cost for each potential regionalization scenario. As discussed previously, without any grant or low-interest loan funding, development of a regional WTP may not be feasible due to the high cost of infrastructure. Therefore, the obvious fatal flaw in this Study is the availability of grant and low-interest funding for the final recommended improvements. To show the impact of this type of funding, several analyses were developed to compare varying levels of grant and/or low-interest loan funding. Anticipated cost of service assuming that no grant funding is available (i.e. 100% loan funding) is shown for each regionalization scenario in Table 6-34.

Table 6-34
Cost of Service for Each Scenario at 100% Loan

SCENARIO	WTP ANNUAL DEBT SERVICE	DISTRIBUTION ANNUAL DEBT SERVICE	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	COST PER THOUSAND GALLONS
1	$2,646,700	$414,508	$1,400,900	$105,375	$2.53
2	$3,115,300	$1,003,841	$1,688,555	$145,518	$2.70
3	$2,798,700	$806,371	$1,496,272	$145,518	$2.71
4	$2,953,500	$1,612,963	$1,562,417	$224,800	$3.13
5	$3,188,900	$1,484,012	$1,740,856	$210,750	$2.91
6	$3,269,500	$1,274,182	$1,783,927	$180,643	$2.78
7	$3,329,600	$1,960,566	$1,850,072	$231,825	$3.03
8	$3,576,200	$1,950,893	$2,028,510	$224,800	$2.90
9	$3,061,200	$1,611,838	$1,657,790	$217,775	$3.03
10	$3,311,700	$1,577,927	$1,836,228	$210,750	$2.87
11	$3,405,200	$2,012,639	$1,902,373	$235,338	$3.02
12	$3,462,200	$2,187,576	$1,945,444	$279,996	$3.07
13	$3,728,300	$2,068,336	$2,123,883	$262,434	$2.91
14	$3,823,300	$2,503,049	$2,190,028	$287,021	$3.03
15	$3,538,200	$2,164,626	$1,997,745	$283,509	$3.03
16	$3,956,300	$2,537,591	$2,285,400	$297,559	$2.99

Notes
1 - Annual inflation calculation based on an annual interest rate of 3.5%.
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements.
3 - Annual inflation calculation based on an annual interest rate of 3.5%.
4 - Costs in 2012 dollars.

In order to determine the economic viability of each regionalization alternative, it is necessary to determine the anticipated water household cost factor (HCF) based on anticipated annual water service cost along with anticipated annual debt service. Because only some of the Study participants provide centralized wastewater service, this cost component has not been incorporated into the HCF calculation. Since the Study Area includes multiple census block tracts, the average median household income (MHI) for Starr County has been used in determining the anticipated HCF. As an example, the anticipated HCF for Scenario 16 is calculated as follows:

- (Annual household water service cost + Annual household debt service cost) / MHI
- Household water service cost = ($2,285,400 + $297,559) / 16,379 connections = $158 per household per year
- Household debt service cost = ($3,956,300 + $2,537,591) / 16,379 connections = $397 per household per year
- Scenario 16 HCF = ($158 + $397) / $24,441 = 2.3% of MHI

The anticipated HCF for each regionalization scenario has been calculated and included in Table 6-35.

Table 6-35
Household Cost Factor for Each Scenario

SCENARIO	WTP ANNUAL DEBT SERVICE	DISTRIBUTION ANNUAL DEBT SERVICE	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	HCF
1	$2,646,700	$414,508	$1,400,900	$105,375	1.92%
2	$3,115,300	$1,003,841	$1,688,555	$145,518	2.05%
3	$2,798,700	$806,371	$1,496,272	$145,518	2.06%
4	$2,953,500	$1,612,963	$1,562,417	$224,800	2.38%
5	$3,188,900	$1,484,012	$1,740,856	$210,750	2.21%
6	$3,269,500	$1,274,182	$1,783,927	$180,643	2.11%
7	$3,329,600	$1,960,566	$1,850,072	$231,825	2.30%
8	$3,576,200	$1,950,893	$2,028,510	$224,800	2.20%
9	$3,061,200	$1,611,838	$1,657,790	$217,775	2.30%
10	$3,311,700	$1,577,927	$1,836,228	$210,750	2.18%
11	$3,405,200	$2,012,639	$1,902,373	$235,338	2.29%
12	$3,462,200	$2,187,576	$1,945,444	$279,996	2.33%
13	$3,728,300	$2,068,336	$2,123,883	$262,434	2.21%
14	$3,823,300	$2,503,049	$2,190,028	$287,021	2.30%
15	$3,538,200	$2,164,626	$1,997,745	$283,509	2.30%
16	$3,956,300	$2,537,591	$2,285,400	$297,559	2.27%

Notes

1 - Annual inflation calculation based on an annual interest rate of 3.5%.

2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements.

3 - Annual inflation calculation based on an annual interest rate of 3.5%.

4 - Costs in 2012 dollars.

Based on the anticipated cost of service for each of the regionalization scenarios, it appears that almost every regionalization alternative under a 100% loan strategy would likely exceed a recommended maximum 2% of MHI threshold, resulting in an economic burden to the customers in the Study Area. Therefore, it appears necessary to evaluate the regionalization scenarios with respect to a reduction in debt service, either via a portion of grant funding or through the use of low interest (2-4% interest on an infrastructure loan) loan funding.

Anticipated annual debt service and cost of service for finished water using a 50% loan funding strategy for each regionalization scenario are identified in Table 6-36.

Table 6-36
Cost of Service for Each Scenario at 50% Loan and 50% Grant

SCENARIO	WTP ANNUAL DEBT SERVICE	DISTRIBUTION ANNUAL DEBT SERVICE	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	COST PER THOUSAND GALLONS
1	$1,323,350	$207,254	$1,400,900	$105,375	$1.68
2	$1,557,650	$501,921	$1,688,555	$145,518	$1.76
3	$1,399,350	$403,186	$1,496,272	$145,518	$1.78
4	$1,476,750	$806,482	$1,562,417	$224,800	$2.00
5	$1,594,450	$742,006	$1,740,856	$210,750	$1.88
6	$1,634,750	$637,091	$1,783,927	$180,643	$1.81
7	$1,664,800	$980,283	$1,850,072	$231,825	$1.94
8	$1,788,100	$975,447	$2,028,510	$224,800	$1.87
9	$1,530,600	$805,919	$1,657,790	$217,775	$1.95
10	$1,655,850	$788,964	$1,836,228	$210,750	$1.86
11	$1,702,600	$1,006,320	$1,902,373	$235,338	$1.93
12	$1,731,100	$1,093,788	$1,945,444	$279,996	$1.97
13	$1,864,150	$1,034,168	$2,123,883	$262,434	$1.88
14	$1,911,650	$1,251,525	$2,190,028	$287,021	$1.94
15	$1,769,100	$1,082,313	$1,997,745	$283,509	$1.95
16	$1,978,150	$1,268,796	$2,285,400	$297,559	$1.92

Notes

1 - Annual inflation calculation based on an annual interest rate of 3.5%.

2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements.

3 - Annual inflation calculation based on an annual interest rate of 3.5%.

4 - Costs in 2012 dollars.

Based on the anticipated cost of service for each of the regionalization scenarios using a 50% loan funding strategy, it appears that any of the regionalization scenarios could be economically viable at a cost per thousand gallons of $2.00 or less, which results in maintaining the anticipated HCF below 2% of the MHI in the Study Area. However, due to the financial capability of each of the Study participants, it is recommended to further evaluate the regionalization scenarios with respect to an additional reduction in debt service, via both a larger portion of grant funding and through the use of low interest (0-2% interest on an infrastructure loan) loan funding, with a result of a net reduction of annual debt service by 75%. Anticipated annual debt service and cost of service for finished water using a 25% loan funding strategy for each regionalization scenario are identified in Table 6-37.

Table 6-37
Cost of Service for Each Scenario at 25% Loan and 75% Grant

SCENARIO	WTP ANNUAL DEBT SERVICE	DISTRIBUTION ANNUAL DEBT SERVICE	ANNUAL WTP COST	ANNUAL DISTRIBUTION COST	COST PER THOUSAND GALLONS
1	$661,675	$103,627	$1,400,900	$105,375	$1.26
2	$778,825	$250,960	$1,688,555	$145,518	$1.30
3	$699,675	$201,593	$1,496,272	$145,518	$1.31
4	$738,375	$403,241	$1,562,417	$224,800	$1.44
5	$797,225	$371,003	$1,740,856	$210,750	$1.37
6	$817,375	$318,546	$1,783,927	$180,643	$1.33
7	$832,400	$490,142	$1,850,072	$231,825	$1.40
8	$894,050	$487,723	$2,028,510	$224,800	$1.36
9	$765,300	$402,960	$1,657,790	$217,775	$1.41
10	$827,925	$394,482	$1,836,228	$210,750	$1.36
11	$851,300	$503,160	$1,902,373	$235,338	$1.39
12	$865,550	$546,894	$1,945,444	$279,996	$1.42
13	$932,075	$517,084	$2,123,883	$262,434	$1.36
14	$955,825	$625,762	$2,190,028	$287,021	$1.40
15	$884,550	$541,157	$1,997,745	$283,509	$1.41
16	$989,075	$634,398	$2,285,400	$297,559	$1.38
Notes					
1 - Annual inflation calculation based on an annual interest rate of 3.5%.					
2 - Anticipated annual distribution O&M cost based on reduced booster pump station size, if using elevated storage to meet total storage requirements.					
3 - Annual inflation calculation based on an annual interest rate of 3.5%.					
4 - Costs in 2012 dollars.					

Based on the anticipated cost of service for each of the regionalization scenarios using a 25% loan funding strategy, it appears that any of the regionalization scenarios are economically viable. While the financial capability of each of the Study participants could allow for such a high grant and low-interest funding option, the amount of grant funding required in one single project is likely beyond the funding capability of a single funding agency. Therefore, it is critical to identify not only funding options but also logical phasing strategies to develop a realistic funding situation for the recommended project.

RECOMMENDATIONS FOR SELECTING A REGIONALIZATION ALTERNATIVE

Based on an evaluation of the anticipated WTP and distribution system capital costs, treatment and distribution operations costs and anticipated annual debt service and cost of service discussed previously in this TM, it appears each of the regionalization scenarios are equally viable. Since the ultimate cost of service is very similar for each of the regionalization scenarios, it is recommended to develop a project phasing strategy for Scenario 16, to provide the capability of regional water service for all of the Study participants. Multiple advantages and several potential disadvantages relate to the development of a regional WTP for all of the Study participants, including, but not limited to:

- **Advantages**
  - Largest existing treatment site in the City, provides adequate space for expanding upwards of 16.7 mgd if using more efficient treatment processes;
  - Reduced cost for monitoring and reporting for surface water monthly operating reports (SWMOR) and annual sludge reporting by eliminating an existing WTP;
  - Reduced environmental impact by operating a single WTP facility rather than multiples facilities in a localized area;
  - Potentially lower water rates due to economies of scale for treatment cost and lower O&M via a single treatment facility; and
  - The existing administration for each Study participant could still be maintained even though treatment would occur at only one location.

- **Disadvantages**
  - There may be existing debt service that would need to be incorporated into the costing scenarios discussed previously, that could impact the direction taken in the regionalization scenarios;
  - Depending on the form of regionalization taken, regionalization to be served by a regional WTP will require extensive coordination with the WSCs to operate and maintain multiple rate structures (if necessary); and
  - There could be a perceived loss of ownership and control by the WSCs.

Since the initial regional WTP will be brand new, the work needed at the new regional WTP will be based on expansions to incorporate offsite WTP demands, which could be constructed over multiple phases as needed to supply treated water to WSCs at a rate of 1-2 additional WSCs served every five years. The total projected capital cost (in 2012 dollars) for this recommended scenario (Scenario 16) is $104,823,900, including contingency and engineering (refer to Table 6-26).

METHODOLOGY FOR PHASING REGIONALIZATION IMPROVEMENTS

Implementation of the recommended scenario is not expected to be completed all at once. In fact, implementation of the recommended regionalization scenario would be best completed in phases over a period of time. By implementing this scenario in a phased approach, the Study participants could accomplish regionalization at a controlled pace that is balanced with project funding. A draft implementation plan has been developed and is included below and in TM No. 7 in greater detail.

- **Current – 2 WTPs in Operation**
  - City of Roma supplied by its own WTP
  - Falcon Rural WSC supplied by its own WTP
  - El Sauz WSC supplied by the City of Rio Grande City
  - El Tanque WSC supplied by the City of Rio Grande City
  - Rio WSC supplied by the City of Rio Grande City

- **2010-2015 – 2 WTPs in Operation**
  - ***City of Roma supplied by its own WTP, starts design and construction of new 3-4 mgd Regional WTP***
  - Falcon Rural WSC supplied by its own WTP
  - El Sauz WSC supplied by the City of Rio Grande City
  - El Tanque WSC supplied by the City of Rio Grande City
  - Rio WSC supplied by the City of Rio Grande City

- **2015-2020 – 3 WTPs in Operation**
  - ***City of Roma supplied by its own WTP, begins operating new 3-4 mgd Regional WTP***
  - Falcon Rural WSC supplied by its own WTP
  - El Sauz WSC supplied by the City of Rio Grande City
  - El Tanque WSC supplied by the City of Rio Grande City
  - Rio WSC supplied by the City of Rio Grande City

- **2020-2025 – 2 WTPs in Operation**
  - City of Roma supplied by its own WTP, also operates Regional WTP, expands Regional WTP to 8 mgd
  - ***Falcon Rural WSC now supplied by Regional WTP***
  - El Sauz WSC supplied by the City of Rio Grande City
  - El Tanque WSC supplied by the City of Rio Grande City
  - Rio WSC supplied by the City of Rio Grande City

- **2025-2030 – 1 WTP in Operation**
  - ***City of Roma now only operates Regional WTP (8 mgd)***
  - Falcon Rural WSC supplied by Regional WTP
  - ***El Sauz WSC now supplied by Regional WTP***
  - El Tanque WSC supplied by the City of Rio Grande City
  - Rio WSC supplied by the City of Rio Grande City

- **2030-2035 – 1 WTP in Operation**

    - ***City of Roma only operates Regional WTP, expands Regional WTP to 12 mgd***
    - Falcon Rural WSC supplied by Regional WTP
    - El Sauz WSC supplied by Regional WTP
    - El Tanque WSC supplied by the City of Rio Grande City
    - ***Rio WSC now supplied by Regional WTP***

- **2035-2040 – 1 WTP in Operation**

    - ***City of Roma only operates Regional WTP, expands Regional WTP to 16.7 mgd***
    - Falcon Rural WSC supplied by Regional WTP
    - El Sauz WSC supplied by Regional WTP
    - ***El Tanque WSC now supplied by Regional WTP***
    - Rio WSC supplied by Regional WTP

This Technical Memorandum summarizes the findings of Task VI of the City of Roma Regional Water Planning Study (the Study). The focus of Task VI of the Study is the preparation of an Implementation Schedule for the Study area.

Activities in Task VI included the following:

- ✓ Develop phasing for recommended water treatment and distribution projects; and
- ✓ Prepare a technical memorandum summarizing the findings.

WATER IMPLEMENTATION SCHEDULE

A schedule has been prepared for the implementation of various water regionalization projects identified in Technical Memorandum (TM) No. 3 and 4 of this Study. The proposed timing of the implementation for these projects is based on information from the Study participants and the inherent nature of the projects.

Projects such as construction or expansion of a regional water treatment plant (WTP) are dependent on when the current growth (in number of active connections) approaches or exceeds the 85% of the existing infrastructure capacity, resulting in noncompliance with the Texas Commission on Environmental Quality's (TCEQ) 85% Capacity Rule. In addition, other factors can impact the implementation of specific infrastructure improvements, such as the condition and/or performance of existing treatment facilities, and the viability and capacity of existing water supply sources. The implementation period matches the projected growth discussed in TM No. 1 so the projects are scheduled in 5-year increments.

RECOMMENDED PROJECT PACKAGES

The goal of the previous TMs in this Study has been to identify various regionalization alternatives during the evaluation of projected water needs for each Study participant. However following the completion of TM No. 6, the regionalization alternative ultimately recommended in this Study is to develop an overall regionalization concept with the capability of providing potable water to each Study participant either as its primary drinking water supply or as a viable alternative supply. As discussed in the previous TMs, the anticipated cost to implement a five-utility regionalization alternative in one single project may not be feasible, due to existing funding constraints. For that reason, the overall five-utility regionalization concept has been divided into five "project packages" in order to develop "fundable" project packages via funding agencies such as the Texas Water Development Board (TWDB). A description of improvements, current costs matching the previous TMs (in 2012 dollars) and cost adjustments to reflect delayed implementation of project improvements beyond 2012 are included in the following tables.

Project Package No. 1 – 2011-2015

Proposed infrastructure improvements under Project Package No. 1 include construction of a new regional WTP and storage improvements to serve the City of Roma. These improvements are proposed to begin construction by the end of 2015, so the costs shown in the previous TMs have been escalated by 3.5% annually for three years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 1 are included in Table 7-1.

Table 7-1
Project Package No. 1 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$4,539,225	$4,539,300
2	Construct new 36-inch RW transmission main via directional drilling or boring	LF	9,100	$292.24	$2,666,300
3	Construct new 184 MG reservoir adjacent to Rio Grande River	LS	1	$2,180,400	$2,180,400
4	Phase I WTP - 3 mgd	LS	1	$6,000,000	$6,000,000
5	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
6	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,136,000
				Contingencies (20%)	$3,427,200
				TOTAL ESTIMATED CONSTRUCTION COST	$20,563,200
				Engineering & Testing (18%)	$3,701,400
				TOTAL ESTIMATED CAPITAL COST	**$24,264,600**
				Annual Escalation	$2,547,800
				TOTAL ESTIMATED CAPITAL COST BY 2015	**$26,812,400**

Notes
1 - 75% of PS improvements budget included in PP No. 1 to allow for construction of structure and initial pumps.
2 - 50% of reservoir budget allocated to PP No. 1 to construct the first large raw water reservoir.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Project Package No. 2 – 2016-2020

Proposed infrastructure improvements under Project Package No. 2 include expansion of the new regional WTP and distribution improvements to serve both the City of Roma and Falcon Rural WSC. These improvements are proposed to begin construction by the end of 2020, so the costs shown in the previous TMs have been escalated by 3.5% annually for eight years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 2 are included in Table 7-2.

Table 7-2
Project Package No. 2 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase II WTP - 6 mgd	LS	1	$6,000,000	$6,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$750,000	$750,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	30-inch transmission main from Roma to TxDOT US 83 Bypass connection point within TxDOT ROW	LF	13,985	$150	$2,097,800
7	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon Rural WSC service connection	EA	1	$250,000	$250,000
8	Construct one new 0.1 MG standard EST at Falcon Rural WSC service connection	EA	1	$250,000	$250,000
9	Site improvements for new ESTs	EA	2	$250,000	$500,000
10	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon Rural WSC service connection within TxDOT ROW	LF	26,277	$75	$1,970,800
11	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon Rural WSC service connection within TxDOT ROW	LF	7,286	$100	$728,600
				subtotal	$14,050,500
				Contingencies (20%)	$2,810,100
				TOTAL ESTIMATED CONSTRUCTION COST	$16,860,600
				Engineering & Testing (18%)	$3,035,000
				TOTAL ESTIMATED CAPITAL COST	**$19,895,600**
				Annual Escalation	$5,570,800
				TOTAL ESTIMATED CAPITAL COST BY 2020	**$25,466,400**

Notes
1 - 25% of remaining PS improvements budget included in PP No. 2 to allow for installation of additional pumps.
2 - No reservoir improvements proposed under PP No. 2.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Project Package No. 3 – 2021-2025

Proposed infrastructure improvements under Project Package No. 3 include expansion of the new regional WTP and distribution improvements to serve the City of Roma, Falcon Rural WSC and El Sauz WSC. These improvements are proposed to begin construction by the end of 2025, so the costs shown in the previous TMs have been escalated by 3.5% annually for thirteen years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 3 are included in Table 7-3.

Table 7-3
Project Package No. 3 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase III WTP - 9 mgd	LS	1	$6,000,000	$6,000,000
4	Construct one new 0.25 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection within TxDOT ROW	LF	26,329	$100	$2,632,900
8	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
9	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$13,351,400
				Contingencies (20%)	$2,670,300
				TOTAL ESTIMATED CONSTRUCTION COST	$16,021,700
				Engineering & Testing (18%)	$2,884,000
				TOTAL ESTIMATED CAPITAL COST	**$18,905,700**
				Annual Escalation	$8,602,100
				TOTAL ESTIMATED CAPITAL COST BY 2025	**$27,507,800**

Notes
1 - 25% of remaining PS improvements budget included in PP No. 2 to allow for installation of additional pumps.
2 - Start of construction of second large reservoir proposed under PP No. 3.
3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Project Package No. 4 – 2026-2030

Proposed infrastructure improvements under Project Package No. 4 include expansion of the new regional WTP and distribution improvements to serve the City of Roma, Falcon Rural WSC, El Sauz WSC and Rio WSC. These improvements are proposed to begin construction by the end of 2030, so the costs shown in the previous TMs have been escalated by 3.5% annually for eighteen years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 4 are included in Table 7-4.

Table 7-4
Project Package No. 4 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase IV WTP - 13 mgd	LS	1	$8,000,000	$8,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$750,000	$750,000
4	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	24-inch transmission main from El Sauz WSC service connection to Rio WSC service connection within TxDOT ROW	LF	38,074	$125	$4,759,300
7	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
8	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,137,600
				Contingencies (20%)	$3,427,600
				TOTAL ESTIMATED CONSTRUCTION COST	$20,565,200
				Engineering & Testing (18%)	$3,701,800
				TOTAL ESTIMATED CAPITAL COST	**$24,267,000**
				Annual Escalation	$15,288,300
				TOTAL ESTIMATED CAPITAL COST BY 2030	**$39,555,300**

Notes

1 - 25% of remaining PS improvements budget included in PP No. 4 to allow for installation of additional pumps.

2 - No reservoir improvements proposed under PP No. 4.

3 - WTP capacity is based on the assumption that the existing Roma WTP is still operational at this time.

Project Package No. 5 – 2031-2035

Proposed infrastructure improvements under Project Package No. 5 include expansion of the new regional WTP and distribution improvements to serve all five Study participants. These improvements are proposed to begin construction by the end of 2035, so the costs shown in the previous TMs have been escalated by 3.5% annually for twenty-three years to allow for inflation. The current costs (in 2012 dollars) and cost escalations for both treatment and distribution (and storage) for Project Package No. 5 are included in Table 7-5.

Table 7-5
Project Package No. 5 - Proposed Treatment and Distribution Improvements

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase V WTP - 16.7 mgd	LS	1	$7,400,000	$7,400,000
4	Construct one new 0.25 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Tanque WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from Rio WSC service connection to El Tanque WSC service connection within TxDOT ROW	LF	12,250	$100	$1,225,000
8	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection within TxDOT ROW	LF	6,789	$75	$509,200
				subtotal	$12,352,700
				Contingencies (20%)	$2,470,600
				TOTAL ESTIMATED CONSTRUCTION COST	$14,823,300
				Engineering & Testing (18%)	$2,668,200
				TOTAL ESTIMATED CAPITAL COST	**$17,491,500**
				Annual Escalation	$14,080,700
				TOTAL ESTIMATED CAPITAL COST BY 2035	**$31,572,200**

Notes

1 - 25% of remaining PS improvements budget included in PP No. 5 to allow for installation of additional pumps.

2 - Completion of construction of second large reservoir proposed under PP No. 5.

3 - WTP capacity is based on the assumption that the existing Roma WTP is no longer operational at this time.

WATER IMPLEMENTATION FLOW CHART

It should be noted that a number of factors may impact the schedule presented in the implementation schedule flow chart in this TM. These include, but are not limited to, the following influences:

- The projects identified are at a pre-planning level at this point. Preliminary design may delay or accelerate the projects once begun.
- Implementation of the projects is dependent on available funding.
- Utility conflicts, ROW and easement acquisition may delay projects.
- Many of the recommended regionalization projects will involve agreements and contracts between the City of Roma and individual water supply corporations, including project costs and payment agreements. These negotiated agreements may delay implementation.
- A slow down or acceleration in projected growth will impact the implementation schedule.
- Stricter water treatment regulations may accelerate the implementation schedule.

Based on the project data developed in previous TMs and the implementation schedule shown previously, a projected cash draw analysis has been developed for the proposed water system improvements projects, which is shown in Table 7-6.

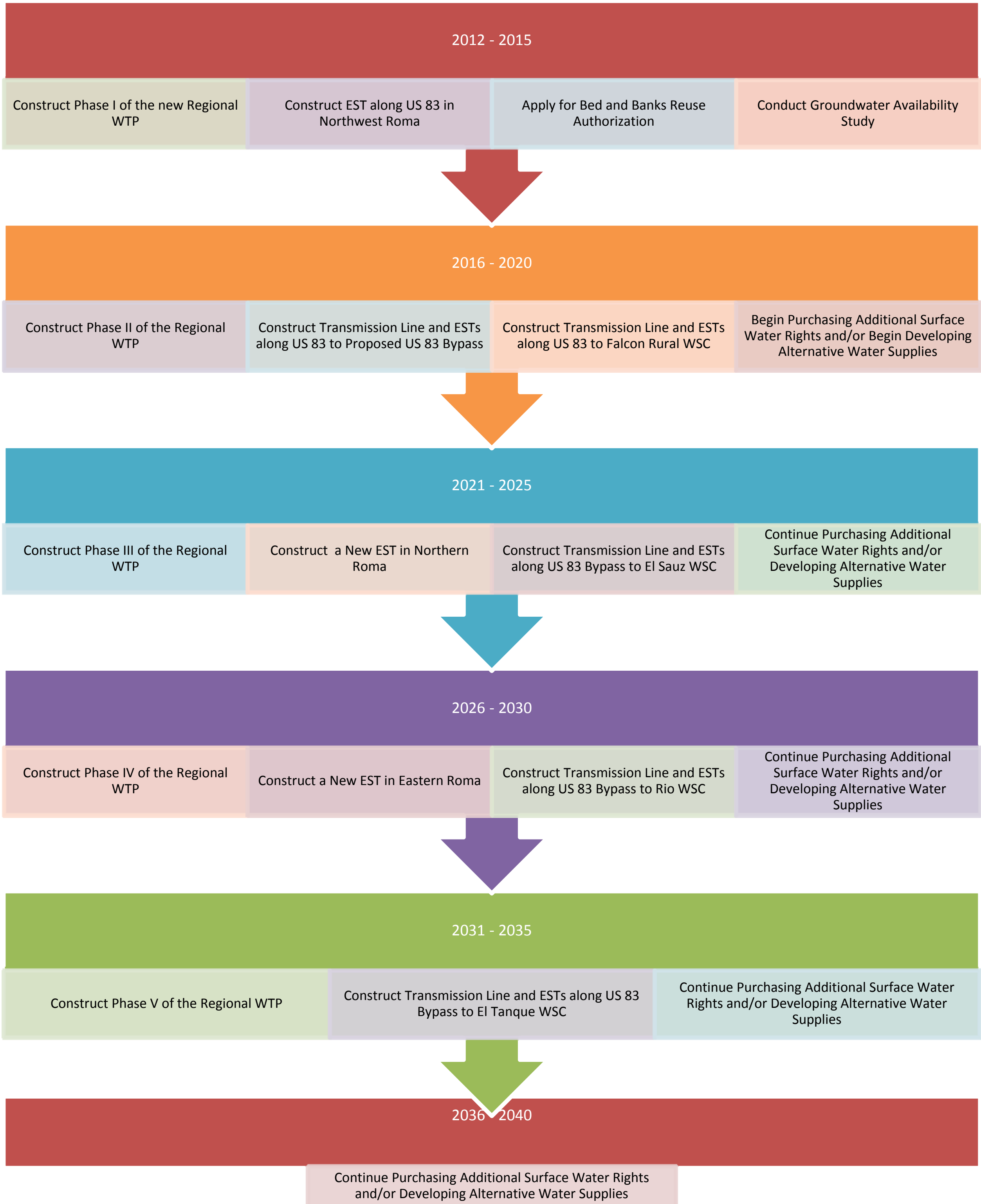

2012 - 2015
Construct Phase I of the new Regional WTP
Construct EST along US 83 in Northwest Roma
Apply for Bed and Banks Reuse Authorization
Conduct Groundwater Availability Study
2016 - 2020
Construct Phase II of the Regional WTP
Construct Transmission Line and ESTs along US 83 to Proposed US 83 Bypass
Construct Transmission Line and ESTs along US 83 to Falcon Rural WSC
Begin Purchasing Additional Surface Water Rights and/or Begin Developing Alternative Water Supplies
2021 - 2025
Construct Phase III of the Regional WTP
Construct a New EST in Northern Roma
Construct Transmission Line and ESTs along US 83 Bypass to El Sauz WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2026 - 2030
Construct Phase IV of the Regional WTP
Construct a New EST in Eastern Roma
Construct Transmission Line and ESTs along US 83 Bypass to Rio WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2031 - 2035
Construct Phase V of the Regional WTP
Construct Transmission Line and ESTs along US 83 Bypass to El Tanque WSC
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies
2036 - 2040
Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies

Table 7-6
Projected Cash Draw for Proposed Water Improvements

Year	Project 1	Project 2	Project 3	Project 4	Total Cost for Water Projects
2011-2015	Construct Phase I of the new Regional WTP	Construct EST along US 83 in Northwest Roma	Apply for Bed and Banks Reuse Authorization	Conduct Groundwater Availability Study	-
Project Cost [1]	$24,074,200	$2,738,200	-	-	**$26,812,400**
2016-2020	Construct Phase II of the Regional WTP	Construct Transmission Line and ESTs along US 83 to Proposed US 83 Bypass	Construct Transmission Line and ESTs along US 83 to Falcon Rural WSC	Begin Purchasing Additional Surface Water Rights and/or Begin Developing Alternative Water Supplies	-
Project Cost [1]	$11,560,400	$7,200,800	$6,705,200	-	**$25,466,400**
2021-2025	Construct Phase III of the Regional WTP	Construct a New EST in Northern Roma	Construct Transmission Line and ESTs along US 83 Bypass to El Sauz WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-
Project Cost [1]	$15,387,100	$3,090,500	$9,030,200	-	**$27,507,800**
2026-2030	Construct Phase IV of the Regional WTP	Construct a New EST in Eastern Roma	Construct Transmission Line and ESTs along US 83 Bypass to Rio WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-
Project Cost [1]	$19,337,800	$3,462,200	$16,755,300	-	**$39,555,300**
2031-2035	Construct Phase V of the Regional WTP	Construct Transmission Line and ESTs along US 83 Bypass to El Tanque WSC	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-	-
Project Cost [1]	$22,666,800	$8,905,400	-	-	**$31,572,200**
2036-2040	Continue Purchasing Additional Surface Water Rights and/or Developing Alternative Water Supplies	-	-	-	
Project Cost [1]	-	-	-	-	-
Total	**$150,915,000**				

Notes:

1 - Note that these costs (presented for infrastructure improvements only) are higher than the costs discussed in TM No. 6 (shown in 2012 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this Study. This cost is based on the timeline for projects discussed in TM No. 6 and this TM and assumes that projects will be funded toward the middle of each 5-year implementation period.

This Technical Memorandum (TM) summarizes the findings of Task VIII of the City of Roma Regional Water Planning Study (the Study). The focus of Task VIII of the Study is the development of funding options for proposed improvements in the Study.

Activities in Task VIII included the following:

- ✓ Identify potential funding agencies;
- ✓ Determine likely options for grant and loan funding;
- ✓ Determine the amount of available grant and loan funding;
- ✓ Determine potential organizational consolidations and regionalization concepts;
- ✓ Identify potential rate structure options; and
- ✓ Prepare a technical memorandum summarizing the findings.

FUNDING ALTERNATIVES

This Study identified various water projects including treatment and water storage, distribution, and transmission improvements. There are 5 project packages incorporating treatment, storage and transmission. The total cost for the recommended water project packages in the Study is $104,823,900.

Obviously not all of the funding would be needed at the same time, but with the tightening of the bond market and the fact that the requests for water funding to the Texas Water Development Board (TWDB) are always greater than the funding available, the identification of funding sources is crucial.

The primary source of funding for water improvements in Texas has been the TWDB. TWDB financial assistance programs are funded through state-backed bonds, a combination of state bond proceeds and federal grant funds, or limited appropriated funds. Since 1957, the Legislature and voters approved constitutional amendments authorizing the TWDB to issue up to $2.68 billion in Texas Water Development Bonds. To date, the TWDB has sold nearly $1.55 billion of these bonds to finance the construction of water-related projects.

The TWDB administers the Drinking Water State Revolving Fund (DWSRF) to make low-interest loans for financing public drinking water systems that facilitate compliance with primary and secondary drinking water regulations or otherwise significantly further the health protection objectives of the federal Safe Drinking Water Act (SDWA), as amended in 1996.

Loans from the DWSRF finance all costs associated with the planning, design and construction of projects to upgrade or replace water supply infrastructure, to correct exceedances of SDWA health standards, to consolidate water supplies and to purchase capacity in water system. Funded in part by federal grant money, the DWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. Initially, the DWSRF offers 20-year loans with a net long-term interest rate that is effectively 1.2 percent below the rate the borrower would receive on the open market at the time of closing. This 1.2 percent interest rate reduction equates to a savings of approximately $165,000 per $1 million borrowed during the life of a loan.[1]

Mainstream funds offer a net long-term fixed interest rate of 1.25% below market rate for those applicants financing the origination fee. Disadvantaged community funds offer an interest rate of 1.25% below market rate to eligible communities and principal forgiveness of 70% if the community's adjusted annual median household income (AMHI) is less than or equal to 75% and greater than 60% of the state adjusted AMHI. Principal is forgiven at 100% if the community's adjusted AMHI is less than or equal to 60 percent of the state adjusted AMHI. A limited amount of funding is available each year to applicants who qualify as disadvantaged communities.

The TWDB Economically Distressed Areas Program (EDAP) was established in 1989 by the 71st Texas Legislature, and provides grants, loans, or a combination grant/loan when specific project requirements are met, such as for water and wastewater services, for projects in economically distressed areas and when present facilities are inadequate to meet residents' minimal needs. The EDAP program also includes measures to prevent future substandard development.

Under the law, projects must be located in economically distressed areas. An economically distressed area is one which has a median household income that is not greater than 75% of the median state household income. The EDAP program provides planning, acquisition, design and construction phase funding for projects that have been determined eligible for the program (associated with water supply, wastewater collection and treatment). It should be noted that Roma is EDAP-eligible, as well as all of Starr County.

EDAP and other TWDB funding is available in a two (or more) phase application process. The first phase is funding for planning, acquisition and design (PAD) which is offered at 50%-100% grant. State law requires a determination of an existing health and safety nuisance issued by the Texas Department of State Health Services for grant funding greater than 50% from the EDAP program. TWDB staff will process requests for nuisance surveys for EDAP applicants once eligibility determinations have been made. PAD phase activities must be completed, and approved by TWDB staff, prior to consideration of a construction phase financial application.
The second phase (construction) funding is available in a combination grant and loan. The amount of the loan is determined by a grant-to-loan calculation which is based on either the applicant's existing capital component or on regional benchmarks.

[1] Texas Water Development Board Website

The competition for DWSRF and EDAP is fierce. For example, the TWDB received funding requests totaling $705,196,856 while only $70,658,400 of funding available for SFY 2012 DWSRF. [2]

The addition of new funding mechanisms (such as the Water Infrastructure Fund) to facilitate state water plan implementation, has dramatically increased demand for the TWDB's financial assistance. With additional water plan funds received in 2007, the TWDB more than quadrupled the financial commitments it provided from 2006 to 2010. In fiscal year 2010, the TWDB committed approximately $1.5 billion in loans and grants to 92 different entities across all programs.[3] Table 8-1 shows the various funding programs administered by the TWDB and their general characteristics.

[2] Draft Intended Use Plans, DWSRF and EDAP
[3] Texas Water Development Board Sunset Advisory Commission Report

Table 8-1
Texas Water Development Board Funding Programs

Name	Description	Applicants	Availability
DWSRF	Loan and Loan Subsidies (grants for disadvantaged) available for planning, acquisition and construction of water-related infrastructure, including Water Supply and Source. Funding division includes disadvantaged, green and Source Water Protection. Interest rate is 130 – 150 basis points below market.	Community Water System Owners and Non-Profits and political subdivisions of the state and private	Annual Priority Rating Process applies to all projects.
Rural Water Assistance Fund (RWAF)	Planning, acquisition and construction of water and wastewater related infrastructure. May also be used to obtain service or to finance consolidation/regionalization. Loan only – very limited funds available.	Political Subdivisions and Nonprofit Water Supply Corporations	Open Year Round.
Water Infrastructure Fund (WIF)	Water-related projects that must be recommended in water management strategies in the most recent TWDB approved regional plan or approved State Water Plan. May not be used to maintain a system or develop a retail distribution system. In summary, funding to implement regional water plan components - $998 million funded to date.	Political Subdivisions of the State and Water Supply Corporations.	Multiple invitations annually.
State Participation Program	Construction only of regional water and wastewater construction projects when the local sponsors are unable to assume the debt for optimal sizing of the facility. Deferred Interest loan (State has temporary ownership interest in a facility). State's ownership is purchased by the applicant as the customer base grows.	Political Subdivisions of the State and Water Supply Corporations.	Open year around but limited funds.
Regional Facility Planning Grant Program	Studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing feasible regional water supply and wastewater facility alternatives, and identify institutional arrangements to provide regional facilities in Texas. Grant for 50% of Study Cost (75% for disadvantaged) with usual amount of $225,000 per study. Usually $1 million available annually.	Political Subdivisions with legal authority to plan, develop, and operate regional facilities and Nonprofit Water Supply Corporations.	Annual Priority Rating Process applies to all projects.
Texas Water Development Fund (DFund)	Planning, acquisition, and construction of water related infrastructure, including water supply, wastewater treatment, storm water and nonpoint source pollution control, flood control, reservoir construction, storage and acquisition, agricultural water conservation projects, and municipal solid waste facilities. Loan with limited funds – interest rate at market.	Political Subdivisions of the State and Nonprofit Water Supply Corporations.	Open Year-Round
Economically Distressed Areas Program (EDAP)	Grant up to 100%, Loan or combination of both to bring water and wastewater services to economically distressed areas (designated by the TWDB state-wide) where the present water and wastewater are inadequate to meet the minimal needs of the residents. The program includes measures to prevent future substandard development.	Political Subdivisions and Nonprofit Water Supply Corporations.	Open Year-Round

While the list above is not all inclusive (there are certain funding programs dedicated solely to specific groups such as regional water planning), it does provide some idea of the breadth and depth of the funding types available for the proposed projects. Each program will have their own unique conditions and these change each legislative session or congressional act. For example, recently the TWDB notified applicants that all DWSRF projects will have to comply with the Davis-Bacon Act (payroll monitoring/reporting of contracts for regional minimum standards).

The TWDB State Participation Program is an ideal funding mechanism for large regional water projects. The State Participation Program enables the TWDB to assume a temporary ownership interest in a regional project when the local sponsors are unable to assume debt for the optimally sized facility. The program is authorized under Texas Water Code §16, Subchapters E and F, and governed by TWDB rules in Texas Administrative Code Title 31 §363, Subchapter J. The TWDB may acquire ownership interest in the water rights or a co-ownership interest of the property and treatment works. The loan repayments that would have been required had the assistance been from a loan are deferred. Ultimately, the cost of the funding repaid to the TWDB is based upon purchase payments, which allow the TWDB to recover its principal and interest costs and issuance expenses, but on a deferred timetable.

The program is intended to allow for optimization of regional projects through limited State participation where the benefits can be documented, and where such development is unaffordable without State participation. The goal is to allow for the “right sizing” of projects in consideration of future growth. On new water supply and state water plan projects the TWDB can fund as much as 80 percent of costs, provided that the applicant finances at least 20 percent of the total project cost from sources other than the State Participation account and that at least 20 percent of the total capacity of the proposed project serves existing needs. On other State Participation projects, the TWDB can fund as much as 50 percent of costs, provided that the applicant finances at least 50 percent of the total project cost from sources other than the State Participation account and that at least 50 percent of the total capacity of the proposed project serves existing needs.

Any political subdivision of the state and water supply corporations that may sponsor construction of a regional water or wastewater project can apply to the TWDB for the State’s participation in the project. Although it is not required, the applicant usually acquires a loan from the TWDB for the community’s immediate needs.

The Texas Legislature, recognizing the value in optimizing and “right sizing” systems, has appropriated funds to assist local governments in regional optimization projects. To offset some of the initial cost of processing these projects, the TWDB charges an administrative cost recovery fee of 0.77 percent. As the earlier projects repurchase the TWDB’s interest, additional funds become available for future projects.

The benefits to the participant are threefold: (1) payments are deferred until the customer base grows into the added capacity facilitated, which will augment the applicant’s ability to make the payments to the TWDB; (2) the TWDB does not accrue interest on the deferred interest portion, thereby reducing the overall carrying cost of the facility for the applicant; and (3) optimizing regional projects reduces the necessity and added expense to local governments of building new structures or replacing undersized structures in the future.

These funds are limited in availability both as to the total amount approved by the legislature each biennium and as to participation in individual projects. The TWDB’s participation in this program is limited to a maximum of 80 percent of costs for projects creating a new water supply or projects identified in the state water plan. TWDB participation is limited to 50 percent of costs for other types of projects. In both cases, State Participation funding is limited to the portion of the project designated as excess capacity. The remaining costs of the project may be funded through other TWDB programs. A project must meet several requirements, including a requirement that it cannot be reasonably financed without State Participation assistance and that the optimal regional development of the project cannot be reasonably financed without State Participation funds.

A master agreement will be developed to establish responsibilities, duties, and liabilities of each party and to govern the funding arrangements, including provisions for a defined source of revenue that will be used to purchase the State's portion of the facility. System revenues and/or tax pledges are typically required. Contract revenue pledges for river authorities and others are possible. The TWDB may subordinate this obligation relative to debt issuance. The duration of the agreement is the useful life of the project facilities being constructed with a maximum financing life of 34 years. Contracts between the TWDB and the applicant include a repurchase payment schedule that approximates the following:

- 1st & 2nd years at $0 interest payable/$0 principal (interest accrues but payment is deferred)
- 3rd & 4th years at 20 percent of accrued interest/$0 principal (80 percent of accrued interest deferred)
- 5th year at 30 percent of accrued interest/$0 principal (70 percent of accrued interest deferred)
- 6th year at 40 percent of accrued interest/$0 principal (60 percent of accrued interest deferred)
- 7th year at 55 percent of accrued interest/$0 principal (45 percent of accrued interest deferred)
- 8th year at 70 percent of accrued interest/$0 principal (30 percent of accrued interest deferred)
- 9th year at 85 percent of accrued interest/$0 principal (15 percent of accrued interest deferred)
- 10th–12th years at 100 percent of accrued interest/$0 principal (no accrued interest deferred)
- 13th–19th years at all annual accruing interest plus recovery of equal portions of the previously deferred interest each year
- 20th–34th years at all annual accruing interest plus principal

A portion of the TWDB's ownership is transferred only when the principal portion of the payment begins. *The intent of the schedule is to produce approximately level debt service beginning in the 13th year, but the deferred interest component is recovered prior to the application of payments to principal.*

Although the assistance is not a loan, the purchase requirement is certain as to terms of payment and includes a component of the repurchase cost that includes the interest costs of TWDB's funds in financing the project. These rates are based upon the TWDB's cost of funds for loans at such time as the TWDB's acquisition payment is made to establish its participation in the project. Rates are established by maturity date for each installment closed. The rates are set approximately 45 days prior to installment closing and are based upon the TWDB's true interest cost composite lending rate scale for State Participation bonds. The rate is set in accordance with the TWDB rules governed by Texas Administrative Code Title 31 § 363.33(a).

An administrative cost recovery fee of $0.77 per $100 of State Participation funds provided is assessed for State Participation commitments. The fee will be paid at closing, either in full, or at a minimum of one-third of the fees. If the applicant chooses to pay one-third at closing, the remaining two-thirds may be arranged in two subsequent installments in the first, second, or third years of the commitment. Terms for payment of fees are agreed upon in the individual contracts.

All of the above information regarding the State Participation Program was developed from the TWDB web site under "Financial Assistance." Although this program could be very attractive to fund the project, the State Water Plan Projects identified by the various regions plan to use this fund as well. Since these projects represent over $50 billion in need, the availability of these funds will be extremely limited.

The Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADB) were created in 1993 under a side-agreement to the North American Free Trade Agreement (NAFTA) for the purpose of enhancing the environmental conditions of the US-Mexico border region and advancing the well-being of residents in both nations. The institutions fulfill an essential role in effectively applying bi-national policies and programs that support the sustainable development of environmental infrastructure in the border region. The scope of their mandate and the specific functions of each institution are defined in an agreement between the two governments (the "Charter"), as amended in August 2004. BECC and NADB work closely with other border stakeholders including federal, state, and local agencies, the private-sector and civil society to identify, develop, finance and implement environmental infrastructure projects on both sides of the US-Mexico border. BECC focuses on the technical, environmental, and social aspects of project development, while NADB concentrates on project financing and oversight for project implementation. Both entities offer various types of technical assistance to support the development and long-term sustainability of these projects. Created as interdependent institutions, BECC and NADB function as a team, working with communities and project sponsors in the U.S.-Mexico border region to develop, finance and build affordable and self-sustaining projects that address a human health or environmental need. Within this project development process, each institution is charged with specific responsibilities:

BECC	NADB
Certify the technical feasibility and environmental - health impacts of project	Provide financing for project implementation
Ensure transparency and promote community-based support for project	Offer guidance on financial issues
Provide technical assistance for project development	Provide technical assistance for project development & institutional strengthening

Every project submitted to BECC and NADB must meet the following eligibility requirements:

GEOGRAPHIC JURISDICTION	ELIGIBLE ENVIRONMENTAL SECTORS
Eligible communities must be located:	Potable water supply*
Within 100 kilometers (about 62 miles) north of the international boundary in the four U.S. states of Arizona, California, New Mexico, and Texas; or	Wastewater treatment*
Within 300 kilometers (about 186 miles) south of the border in the six Mexican states of Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas.	Water conservation*
	Municipal solid waste management*
	Air quality improvement
	Clean and renewable energy
	Energy efficiency
	Industrial and hazardous waste
	Public transportation
* Priority sectors	
* Communities beyond these areas may be eligible if they address a transboundary health or environmental issue.	

The purpose of the Technical Assistance and Project Certification Program is to offer technical services and/or financial assistance to help project sponsors effectively implement high-quality project development efforts and achieve certification for their environmental infrastructure projects.

Technical services for each project are provided by a specialized, multi-disciplinary project development team that has the experience to assist a project sponsor with a wide range of needs. These services are provided at no cost by BECC staff; however, the direct participation of the project sponsors in each service task is critical for project success and provides an ideal forum to strengthen their own institutional capacity. In performing any service, BECC staff strives to provide a model for best management practices that can be routinely implemented by the project sponsor in all infrastructure projects.

In addition to providing technical services, the BECC manages two technical assistance grant funds – the Project Development Assistance Program (PDAP) and a special BECC Technical Assistance Fund. These resources enable border communities to undertake initial project development activities, facilitating the detailed technical work necessary to formulate high-quality projects. Sponsors can also utilize the resulting technical product as a tool to determine the resources needed from project stakeholders to implement the project.

The PDAP, supported by the EPA's US-Mexico Border Program, is available for public water and wastewater infrastructure projects identified for funding opportunities through a program-specific prioritization process. BECC, in close coordination with EPA and NADB, conducts the application, evaluation and ranking process for projects applying for technical assistance through PDAP and construction funding through the Border Environment Infrastructure Fund (BEIF) administered by NADB. The objective of this process is to prioritize projects based on the severity of the human health and/or environmental conditions to be addressed by the new or improved water and wastewater infrastructure proposed by the project.

BECC has also established a special Technical Assistance Fund designed to support the development of water and wastewater projects that will not receive PDAP funding, as well as all other BECC-NADB eligible project types. Because these funds are derived from its operations budget, BECC has committed to incorporating cost-saving practices in all of its budget areas in an effort to increase the resources available for this special fund.

BECC works to facilitate projects, conceived by local, state, federal and private-sector sponsors, through an appropriate project development process aligned with its Project Certification Criteria, NADB financing prerequisites, and other applicable regulatory or leveraging source requirements. This well-balanced process evaluates the environmental, technical, financial, and social feasibility of the proposed infrastructure investment and seeks long-term project sustainability for the sponsor, investors and the intended beneficiaries. Once a project sufficiently satisfies these elements, it is presented to the Board of Directors for certification.

The primary objective of NADB is to facilitate financing for the development, execution and operation of environmental infrastructure projects located in the U.S.-Mexico border region and certified by the Border Environment Cooperation Commission (BECC). In accordance with its charter, NADB may provide loans for infrastructure projects with a demonstrable and reasonable assurance of repayment. This webpage outlines the eligibility and evaluation criteria, general financing terms, and procedures for the NADB's Loan Program.

BASIC ELIGIBILITY CRITERIA

Under its charter, NADB is authorized to make loans to both *public* and *private* sector borrowers, operating within the United States and Mexico. Any project, regardless of community size or project cost, is eligible for financing and other forms of assistance from NADB, if it meets all three of the following eligibility criteria:

- The project must be located within 100 km (62 miles) north of the international boundary in the four U.S. states of Texas, New Mexico, Arizona and California or within 300 km (about 186 miles) south of the border in the six Mexican states of Tamaulipas, Nuevo Leon, Coahuila, Chihuahua, Sonora, and Baja California. Projects beyond these areas may be eligible if they remedy a transboundary environmental or health problem, as determined by the BECC-NADB Board of Directors.

- It must remedy an environmental and/or human health problem.

- It must pass through the BECC certification process.

Through its Loan Program, NADB is prepared to finance a portion of the capital costs of a project. Eligible capital costs may include the acquisition of land and buildings; site preparation and development; system design, construction, rehabilitation, and improvements; and the procurement of necessary machinery and equipment.

GENERAL EVALUATION CRITERIA

NADB carefully reviews each project proposal to ensure that the project is technically, environmentally, financially and economically sound; that the project sponsor has the institutional, managerial and structural capability to carry out the project; and that the project meets the standards of the financial community in terms of viability, security, and legal structure. In evaluating a loan application, NADB is primarily concerned with the following factors:

Technical Criteria:

- The project is part of a long-term master plan that promotes the most efficient use of all resources.

- The proposed technology is appropriate and effective.

- The project contains a comprehensive operations and maintenance plan.

Economic Criteria:

- The service area can sustain a sufficient level of user fees or other revenue or income streams to repay the debt.

Financial Criteria:

- There is a demonstrable and reasonable assurance of repayment at the time of funding.
- The project is self-sustaining through user fees or other revenue or income streams in order to repay all debts, cover operations and maintenance costs, and create reserves.

Legal/Regulatory Criteria:

- The project meets all the applicable legal and regulatory requirements of its locality.
- The proposed procurement procedures are fair, reasonable, competitive and transparent.

Sponsor Criteria:

- Project sponsors, borrowers and guarantors must demonstrate their technical, managerial and financial capabilities for carrying out their respective obligations.
- Project sponsors, borrowers or guarantors must have the legal authority to set and increase user fees and rates.

TYPES OF FINANCING AVAILABLE

NADB works closely with project sponsors to structure appropriate and affordable financing packages to meet the specific needs of each community or project. NADB can provide financing in a number of ways, including: direct loans, interim financing and participation in municipal bond issues or as part of a syndicate.

GENERAL FINANCING TERMS

All NADB project financing operations must be structured with a view toward preserving the bank's resources and credit rating for the benefit of current and future border residents. Funding from other sources in the form of grants, equity or cofinancing is required as NADB generally cannot finance more than 85 percent of the eligible costs of a project.

Loan maturities may range up to 25 years, depending on individual project requirements, but cannot exceed the useful life of the project. Grace periods for principal repayment are negotiable and may cover the anticipated project construction and start-up phase. The borrower must maintain the debt coverage ratio set by NADB at the time of funding.

Loans must be paid back in the currency in which they are originally funded. An exchange rate hedging mechanism is available to protect against currency risks, where necessary.

NADB loans must be secured with collateral in the form of project and/or borrower cash flows or other assets. The value of the collateral must be greater than the unpaid balance of the loan. Third-party guaranties may be required to demonstrate a reasonable assurance of repayment or to support collateral requirements.

The terms and conditions of NADB financing will be appropriate to the project financed. In making a loan, NADB must be reimbursed for its expenses, including legal fees and loan supervision costs, as well as receive suitable compensation for its risk.

Interest rates for particular loans are established at loan closing, and payments may be made on a monthly, quarterly or semi-annual basis. NADB generally charges an interest rate that is composed of a base rate plus an administrative margin and a risk exposure spread.

Project sponsors are responsible for the procurement of all goods and services related to the project. However, procurement of goods and services with NADB loans must be carried out in compliance with NADB Procurement Policies and Procedures.

In addition to its loan program, NADB also provides and administers grant financing to help make environmental infrastructure projects more affordable for border communities. Grant financing is currently available through two programs shown below.

Border Environment Infrastructure Fund (BEIF)

Funded by the U.S. Environmental Protection Agency (EPA), this program offers grant financing exclusively for the implementation of high-priority municipal drinking water and wastewater infrastructure projects located within 100 kilometers of the U.S.-Mexico border.

Community Assistance Program (CAP)

Funded with NADB retained earnings, this program offers grant financing to support the implementation of projects sponsored by public entities in all environmental sectors eligible for NADB financing.

Similar to the TWDB EDAP, grant funds are currently very limited from the NADB and BECC. Note that the loan terms for the TWDB DWSRF program are much more favorable under the disadvantaged communities program than the loan terms from the NADB. However, as the project proceeds discussions with the BECC and NADB are recommended to continue to identify and evaluate potential funding sources. Again, both Roma and Starr County are eligible for assistance from BECC and NADB.

Another alternative for financing projects is bond issuance. Water supply corporations provide developers a vehicle for getting their investment back through the sale of bonds, which are repaid with property taxes. Typically the amount of bond issuance is calculated for build-out and the appropriate bonds are issued as the utility develops. Since the majority of the water supply corporations in the Study area are still less than 50% developed, the issuance of bonds for new facilities may still be a viable option in the future.

While water supply corporations have the capacity to issue bonds, a municipality such as the City of Roma, by its very nature, typically enjoys economic advantages over water supply corporations in terms of bond issuance costs and interest charges. That advantage is that interest rates are usually much lower for municipal bonds when compared to water supply corporations or Investor Owned Utilities (IOUs). A prime example of this is the financing for the past improvements at the City's WTP and WWTP.

Another alternative that can be used for financing regionalization projects that affect only a few water supply corporations could be an interlocal agreement between the water supply corporations and the City of Roma to pay for the project in their proportionate shares through a utility fee. If the overall recommended project can be divided into small, local project packages to serve each utility, smaller projects could be financed by this method. However, for larger regional projects such as the constructing a new regional WTP, having the City sponsor the financing would probably be the most cost-effective method of funding.

Conclusions and Summary

TWDB financing is strongly recommended for a new regional WTP and distribution system. The TWDB DWSRF and EDAP Programs should be considered based on their subsidized interest rates and the additional points given to projects that result in consolidation of facilities. It should also be noted that this Study, funded in part by the TWDB, improves the chances of a project making the fundable list. Both BECC and NADB funding should be investigated as well.

The conclusions regarding the funding of regionalization projects are listed below.

- Municipalities can typically issue bonds at lower interest rates than water supply corporations or IOUs.

- Using a City-financed model for the proposed new regional WTP is applicable to the regionalization projects.

- The smaller water distribution projects may be financed via interlocal agreements between the affected water supply corporations.

CONSOLIDATION ALTERNATIVES

The term "regionalization" has political connotations that infer a single, regional authority which is not the intent when the term is used in this Study. The direction and goal for this Study has been to identify win-win consolidation opportunities between the participants that benefit the area in a regional manner. Consequently, as we go forward in the discussion of regionalization, the term "consolidation" is used interchangeably to convey the identification of "win-win projects" that achieve the objectives of this Study.

Regionalization is a general concept that encourages the orderly planning of water facilities and services areas. The goal of regionalization is to limit the number of smaller, less efficient plants by planning larger service areas and larger, more efficient treatment, distribution, storage, and pumping facilities. The Study area has experienced rapid growth during the past 20 years despite the economic conditions that continue to exist today.

The creation of the various WSCs in the region came about as a way to serve the rural areas that were too far away from municipal facilities to be economically served. As way of background, a water supply corporation is a political subdivision of the State of Texas authorized by the Texas Water Code and TCEQ to provide water, wastewater, drainage and other services within the water supply corporation boundaries. Upon creation of the water supply corporation, temporary board members are appointed by the TCEQ as the water supply corporation's interim Board of Directors until an election is held to elect the individual members. Upon election of the Board of Director's the water supply corporation's creation is confirmed and bonds are authorized and establishment of taxing authority for bond repayment is established.

There are advantages of a water supply corporation which are listed below.

- Water Supply Corporations match those who benefit with those who pay.

- Water Supply Corporations allow desirable land away from a city to be developed.

Regionalization can occur in two ways. Proactive regionalization occurs prior to development of an area and involves agreements and contracts between political subdivisions, businesses and property owners. This is the preferred method of regionalization as it allows for pre-development planning and proper sizing of treatment facilities and sites, distribution and storage facilities. Obviously the opportunity for proactive regionalization is lost given the establishment of 2 existing and 1 proposed WTPs and 4 water supply corporations in the Study area alone.

Retroactive regionalization, on the other hand, is consolidation of interim/small facilities at a later date. There are inherent disadvantages to relying on a retroactive approach that are listed below.

- Costly distribution infrastructure (pump stations, transmission mains) may make a regional distribution process cost-prohibitive.
- Agreements and contracts among political subdivisions are much harder to complete once independent service areas are established.
- Sites ideal or suitable for regional facilities may already be developed.
- Determination of an overall rate structure for combined service areas is very difficult to establish once single-service areas and rate schedules have been established. Especially when trying to consolidate an older water supply corporation and a newer water supply corporation that typically has a much higher debt service component.
- There usually is not an economic incentive for consolidation or regionalization after infrastructure is established.

The regionalization of infrastructure was the primary focus of this Study. However, the type of regional authority that could be feasible to implement the regional infrastructure recommendations contained herein was examined. In other words, in addition to just agreement between all parties to implement regional projects, is a single-management authority better for the Study area as opposed to agreements between the City and the WSCs?

The type of entity to promote and implement regionalization can be in the form of the Southmost Regional Water Authority (SRWA) in Cameron County that was created in response to requirements from multiple utilities to develop a secondary water supply, or in the creation of a quasi-governmental organization. It should be noted that neither of these vehicles for the creation of a regional entity are exclusive; there are a variety of methods and forms of agreements that are available. However, by and large the use of an organization similar to the SRWA or a quasi-governmental entity is very common. Brief discussions of the potential for the establishment of an organization such as the SRWA, or a quasi-governmental entity are provided below.

The SRWA was created in the 1990s by six entities (including the City of Brownsville, the Port of Brownsville, Los Fresnos, Rancho Viejo, Indian Lake and the Laguna Madre Water District) that were searching for a regional approach to solving the area's water needs. One such approach is the SRWA Regional Desalination Plant (RDP), which is located east of FM 511 in southern Cameron County. The purpose of the SRWA RDP is to provide treated brackish groundwater for the southern Cameron County region. This project also provides for an alternative water supply source away from the Rio Grande River for the majority of the SRWA partners. The water purchase agreement for the SRWA RDP is based on a "take or pay" system, where each purchasing entity utilizes its "SRWA share" of the RDP production, then utilizes its own individual water supplies to make up its remaining daily demand.

A quasi-governmental entity is not an agency of government; rather it is a hybrid organization that has been assigned by law some of the legal characteristics of both government and the private sector. It should be noted here that there are numerous types of quasi-government including non-profits, research organizations and utilities. The creation of a quasi-governmental entity separate from City government is not new. One of the most well-known examples is the San Antonio Water System (SAWS).

SAWS was created by the City of San Antonio City Council in 1991 to establish a single utility responsible for water, wastewater, storm water, and reuse. This creation involved the consolidation of three City of San Antonio agencies: the City Water Board; the City Wastewater Department; and the Alamo Water Conservation and Reuse District. SAWS is governed by the SAWS Board of Trustees which consists of the Mayor and six members appointed by the San Antonio City Council.

Of significance and applicability to the current situation between the City of Roma and the water supply corporations in the Study area, the consolidation of the San Antonio agencies required the refinancing of $635 million in water and wastewater bonds. Similar to the concept of regional infrastructure, the creation of a quasi-governmental entity could provide a single, autonomous authority to plan and manage future water improvements while conducting the day-to-day operations of providing water services.

While the creation of a single, regional entity sounds appealing, there are a number of factors, not limited to those listed below, that could prevent or severely limit the effectiveness of such an agency.

- In creating a single entity, how do you ensure equal representation among over 5 utilities in the region?
- Will the creation of a quasi-governmental entity require the dissolution of the water supply corporations or simply a legal agreement between the entities?
- How can a utility rate structure be developed fairly that accounts for significant differences between the water supply corporations' current rates and debt service?

- Finally what is the incentive to create a quasi-governmental entity versus the local representation and system familiarity offered by the local water supply corporations?

While the answer for many of the questions listed above would constitute a separate study in and of themselves, an attempt was made to list some of the advantages associated with creating a quasi-governmental entity for the Study area.

- The ability to plan and manage long-term water supply, treatment, distribution, and storage on a regional level through a single authority.

- The ability to manage water treatment and distribution on a regional level through a single authority.

- The ability to take advantage of the City's favorable bond rating and variety of finance options to implement regional water improvements.

- A single rate structure for water services throughout the Study area.

As noted above there are a number of pros and cons associated with the creation of a quasi-governmental entity. Given the current conditions this Study does not recommend that a quasi-governmental entity be established to plan and manage the implementation of regional facilities. Perhaps the creation of a regional quasi-governmental entity will be attractive as the water supply corporations mature and/or the continued operation of the existing corporations leads to a shift in views regarding regional management and infrastructure.

Consequently, the most feasible alternative to implement a single, regional water treatment and conveyance system is to copy the paradigm established by the SRWA - each entity participates but maintains their autonomy via a legal agreement.

Water Treatment & Supply Consolidation

The consolidation of any current water facilities will likely require a specific financial or regulatory driver in the form of stricter regulatory requirements such as lower turbidity requirements in drinking water or enforcement of secondary drinking water standards such as total dissolved solids (TDS), chlorides and/or sulfates. In addition, the historical precedence of insufficient water supply for several of the Study participants shows that the pursuit of a secondary or alternative primary water supply is necessary and a worthwhile investment.

Several past studies throughout the State identified some general impediments to regionalization that are still applicable today for this Study area. These are listed below.

- Regionalization is optional. Currently a regulation does not exist to force regionalization of utilities. Regionalization of infrastructure is encouraged by the regulatory agencies but not required.

- Lack of Financial Incentives. Just as there is not a "stick" to force regionalization, a "carrot" does not exist either to encourage regionalization. For example, if abutting water supply corporations are better off constructing individual plants from a construction cost perspective, there is no mechanism to bridge the financial gap to make regionalization a viable option.

- Individual Control. While costs are important, control is paramount. Generally speaking the number one problem of regionalization involves the fear of losing autonomy, including concerns about loss of control or power by one group or another and not being able to control their own destiny.

- Occupational Resistance. There are numerous professions involved in the industry through the operation and maintenance, billing, engineering, financial and legal services. In addition to resistance to regionalization by a water supply corporation Board due to control reasons, resistance is also encountered from those who work for the water supply corporations. With a reduced number of plants and plant owners through regionalization or consolidation, there may be the perception that the water industry will turn into a "winner take all" system of engineering, financial, legal and maintenance contracts.

Several scenarios were developed to determine anticipated capital and O&M costs for various WTP consolidation scenarios. Given the five participating entities in this Study, there are sixteen potential alternatives for regionalization, which will ultimately take into account anticipated treatment and distribution capital and O&M costs. The regionalization scenarios evaluated in this Study are included in Table 8-2.

Table 8-2
Regionalization Scenarios

Scenario	City of Roma	Falcon Rural WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

Notes
1 - Implementation of any of the scenarios would likely require the construction of a new regional WTP.
2 - Existing WTPs would likely remain online for their respective remaining useful life to serve as a backup to a regional WTP.

Life cycle costs were developed for each WTP with respect to the alternatives discussed in TM No. 3, 4 and 5. The goal was to identify which WTPs were best suited for expansion, rehabilitation or consolidation into an offsite WTP facility, and how best the recommended alternative for each WTP fit in with an overall consolidation scenario.

A total of over 16 scenarios were completed to evaluate capital, O&M and life-cycle costs. The result was surprising in that consolidation to a single regional WTP was the most cost-effective scenario despite the costs for conveying treated water to other service areas. The various methods of analysis and conclusions are discussed in detail in TM No. 3, 4, 5 and 6.

The recommended scenario of consolidating all water treatment to a new regional WTP located in the City of Roma will have its share of challenges for the reasons discussed previously in this section. However, after exhaustive analyses of costs comparisons it is the most cost-effective alternative for the long-term water treatment needs of the Study area.

Conclusions and Summary

By participating in this Study, the City and the water supply corporations have successfully begun implementing the steps needed to secure necessary water supplies for the foreseeable future. There are additional opportunities for regionalization of treatment, storage and pumping, especially as the distribution systems become mature.

The recommendation to establish a new regional WTP within the City of Roma could follow the same model as the SRWA RDP, allowing the various water supply corporations to retain their autonomy. However, the issues of costs to convey treated water, of control and of how costs are apportioned in accordance with utility rates will play a major role in deciding whether or not a regional approach is taken.

One thing is certain – while the two existing WTPs have 10-20 years of life remaining, additional treatment capacity is already needed. In addition, should anything happen to the reliability of the existing wholesale water supply for the remaining water supply corporations, those water supply corporations currently have no other means of supplying their customers with safe drinking water. Therefore, it appears that additional treatment capacity is needed for all of the Study participants. Subtract the time for permitting, design and possible acquisition of land necessary for construction of new treatment capacity, and a decision will have to be made in the very near future on which direction the Study participants will take.

This Technical Memorandum (TM) summarizes the findings of Task XII of the City of Roma Regional Water Planning Study (the Study). The focus of Task XII of the Study is the participation in public meetings to discuss key issues regarding the Study.

Activities in Task XII included the following:

- ✓ Conduct initial project kick-off meeting;
- ✓ Conduct meeting to discuss population projections and associated projected water demands (discussed during 50% meeting);
- ✓ Conduct meeting to discuss regionalization alternatives (discussed during 50% meeting);
- ✓ Conduct Study participant workshops as needed;
- ✓ Conduct TM and Report review meetings as needed;
- ✓ Conduct a final public meeting following direction from TWDB; and
- ✓ Prepare a technical memorandum summarizing the findings.

Meeting No. 1: Kick-Off Presentation

Meeting No. 1 was held on August 18, 2011. This meeting was held at commencement of the project and provided an introduction, presentation of the project goals, and description of the project deliverables. The meeting notice and sign-in sheet are included in this TM. A copy of the PowerPoint slides used in this presentation is included in Appendix D.

CITY COUNCIL

JOSE ALFREDO GUERRA, Jr., *Mayor*
JAIME ESCOBAR, Jr., *Councilman*
RUBEN R. GONZALEZ, *Councilman*
JOSE NOEL SAENZ, *Councilman*
ROBERTO A. SALINAS, *Councilman*
JUAN CARLOS SAENZ, *Councilman*

NOTICE OF REGULAR MEETING
GOVERNING BODY OF THE CITY COUNCIL OF THE
CITY OF ROMA, TEXAS
WEDNESDAY, AUGUST 17, 2011 AT 5:30 P.M.

NOTICE IS HEREBY GIVEN THAT A REGULAR MEETING OF THE CITY COUNCIL OF THE CITY OF ROMA, TEXAS WILL BE HELD ON WEDNESDAY AUGUST 17, 2011 AT 5:30 P.M. AT THE ROMA CITY HALL COUNCIL CHAMBER, 77 CONVENT STREET, ROMA, TEXAS 78584 AT WHICH THE FOLLOWING SUBJECTS WILL BE DISCUSSED TO WIT:

AGENDA

2011-188 Roll call by City Secretary.

2011-189 Invocation and Pledge of Allegiance.

2011-190 Welcome by Mayor Jose Alfredo Guerra, Jr.

2011-191 Open forum.

2011-192 Kick-off Presentation of the Texas Water Development Board-City of Roma Regional Water Plan Study by Enprotec/Hibbs & Todd, Inc.

2011-193 Presentation of the 2011 Certified Appraisal Value by Mrs. Alma Y. Canales, Tax Assessor and Collector for the City of Roma.

2011-194 Presentation of certification of anticipated collection rate for 2011 by Mrs. Alma Y. Canales, Tax Assessor Collector for the City of Roma.

2011-195 Discuss and take possible action on the adoption of Resolution No. 2011-09, a resolution to support and participate in the South Texas Development Council and confirming the appointment of representative from the City of Roma, Texas to serve on the Board of Directors of the South Texas Development Council for the period of October 1, 2011 through September 30, 2012.

2011-196 Discuss and take possible action on membership dues to South Texas Development Council for the period covering October 1, 2011 to September 30, 2012 in the amount of $3,353.40.

P. O. BOX 947 ROMA, TEXAS 78584-0947 956-849-1411 FAX 956-849-3963
The City of Roma is an Equal Opportunity Employer.

2011-197	Discuss and take possible action for proposed amendment of Ordinance No. 2006-05 Subdivision Ordinance, Section 2.8 Street Specifications, A. (1.) minimum width of right-of-way of 60ft. for residential (minor) to 50 ft. for residential (minor).
2011-198	Discuss and take possible action on the appointment of (5) members to a FHAST Form Work Group in the City of Roma for the Texas Department of Housing & Community Affairs (TDHCA).
2011-199	Presentation on the City of Roma 2011-2012 Budget by Mr. Crisanto Salinas, City Manager
2011-200	Status report on City of Roma ongoing projects by Mr. Crisanto Salinas, City Manager.
2011-201	Discuss and take possible action on approval of financial report for month ended July 2011.
2011-202	Discuss and take possible action on approval of accounts payable for month ended July 2011.
2011-203	Discuss and take possible action on approval of minutes from July 13, 2011, July 20, 2011 and August 1, 2011.
2011-204	Meeting adjourn.

Juan Carlos Saenz, Councilman
City of Roma, Texas

Jaime Escobar, Jr., Councilman
City of Roma, Texas

ATTEST:

Robert Escobar, Jr., City Secretary
City of Roma, Texas

I, the undersigned authority, do hereby certify that the above Notice of Meeting of the governing body of the City of Roma is a true and correct copy of said Notice and that I posted a true and correct of said Notice on the bulletin board, in the City Hall of said City of Roma, Texas, a place convenient and readily accessible to the general public at all times, and said Notice was posted on August 12, 2011 at 5:00 p.m. and remained so posted continuously for at least 72 hours preceding the scheduled time of said meeting. Persons with disabilities who plan to attend this meeting and who may need auxiliary aids or services such as interpreters for persons who are deaf or hearing impaired, readers, large print or braille, are requested to contact Mayor Jose Alfredo Guerra, Jr. at (956) 849-1411 three (3) working days prior to the meetings so that appropriate arrangements can be made.

Dated this the 12th day of August, 2011. Robert Escobar, Jr. _[signature]_, City Secretary

THE CITY COUNCIL FOR THE CITY OF ROMA RESERVES THE RIGHT TO RETIRE INTO EXECUTIVE SESSION AT ANY TIME CONCERNING ANY OF THE ITEMS LISTED ON THIS AGENDA, OR FOR ATTORNEY CLIENT CONSULTATION WHENEVER IT IS CONSIDERED NECESSARY AND LEGALLY JUSTIFIED

Wednesday, August 17, 2011 at 5:30 p.m.
Agenda Items 2011-188 through 2011-204

[illegible]
Zeyn Diller
Alma Y Canales
[illegible]
[illegible]
[illegible]
Steve R Salinas Rio Water Supply Co
Keith Cole, eHT
Robert [illegible] Jr.

Meeting No. 2: 50% Completion

Meeting No. 2 was held on January 18, 2012. This meeting was held at 50% completion of the project and provided a summary of the information collected on the existing conditions of the project area and an overview of the regionalization projects that were identified during the Study. The meeting notice and sign-in sheet are included in this TM. A copy of the PowerPoint slides used in this presentation is included in Appendix D.

PUBLIC MEETING NOTICE

Notice is hereby given of a Public Meeting to be held on **Wednesday, January 18th, 2012, at 6:00 p.m.** at: **Roma City Hall, Council Chambers,** 77 Convent Street, Roma, Texas, for the purposes of providing a Status Report at 50% Completion of the proposed City of Roma Regional Water Planning Study funded by the Texas Water Development Board and the City of Roma as follows.

1. **INTRODUCTION OF STUDY OBJECTIVES & DELIVERABLES**
2. **EXISTING CONDITIONS**
3. **DEVELOPMENT OF NEW WATER RIGHTS**
4. **ANTICIPATED GROWTH AND FUTURE WATER DEMANDS**
5. **REGIONALIZATION ALTERNATIVES**
6. **POTENTIAL REGIONALIZATION / CONSOLIDATION PROJECTS**
7. **DISCUSSION**

In compliance with the Americans with Disabilities Act, the City of Roma will provide for reasonable accommodations for persons attending City Council and Public Meetings. To better serve you, requests should be received 24 hours prior to the meetings. Please contact Robert Escobar, Jr., City Secretary, at 956-849-1411.

CERTIFICATION

I certify that a copy of the January 18th, 2012, agenda of the Second Public Meeting for the City of Roma Regional Water Planning Study was posted on the City Hall bulletin board on or before Tuesday, January 13th, 2012 at 5:30 p.m.

Crisanto Salinas, City Manager

P. O. BOX 947 ROMA, TEXAS 78584-0947 956-849-1411 FAX 956-849-3963

CITY OF ROMA

TEXAS WATER DEVELOPMENT BOARD

REGIONAL WATER PLANNING STUDY

50% PUBLIC MEETING

JANUARY 18, 2012

NAME	ORGANIZATION	CONTACT INFO (EMAIL)
Sage Diller	e-HT	(325) 698-5560 sage.diller@e-ht.com
Raul Gonzalez Jr	CRG	rgonzalez@crg.org
Joe Garza	City of Roma	jgarza@cityofroma.net
Josh Berryhill	eHT	joshua.berryhill@e-ht.com
[illegible]		City Council
[illegible]		city manager
Keith Kindle	eHT	(210) 683-6542 keith.kindle@e-ht.com
Aaron Ramos	Falcon Rural WSC	falconwat@yahoo.com
[illegible]	City of Roma	rasalinas@csbroma.com
[illegible]		City Council
Angela Kennedy	TWDB	angela.kennedy@twdb.texas.gov

ENPROTEC / HIBBS TODD, INC.
PROJECT 5788

1/18/12
PAGE 1

Meeting No. 3: Final Public Meeting

Meeting No. 3 was held on September 12, 2012. This meeting was held at 100% completion of the project and provided a summary of the information collected on the existing conditions of the project area, information developed for conditions at the end of the 30-year planning horizon for the Study, and an overview of the regionalization projects that were identified during the Study. The meeting notice and sign-in sheet are included in this TM. A copy of the PowerPoint slides used in this presentation is included in Appendix D.

PUBLIC MEETING NOTICE

Notice is hereby given of a Public Meeting to be held on **Wednesday, September 12th, 2012,** at **5:30 p.m.** at: **Roma City Hall, Council Chambers,** 77 Convent Street, Roma, Texas, for the purposes of providing a presentation of the Final Draft of the proposed City of Roma Regional Water Planning Study funded by the Texas Water Development Board and the City of Roma as follows.

1. **INTRODUCTION OF STUDY OBJECTIVES & DELIVERABLES**
2. **EXISTING CONDITIONS**
3. **DEVELOPMENT OF NEW WATER RIGHTS**
4. **ANTICIPATED GROWTH AND FUTURE WATER DEMANDS**
5. **REGIONALIZATION ALTERNATIVES**
6. **POTENTIAL REGIONALIZATION / CONSOLIDATION PROJECTS AND RECOMMENDED ALTERNATIVES**
7. **DISCUSSION**

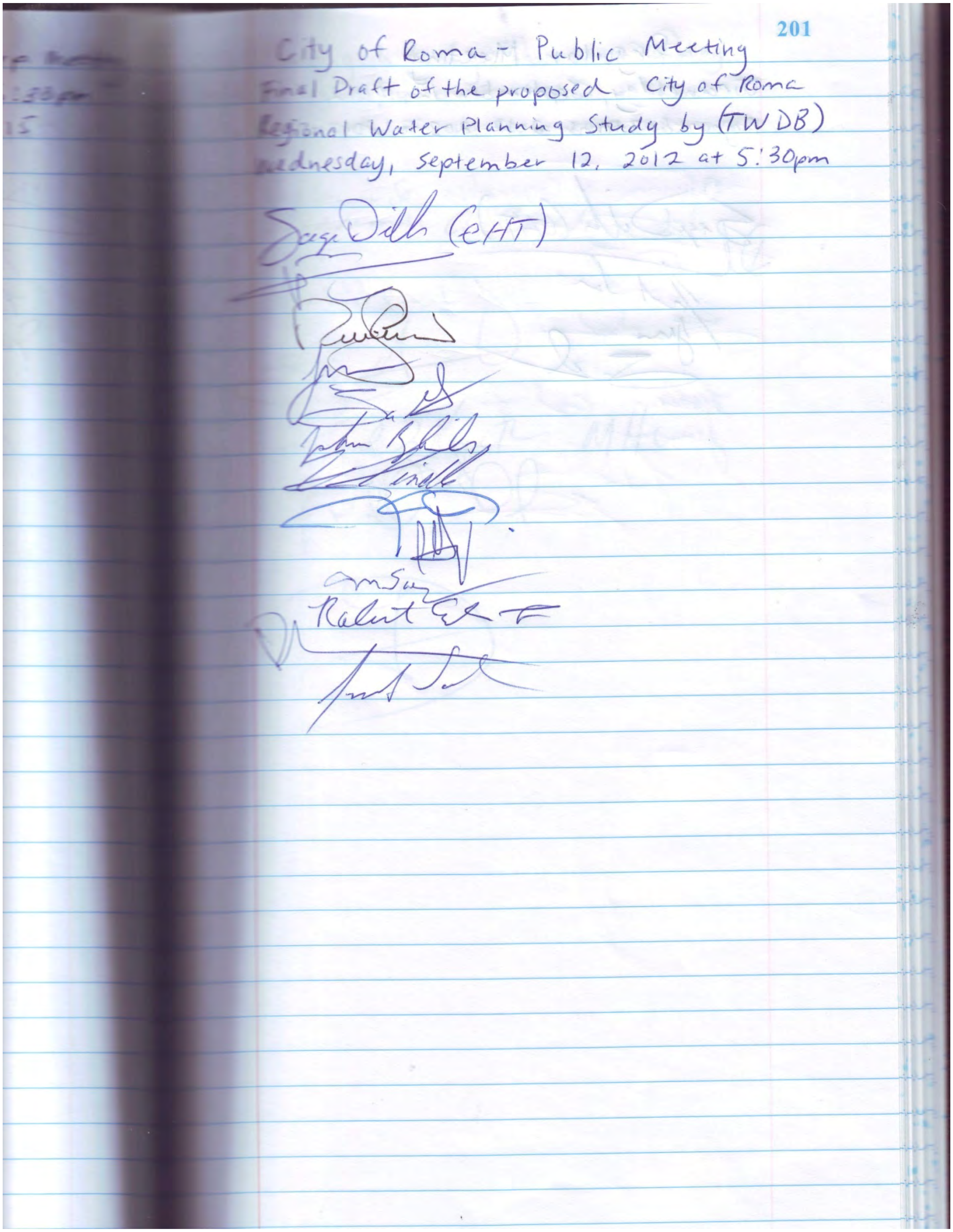
In compliance with the Americans with Disabilities Act, the City of Roma will provide for reasonable accommodations for persons attending City Council and Public Meetings. To better serve you, requests should be received 24 hours prior to the meetings. Please contact Robert Escobar, Jr., City Secretary, at 956-849-1411.

CERTIFICATION

I certify that a copy of the September 12th, 2012, agenda of the Third Public Meeting for the City of Roma Regional Water Planning Study was posted on the City Hall bulletin board on or before Friday, August 24th, 2012 at 5:30 p.m.

Crisanto Salinas, City Manager
City of Roma, Texas

P. O. BOX 947 ROMA, TEXAS 78584-0947 956-849-1411 FAX 956-849-3963



201

City of Roma - Public Meeting
Final Draft of the proposed City of Roma
Regional Water Planning Study by (TWDB)
Wednesday, September 12, 2012 at 5:30pm

This Technical Memorandum (TM) summarizes the findings of Task XI of the City of Roma Regional Water Planning Study (the Study). The focus of Task XI of the Study is the development of an environmental assessment of the proposed project as recommended in earlier TMs in the Study.

Activities in Task XI included the following:

- ✓ Describe environmental setting of the proposed project area(s);
- ✓ Identify potential geologic, wetland and flooding compliance issues with proposed project;
- ✓ Identify potential ecological and socioeconomic impacts as a result of proposed project;
- ✓ Identify necessary coordination required to adequately address potential environmental issues during design and construction of proposed project; and
- ✓ Prepare a technical memorandum summarizing the findings.

ENVIRONMENTAL SETTING

The Study Area is located in Starr County along the Rio Grande River in the southwest part of Texas. The land use for the majority of the Study Area is in agricultural use, however the land use within the City of Roma is primarily residential. The terrain is level to gently sloping toward the Rio Grande River. Elevations range from 150 feet above mean sea elevation (ft-msl) to 400 ft-msl. The average rainfall is 22 inches. The Study Area drains toward the Rio Grande River by a network of creeks including Arroyo Roma, Los Negros Creek, Arroyo los Morenos, Arroyo Grande, Arroyo Garceño, and Arroyo Quiote. The area around WTP Site Alternative #1, the proposed North WTP site, is drained by an unnamed segment of Arroyo Roma. WTP Site Alternative #2, the proposed Downtown WTP site, drains directly into the Rio Grande River. The Gulf of Mexico is located approximately 120 miles east of the Study Area. Exhibit 1-1 and Exhibit 1-2 provide the location of the Study Area. A US Geological Survey Topographic Map showing the two proposed WTP sites is found in the attached Appendix, and aerial photos of each alternative WTP location are provided as Exhibit 3-4 and Exhibit 3-5.

GEOLOGICAL ELEMENTS

The geologic units within the Study Area range in age from Oligocene to Holocene. From oldest to youngest, they are Frio Clay, Catahoula Tuff or Sandstone, Oakville Sandstone, Fleming Formation, Goliad Sand, Willis Sand, Lissie Formation including Bentley Formation and Montgomery Formation, Beaumont Clay, and Quaternary Alluvium. These units generally consist of alternating beds of sand, gravel, clay, and silt. The Catahoula Tuff or Sandstone outcrop in the Study Area. One or more of the geological units may be absent at any specific project location due to non-deposition or erosion.

The Geologic Atlas Map of the Study Area along with the key are included in the Appendix. This map indicates the presence of the Jackson Group at both the proposed alternative WTP site locations. In addition, Uvalde Gravel is present at the WTP Site Alternative #1 North WTP site.

Soils Maps for the two potential WTP sites are found within the Soil Reports in the Appendix. The soils within the Study Area are sandy loams and clay loams. A summary of the soil types at each WTP alternative site is presented in Table 10-1.

Table 10-1
Soils Summary

Proposed Construction Location	Soil Classifications	Soil Descriptions
Alternative #1 Proposed North WTP Site	Cp, Ga, Jq	Copita fine sandy loam, 0-3% slopes; Garceno clay loam, 0-1% slopes; Jimenez-Quemado association, 3-8% slopes
Alternative #2 Proposed Downtown WTP Site	Cp, Jq	Copita fine sandy loam, 0-3% slopes; Jimenez-Quemado association, 3-8% slopes

HYDROLOGICAL ELEMENTS

The hydrologic units within the Study Area include one major aquifer (the Gulf Coast Aquifer) and the Yegua-Jackson minor aquifer. The Gulf Coast aquifer exists in an irregular band along the Texas coast from the Texas-Louisiana border to Mexico. Historically, the Gulf Coast aquifer has been used to supply varying quantities of water in Cameron, Hidalgo, Jim Hogg, eastern Starr, southeastern Webb, and southern Willacy counties. The Gulf Coast aquifer consists of interbedded clays, silts, sands, and gravels, which are hydrologically connected to form a leaky aquifer system. The underlying confining unit is the Catahoula; above the Catahoula is the Jasper aquifer located within the Oakville Sandstone; the Evangeline aquifer contained within the Fleming and Goliad sands is separated from the Jasper by the Burkeville confining layer; and the uppermost aquifer—the Chicot—consists within Willis Sands, Lissie Formations including Bentley and Montgomery, Beaumont Clays, and overlying alluvial deposits. In the Rio Grande Valley, these overlying alluvial deposits include portions of the Rio Grande alluvium.

The Yegua-Jackson minor aquifer extends in a narrow band from the Rio Grande and Mexico across Texas to the Sabine River and Louisiana. In the Rio Grande Valley, the Yegua-Jackson aquifer extends in a narrow band from the Rio Grande through Starr, Zapata, and Webb counties. The Yegua-Jackson aquifer consists of complex associations of sand, silt, and clay deposited during the Tertiary Period. Net sand thickness is generally less than 200 feet at any location within the aquifer. An in-depth discussion of these hydrologic units is found in TM No. 2 under the "Development of Brackish Groundwater" Section.

FLOODPLAINS AND WETLANDS

Maps of the two proposed WTP locations are overlaid on Flood Insurance Rate Maps and on National Wetlands Inventory Maps (see the Appendix). Summaries of the floodplain zones and impacted wetland designations for the alternative WTP site locations are presented in Table 10-2.

Table 10-2
Floodplains & Wetland Summary

Proposed Option	Floodplain Zone	Impacted Wetland Designation
Alternative #1 Proposed North WTP Site	None	PFO3Jh, PUSAh
Alternative #2 Proposed Downtown WTP Site	None	None

Wetlands Legend Key – Included in Appendix

The United States Army Corps of Engineers (USACE) reviews proposed construction projects in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors act of 1899. Under Section 404, the USACE regulates the discharge of dredged and fill material into waters of the United States, including wetlands. Under Section 10, the USACE regulates any work in, or affecting, navigable waters of the Unites States. Any selected water infrastructure improvement project involving construction must be submitted to the USACE for review. The USACE will review the project and will provide a determination of the type of permit required, if any. In addition, the USACE addresses the project's affects on threatened and endangered species within the Study Area.

The Study Area is located within the USACE Galveston District. In addition to the standard permit review as described above, the Galveston District will determine if stream mitigation requirements are applicable for a selected proposed project location. Stream mitigation requirements may apply when direct impacts occur within the stream bed of a water of the United States. For any selected project, the design should avoid and minimize project impacts to aquatic resources.

An additional regulatory agency for floodplain environmental consideration is the International Boundary & Water Commission (IBWC). The IBWC is charged with restoring and preserving the character of the Rio Grande River as the international boundary where that character has been lost, to minimize changes in the channel, and to resolve problems of sovereignty that might arise. Major functions of the IBWC include the coordination of leases, licenses, and permits for activities in the IBWC right-of-way at the US-Mexico Border or on IBWC-maintained floodways. Development of a new raw water pump station on the Rio Grande River and development of a new raw water reservoir in proximity to the Rio Grande River will both likely require extensive coordination with IBWC prior to completion of design.

COASTAL ZONES

The Study Area is located within Starr County; therefore, no proposed water infrastructure improvements are located within the Texas Coastal facility designation line as defined by the Texas Coastal Management Program. The Texas Coastal facility designation line only extends into Cameron County along the Rio Grande River.

CLIMATIC ELEMENTS

The climate in the Study Area is subhumid, subtropical. The temperatures range from an average high of 99° F in July to an average low of 44° F in January. Rainfall averages 22 inches annually in the Study Area. Rainfall amounts are fairly consistent each month throughout the year. Prevailing winds are from the south and southeast. The average wind speeds are from 12 to 16 knots.

The air quality in the Study Area is generally good. The EPA has provided a scale called the Air Quality Index (AQI) for rating air quality. This scale is based on the National Ambient Air Quality Standards and is described in 40 Code of Federal Regulations (CFR), Part 58, Appendix G. Starr County does not have an air quality monitoring station. However, Webb County and Hidalgo Counties have air quality monitor stations. Based on comparisons of the available surrounding county data, the annual AQI is generally good (0 to 50) in Starr County.

BIOLOGICAL ELEMENTS

Biological elements of concern may be present within the Study Area. In accordance with the Texas Parks & Wildlife Department (TPWD) form PWD1059, early project coordination is accomplished by review of county-level database and by requesting preliminary project review through the Texas Natural Diversity Database (TXNDD) in lieu of submitting a Project Review form or letter request. A preliminary project review data request through TXNDD and their response are included in the Appendix. The first page of the TXDD response, dated April 19, 2012, indicates that the Study Area contains known ecologically significant stream segments and federal designated critical habitat for the Zapata bladderpod.

The ecologically known stream segment within the Study Area is the Rio Grande River. The Texas Parks & Wildlife website, Water Planning Data for Region M[1], indicates that the Rio Grande River is an ecologically significant river from the confluence with the Gulf of Mexico in Cameron County upstream to Falcon Dam in Starr County (TNRCC classified stream segments 2301 and 2302). The Rio Grande River provides priority bottomland habitat with extensive freshwater and estuarine wetland habitats. This resource area is

[1] http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/regionm.phtml

managed through the Las Palomas Wildlife Management Area – Lower Rio Grande Valley Units.

Occurrence records for the Zapata bladderpod within the Study Area are found in the attached element occurrence records from the TXNDD on pages 23, 49, 53, 55, 58, 60, and 62. The Zapata bladderpod (*Lesquerella thamnophila*) is a long bright, yellow-petaled perennial. The sprawling branched stems grow up to 34 inches in length with linear to elliptical leaves. The plant usually flowers from February to April depending on the amount of rainfall. The Zapata bladderpod occurs in thorny shrublands with graveled to sandy loam soil types underlain by sandstone.

If a rare plant or animal is observed on-site, the attached TXNDD form should be completed and submitted to the Texas Parks and Wildlife Department.

The TXNDD also references general considerations, each of which are discussed in relation to this Study as follows:

- The Study Area is not located in Travis, Williams, or Bexar County.
- Neither the Bald Eagle nor colonial waterbirds are listed as a species of concern on the TXNDD report.
- The Study does not include construction of a communication tower.
- The Study does not involve wind energy.
- The TXNDD report does not list the Texas trailing phlox.

Additional rare species may be present within the Study Area. The Texas Parks and Wildlife Department's website[2] is the source for the current Starr County lists for rare species. County-listed species include amphibians, birds, fishes, insects, mammals, mollusks, reptiles, and plants. The descriptions of each potential species within the Study Area are found in the Appendix. The U.S. Fish and Wildlife Services' (USFWS) Information, Planning, and Conservation system provides data for additional considerations such as threatened and endangered species, migratory birds, National Refuge lands, and the management of invasive species within the Study Area. The USFWS indicates that endangered species may be present in Starr County. Site-specific endangered species information is not available at the planning level without conducting a site biological survey. The following are the federally-listed species in Starr County: Ashy dogweed, Gulf Coast jaguarondi, Johnston's frankenia, Least tern, Mountain plover, Ocelot, Star cactus, Walker's manioc, and Zapata bladderpod. The Zapato baldderpod is described above.

Ashy dogweed (*Thymophylla tephroleuca*) is an herbaceous perennial wildflower that grows almost one foot tall and is generally circular in shape. Its ashy, grayish-green color of the stems and very thin leaves are covered with woolly white hairs which are responsible for the

[2] http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species

distinctive color. The daisy-like flowers have bright, golden yellow "petals" with a yellow center about the size of a penny. Ashy dogweed is restricted to sandy pockets of Maverick-Catarina, Copita-Zapata, and Nueces-Comita soils of southern Webb and northern Zapata counties. Historically, ashy dogweed was found in Starr County, but it has not been seen there since 1932. Ashy dogweed has been observed in areas where the ground has been disturbed and on nondisturbed sites.

The Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*) is the rarest wildcat in Texas. It is typically slightly larger than a domestic cat with an appearance more like a large weasel or otter. Its body is long and low with short legs. Its small, flattened head has weasel-like ears and narrow brown eyes. The Gulf Coast Jaguarundi is uniform in color with a dark gray-brown to chestnut brown coat. Little is known about the habitat of Jaguarundis in Texas, although it is thought that they occur in the dense thorny shrublands of the Rio Grande Valley.

Johnston's frankenia (*Frankenia johnstonii*) is a grayish-green or bluish-green, spineless, salt-loving shrub. It growns one to two feet wide and is round in shape. It has very small, oblong leaves with margins that curl under. The underside of the leaf is lighter in color due to small, dense, grayish-white hairs that are barely visible with the naked eye. Salt crystals are often visible on the underside of the leaves. From November through February, Johnston's frankenia turns from grayish-green to its autumn color, crimson red. During this red phase, when many other south Texas shrubs have lost their leaves, these endangered plants are easy to detect. The Johnston's frankenia is found in highly saline soils, often rocky or eroding and reddish in color, generally associated with the Maverick soil series.

Least terns (*Sterna antillarum*) are the smallest member of the gull and tern family at approximately 9" in length. Terns will dive into the water for small fish. Its body is predominately gray and white with black streaking on the head. Least terns have a forked tail and narrow pointed wings. Least terns less than a year old have less distinctive black streaking on the head and less of a forked tail.
The mountain plover *(Charadrius montanus)* is a migratory bird slightly smaller than an American robin and is native to short-grass prairie and shrub-steppe landscapes. The mountain plover is light brown above, with a lighter-colored breast. During the breeding season, it has a white forehead and a dark line between the beak and eye which contrasts with the dark crown. It breeds in the western Great Plains and Rocky Mountain States, although some breeding occurs in Texas. Mountain plovers winter mostly in California, southern Arizona, Texas and Mexico. Unlike other plovers, mountain plovers are not found near water, and will only inhabit areas with sparse vegetation or bare ground.

The ocelot (*Felis pardalis*) is a nocturnal small, spotted cat with grayish to cinnamon back, paler sides, whitish underparts and inside limbs, dark streaks that run obliquely down the sides, and two black stripes on each cheek. Young ocelots are darker than adults. The ocelot's tail is about half the length of its head and body. The ocelot's habit is generally dense, almost impenetrable thickets in Texas.

The Star Cactus *(Astrophytum asterias)* is a flat to low dome-shaped, spineless cactus that blooms from March through May and fruits from April through June. It grows two to six inches in diameter and less than two and a half inches tall. In Texas, it is now limited to one site along a creek drainage in Starr County.

Walker's manioc *(Manihot walkerae)* is a profusely branching, perennial herb with five-lobed leaves that grows up to 6 feet tall from a carrot-like root. It flowers from April to September and thrives in open areas within native brush in sandy loam with underlying caliche layers.

As the project moves forward, precautions must be taken during any construction activity to avoid impacts to rare species or habitats, natural plant communities, or special features should they be present. Riparian habitats, including arroyos, in the Study Area provide valuable habitat for many wildlife species and are frequently used as travel corridors. Loss and fragmentation of these travel corridors can inhibit the movement of these species between food, cover, and breeding locations. Impacts to riparian vegetation and aquatic habitat at water crossings should be avoided by boring under waterways when allowable. Staging areas during construction should be located outside of the riparian corridors. Once project locations are selected and design is initiated, the Texas Parks and Wildlife Department must be contacted prior to initiating any proposed projects for up-to-date information and project construction considerations. Updated species lists should be reviewed and a wildlife habitat assessment should be processed to obtain current project-specific mitigation measure recommendations.

For Alternative #1 (Proposed North WTP Site), TM No. 3 recommends purchase of the additional private property highlighted in yellow on Exhibit 3-4 to ensure sufficient space for constructing future WTP expansions. In some cases, biological mitigation measures restrict the use or times of use on a construction site; therefore, during the purchase negotiations, biological resources, along with cultural resources (discussed in the following section), should be evaluated by conducting a biological survey of the entire proposed WTP site during a contingency period of a property purchase.

Although Alternative #2 is on disturbed land, it is recommended that the biological survey include that tract of land since the survey costs for an additional small tract of land during a local survey are significantly lower than an independently-scheduled survey due to single mobilization and combined reporting costs. Any other proposed construction areas may be included within the same biological survey to cover all proposed construction locations.

As the project moves into construction, precautions must be taken during any construction activity to avoid impacts to rare species or habitats, natural plant communities, or special features should they be present.

Environmental receptors within the Study Area were reviewed by using topographic maps and by consulting the TXNDD results. Types of environmental receptors include national or state parks, forests, and monuments; officially designated wildlife sanctuaries, preserves or refuges; and Federal wilderness areas. There are no state-designated or federally-designated environmental receptors in the Study Area.

CULTURAL RESOURCES

In the preliminary planning stages of a project, identification of historic and prehistoric resources is generally not recommended since the Texas Historical Commission (THC) may require an archeological survey of the specific project area to be conducted if no survey has been conducted for the proposed sites. However due to the rich, diverse cultural history of the Study Area, early consideration of the cultural resources is recommended.

The Alternative #1 North WTP Site is located west of the Roel and Celia Saenz Elementary School on undisturbed land. TM No. 3 proposes acquisition of the strip of land east of the City-owned piece (see Exhibit 3-4.) In some cases, portions of a proposed WTP site may need to be excluded from construction due to archaeological investigations; therefore, an archaeological survey is recommended to be conducted for the tract proposed to be acquired in conjunction with surveys of the City-owned tract as part of a contingency purchase agreement with the current land owner. Any other proposed construction areas may be included within the same archeological survey to cover all proposed construction locations. However, the archeological and biological surveys are not generally conducted at the same time or by the same consultants.

As stated in TM No. 3, the entire City block at the Alternative #2 (Downtown WTP Site) entire is located within the City of Roma's Historical Landmark District that was identified in 1993. The level of improvements allowed depends on each property's historical designation. As determined through coordination with the National Park Service (NPS), the Roma Historical Landmark District is currently identified as a collection of National Register of Historic Places (NRHP) properties under the NPS National Register of Historic Places.[3] NRHP is a federal program administered in Texas by the THC in coordination with the NPS. Listing in the NPS National Register provides national recognition of a property's historical or architectural significance and denotes that it is worthy of preservation[4].

While the NRHP designation for the Roma Historical Landmark District is the highest historical designation for the property, there is no review process for changes. Any conceptual improvements to the site will need to be coordinated with THC as soon as possible to determine feasibility of completing the conceptual improvements.

[3] National Park Service, National Register of Historic Places
[4] Texas Historical Commission, Historical Designations

ECONOMIC CONDITIONS

The Study Area is located in one of the most economically distressed counties in Texas. The average residential household income is $24,500. As a result, approximately 39% of the population is below the poverty level. The unemployment rate is very high in Starr County at 18% as compared to the State average of 7%. The population in Study Area is 95% Hispanic with over 96% of the population speaking a language other than English at home. Approximately 49% of the adult population graduate from high school as compared with the state average of 79% and only 10% of those graduating in Starr County have a bachelor's degree or higher compared with the average rate of 25.4% in Texas. Due to these economic conditions, significant grants may be required for affordability.

Current and projected population counts are found in Table 10-3. The comparisons among population numbers from the various sources of population data researched for this Study are presented in Table 10-4. The detailed basis for the population estimates is found in TM No. 1.

Table 10-3*
Current and Projected Population Counts

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	18,467	19,852	21,341	22,941	24,662	26,512	28,500	37,050
Falcon Rural WSC	2,600	2,860	3,146	3,461	3,807	4,187	4,606	6,448
El Sauz WSC	1,510	1,687	1,886	2,107	2,355	2,632	2,941	4,323
El Tanque WSC	1,950	2,179	2,435	2,721	3,041	3,398	3,798	5,583
Rio WSC	3,900	4,366	4,888	5,472	6,126	6,858	7,677	11,347
Total Projected Population	**28,427**	**30,945**	**33,696**	**36,703**	**39,990**	**43,587**	**47,522**	**64,751**

* Excerpted directly from TM No. 1, Table 1-7

Table 10-4 *
Comparison of Population Estimates

Population Source	2010	2015	2020	2025	2030	2035	2040
TWDB Population Estimate [1]	14,931	N/A	17,659	N/A	20,482	N/A	23,341
Study Population Estimates [2]	28,427	30,945	33,696	36,703	39,990	43,587	47,522
2010 Census Count	19,725						
Notes							
1 - TWDB Population Estimates were taken from the 2011 Regional Water Plan for Region M. Available online at http://www.twdb.state.tx.us/wrpi/rwp/rwp.asp. Population not listed individually for Falcon WSC, El Sauz WSC and El Tanque WSC.							
2 - Population estimates developed from current utility data and TCEQ WUD data.							

* Excerpted directly from TM No. 1, Table 1-8

Household population density factors in the Study Area range from as low as 2.13 people per household for Falcon WSC to as high as 4.08 for El Sauz WSC, with an average of roughly 3.1. The Study Area annual average projected growth rate is 2.1%.

LAND USE

The Study Area includes residential and commercial areas. The current land uses for the two proposed alternative WTP locations are listed in Table 10-5.

Table 10-5
Land Use Summary

Proposed WTP Location	Current Land Use	Anticipated Land Use
Alternative #1 Proposed North WTP Site	Directly west of the Roel and Celia Saenz Elementary School on undeveloped land.	No change anticipated
Alternative #2 Proposed Downtown WTP Site	Built out historic/commercial corridor bordered by residential dwellings.	No change anticipated

SITE ASSESSMENT

In the planning stages of project selection, a site assessment is not generally recommended. However, when land acquisitions are being evaluated, a site assessment is strongly recommended as part of the land acquisition contingency along with the cultural resource and biological resources surveys. An initial site assessment may be required to assess the potential for hazardous materials contamination on any property being acquired or constructed upon as a part of the project that may result in liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). A Phase I Environmental Site Assessment is generally recommended prior to land acquisitions. The Phase I should be conducted according to current American Society of Testing and Materials (ASTM) standards. The assessment documents existing and prior uses of the site and includes a survey for unusual soil discoloration, vegetation anomalies, and odors from the property and adjacent properties. If the initial assessment indicates a potential for hazardous material contamination, more detailed environmental sites assessments should be conducted according to current ASTM standards.

OTHER PROGRAMS AND PROJECTS

Due to proposed construction in the Study Area of a major loop or bypass road for US Hwy 83 beginning east of Rio Grande City and extending north of the City of Roma, consultation with the local Texas Department of Transportation (TxDOT) branch (Pharr Office) is recommended for any proposed construction during the preliminary design phase. Coordination with TxDOT will ensure a cohesive construction timeline.

FUTURE ENVIRONMENT WITHOUT PROJECT OPTIONS

Both proposed WTP locations provide a significant degree of water infrastructure improvement. The future environment without a new WTP will perpetuate the existing water system shortfalls and restrict future growth. Long-term impacts may include additional compliance issues which may compromise the public's health and safety due to lack of sufficient infrastructure.

POTENTIAL IMPACTS TO SOCIAL, ECONOMIC AND ENVIRONMENTAL RESOURCES

DIRECT AND INDIRECT IMPACTS TO SOCIAL RESOURCES

Social issues involved with proposed projects within this Study Area are likely to be both positive and negative. Social resources should be closely monitored during the WTP proposal process. Public sentiment for the Alternative #1 proposed North WTP site may be negative due to its location just west of the Roel and Celia Saenz Elementary School. Care must be taken to ensure adequate protection for children from exposure to water treatment chemicals and plant processes. While design of the WTP can address safety issues, City parents and residents may find the proposal unsettling. Alternative #2, Downtown WTP site has its own set of issues related to public sentiment. With the City's rich cultural history, City residents may not feel that adaptive reuse of the existing historical buildings is the best solution for extending the life of the existing buildings. For either alternative WTP location, it is critical to incorporate City resident input in the early planning stages and to gain buy-in from residents on the recommended project and location.

An additional negative social impact will be the inconveniences to the public caused by the water system improvements. Temporary street closures, dust and dirt caused by construction, and increased noise and traffic from construction vehicles and equipment are typical problems associated with these types of projects. These inconveniences can be addressed by rerouting traffic away from the working areas. Dirt and dust can be controlled by timely applications of water. In addition, the contractors should be requested to obtain a Texas Pollution Discharge Elimination System (TPDES) Stormwater Construction permit. Compliance with the TPDES permit will limit, if not eliminate, potential pollutants such as sediments from entering area water courses. Noise from construction will be temporary. Properly equipped and functioning equipment will reduce the amount of noise generated by the construction equipment. In addition, no night work is anticipated; therefore, noise should not be a significant issue.

The main indirect impact to social resources will be the ability for the Study Area to expand and grow. The water system improvements will provide adequate, compliant water services for the current users, as well as future users throughout the Study Area.

DIRECT AND INDIRECT IMPACTS TO ECONOMIC RESOURCES

As funding sources are researched, the economic impacts should be considered. Generally, the impacts to economic resources occur when a utility rate increase is proposed to offset project costs. One of the goals in this project is to develop a project phasing or implementation plan such that both the project capital costs (including construction and non-construction costs) and the annual operating costs (for both treatment and distribution of drinking water) can be offset by existing utility rates without rate increases.

DIRECT AND INDIRECT IMPACTS TO ENVIRONMENTAL RESOURCES

Alterations to Land Forms, Streams, and Natural Drainage Patterns: The proposed construction activities will temporarily alter the landform during construction and may create a short-term modification to natural drainage. These impacts will be short-term, as the terrain should be compacted and restored to preconstruction contours on the same day as placement. There should be no indirect impacts to landforms from the water infrastructure improvements.

There should no direct impacts to the Rio Grande River or the unnamed tributaries to Arroyo Roma (near Alternative #1 Proposed North WTP Site). If water system improvements include water course crossings, boring under the water courses is recommended. The indirect impact of boring the line as opposed to installing the line by the cut and fill methods will prevent the temporary disturbance of the water course channels and should allow the activities to be permitted under the USACE Nation-Wide Permitting (NWP) program. The boring method will not temporarily or permanently alter the water course contours or drainage patterns.

An indirect impact of boring the line as opposed to installing it by the cut and fill method is that it is more expensive.

Erosion Control Measures: In accordance with Section 402 of the Clean Water Act and Chapter 26 of the Texas Water Code and as further defined in the TPDES General Permit TXR150000, construction permit(s) for storm water discharges associated with construction activities will be required. The permit should be obtained by the contractor. The permit will require the project owner and the contractor to prepare a Storm Water Pollution Prevention Plan which identifies potential sources of water contamination and preventative measures to be taken during and after project construction. Compliance with this regulation will minimize the impacts of erosion during and after construction.

Siltation and Sedimentation of Waterways: There should be no direct impact to waterways by siltation or sedimentation. Any waterway crossings should be performed by boring beneath the water way channels. Utility line trenches should be covered daily following pipe installation. Re-vegetation of the soils following reclamation of the affected areas will reduce sedimentation and siltation.

Effects of Dredging, Tunneling and Trenching on Area Water Courses: No proposed construction involves dredging of water courses. Any boring of the lines under a waterway will generate excess soil. This soil should be removed from the project site to an approved location away from other area waterways. There will be no direct or indirect impacts to the water courses by tunneling or trenching. Line installations away from water courses, including arroyos, may be trenched. In an effort to preserve top soil, the upper 6-inches of soil should be removed and stockpiled during trenching. The backfill should be redressed with the topsoil after the line has been placed to enhance re-vegetation and thus, controlling erosion.

Precaution to Avoid Injury to Cover Vegetation: Line installations should be installed within or adjacent to existing right-of-ways. Within developed areas, the direct impact to vegetation will be minimal. However, in undeveloped areas and areas outside of existing right-of-ways, existing vegetation require mitigation during construction. Potential impacts include trees which are generally located within riparian corridors. The vegetation provides valuable habitat for many wildlife species and are frequently used as travel corridors. Loss and fragmentation of these travel corridors can inhibit the movement of these species between food sources, cover and breeding locations. Therefore, in an effort to preserve these habitats, impacts to riparian vegetation should be minimized by boring under waterways and locating staging areas for boring equipment outside of the riparian corridors. Unavoidable impacts to woody vegetation should be mitigated by replacing native trees removed during construction. A replacement ratio of three trees for each tree lost is the current rule of thumb. A maintenance plan should be developed as part of the design to ensure an 80% survival rate for the first two years.

Re-vegetation of disturbed areas and landscaping within developed areas should use only site-specific native plant species. Coordination with the Natural Resource Conservation Service will identify native plant species needed for re-vegetation of disturbed and developed areas.

404 Requirements: The Galveston District of the USACE should be contacted to review selected project to determine permitting requirements under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Rare and Protected Species: The USFWS, TPWD and USACE should be contacted to review selected the project for potential impacts to Federally- and State-listed species which could occur within the project area.

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROJECTS BE IMPLEMENTED

Adverse impacts which cannot be avoided should the projects be implemented will be the activities associated with the installation of the water infrastructure improvements. Equipment noise, dust emissions, and the disruption and rerouting of traffic during construction will be the primary adverse affects of proceeding with any of the construction projects. Some land clearing will be necessary at some project locations and along water line corridors. Land clearing will be minimal and restricted to the minimum requirements for WTP site operations and the line corridor and right-of-way.

The nature of the project, plant sites and utility alignment preclude the need for extensive cutting. If certain construction operations produce excessive temporary noise levels impairing the normal activities of individuals or businesses in the area, the contractor will have to take reasonable actions to minimize construction noise through abatement measures such as work controls and maintenance of equipment muffler systems. Excessive dust will be controlled during construction with timely applications of water, as necessary. The volume of construction related traffic in the majority of the construction area is expected to be minor and should not cause a significant disruption of traffic patterns. Traffic plans for these high traffic areas should be prepared to minimize impacts on the traffic flow during construction.

TRADE OFFS BETWEEN SHORT TERM ENVIRONMENTAL LOSSES AND LONG TERM GAINS OR VICE VERSA

Construction of the proposed water improvements can be considered a short-term use of the environment during which energy and labor are expended and the community may be slightly inconvenienced by noise and/or construction traffic. This short-term usage of the environment is expected to enhance and maintain long-term productivity in the Study Area by continuing to provide adequate, efficient, and compliant water utility services and facilities to meet the needs of the community.

The primary long-term environmental gain from any of the proposed WTP regionalization projects ensures the continued viability of water resources throughout the Study Area.

FUTURE OF THE ENVIRONMENT WITHOUT PROPOSED PROJECTS

All proposed construction including either proposed alternative WTP location provides a significant degree of water infrastructure improvement. The future environment without any water improvements will restrict growth and perpetuate the existing water utility shortfalls. Long-term impacts may include potential compliance issues which may compromise the public's health and safety due to lack of modern infrastructure.

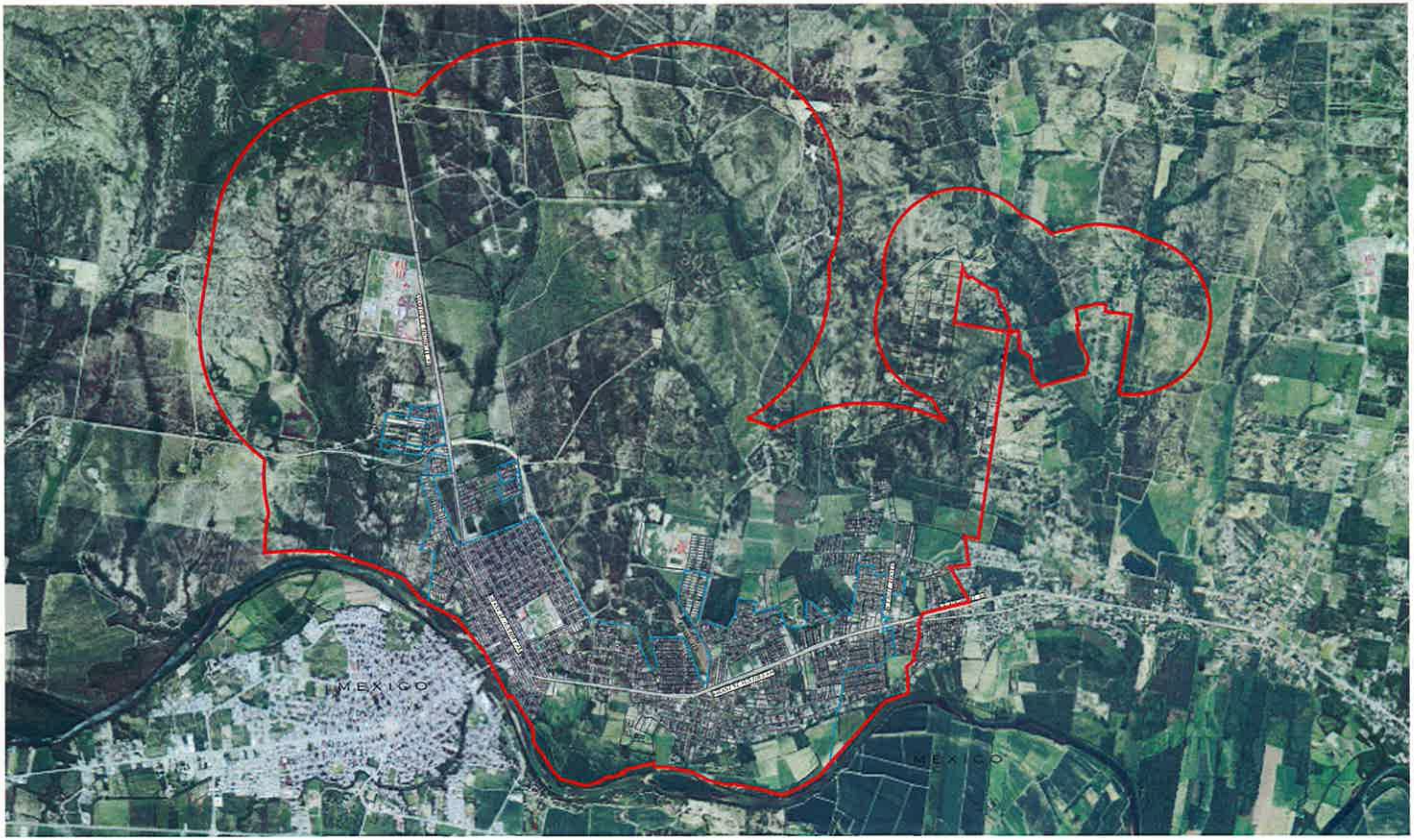
List of Acronyms and Abbreviations

AQI	Air Quality Index
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
eHT	Enprotec / Hibbs & Todd, Inc.
EPA	U.S. Environmental Protection Agency
EST	Elevated Storage Tanks
ETJ	Extra-Territorial Jurisdiction
FEMA	Federal Emergency Management Agency
FIRM	FEMA Flood Insurance Rate Map
FM	Farm-to-Market Road
GIS	Geographic Information System
GPM	Gallons per Minute
GW	Ground Water
GWTP	Ground Water Treatment Plant
HRT	Hydraulic Retention Time
IPaC	Information, Planning, and Conservation system
LS	Lift Station
MG	Million Gallons
mgd	Million Gallons per Day
mg/L	Milligrams per Liter
MUD	Municipal Utility District
NH_3	Ammonia
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWP	Nationwide Permit
O & M	Operation & Maintenance
PE	Professional Engineer
PS	Pump Station – not defined in Section 4
ROW	Right Of Way
SB1	Senate Bill 1
SH	State Highway
SqMi	Square Miles
SW	Surface Water
SWP3	Storm Water Pollution Prevention Plan
SWTP	Surface Water Treatment Plant
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks & Wildlife Department
TSS	Total Suspended Solids
TWDB	Texas Water Development Board

TxDOT	Texas Department of Transportation
TXNDD	Texas Natural Diversity Database
US	United States
USA	Utility Service Area
USACE	United States Corps of Engineers
USFWS	U.S. Fish and Wildlife Services
VFD	Variable Frequency Drives
WHAB	Wildlife Habitat Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXHIBITS

MAPS & FIGURES



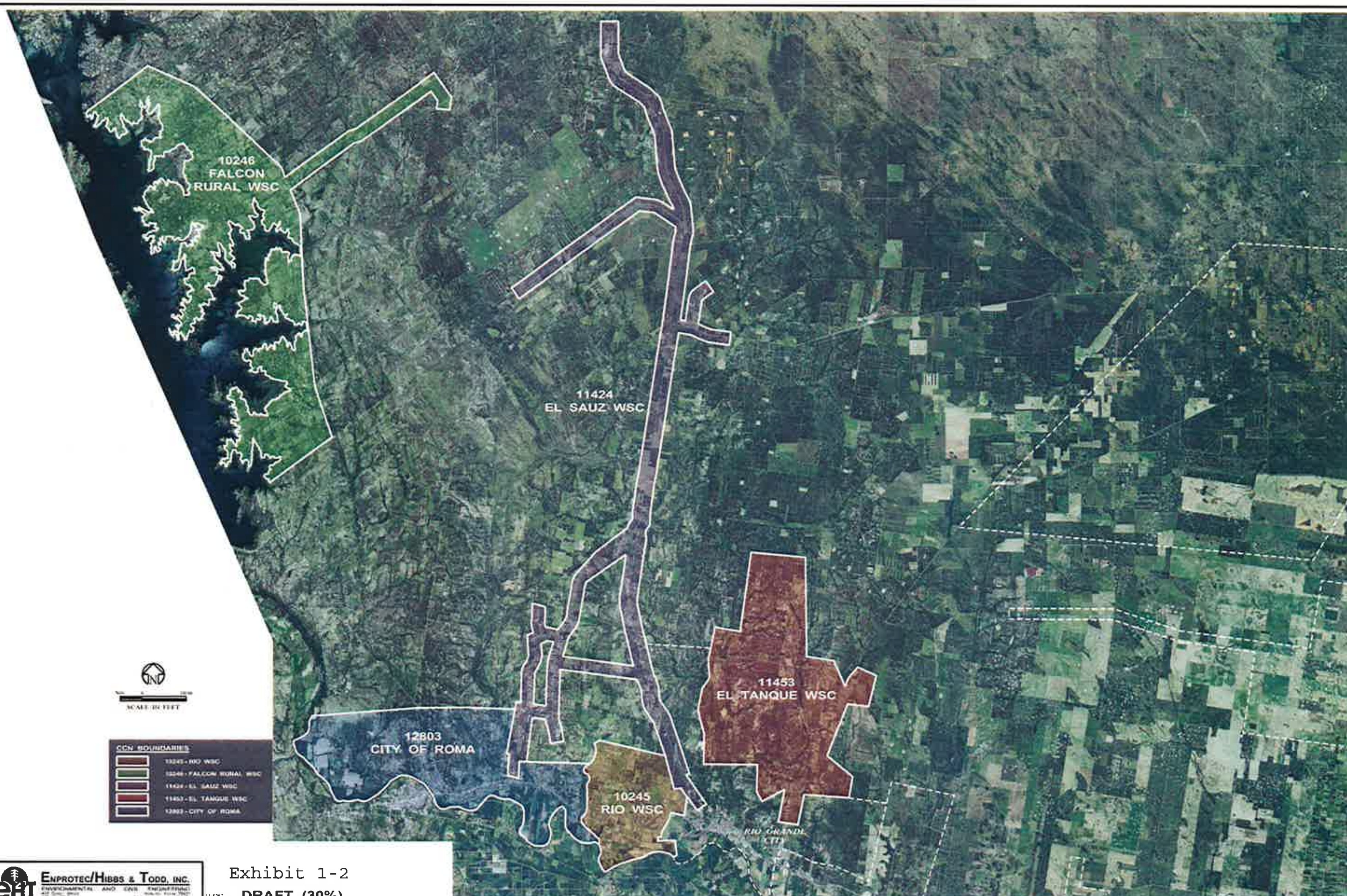
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING

DRAFT Exhibit 1-1.1

Enprotec/Hibbs & Todd, Inc.
Environmental and Civil Engineering

DRAFT

Exhibit 1-1.2



ENPROTEC/HIBBS & TODD, INC.

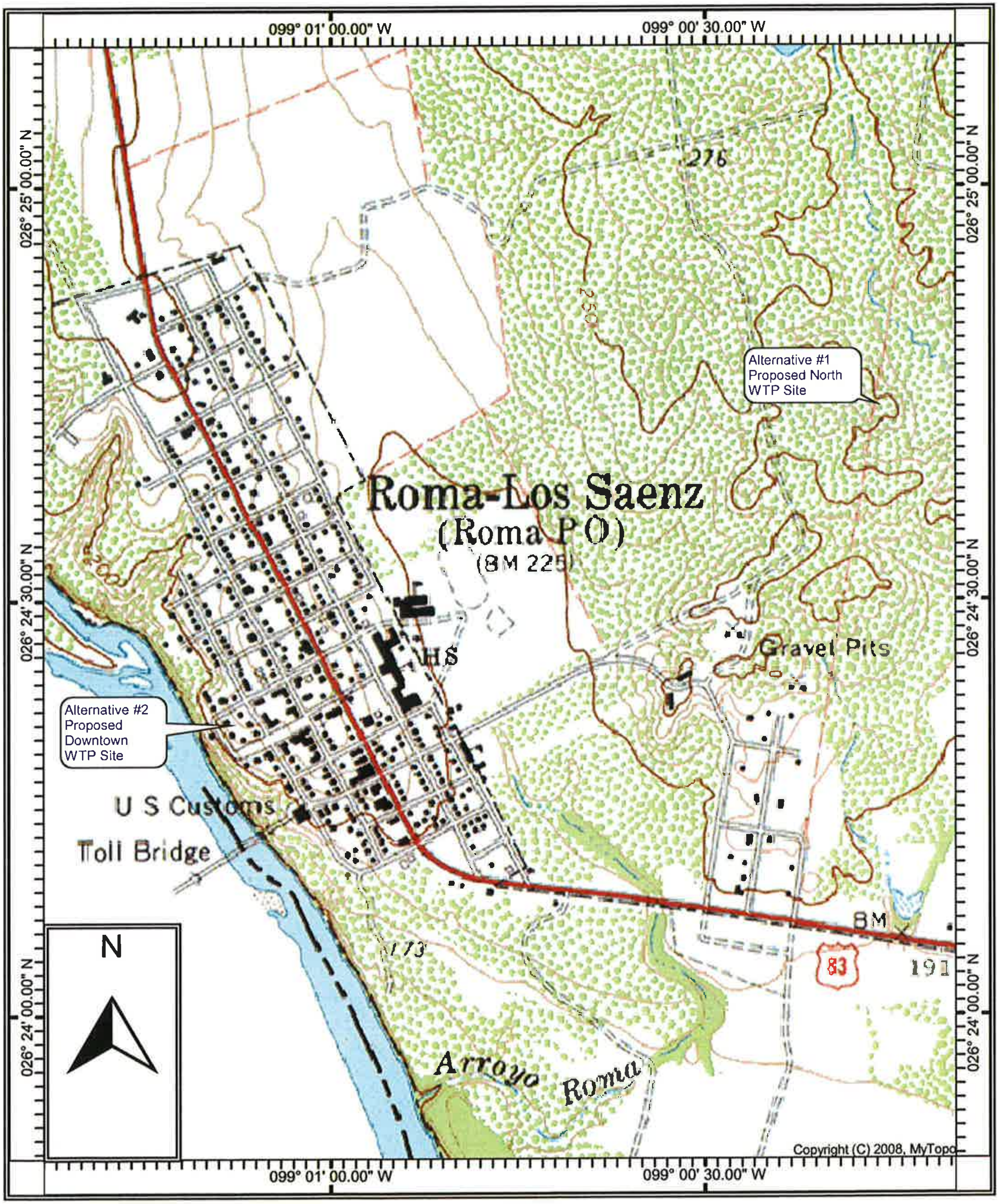
ENVIRONMENTAL AND CIVIL ENGINEERING

Exhibit 1-2

DRAFT (30%)

Exhibit 3-4
Potential New WTP Site in North Roma

Exhibit 3-5
Existing and Potential WTP Sites in Downtown Roma



Enprotec / Hibbs & Todd

Civil, Environmental and Geotechnical Engineers

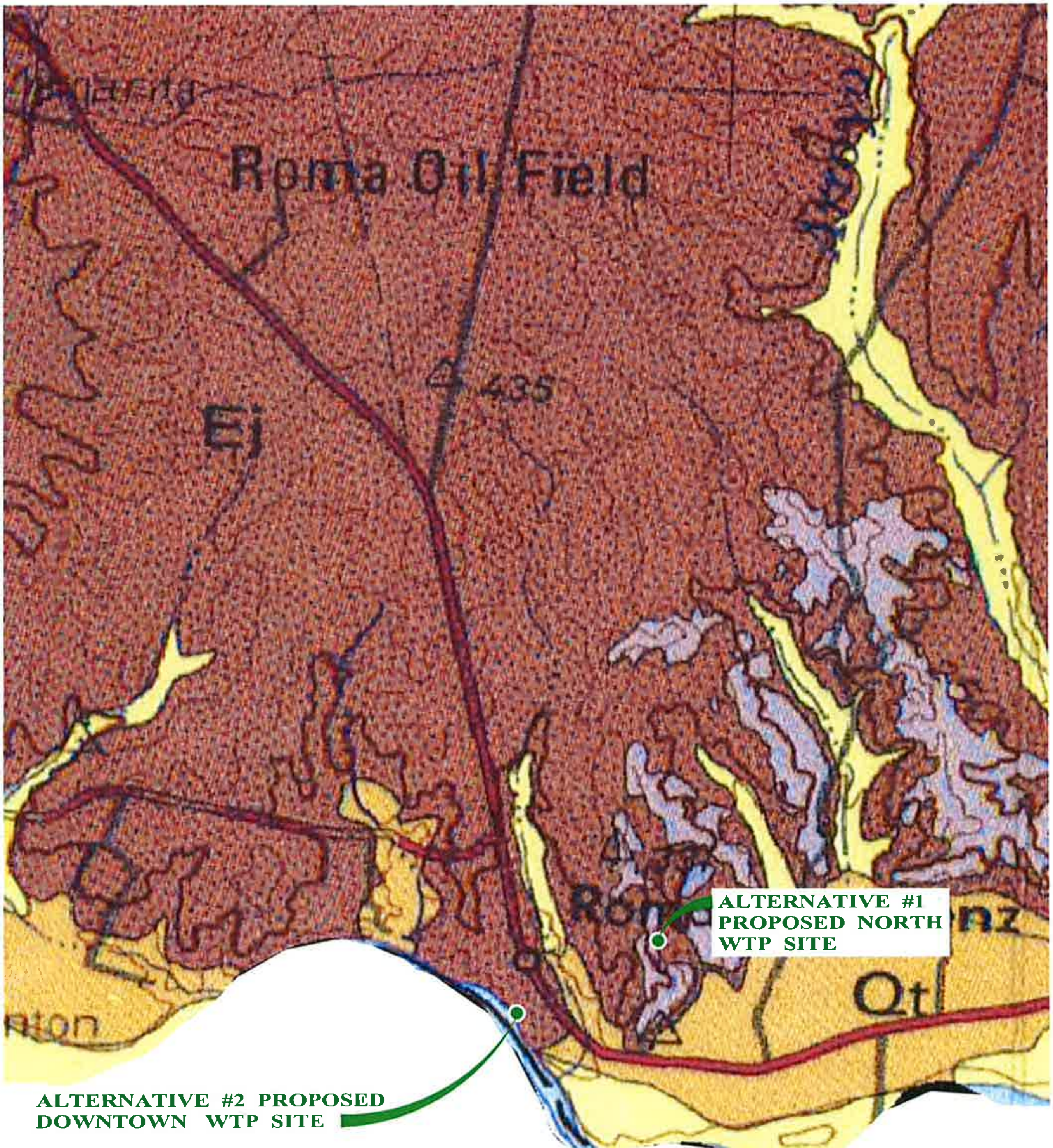
Abilene | Lubbock | Granbury www.e-ht.com

SCALE 1:12000

0 1000 2000 3000

FEET

Topographic Map
Proposed WTP Sites
City of Roma, Texas
eHT 5287



N

2000 0 5000

SCALE IN FEET

GEOLOGIC ATLAS MAP
PROPOSED WTP SITES
CITY OF ROMA, TEXAS

11-5287 04/13/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

Qt

Fluviatile terrace deposits

Gravel, sand, silt, and clay; composed of materials similar to those in contiguous alluvium; contiguous terraces are separated by a solid line

Qb

Beaumont Formation

Mostly clay, silt, sand, and gravel; includes mainly stream channel, point bar, natural levee, and backswamp deposits; concretions and massive accumulations of calcium carbonate (caliche) and concretions of iron oxide and iron-manganese oxides in zone of weathering

The stippled overprint shows areas that are "Dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity; geologic units include interdistributary muds, abandoned channel-fill muds, and fluvial overbank muds." The nonstippled areas are "Dominantly clayey sand and silt of low-moderate permeability, moderate drainage, level relief with local mounds and ridges, and high shear strength; geologic units include meanderbelt, levee, crevasse splay, and distributary sands"

The lined overprint shows areas of floodplain deposits consisting of mud veneer over meanderbelt sand, little grain preserved, grass covered

Ql

Lissie Formation undivided

Clay, silt, sand, gravel, and caliche; gray to brown to pale yellow; gravel mainly siliceous, locally cemented by and interbedded with sandy caliche; caliche massive to nodular; surface characterized by many undrained circular to irregular depressions, by relict clay dunes, and by stabilized northwest-trending longitudinal dunes

Pleistocene — QUATERNARY

T-Qu

Uvalde Gravel

Chert, well-rounded pebbles and cobbles; thickness up to about 20 feet

Pleistocene or Pliocene — QUATERNARY or TERTIARY

Pg

Goliad Formation

Clay, sand, sandstone, marl, caliche, limestone, and conglomerate; clay, commonly light shades of pink and green, calcareous concretions; sand and sandstone, medium to very coarse grained, in part crossbedded, mostly quartz, some black and red chert; conglomerate, black chert and dark siliceous granules and pebbles in calcareous (caliche) matrix; sandstone and conglomerate locally well bedded; marl and limestone poorly bedded or massive; Tertiary vertebrate and reworked Cretaceous invertebrate fossils fairly common; thickness up to 600 feet

The stippled overprint shows areas of caliche, sand veneered with strong relict eolian grain

Pliocene

M¢ct

Catahoula and Frio Formations undivided

Mudstone, claystone, sandstone, tuff, and clay; mudstone and claystone, silty, pale olive, brown, light gray to pink; sandstone, varicolored grains, in part interlaminated with pale-brown clay; tuff, grayish white, massively bedded, moderately well indurated, lumpy pisolitic texture; clay, dark greenish gray, massive; thickness 800± feet

Miocene

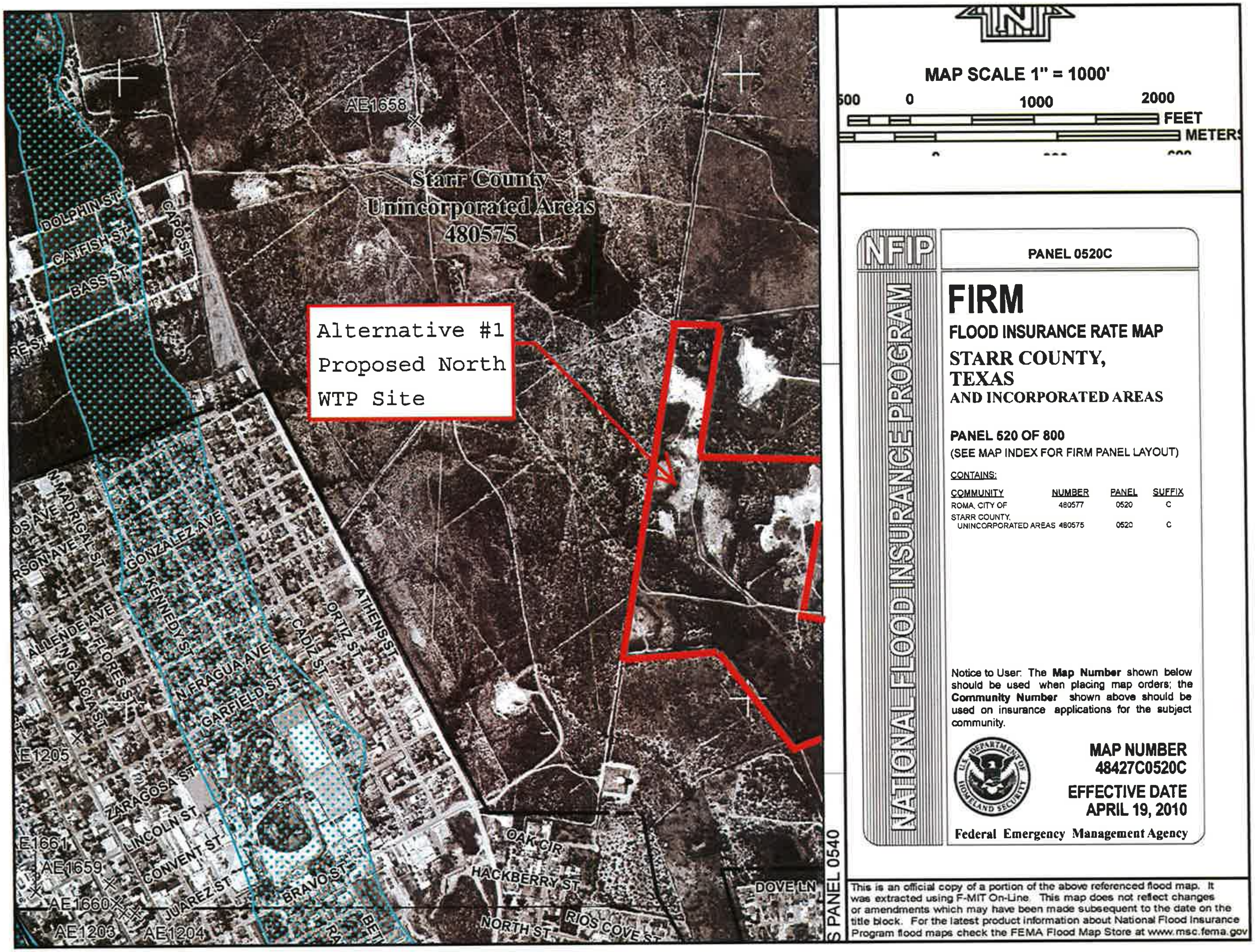
Ej

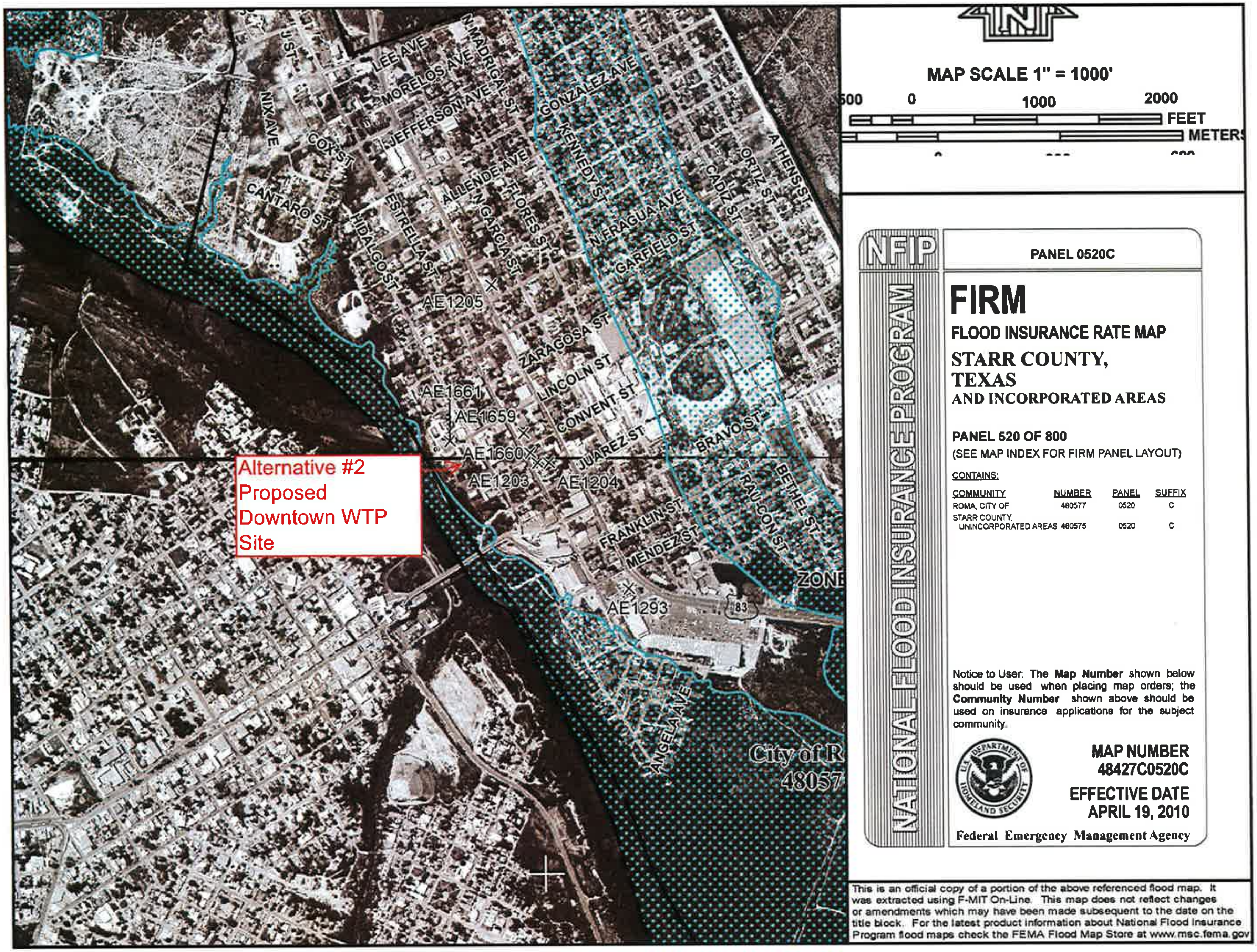
Jackson Group

Sandstone and clay; mostly sandstone, fine to coarse grained, friable to quartzitic, commonly laminated and crossbedded, white, gray, greenish brown, light brownish yellow, fossiliferous; clay, sandy, calcareous, greenish gray, pink, red, silicified wood abundant; some beds of white volcanic ash; large, dark limestone concretions composed of coarse calcite common; thickness 360 feet

Eocene

TERTIARY


Alternative #1
Proposed North
WTP Site
Starr County
Unincorporated Areas
480575
AE1658
DOLPHIN ST
CATFISH ST
BASS ST
CAPO ST
GONZALEZ AVE
KENNEDY ST
N FRAGUA AVE
GARFIELD ST
CADIZ ST
ORTIZ ST
ATHENS ST
ALLENDE AVE
N GARCIA ST
FLORES ST
N MADRIGAL ST
ZARAGOSA ST
LINCOLN ST
CONVENT ST
JUAREZ ST
BRAVO ST
OAK CIR
HACKBERRY ST
NORTH ST
RIOS COVE ST
DOVE LN
AE1659
AE1660
AE1203
AE1204
PANEL 0540
MAP SCALE 1" = 1000'
0
1000
2000
FEET
METERS
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0520C
FIRM
FLOOD INSURANCE RATE MAP
STARR COUNTY,
TEXAS
AND INCORPORATED AREAS
PANEL 520 OF 800
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
ROMA, CITY OF 480577 0520 C
STARR COUNTY, UNINCORPORATED AREAS 480575 0520 C
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
48427C0520C
EFFECTIVE DATE
APRIL 19, 2010
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 1000'
500
0
1000
2000
FEET
METERS
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0520C
FIRM
FLOOD INSURANCE RATE MAP
STARR COUNTY, TEXAS
AND INCORPORATED AREAS
PANEL 520 OF 800
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
ROMA, CITY OF 480577 0520 C
STARR COUNTY, UNINCORPORATED AREAS 480575 0520 C
Notice to User. The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER 48427C0520C
EFFECTIVE DATE APRIL 19, 2010
Federal Emergency Management Agency
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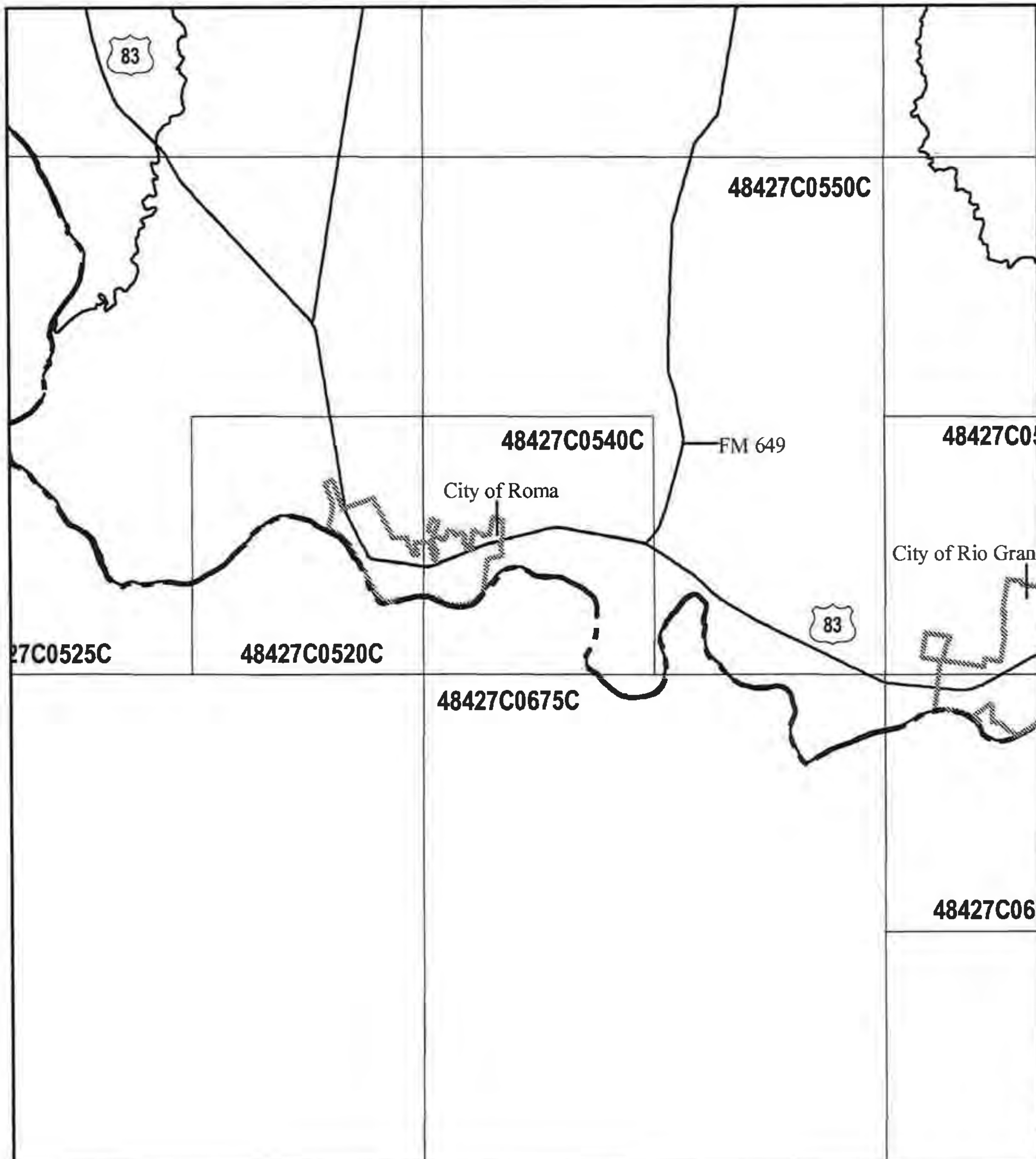
Alternative #2
Proposed
Downtown WTP
Site
J ST
NIX AVE
COX ST
CANTARO ST
HIDALGO ST
ESTRELLA ST
LEE AVE
MORELOS AVE
JEFFERSON AVE
N MADRIGAL ST
ALLENDE AVE
N GARCIA ST
FLORES ST
GONZALEZ AVE
KENNEDY ST
N FRAGUA AVE
GARFIELD ST
CADIZ ST
ORTIZ ST
ATHENS ST
ZARAGOSA ST
LINCOLN ST
CONVENT ST
JUAREZ ST
BRAVO ST
BETHEL ST
RAU-CON ST
FRANKLIN ST
MENDEZ ST
ANGELA AVE
AE1205
AE1661
AE1659
AE1660
AE1203
AE1204
AE1293
83
ZONE
City of R
48057



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

STARR COUNTY, TEXAS

AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

PANELS PRINTED: 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 375, 400, 425, 450, 475, 500, 520, 525, 540, 550, 565, 570, 575, 600, 625, 650, 675, 680, 685, 700, 725, 750, 775, 800

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
48427CIND0A

EFFECTIVE DATE
APRIL 19, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

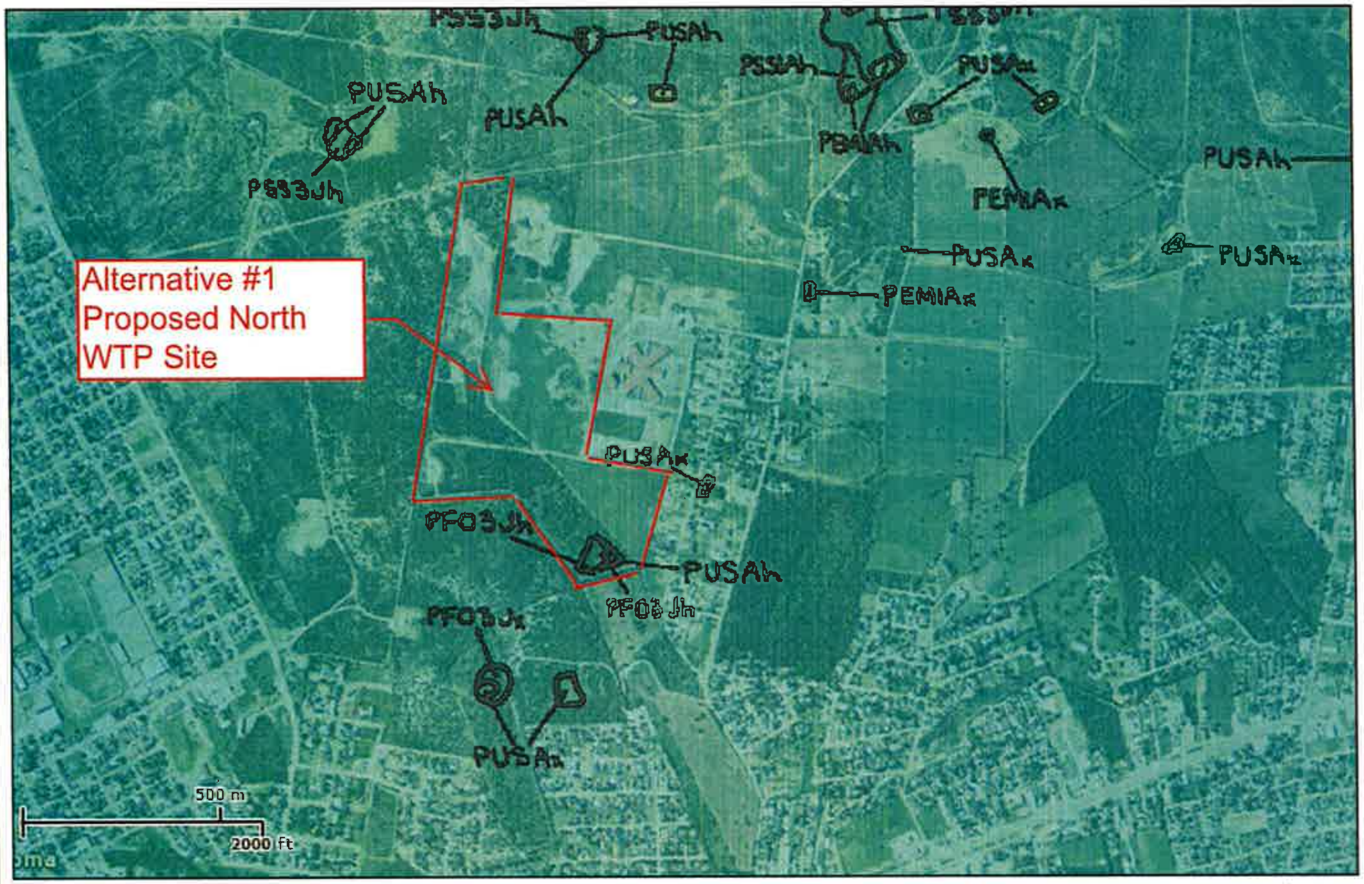
U.S. Fish and Wildlife Service

National Wetlands Inventory

Proposed North WTP Site

Alternative #1

Apr 11, 2012



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Status

- Digital
- Scan
- Non-Digital
- No Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

U.S. Fish and Wildlife Service

National Wetlands Inventory

Proposed Downtown WTP Site

Apr 11, 2012

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Status

- Digital
- Scan
- Non-Digital
- No Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

System: L - Lacustrine

Subsystem: 1 - Limnetic

Class	RB – Rock Bottom	UB – Unconsolidated Bottom	AB – Aquatic Bed
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular

Subsystem: 2 - Littoral

Class	RB – Rock Bottom	UB – Unconsolidated Bottom	AB – Aquatic Bed	RS – Rocky Shore	US – Unconsolidated Shore	EM – Emergent
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent

System: P - Palustrine

Class	RB – Rock Bottom	UB – Unconsolidated Bottom	AB – Aquatic Bed	US – Unconsolidated Shore	ML – Moss-Lichen	EM – Emergent	SS – Scrub-Shrub	FO – Forested
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent 5 *Phragmites australis*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

MODIFIERS

In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	**Saltwater Tidal**	**Freshwater Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	l Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
			r Artificial	5 Mesohaline			
F Semipermanently Flooded			s Spoil	6 Oligohaline			
G Intermittently Exposed			x Excavated	0 Fresh			
H Permanently Flooded							
J Intermittently Flooded							
K Artificially Flooded							

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

System: M - Marine

Subsystem	Class	Subclass
1 - Subtidal	RB – Rock Bottom	1 Bedrock 2 Rubble
1 - Subtidal	UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud
1 - Subtidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular
1 - Subtidal	RF – Reef	1 Coral 3 Worm
2 - Intertidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular
2 - Intertidal	RF – Reef	1 Coral 3 Worm
2 - Intertidal	RS – Rocky Shore	1 Bedrock 2 Rubble
2 - Intertidal	US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic

System: E - Estuarine

Subsystem	Class	Subclass
1 - Subtidal	RB – Rock Bottom	1 Bedrock 2 Rubble
1 - Subtidal	UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
1 - Subtidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular 4 Floating Vascular
1 - Subtidal	RF – Reef	2 Mollusk 3 Worm
2 - Intertidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular 4 Floating Vascular
2 - Intertidal	RF – Reef	2 Mollusk 3 Worm
2 - Intertidal	SB – Streambed	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic
2 - Intertidal	RS – Rocky Shore	1 Bedrock 2 Rubble
2 - Intertidal	US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
2 - Intertidal	EM – Emergent	1 Persistent 2 Non-persistent 5 *Phragmites australis*
2 - Intertidal	SS – Scrub-Shrub	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen
2 - Intertidal	FO – Forested	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

System: R - Riverine

Subsystem: 1 - Tidal; 2 – Lower Perennial; 3 – Upper Perennial; 4* - Intermittent; 5* – Unknown Perennial

Class	Subclass
RB** – Rock Bottom	1 Bedrock 2 Rubble
UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
SB** – Streambed	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated
AB – Aquatic Bed	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular
RS – Rocky Shore	1 Bedrock 2 Rubble
US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated
EM – Emergent	2 Nonpersistent

* **Intermittent** is limited to the **Streambed** Class;
Unknown Perennial is limited to **Unconsolidated Bottom** Class code **R5UB** only

** **Rock Bottom** is not permitted for the **Lower Perennial** Subsystem;
Streambed is limited to **Tidal** and **Intermittent** Subsystems

Classification of Wetlands and Deepwater Habitats of the United States, Cowardin *et al.* 1979

February, 2011

TEXAS NATURAL DIVERSITY DATABASE INFORMATION

Luci English

From: Texas Natural Diversity Database [txndd@tpwd.state.tx.us]
Sent: Thursday, April 19, 2012 10:49 AM
To: Luci English
Subject: RE: Early Project Coordination - Roma Planning Project (5287)
Attachments: english_20120412.zip

Ms. English,

Your information request area contains known ecologically significant stream segments and federal designated critical habitat for Zapata bladderpod. Use the links below to obtain that data.

The Texas Natural Diversity Database (TXNDD) includes federal, and state listed and tracked Threatened, Endangered, and Rare species. The attached .zip file contains documents that will guide you in appropriate use, restrictions, and shapefile interpretation of Texas NDD data as well as a request for adding data to the TXNDD. Also included is a shapefile of the T&E and Rare species element occurrences, information the TXNDD has available presently, within and touching the requested quads along with a companion EO **report**; areas where EO data are absent **do not mean** absence of occurrence for Threatened, Endangered, and Rare species. Included is an **EO List** of the T&E and Rare species element occurrences that are on the quads adjacent to your request area. The **EO List** is to inform you of other potential federal, and state listed and tracked Threatened, Endangered, and Rare species within the area. To round out your review, please use the Rare, Threatened, and Endangered Species of Texas by County application found here. For questions regarding the application please contact Julie Wicker at julie.wicker@tpwd.state.tx.us or (512)389-4579.

- If your project area is in Travis, Williamson, or Bexar county it is highly recommended that you download the GIS shapefiles for the Karst Zones from the USFWS website http://www.fws.gov/southwest/es/austintexas/ and/or contact Jenny Wilson – USFWS at (512)490-0057 x 231 for a review of the project location. All three counties are known to have multiple important karst features.
- If your information request includes one or more records for **Bald Eagle** or **colonial waterbirds**, contact Brent Ortego at brent.ortego@tpwd.state.tx.us or (361) 576-0022 for more up-to-date information on the ***Bald Eagle*** or **colonial waterbirds**.
- **For communication towers**, in addition to the USFWS guidelines in the attachment and the links at towerkill.com, there is research identifying a simple way to reduce bird strike and high bird mortality at towers. Gehring J., P. Kerlinger, A.M. Manville II. (2009) Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications: Vol. 19, No. 2, pp. 505-514.doi: 10.1890/07-1708.1
- For **wind energy or transmission related projects**, to obtain the Department's guidelines it is also recommended to contact Kathy Boydston, the Department lead, at kathy.boydston@tpwd.state.tx.us or 512/389-4638. In addition, the U.S. Fish and Wildlife Service's Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines, along with other helpful links and information, can be accessed at: http://www.fws.gov/habitatconservation/wind.html.
- If your information request contains records for **Texas trailing phlox** you should contact Jason Singhurst at jason.singhurst@tpwd.state.tx.us or (512) 389-8726.

Absence of information in an area does not mean absence of occurrence. *Given the small proportion of public versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. Data from the TXNDD do not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features within your project area. These data cannot substitute for an on-site evaluation by qualified biologists.*

Additional sources of data:
TPWD Annotated County Lists: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/
USFWS species lists: http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_pulic.servlets.EntryPage
USFWS CRITICAL HABITAT: http://criticalhabitat.fws.gov/
Ecologically Significant Stream Segments: http://www.tpwd.state.tx.us/landwater/land/maps/gis/data_downloads/
Ecologically Significant Stream Segment Information:
http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/

Bob Gottfried
Texas Natural Diversity Database Administrator
Texas Parks and Wildlife - Wildlife Division
4200 Smith School Rd
Austin, TX 78744
512-389-8744

From: Luci English
To: Texas Natural Diversity Database
Subject: Early Project Coordination - Roma Planning Project (5287)
Date: Thursday, April 12, 2012 2:11:24 PM
Attachments: ROMA-LOS SAENZ WEST.jpg
Soil Map Alt #2.pdf
Soil Map Alt #1.pdf

Per PWD 1059, Early Project Coordination, on Page 1 of 3:
This project is in the early information gathering phase of the project coordination and assessment. Therefore, in lieu of submitting a Project Review form or letter request, the two sources of information suggested are being utilized. The TPWD database was consulted as recommended. And, this e-mail is serving as the request to gather data from the TXNDD.

An overview topographic location map is attached showing the general location of the two proposed alternative WTP site locations. An outline of the area of interest on a soils map is attached for each site which includes coordinates to help define the site location. The project type is water treatment/distribution system.

If you have any questions, please feel free to contact me via e-mail, cell, or @ the office. Thank you.

Luci English, PE
Project Manager
eHT I Enprotec / Hibbs & Todd, Inc.
Tel (325) 698-5560 I Cell (817) 694-8382 I Email luci.english@e-ht.com

Abilene I Lubbock I Granbury I Plano
www.e-ht.com I PE Firm Registration No. 1151 I PG Firm Registration No. 50103

Water Planning Data for Region M (Rio Grande)

Arroyo Colorado - This tidal segment of the Arroyo Colorado (TNRCC classified segment 2201) runs just upstream of Port of Harlingen to its confluence with Laguna Madre in Willacy/Cameron Counties.

Biological function - priority riparian and extensive freshwater wetland habitats displays significant overall habitat value

Riparian conservation area - Laguna Atascosa National Wildlife Refuge; Las Palomas Wildlife Management Area.

Las Moras Creek - From the confluence with the Rio Grande in Maverick County upstream to the Maverick/Kinney County line. High water quality/exceptional aquatic life/high aesthetic value - ecoregion stream; high water quality, diverse benthic macroinvertebrate community (Bayer et al., 1992)

Threatened or endangered species/unique communities - proserpine shiner (SOC/St.T) (Hubbs et al., 1991)

Rio Grande - From the confluence with the Gulf of Mexico in Cameron County upstream to Falcon Dam in Starr County (TNRCC classified stream segments 2301 and 2302). Biological Function: Priority bottomland habitat; Extensive freshwater and estuarine wetland habitats (Bauer et al. 1991)

Riparian conservation area - Lower Rio Grande Valley National WildlifeRefuge; Bentsen Rio Grande Valley State Park Santa Ana National Wildlife Refuge

High water quality/exceptional aquatic life/high aesthetic value - high water quality and exceptional aquatic life use (TNRCC, 1996); diverse benthic macroinvertebrate community (J. Davis, 1998, pers. comm.)

Threatened or endangered species/unique communities - blackfin goby (SOC/St.T) (Hubbs et al., 1991); unique Black Mangrove Series community; unique Texas Palmetto Series habitat (Texas Organization for Endangered Species. 1992)

References

Bauer, J., R. Frye, B. Spain. 1991. A natural resource survey for proposed reservoir sites and selected stream segments in Texas. Texas Parks and Wildlife Department, Austin, Texas.

Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

Davis, J.R. 1998. Personal communication. Texas Natural Resource Conservation Commission, Austin, Texas.

Hubbs, C., R.J. Edwards, and G.P. Garrett. 1991. An annotated checklist of the freshwater fishes of Texas, with keys to identification of species. Texas Journal of Science 43: 1-56.

Texas Natural Resource Conservation Commission (TNRCC). 1996. Texas surface water quality standards. Texas Natural Resource Conservation Commission, Austin, Texas.

Texas Organization for Endangered Species. 1992. Endangered, threatened, and watch list of natural communities of Texas. Texas Organization for Endangered Species, Austin, Texas.

Managed Area Information

Managed Area Name: Las Palomas Wildlife Management Area - Lower Rio Grande Valley Units

Acres: 687.40

Alias:

County Name:	Mapsheet Name:	Mapsheet Code:
Cameron	Las Milpas	26098-A2
Hidalgo	East Brownsville	25097-H4
Presidio	La Paloma	26097-A6
Starr	La Joya	26098-B4
Willacy	Los Garzas	26098-C8
	Santa Rosa	26097-C7
	Las Conchas	29104-H6
	Pueblo Nuevo	30104-A6
	Roma-Los Saenz East	26098-D8
	La Grulla	26098-C6
	Rio Hondo	26097-B5
	Los Ebanos NW	26098-B6
	Santa Maria	26097-A7
	San Juan SE	26098-A1
	Progreso	26097-A8

Description:

LOCATED CA. 12 MILES NORTHEAST OF HARLINGEN ON FM 2925; VEGETATIVE COMPOSITION OF THIS UNIT IS CA. 647 ACRES OF NATIVE BRUSH AND 40 ACRES OF WETLANDS

Comments:

Manager:

GARY WAGGERMAN

410 NORTH 13TH

EDINBURG,TX 78539
210 383-8982

Managed Area Information

Managed Area Name: Lower Rio Grande Valley National Wildlife Refuge **Acres:**

Alias: LOWER RIO GRANDE VALLEY NWR COMPLEX

Alias: LOWER RIO GRANDE VALLEY WILDLIFE CORRIDOR

Managed Area Information

County Name:	Mapsheet Name:	Mapsheet Code:
Cameron	Falcon Village	26099-E2
Hidalgo	Southmost OE E	25097-G3
Starr	Linn	26098-E1
Willacy	La Sal Vieja	26097-E8
	Yturria	26097-E7
	San Perlita North	26097-E6
	El Jardin	26097-E5
	Roma-Los Saenz West	26099-D1
	Roma-Los Saenz East	26098-D8
	Rio Grande City North	26098-D7
	Sagunada Ranch	26098-D6
	Monte Christo	26098-D3
	Faysville	26098-D2
	Hargill	26098-D1
	Lasara	26097-D8
	Willamar	26097-D5
	Rio Grande City South	26098-C7
	La Grulla	26098-C6
	Sullivan City	26098-C5
	La Blanca	26098-C1
	Edcouch	26097-C8
	Santa Rosa	26097-C7
	Los Ebanos NW	26098-B6
	Los Ebanos	26098-B5
	La Joya	26098-B4
	Mission	26098-B3
	Mercedes	26097-B8
	La Feria	26097-B7
	Harlingen	26097-B6
	Rio Hondo	26097-B5
	Hidalgo	26098-A3
	Las Milpas	26098-A2
	San Juan SE	26098-A1
	Progreso	26097-A8
	Santa Maria	26097-A7
	La Paloma	26097-A6
	Olmito	26097-A5
	Laguna Vista	26097-A3
	Port Isabel	26097-A2
	West Brownsville OE W	25097-H6
	West Brownsville	25097-H5
	East Brownsville	25097-H4

Managed Area Information

Palmito Hill	25097-H3
Mouth of Rio Grande	25097-H2
Southmost	25097-G4
Salineno	26099-E1

Description:

SCATTERED TRACTS OF NATIVE OR RESTORED RIPARIAN BRUSH ALONG THE LOWER RIO GRANDE RIVER; EVENTUALLY THE MANAGED AREA SHOULD INCLUDE THE ENTIRE AREA ALONG THE RIVER. 96 NON-CONTIGUOUS PARCELS OF TAMAULIPAN THORN SCRUB; REFUGE CONTAINED IN CAMERON, WILLACY, HIDALGO, AND STARR COUNTIES; SEE MA FILES FOR INFORMATION ON INDIVIDUAL TRACTS, ACREAGES, AND LOCATIONS.

Comments:

ADDITION TO LOWER RIO GRANDE VALLEY NATIONAL WILDLIFE REFUGE COMPLEX. MANAGED BY USFWS AS PART OF SANTA ANA NWR. NOT FINAL, MORE ACQUISITIONS IN THE NEAR FUTURE. TRACTS INCLUDE: BOSCAJE DE LA PALMA, LOMA PRESERVE, CAJA PINTO BANCO, TULOSA RANCH, VISTA DEL MAR, PALMITO HILL, BROWNSVILLE, NORIEGA, CHAMPION BEND, TAHUACHAL BANCO, GARZA-CAVAZOS, VILLA NUEVA, BRAZOS ISLAND, CLARK ISLAND, RANCHITO, VAQUETERIA BANCO, RANGERVILLE, SAN BENITO SETTLING BASIN, LAS PALOMAS BANCO, CULEBRON BANCO, RESACA DE LOS FRESNOS, RESACA DEL RANCHO VIEJO, LA GLORIA, LAS SIERRITAS BANCO, VILLITAS BANCO, SANTA MARIA, RELAMPAGO, LLANO GRANDE BANCO, MERCEDES, ROSARIO BANCO, LA SELVA VERDE, LANTANA, TIOCANO LAKE, THOMPSON ROAD, WILLAMAR, TENIENTE, EL JARDIN, SAN PERLITA, EAST LAKE, PAYNE, MONTERREY BANCO,' LA COMA, HIDALGO BEND, PHARR SETTLING BASIN, MARINOFF, MILAGRO, VELA WOODS, COTTAM, PATE BEND, GABRIELSON, MADERO, EL MORILLO BANCO, TORTUGA BANCO, GRANJENO, ABRAMS, LA JOYA, LA PARIDA BANCO, PALMVIEW, ZAMORA BEND, HAVANA NORTH AND SOUTH, CHICHARRA BANCO, SAM FORDYCE NORTH AND SOUTH, LOS EBANOS, ZAMBRANO, VALADECES BANCO, GOODFIELDS, CUEVITAS, YTURRIA BRUSH, ZARATE, ALTO BONITO, RETAMA, LA PUERTA, FARIAS, CASTILLO, GUERRA, RIO SAN JUAN, LOS VELAS, SCHALEBEN, MONTE CRISTO, LOS OLMOS, GARCENO, LA SAL DEL REY, FRONTON, LAS RUINAS, SALINENO (KEPLER), CUELLAR, CHAPENO, BOCA CHICA, PHILLIPS BANCO, PALO BANCO, CAPOTE BANCO, LAS YESCAS, LOZANO, OTHAL HOLLAND WILDLIFE CORRIDOR, LA PESQUERA, LOMA VERDE, JERONIMO, ABRAMS WEST, LOS ARBOLITOS, GUERRA NORTH, VILLARREALES BANCO, LOS FRESNOS BANCO, GARZA, LA CASITA EAST AND WEST, LOS VELAS WEST, ARROYO RAMIREZ, LOS NEGROS, ARROYO MORTEROS

Manager:

MICHAEL BRYANT
C/O SANTA ANA NWR
ROUTE 2, BOX 202A

ALAMO,TX 78516
210 787-3079

Notes for
County Lists of Texas' Special Species

The Texas Parks and Wildlife (TPWD) county lists **include**:

Vertebrates, Invertebrates, and Vascular Plants identified as being of conservation concern by TPWD within Texas. These special species lists are comprised of species, subspecies, and varieties that are federally listed; proposed to be federally listed; have federal candidate status; are state listed; or carry a global conservation status indicating a species is critically imperiled, very rare, vulnerable to extirpation, or uncommon.

The TPWD county lists **do not include**:

Natural Plant Communities such as Little Bluestem-Indiangrass Series (native prairie remnant), Water Oak-Willow Oak Series (bottomland hardwood community), Saltgrass-Cordgrass Series (salt or brackish marsh), Sphagnum-Beakrush Series (seepage bog).

Other Significant Features such as bird rookeries, migratory songbird fallout areas, comprehensive migratory bird information, bat roosts, bat caves, invertebrate caves, and prairie dog towns.

These lists are not all inclusive for all rare species distributions. The lists were compiled, developed, and are updated based on field guides, staff expertise, scientific publications, and the TPWD Texas Natural Diversity Database (TXNDD) (formerly the Biological and Conservation Data System) occurrence data. Historic ranges for some state extirpated species, full historic distributions for some extant species, accidentals and irregularly appearing species, and portions of migratory routes for particular species are not necessarily included. Species that appear on county lists do not all share the same probability of occurrence within a county. Some species are migrants or wintering residents only. Additionally, a few species may be historic or considered extirpated within a county.

TPWD includes the Federal listing status for your convenience and makes every attempt to keep the information current and correct. However, the US Fish and Wildlife Service (FWS) is the responsible authority for Federal listing status. The TPWD lists do not substitute for contact with the FWS and federally listed species county ranges may vary from the FWS county level species lists because of the inexact nature of range map development and use.

Status Key:

LE, LT -	Federally Listed Endangered/Threatened
PE, PT -	Federally Proposed Endangered/Threatened
SAE, SAT -	Federally Listed Endangered/Threatened by Similarity of Appearance
C -	Federal Candidate for Listing; formerly Category 1 Candidate
DL, PDL -	Federally Delisted/Proposed for Delisting
NL -	Not Federally Listed
E, T -	State Listed Endangered/Threatened
NT -	Not tracked or no longer tracked by the State
"blank" -	Rare, but with no regulatory listing status

This information is specifically for your assistance only; due to continuing data updates, **please do not redistribute the lists**, instead refer all requesters to the web site at: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/ or to our office for the most current information available. For questions regarding county lists, please call (512) 389-4571.

Please use the following citation to credit the source for this county level information:

Texas Parks and Wildlife Department, Wildlife Division, Diversity and Habitat Assessment Programs. County Lists of Texas' Special Species. [county name(s) and revised date(s)].

Occurrence List for Quads Surrounding Request Area

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Acacia rigidula series	Blackbrush Series	5			1126
Acacia rigidula series	Blackbrush Series	9			4919
Acacia rigidula series	Blackbrush Series	10			4918
Asclepias prostrata	prostrate milkweed	5			1572
Asclepias prostrata	prostrate milkweed	11			8325
Astrophytum asterias	star cactus	1	E	LE	3563
Astrophytum asterias	star cactus	2	E	LE	4575
Atriplex klebergorum	Kleberg saltbush	7			2898
Cardiospermum dissectum	Chihuahua balloon-vine	5			2189
Cardiospermum dissectum	Chihuahua balloon-vine	6			6435
Cardiospermum dissectum	Chihuahua balloon-vine	8			7609
Cardiospermum dissectum	Chihuahua balloon-vine	9			5658
Cardiospermum dissectum	Chihuahua balloon-vine	10			5659
Cardiospermum dissectum	Chihuahua balloon-vine	17			5938
Cardiospermum dissectum	Chihuahua balloon-vine	18			147
Cardiospermum dissectum	Chihuahua balloon-vine	20			7555
Cardiospermum dissectum	Chihuahua balloon-vine	24			8322
Cardiospermum dissectum	Chihuahua balloon-vine	25			8323
Coryphantha macromeris var. runyonii	Runyon's cory cactus	1			3293
Coryphantha macromeris var. runyonii	Runyon's cory cactus	3			4944
Coryphantha macromeris var. runyonii	Runyon's cory cactus	4			204

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Coryphantha macromeris var. runyonii	Runyon's cory cactus	6			3060
Coryphantha macromeris var. runyonii	Runyon's cory cactus	8			5673
Coryphantha macromeris var. runyonii	Runyon's cory cactus	10			312
Coryphantha macromeris var. runyonii	Runyon's cory cactus	13			6370
Coryphantha macromeris var. runyonii	Runyon's cory cactus	14			1559
Coryphantha macromeris var. runyonii	Runyon's cory cactus	15			3490
Coryphantha macromeris var. runyonii	Runyon's cory cactus	20			8313
Coryphantha macromeris var. runyonii	Runyon's cory cactus	21			8314
Crotaphytus reticulatus	Reticulate Collared Lizard	13	T		3892
Crotaphytus reticulatus	Reticulate Collared Lizard	21	T		613
Crotaphytus reticulatus	Reticulate Collared Lizard	32	T		3666
Crotaphytus reticulatus	Reticulate Collared Lizard	52	T		5482
Frankenia johnstonii	Johnston's frankenia	5	E	LE, PDL	6402
Gopherus berlandieri	Texas Tortoise	40	T		8873
Herpailurus yaguarondi	Jaguarundi	16	E	LE	2286
Herpailurus yaguarondi	Jaguarundi	17	E	LE	2074
Hybognathus amarus	Rio Grande Silvery Minnow	2	E	LE	7508
Hypopachus variolosus	Sheep Frog	28	T		8813
Leptodactylus fragilis	White-lipped Frog	2	T		4735
Leptodactylus fragilis	White-lipped Frog	4	T		8821
Leptodactylus fragilis	White-lipped Frog	6	T		8823
Manfreda longiflora	St. Joseph's staff	2			6870
Manfreda longiflora	St. Joseph's staff	5			6229

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Manfreda longiflora	St. Joseph's staff	6			2863
Manfreda longiflora	St. Joseph's staff	7			7818
Manfreda longiflora	St. Joseph's staff	11			4263
Manfreda longiflora	St. Joseph's staff	12			304
Manfreda longiflora	St. Joseph's staff	13			8203
Manfreda longiflora	St. Joseph's staff	17			104
Manfreda longiflora	St. Joseph's staff	20			8321
Manihot walkerae	Walker's manioc	4	E	LE	8235
Manihot walkerae	Walker's manioc	9	E	LE	6219
Manihot walkerae	Walker's manioc	10	E	LE	6220
Physaria thamnophila	Zapata bladderpod	2	E	LE	5996
Physaria thamnophila	Zapata bladderpod	7	E	LE	2223
Physaria thamnophila	Zapata bladderpod	14	E	LE	8927
Prosopis glandulosa-acacia smallii series	Mesquite-huisache Series	3			1520
Rhinophrynus dorsalis	Mexican Burrowing Toad	1	T		8217
Rhinophrynus dorsalis	Mexican Burrowing Toad	2	T		2199
Rhinophrynus dorsalis	Mexican Burrowing Toad	3	T		363
Rhinophrynus dorsalis	Mexican Burrowing Toad	4	T		5982
Rhinophrynus dorsalis	Mexican Burrowing Toad	5	T		4060
Rhinophrynus dorsalis	Mexican Burrowing Toad	6	T		7093
Rhinophrynus dorsalis	Mexican Burrowing Toad	7	T		8824
Rhinophrynus dorsalis	Mexican Burrowing Toad	11	T		8829
Rookery		560			3614

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Rookery		561			5132
Rookery		565			4038
Sterna antillarum athalassos	Interior Least Tern	2	E	LE	4356
Sterna antillarum athalassos	Interior Least Tern	28	E	LE	4234
Sterna antillarum athalassos	Interior Least Tern	29	E	LE	3786
Sterna antillarum athalassos	Interior Least Tern	30	E	LE	3785
Thymophylla tephroleuca	ashy dogweed	2	E	LE	7995

Element Occurrence Record

Scientific Name: Acacia rigidula series

Common Name: Blackbrush Series

Global Rank: G5 **State Rank:** S5

Occurrence #: 5 **Eo Id:** 1126

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26099-E1, Salineno

26099-D1, Roma-Los Saenz West

26098-E8, El Chapote Creek

Directions:

LOMA BLANCA ROAD, FROM JCT HWY 83 NEAR ROMA NORTH 11 MILES

Survey Information:

First Observation: 1986 **Survey Date:** 1986-04-? **Last Observation:** 1986-04

Eo Type: **Eo Rank:** BC **Eo Rank Date:**

Observed Area: 7,040.00

Comments:

General Description: DIVERSE AREA, MOSTLY ON A RIDGE, WITH MESQUITE, BLACKBRUSH, GUAJILLO, KIDNEYWOOD; SALINE SITES WITH VARILLA, HECTIA, FRANKENIA JOHNSTONII; SOME ROOT PLOWING

Comments: AREA CIRCUMSCRIBES FRANKENIA JOHNSTONII SITES (G1S1); OTHER RELATIVELY UNCOMMON SPECIES

Protection Comments:

Management Comments:

Data:

EO Data: SOILS MOSTLY GYPSEOUS OR SALINE WHERE NO CLEARING HAS OCCUR- RED

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

EVERETT, J. H. & GONZALES. IN PRESS. BOTANICAL COMPOSITION OF ELEVEN SOUTH TEXAS RANGE SITES. IN. BIOLOGICAL RESOURCES OF THE TAMAULIPAN BIOTIC PROVINCE. ED. BY D. H. RISKIND & G. W. BLACKWOOD.

Specimen:

Element Occurrence Record

Scientific Name: Asclepias prostrata

Common Name: prostrate milkweed

Global Rank: G1G2 **State Rank:** S1S2

Occurrence #: 1 **Eo Id:** 6491

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

1.4-1.6 MILES NORTH OF THE INTERSECTION OF HIGHWAY 83 AND THE INTERNATIONAL BRIDGE ROAD IN ROMA; SOUTHWEST CORNER OF THE INTERSECTION OF HIGHWAYS 83 AND 650, TO 0.1 MILE NORTH ON THE EAST SIDE OF HIGHWAY 83 AND ADJACENT PASTURE AND DIRT ROAD

Survey Information:

First Observation: 1966-03-17 **Survey Date:** 1993 **Last Observation:** 1993

Eo Type: **Eo Rank:** C **Eo Rank Date:** 1993-01-01

Observed Area: 1.00

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: IN 1991, 11 INDIVIDUALS; IN 1992, 15 INDIVIDUALS; IN 1993, 12 INDIVIDUALS

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

Poole, Jackie M. and G. K. Janssen. 1993. Project No. 35: Assessment and management plan development for listed and category plants on Texas Department of Highways and Public Transportation rights-of-way. Grant No.: E-1-5. Submitted to Texas Parks & Wildlife Dept., Austin, TX. 15 November 1993.

POOLE, J.M. 1988. FIELD SURVEY TO ARROYO ROMA OF 20 OCTOBER 1988.

Specimen:

UNIVERSITY OF TEXAS AT AUSTIN HERBARIUM. 1966. D.S. CORRELL #32275, SPECIMEN # NONE TEX-LL. 17 MARCH 1966.

Element Occurrence Record

Scientific Name: Asclepias prostrata

Common Name: prostrate milkweed

Global Rank: G1G2 **State Rank:** S1S2

Occurrence #: 2 **Eo Id:** 6223

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	**State:**	**Mapsheet:**
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

3.5-3.9 MILES NORTH OF ROMA ON HIGHWAY 83 (INTERSECTION OF HIGHWAY 83 AND ROAD TO INTERNATIONAL BRIDGE); BOTH SIDES OF ROAD

Survey Information:

First Observation: 1957-07-15 **Survey Date:** 1991-04-23 **Last Observation:** 1988-10-20

Eo Type: **Eo Rank:** X **Eo Rank Date:** 1991-04-23

Observed Area: 5.00

Comments:

General Description: DISTURBED, BLADED, WEEDY ROADSIDE; SOFT SILTY SOIL; WITH CENCHRUS CILIARIS, HELIANTHUS ANNUUS, AND ACLEISANTHES LONGIFLORA

Comments: REASONS FOR SPECIES DISAPPEARANCE UNKNOWN; CLIMATE NOT NOTICEABLE ALTERED NOR HABITAT

Protection Comments:

Management Comments: BLADE RIGHT-OF-WAY

Data:

EO Data: IN FLOWER AND FRUIT; 137 INDIVIDUALS COUNTED; ALL MATURE AND HEALTHY IN 1986; DOWN TO 2 PLANTS IN 1988 DUE TO COMPETITION; NO INDIVIDUALS OBSERVED IN 1991

Managed Area:

Managed Area Name

Reference:

Citation:

POOLE, J.M. 1988. FIELD SURVEY TO MISSION MIER A VISITA OF 20 OCTOBER 1988.

Poole, J. M. 1986. Field Survey to Mission Mier A Visita of April 8, 1986.

POOLE, JACKIE M. NO DATE. TEXAS PARKS AND WILDLIFE DEPARTMENT, WILDLIFE DIVERSITY BRANCH, 4200 SMITH SCHOOL ROAD, AUSTIN, TEXAS 78744; 512/389-8019; jackie.poole@tpwd.state.tx.us

Specimen:

University of Texas at Austin, Lundell Herbarium. 1957. D.S. Correll #18076 and I.M.Johnston, Specimen # none TEX-LL. 15 July 1957.

Element Occurrence Record

Scientific Name: Asclepias prostrata

Common Name: prostrate milkweed

Global Rank: G1G2 **State Rank:** S1S2

Occurrence #: 10 **Eo Id:** 5533

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

ARROYO RAMIREZ TRACT OF LOWER RIO GRANDE VALLEY NWR; CA. 2.0 AIR MILES WEST OF ROMA

Survey Information:

First Observation: 2003-03-12 **Survey Date:** **Last Observation:** 2003-03-12

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: GROWING IN DIRT ROAD

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: ONE PLANT IN 2003

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

HEMPEL, ALICE. 2003. EMAIL TO DANA PRICE OF 26 MARCH 2003 CONCERNING LOCATION OF ASCLEPIAS PROSTRATA AT ARROYO RAMIREZ TRACT, LOWER RIO GRANDE VALLEY NWR.

BEST, CHRIS. 2003. EMAIL TO DANA PRICE, 21 MARCH 2003, CONCERNING RARE AND ENDANGERED PLANT SURVEYS AT ARROYO RAMIREZ TRACT, LOWER RIO GRANDE VALLEY NWR.

Specimen:

Element Occurrence Record

Scientific Name: Asclepias prostrata

Common Name: prostrate milkweed

Global Rank: G1G2 **State Rank:** S1S2

Occurrence #: 12 **Eo Id:** 8798

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

NORTH OF SANTA MARGARITA RANCH CA. 1.2 MILES WEST FROM SOUTHERN JUNCTION OF OLD HIGHWAY 83 AND LOS ARRIEROUS LOOP ON WEST SIDE OF LOS ARRIEROUS (ON RIGHT-OF-WAY AND ADJACENT LAND)

Survey Information:

First Observation: 1994-06 **Survey Date:** **Last Observation:** 2000-03

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2000-03

Observed Area:

Comments:

General Description: ERODED MAVERICKS SOIL SERIES; JACKSON GROUP GEOLOGY

Comments: ADJACENT PRIVATE LAND IS UNFENCED; OCCURRENCE MAY EXTEND ONTO PRIVATE LAND

Protection Comments:

Management Comments:

Data:

EO Data: ABOUT 20 PLANTS IN VEGETATIVE STATE

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

BEST, CHRIS. NO DATE. PLANT ECOLOGIST, LOWER RIO GRANDE VALLEY NATIONAL WILDLIFE REFUGE, ROUTE 2, BOX 202A, ALAMO, TEXAS 78516; PHONE: 956-784-7580.

Janssen, Gena K. 1998. Letter to Tom Serota, U.S. Fish and Wildlife Service, Corpus Christi, Ecological Services Office, Texas. March 20, 1998.

BEST, CHRIS. 2000. EMAIL TO DANA PRICE REGARDING ADDITIONAL INFORMATION FOR VARIOUS MANIHOT WALKERAE LOCATIONS, INCLUDING AN ASCLEPIAS PROSTRATA. APRIL, 6, 2000.

Specimen:

Element Occurrence Record

Scientific Name: Astrophytum asterias

Common Name: star cactus

Global Rank: G1 **State Rank:** S1

Occurrence #: 1 **Eo Id:** 3563

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26098-E7, El Sauz

26098-D7, Rio Grande City North

Directions:

8 MILES NORTH OF RIO GRANDE CITY

Survey Information:

First Observation: 1931 **Survey Date:** **Last Observation:** 1968

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description: SANDY LOAM ON SOUTH SLOPE

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

CLOVER, E. U. 1932. ASTROPHYTUM ASTERIAS IN THE UNITED STATES. RHODORA 34:227-228.

Benson, Lyman. 1969. Flora of Texas: Cactaceae. Volume 2, Part II, pp. 221-317, plates 1-14. C. L. Lundell and collaborators, editors. Texas Research Foundation, Renner, TX. 97 pp.

Specimen:

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Common Name: Chihuahua balloon-vine

Global Rank: G2G3 **State Rank:** S2S3

Occurrence #: 2 **Eo Id:** 1173

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

3 MILES NORTH OF ROMA

Survey Information:

First Observation: 1957-07-15 **Survey Date:** **Last Observation:** 2002-04-01

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description: 1957, GRAVELLY SOIL; 2002, COPITA SOILS

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: 1957, IN FLOWER, SMALL COLONY; 2002, LOCALLY COMMON, NO FLOWERS OR FRUIT WERE PRESENT

Managed Area:

Managed Area Name

Reference:

Citation:

CARR, W.R. 2002. NOTES ON A BOTANICAL SURVEY OF THE JULIO MARTINEZ PROPERTY, STARR COUNTY, TEXAS, 1 APRIL 2002. UNPUBLISHED REPORT, THE NATURE CONSERVANCY OF TEXAS, SAN ANTONIO.

Specimen:

University of Texas at Austin, Lundell Herbarium. 1957. D.S. Correll #18075 and I.M. Johnston, Specimen # none TEX-LL. 15 July 1957.

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Common Name: Chihuahua balloon-vine

Global Rank: G2G3 **State Rank:** S2S3

Occurrence #: 3 **Eo Id:** 989

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

1 MILE NORTH OF ROMA

Survey Information:

First Observation: 1966 **Survey Date:** **Last Observation:** 1966-03-17

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description: HILLS; ROCKY SLOPES AMONG BUSHES

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

University of Texas at Austin, Lundell Herbarium. 1966. D.S. Correll #32274, Specimen # none TEX-LL. 17 March 1966.

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Occurrence #: 4 **Eo Id:** 6004

Track Status: Track all extant and selected historical EOs

Common Name: Chihuahua balloon-vine

TX Protection Status:

Global Rank: G2G3 **State Rank:** S2S3

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

END OF THE BLUFF ROAD WHICH FOLLOWS THE RIO GRANDE, SOUTHWEST OF SANTA MARGARITA, BETWEEN FALCON AND ROMA

Survey Information:

First Observation: 1975

Survey Date:

Last Observation: 1975-07-23

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area: 1.00

Comments:

General Description: SAND-GRAVEL TERRACE AND SLOPE

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: INFREQUENT

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

University of Texas at Austin Herbarium. 1975. M.L. Butterwick #1306 and S. Strong, Specimen # none TEX. 23 July 1975.

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Common Name: Chihuahua balloon-vine

Global Rank: G2G3 **State Rank:** S2S3

Occurrence #: 5 **Eo Id:** 2189

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26098-E8, El Chapote Creek

Directions:

10 MILES NORTH OF RIO GRANDE CITY, NEAR EL SAUZ ROAD, CAMERON COUNTY [MAPS TO STARR COUNTY]

Survey Information:

First Observation: 1951

Survey Date:

Last Observation: 1951-09-29

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area: 1.00

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: IN FRUIT

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

Southern Methodist University Herbarium. 1951. R. Runyon #4413, Specimen # none SMU. 29 September 1951.

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Common Name: Chihuahua balloon-vine

Global Rank: G2G3 **State Rank:** S2S3

Occurrence #: 7 **Eo Id:** 1939

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:
1 AND 1/4 MILES NORTHWEST OF ROMA

Survey Information:

First Observation: 1940 **Survey Date:** **Last Observation:** 1940-09-11

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: IN FRUIT

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

Southern Methodist University Herbarium. 1940. V.L. Cory #35882, Specimen # none SMU. 11 September 1940.

Element Occurrence Record

Scientific Name: Cardiospermum dissectum

Common Name: Chihuahua balloon-vine

Global Rank: G2G3 **State Rank:** S2S3

Occurrence #: 21 **Eo Id:** 2596

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

ARROYO RAMIREZ TRACT, LOWER RIO GRANDE VALLEY NWR, CA. 1.5 AIR MILES WEST OF ROMA

Survey Information:

First Observation: 2003-02-18 **Survey Date:** 2003-02-18 **Last Observation:** 2003-02-18

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2003-02-18

Observed Area:

Comments:

General Description: SANDSTONE OUTCROP ON RIDGE OVERLOOKING RIO GRANDE;ACACIA RIGIDULA SHRUB COMMUNITY, WITH LESQUERELLA THAMNOPHILA AND MANFREDA LONGIFLORA

Comments: ALSO AT THIS SITE: LESQUERELLA THAMNOPHILA 012 AND MANFREDA LONGIFLORA 018

Protection Comments:

Management Comments:

Data:

EO Data: FREQUENT IN SHRUBS ALONG SLOPES OF SANDSTONE RIDGE; CENSUS NOT ATTEMPTED

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

Price, Dana. 2003. Field Trip to Lesquerella thamnophila sites in Starr and Zapata counties, February 18-20, 2003.

BEST, CHRIS. NO DATE. PLANT ECOLOGIST, LOWER RIO GRANDE VALLEY NATIONAL WILDLIFE REFUGE, ROUTE 2, BOX 202A, ALAMO, TEXAS 78516; PHONE: 956-784-7580.

Best, Chris. 2003. Arroyo Ramirez Tract, LRGVNWR. Zapata Bladderpod Population Survey Data. February-March 2003.

Specimen:

Element Occurrence Record

Scientific Name: Coryphantha macromeris var. runyonii

Common Name: Runyon's cory cactus

Global Rank: G5T2T3 **State Rank:** S2S3

Occurrence #: 1 **Eo Id:** 3293

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26098-D7, Rio Grande City North
26098-C7, Rio Grande City South
26098-C8, Los Garzas
26098-D8, Roma-Los Saenz East
26098-C6, La Grulla
26098-D6, Sagunada Ranch

Directions:
RIO GRANDE CITY

Survey Information:

First Observation: 1918-12-07 **Survey Date:** **Last Observation:** 1921-08-09

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description: GRAVEL AND SANDY HILLS

Comments: TYPE LOCALITY

Protection Comments:

Management Comments:

Data:

EO Data: IN FLOWER AND FRUIT; ABUNDANT

Managed Area:

Managed Area Name

2012-04-19

Element Occurrence Record

Reference:

Citation:

ZIMMERMAN, A. D. DEPT. OF BOTANY, UNIV. OF TEXAS, AUSTIN, TX 78712 (512)471-6329.

Specimen:

U.S. National Herbarium, Smithsonian, Washington D.C. 1921. R. Runyon #15, Specimen # ? US. 10 August 1921. (Co-Type; Lectotype)

U.S. National Herbarium, Smithsonian, Washington D.C. 1921. Unknown Collector, Specimen # ? US. 9 August 1921. (Paratype)

U.S. National Herbarium, Smithsonian, Washington D.C. 1918. Unknown Collector, Specimen # ? US. 7 December 1918.

U.S. National Herbarium, Smithsonian, Washington D.C. No Date. David Griffiths (s.n.), Specimen # ? US.

Element Occurrence Record

Scientific Name: Coryphantha macromeris var. runyonii

Common Name: Runyon's cory cactus

Global Rank: G5T2T3 **State Rank:** S2S3

Occurrence #: 4 **Eo Id:** 204

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26098-E7, El Sauz

26098-D7, Rio Grande City North

Directions:

8 MILES NORTH OF RIO GRANDE CITY

Survey Information:

First Observation: 1933-11-30 **Survey Date:** **Last Observation:** 1933-11-30

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: IN FLOWER; IN CLUMPS TO 3 FEET ACROSS

Managed Area:

Managed Area Name

Reference:

Citation:

ZIMMERMAN, ALLAN D. NO DATE. PERSONAL COMMUNICATION.

Specimen:

University of Michigan Herbarium, Ann Arbor. 1933. E.U. Clover #1883, Specimen # ? MI. 30 November 1933.

Element Occurrence Record

Scientific Name: Coryphantha macromeris var. runyonii

Occurrence #: 7 **Eo Id:** 7069

Track Status: Track all extant and selected historical EOs

Common Name: Runyon's cory cactus

TX Protection Status:

Global Rank: G5T2T3 **State Rank:** S2S3

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26098-D8, Roma-Los Saenz East

Directions:
6 MILES NORTHEAST OF ROMA

Survey Information:

First Observation: 1965

Survey Date:

Last Observation: 1965-04-16

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area: 1.00

Comments:

General Description: SEMIDESERT; SANDY SOIL

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

ZIMMERMAN, ALLAN D. NO DATE. PERSONAL COMMUNICATION.

Specimen:

Rancho Santa Ana Botanic Garden, Claremont, CA. 1965. L. Benson #16544, Specimen # ? RSA. 16 April 1965.

Element Occurrence Record

Scientific Name: Coryphantha macromeris var. runyonii

Occurrence #: 9 **Eo Id:** 311

Track Status: Track all extant and selected historical EOs

Common Name: Runyon's cory cactus

TX Protection Status:

Global Rank: G5T2T3 **State Rank:** S2S3

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	**State:**	**Mapsheet:**
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

SANTA MARGARITA RANCH (1.5 MI. S OF JCT OF HWY 83 & FM 2098, 0.4 MI.S OFF HWY 83, THEN 1.0 MI. WSW, THEN 0.6 MI. SE, THEN 0.2 MI. SW TO MAIN HOUSE); 0.2 MI. S OF MAIN HOUSE

Survey Information:

First Observation: 1987 **Survey Date:** 1987-04-10 **Last Observation:** 1987-04-10

Eo Type: **Eo Rank:** C **Eo Rank Date:**

Observed Area: 1.00

Comments:

General Description: GRAVELLY, BRUSHY, ERODING, NORTHEAST-FACING SLOPE; OPEN MIXED SHRUBLAND; WITH ACACIA BERLANDIERI, ACACIA RIGIDULA, LEUCOPHYLLUM FRUTESCENS, ZIZIPHUS OBTUSIFOLIA

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: ONE DORMANT, HEALTHY INDIVIDUAL

Managed Area:

Managed Area Name

Reference:

Citation:

Poole, J.M. 1987. Field Survey to Santa Margarita Ranch of April 10, 1987.

2012-04-19

Specimen:

Element Occurrence Record

Scientific Name: Coryphantha macromeris var. runyonii

Occurrence #: 19 **Eo Id:** 969

Track Status: Track all extant and selected historical EOs

Common Name: Runyon's cory cactus

TX Protection Status:

Global Rank: G5T2T3 **State Rank:** S2S3

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

PRIVATE PROPERTY, ON UPLAND ON NORTH SIDE OF ACTIVE STOCK TANK, CA. 1.8-1.9 AIR MILES NORTH-NORTHEAST OF JUNCTION OF U.S. ROUTE 83 AND FM 650 NORTH OF ROMA

Survey Information:

First Observation: 2002-04-01 **Survey Date:** 2002-04-01 **Last Observation:** 2002-04-01

Eo Type: **Eo Rank:** BC **Eo Rank Date:** 2002-04-01

Observed Area:

Comments:

General Description: UNDER AND AMONG VARIOUS MEDIUM- TO TALL-STATURE SHRUBS IN THORN SHRUBLAND IN GRAVELLY SOILS OF LEVEL UPLAND UNDERLAIN BY JACKSON GROUP AND IN DEEPER FINE SAND OR CLAYEY SOILS OF BROAD SHALLOW VALLEY JUST DOWNSLOPE; SOILS MAPPED CATARINA SERIES, I.E., CALCAREOUS, GYPSIFEROUS, SALINE CLAY PALEUSTOLLIC TORRERTS, BUT SEVERAL INCLUSIONS MAY BE PRESENT; COMMON SHRUBS INCLUDE ACACIA RIGIDULA, OPUNTIA LINDHEIMERI, CASTELA ERECTA, ZIZIPHUS OBTUSIFOLIUS, AND KARWINSKIA HUMBOLDTIANA, WITH PROSOPIS GLANDULOSA, PHAULOTHAMNUS AND PARKINSONIA CF. TEXANUM INCREASING IN HEIGHT AND IMPORTANCE DOWNSLOPE; ASSOCIATED CACTI INCLUDE ANCISTROCACTUS SCHEERI, ECHINOCEREUS ENNEACANTHUS, ECHINOCEREUS REICHENBACHII VAR. FITCHII, FEROCACTUS SETISPINUS, LOPHOPHORA WILLIAMSII, MAMMILLARIA HEYDERI, OPUNTIA LEPTOCAULIS, OPUNTIA LINDHEIMERI, OPUNTIA SCHOTTII, THELOCACTUS BICOLOR VAR. BICOLOR, WILCOXIA POLSEGERI

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: 5-10 PLANTS OBSERVED ON 1 APRIL 2002, BUT SURVEY INCOMPLETE

Managed Area:

Element Occurrence Record

Managed Area Name

Reference:

Citation:

CARR, W.R. 2002. NOTES ON A BOTANICAL SURVEY OF THE JULIO MARTINEZ PROPERTY, STARR COUNTY, TEXAS, 1 APRIL 2002. UNPUBLISHED REPORT, THE NATURE CONSERVANCY OF TEXAS, SAN ANTONIO.

Specimen:

Element Occurrence Record

Scientific Name: Crotaphytus reticulatus

Common Name: Reticulate Collared Lizard

Global Rank: G3 **State Rank:** S2

Occurrence #: 27 **Eo Id:** 5624

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

CASAS BLANCAS

Survey Information:

First Observation:

Survey Date:

Last Observation: 1975-07-23

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

SUL ROSS STATE UNIVERSITY MUSEUM, ALPINE. 1975. JAMES F. SCUDDAY, SPECIMEN # 3962 SRSC. 23 JULY 1975.

Element Occurrence Record

Scientific Name: Crotaphytus reticulatus

Common Name: Reticulate Collared Lizard

Global Rank: G3 **State Rank:** S2

Occurrence #: 28 **Eo Id:** 3022

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	**State:**	**Mapsheet:**
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

2 MILES NORTHWEST OF ROMA.

Survey Information:

First Observation:	**Survey Date:**	**Last Observation:**	1933-04-25
Eo Type:	**Eo Rank:**	**Eo Rank Date:**	

Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

University of Michigan Museum of Zoology. 1933. H. Monroe, Specimen # 74763 UMMZ. 25 April 1933.

Element Occurrence Record

Scientific Name: Eriogonum greggii

Common Name: Gregg's wild-buckwheat

Global Rank: G2 **State Rank:** S1

Occurrence #: 2 **Eo Id:** 2572

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

SANTA MARGARITA RANCH, (1.5 MI. SOUTH OF JCT. OF HWY 83 & FM 2098, 0.4 MI. SOUTH OF HWY 83, THEN 1 MI. WSW, THEN 0.6 MI. SE, THEN 0.2 MI. SW TO MAIN HOUSE); 0.2 MI. S OF MAIN HOUSE

Survey Information:

First Observation: 1975 **Survey Date:** 1987-04-10 **Last Observation:** 2001-02-27

Eo Type: **Eo Rank:** B **Eo Rank Date:**

Observed Area: 5.00

Comments:

General Description: GRAVELLY, BRUSHY, ERODING SLOPES; OPEN TO DENSE MIXED SHRUBLAND;WITH ACACIA BERLANDIERI, A. RIGIDULA, LEUCOPHYLLUM FRUTESCENS, ZIZIPHUS OBTUSIFOLIA, PORLIERIA ANGUSTIFOLIA

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: IN FLOWER AND FRUIT; APPROXIMATELY 80 HEALTHY INDIVIDUALS IN 1987; IN 2001, FEW PLANTS, IN FLOWER (DID NOT CENSUS)

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

Poole, J.M. 1987. Field Survey to Santa Margarita Ranch of April 10, 1987.

Price, Dana M. 2001. Notes regarding miscellaneous south Texas plant surveys of various dates from October 2000 through June 2001.

Specimen:

University of Texas at Austin Herbarium. 1975. M. Butterwick #1313 and S. Strong, Specimen # none TEX. 23 July 1975.

University of Texas at Austin Herbarium. 2001. Dana Price #148, Specimen # none TEX. 27 February 2001.

Element Occurrence Record

Scientific Name: Frankenia johnstonii

Common Name: Johnston's frankenia

Global Rank: G3 **State Rank:** S3

Occurrence #: 6 **Eo Id:** 842

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE, PDL

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26099-D1, Roma-Los Saenz West

26098-D8, Roma-Los Saenz East

Directions:

HILLS NORTHEAST OF ROMA

Survey Information:

First Observation: 1968-01-30

Survey Date:

Last Observation: 1968-01-30

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: BARE OPEN AREAS OF NO TALL SHRUBS; APPARENTLY ON SALTY SOIL THAT BECOMES VERY WET DURING RAIN, BUT AT OTHER TIMES IS VERY DRY AND HARD.

Comments:

Protection Comments: LE

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

2012-04-19

Specimen:

University of Texas at Austin Herbarium. 1968. Archie D. Wood #835, Specimen # 294586 TEX. 30 January 1968.

Element Occurrence Record

Scientific Name: Leptodactylus fragilis

Common Name: White-lipped Frog

Global Rank: G5 **State Rank:** S1

Occurrence #: 5 **Eo Id:** 8822

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26098-D8, Roma-Los Saenz East

26099-D1, Roma-Los Saenz West

Directions:

North of Roma-Los Saenz. The directions are generalized as this record consists of multiple observations.

Survey Information:

First Observation: 2002-07-10 **Survey Date:** 2002-07-10 **Last Observation:** 2002-07-10

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2002-07-10

Observed Area:

Comments:

General Description:

Comments: Other species heard at the listening stops included: <i>Bufo valliceps</i>, <i>B</i>. <i>speciosus</i>, and <i>Gastrophryne </i>sp.

Protection Comments:

Management Comments:

Data:

EO Data: 10 July 2002: A few L. fragilis were calling at two listening stops.

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

Gottfried, Bob. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database Manager on 2 February concerning observations of Leptodactylus fragilis and Rhinophrynus dorsalis at multiple sites from Roma-Los Saenz to El Sauz, Starr County, TX.

Martin, Dave. 2002. Map depicting listening stations of an anuran road survey on 10 July strecthing from Roma-Los Saenz to El Sauz, Starr County, TX.

Specimen:

Element Occurrence Record

Scientific Name: Manfreda longiflora

Common Name: St. Joseph's staff

Global Rank: G2 **State Rank:** S2

Occurrence #: 8 **Eo Id:** 489

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	**State:**	**Mapsheet:**
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

WEST OF HILL WITH "HOME OF THE GLADIATORS" WATER TOWER NORTHEAST OF ROMA, CA. 5100 FEET SOUTH, 5100 FEET EAST OF JUNCTION OF U.S. ROUTE 83 AND FM 650; SPECIFIC DIRECTIONS TO SITE IN CLAYTON'S REPORT

Survey Information:

First Observation: **Survey Date:** **Last Observation:** 1991-04-24

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: NATIVE SOUTH TEXAS BRUSH TRACT ON COPITA FINE SANDY LOAM

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: ONE PLANT SEEN BY PHIL CLAYTON 24 APRIL 1991

Managed Area:

Managed Area Name

Reference:

Citation:

CLAYTON, PHIL. 1991. FIELD SURVEY OF ROMA AREA, STARR COUNTY, TEXAS FOR RARE PLANTS, 24 APRIL 1991.

Specimen:

2012-04-19

Element Occurrence Record

Scientific Name: Manfreda longiflora

Common Name: St. Joseph's staff

Global Rank: G2 **State Rank:** S2

Occurrence #: 15 **Eo Id:** 8095

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	**State:**	**Mapsheet:**
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

PRIVATE PROPERTY, IN CLAY FLAT NORTH TO NORTHEAST OF ACTIVE STOCK TANK [COORDINATES DEPICT VICINITY EAST AND REPORT MAP INDICATES NORTHEAST], 1.9 AIR MILES NORTH-NORTHEAST OF JUNCTION OF U.S. ROUTE 83 AND FM 650 NORTH OF ROMA

Survey Information:

First Observation: 2002-04-01 **Survey Date:** 2002-04-01 **Last Observation:** 2002-04-01

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2002-04-01

Observed Area:

Comments:

General Description: IN FINE SANDY OR CLAYEY LOAM IN BOTTOM OF SHALLOW VALLEY BETWEEN GRAVELLY HILLS UNDERLAIN BY JACKSON GROUP, IN VEGETATION PERHAPS DOMINATED BY LOW GYPSOPHILES OR HALOPHILES SUCH AS VARILLA TEXANA AND BILLIETURNERA HELLERI BUT ALSO CONTAINING MEDIUM TO TALL THORNY SHRUBS INCLUDING ACACIA RIGIDULA AND PROSOPIS GLANDULOSA

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: FOUR STEMS FROM 2001 BLOOMING PERIOD OBSERVED ON 1 APRIL 2002, SOME WITH DEHISCED CAPSULES STILL CONTAINING SEEDS

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

CARR, W.R. 2002. NOTES ON A BOTANICAL SURVEY OF THE JULIO MARTINEZ PROPERTY, STARR COUNTY, TEXAS, 1 APRIL 2002. UNPUBLISHED REPORT, THE NATURE CONSERVANCY OF TEXAS, SAN ANTONIO.

Specimen:

Element Occurrence Record

Scientific Name: Manfreda longiflora

Common Name: St. Joseph's staff

Global Rank: G2 **State Rank:** S2

Occurrence #: 18 **Eo Id:** 7149

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:

Starr

State:

TX

Mapsheet:

26099-D1, Roma-Los Saenz West

Directions:

ARROYO RAMIREZ TRACT, LOWER RIO GRANDE VALLEY NWR, CA. 1.5 AIR MILES WEST OF ROMA

Survey Information:

First Observation: 2003-02-18 **Survey Date:** 2003-02-18 **Last Observation:** 2003-02-18

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2003-02-18

Observed Area:

Comments:

General Description: SLOPES OF RIDGE OVERLOOKING RIO GRANDE, WITH LESQUERELLA THAMNOPHILA AND CARDIOSPERMUM DISSECTUM

Comments: ALSO AT THIS SITE: CARDIOSPERMUM DISSECTUM 021 AND LESQUERELLA THAMNOPHILA 012

Protection Comments:

Management Comments:

Data:

EO Data: 34 PLANTS, VEGETATIVE, IN 2003

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

Best, Chris. 2003. Arroyo Ramirez Tract, LRGVNWR. Zapata Bladderpod Population Survey Data. February-March 2003.

Price, Dana. 2003. Field Trip to Lesquerella thamnophila sites in Starr and Zapata counties, February 18-20, 2003.

BEST, CHRIS. 2003. EMAIL TO DANA PRICE, 21 MARCH 2003, CONCERNING RARE AND ENDANGERED PLANT SURVEYS AT ARROYO RAMIREZ TRACT, LOWER RIO GRANDE VALLEY NWR.

Specimen:

Element Occurrence Record

Scientific Name: Nasua narica

Common Name: White-nosed Coati

Global Rank: G5 **State Rank:** S2?

Occurrence #: 1 **Eo Id:** 6009

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26098-D8, Roma-Los Saenz East

Directions:

STRAIGHT SOUTH FROM SACRED HEART CATHOLIC CHURCH AT ESCOBARES, FIVE MILES EAST OF ROMA; SIGHTING WAS ONE MILE FROM THE CHURCH AND ABOUT 200 YARDS FROM RIO GRANDE

Survey Information:

First Observation: **Survey Date:** **Last Observation:** 1991-05-24

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: ONE COATI

Managed Area:

Managed Area Name

Reference:

Citation:

LOYA, BALDOMERO. 1991. PERSONAL COMMUNICATION. MEMO TO KATRINA MARTIN DATED MAY 31, 1991 CONCERNING ENDANGERED FELINE SIGHTINGS.

Specimen:

Element Occurrence Record

Scientific Name: Physaria thamnophila

Common Name: Zapata bladderpod

Global Rank: G1 **State Rank:** S1

Occurrence #: 2 **Eo Id:** 5996

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26099-D1, Roma-Los Saenz West
26098-D8, Roma-Los Saenz East
26098-C8, Los Garzas

Directions:
Roma and about 4 miles N of Roma

Survey Information:

First Observation: 188? **Survey Date:** 1966-05-17 **Last Observation:** 1966-05-17

Eo Type: **Eo Rank:** H **Eo Rank Date:** 1966-05-17

Observed Area:

Comments:

General Description: Sandy soil.

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: Between 1882 and 1994: A specimen was collected. 17 May 1966: A specimen was collected.

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

Wendt, Tom. 2000. E-mail of 27 July to Jackie Poole, Texas Parks & Wildlife Dept. Wildlife Diversity Program botanist, concerning the time period when Greenleaf Cilley Nealley was collecting plants in Texas.

Rollins, R.C., and E.A. Shaw. 1973. The genus Lesquerella (Cruciferae) in North America. Harvard Univ. Press. Cambridge, MA. 288 pp.

U.S. Fish and Wildlife Service. 1999. 50 CFR Part 17, RIN 1018-AE54, Endangered and threatened wildlife and plants; determination of endangered status for the plant Lesquerella thamnophila (Zapata bladderpod). Final rule. U.S. Dept. of the Interior Fish and Wildlife Service, Federal Register 64(224):63745-63752. 22 November 1999.

POOLE, JACKIE M. NO DATE. TEXAS PARKS AND WILDLIFE DEPARTMENT, WILDLIFE DIVERSITY BRANCH, 4200 SMITH SCHOOL ROAD, AUSTIN, TEXAS 78744; 512/389-8019; jackie.poole@tpwd.state.tx.us

Specimen:

University of Texas at Austin Herbarium. 1966. Archie D. Wood #763, Specimen # 248905 TEX. 17 May 1966.

Element Occurrence Record

Scientific Name: Physaria thamnophila

Common Name: Zapata bladderpod

Global Rank: G1 **State Rank:** S1

Occurrence #: 6 **Eo Id:** 7965

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

Santa Margarita Ranch: 1.5 miles S of junction of highway 83 & FM 2098, 0.4 mile south off Hwy 83, then 1.0 mile west-southwest, then 0.6 mile SE, then 0.2 mile SW to main house.

Survey Information:

First Observation: 1987-04-10 **Survey Date:** 1987-04-10 **Last Observation:** 2001-02-27

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2007-03-07

Observed Area: 5.00

Comments:

General Description: This population is scattered along 2.5 kilometers of bluffs overlooking the Rio Grande. Plants are mostly found on sandstone outcrops among thornscrub; with Mimosa wherryana, Acacia rigidula, Leucophyllum frutescens, Karwinskia humboldtiana, Diospyros texana, Eysenhardtia texana, Ephedra antisyphilitica, Jatropha dioica, Condalia spp., Lippia graveolens, Forestiera angustifolia, Yucca sp.,Hechtia glomerata, Mammillaria heyderi, Wilcoxia poselgeri, Echinocereus enneacanthus, Eriogonum greggii, Melampodium cinereum, Lupinus texensis, Acalypha sp.,, Thamnosma texana, Synthlipsis greggii, native short and mid-grasses incl. Aristida purpurea, Tridens muticus, Bouteloua trifida, Hilaria belangeri. Soil: eroded Maverick soil series; Jackson group geology.

Comments:

Protection Comments:

Management Comments:

Data:

Element Occurrence Record

EO Data: 23 Jul 1975: Specimens were collected on 23 and 25 July from scattered population on sandstone bluffs. 23 July 1977: Specimen was collected from scattered population on upper sandstone -gravel terrace. April, 1986: 20 fully mature individuals were observed. 10 April 1987: in flower and fruit; 20 fully mature, healthy individuals; population scattered over 5 acres. 1996: Approx. 70 individuals were seen somewhere on the ranch. 01 march 2000: about 50 plants, some flowering and fruiting. 27 Feb 2001: 140 plants were found on the bluffs, about half were reproductive. Approx. 170 were found on the Arrieros loop. 15 Mar 2002: There were 116 plants on the Arrieros loop and 43 plants found on bluffs overlooking the river. 19 Feb 2003: Observer found 263 plants on bluffs in southern part of the ranch. 21 Mar 2003: There were 320 plants on the Arrieros loop, approx 50 percent were in late flower and fruit. 26 Mar 2004: 478 plants observed, at least 11 with flowers and 11 with fruit. 14 Apr 2004: Over 240 plants were found in the southern part of the ranch. Some of the plants had fruit. 23 Mar 2005: Over 130 plants were found, at least 50 had flowers and fruit. 28 Feb 2006: 88 plants were found, 2 with buds. 01 Mar 2006: 181 plants were found. 44 of the plants were dormant. 16 June 2006: There were over 200 plants found, at least 15 of them had fruit. 07 Mar 2007: There were approx. 7,000 plants observed. Of these, at least 420 had flowers, 216 had fruit and 409 were seedlings.

Managed Area:

Managed Area Name

Reference:

Citation:

HURLBURT, DANA PRICE AND CHRIS BEST. 2000. FIELD SURVEY OF MARCH 1, 2000 TO STARR COUNTY.

BEST, CHRIS. NO DATE. PLANT ECOLOGIST, LOWER RIO GRANDE VALLEY NATIONAL WILDLIFE REFUGE, ROUTE 2, BOX 202A, ALAMO, TEXAS 78516; PHONE: 956-784-7580.

U.S. Fish and Wildlife Service. 1999. 50 CFR Part 17, RIN 1018-AE54, Endangered and threatened wildlife and plants; determination of endangered status for the plant Lesquerella thamnophila (Zapata bladderpod). Final rule. U.S. Dept. of the Interior Fish and Wildlife Service, Federal Register 64(224):63745-63752. 22 November 1999.

Price, Dana. 2004. Field notebook with raw data on wild plant populations observed throughout Texas from 27 January 2004 until 13 May 2005. 153 pp.

Price, Dana. 2005. Field notebook with raw data on wild plant populations observed throughout Texas from 15 June 2005 until 6 November 2006. 149 pp.

Price, Dana. 2006. Field notebook with raw data on wild plant populations observed throughout Texas from 7 November 2006 until 31 July 2007. 98 pp.

Janssen, Gena K. 1998. Letter to Tom Serota, U.S. Fish and Wildlife Service, Corpus Christi, Ecological Services Office, Texas. March 20, 1998.

Poole, J.M. 1987. Field Survey to Santa Margarita Ranch of April 10, 1987.

Price, Dana. 2001. Field Surveys for Lesquerella thamnophila of February-April 2001.

Price, Dana. 2007. Excel spreadsheets with data from Physaria thamnophila surveys on the Santa Margarita Ranch in Starr County collected in 2004, 2006 and 2007.

Price, Dana. 2007. Nine point shapefiles documenting observations of Physaria thamnophila on the Santa Margarita Ranch in Starr County, TX during surveys of 2004-2007.

Price, Dana. 2002. Field notebook with raw data on wild plant populations observed throughout Texas from 17 September 2002 to 29 October 2003. 122 pp.

Price, Dana. 2004. Shapefile of plant observations in Brooks, Cameron, Harris, Kenedy, Refugio, Starr, Travis, Uvalde, Webb, and Zapata counties, as well as Mexico, collected during surveys of January-May.

Price, Dana. 2003. Field Trip to Lesquerella thamnophila sites in Starr and Zapata counties, February 18-20, 2003.

Price, Dana. 2006. Shapefiles of rare plant observations in Hidalgo, Kenedy, and Starr counties during surveys of February and March.

Specimen:

The Plant Resources Center, University of Texas, Austin, TX; Dana Price (#147), Accession #00199371, 27 Feb, 2001. TEX.

The Plant Resources Center, University of Texas, Austin, TX; Dana Price (#149), Accession #00199375, 27 Feb, 2001. TEX.

The Plant Resources Center, University of Texas, Austin, TX; M. Butterwick and S. Strong (#1340), Accession # 00166997, 25 JUL 1975, TEX-LL.

The Plant Resources Center, University of Texas, Austin, TX; M. Butterwick and S. Strong (#1353), Accession # 00167316, 23 JUL 1975, TEX-LL.

The Plant Resources Center, University of Texas, Austin, TX; M. Butterwick and S. Strong (#1309), Accession # 00353742, 23 JUL 1977, TEX_LL.

Element Occurrence Record

Scientific Name: Physaria thamnophila

Common Name: Zapata bladderpod

Global Rank: G1 **State Rank:** S1

Occurrence #: 12 **Eo Id:** 7381

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

Arroyo Ramirez Tract of Lower Rio Grande Valley National Wildlife Refuge, approx. 1.5 air miles W of Roma.

Survey Information:

First Observation: 2002-08 **Survey Date:** 2007-04-13 **Last Observation:** 2007-04-13

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2007-04-13

Observed Area:

Comments:

General Description: According to Best (2003): The population occupies about 0.86 ha (2.1 ac) along a sandstone outcrop bordering a small arroyo. According to the Soil Survey of Starr County (USDA-SCS 1972), the soil is mapped in the Jémez-Quemado series, which generally occurs over a caliche substrate. However, I believe this site is actually a Copita Fine Sandy Loam, which is associated with calcareous sandstone. Due to the steep slope, previous overgrazing and susceptibility of this soil to erosion, this site has eroded extensively. Our vegetation survey detected buffelgrass at the relatively low frequency of 0.088 (15/170 intercepts), and no other invasive grasses. Soil erosion appears to be the greatest threat to this site. The vegetation present within the bladderpod population site is a diverse low shrubland, about 0.5 to 2 m in height. Among the dominant and characteristic shrub and sub-shrub species are blackbrush (Acacia rigidula), cenizo (Leucophyllum frutescens), coyotillo (Karwinskia humboldtiana), wild oregano (Lippia graveolens), Texas persimmon (Diospyros texana), Krameria ramosissima and Wherry Mimosa (Mimosa wherryana). Native grasses, such as purple three-awn (Aristida purpurea), slim Tridens (Tridens muticus), silver bluestem (Bothriochloa saccharoides var. torreyana), red grama (Bouteloua trifida) and sand dropseed (Sporobolus cryptandrus) are common. Herbaceous vegetation includes Polygala lindheimeri, Damiana (Turnera diffusa), Berlandier's Trumpets (Acleisanthes obtusa), Dyssodia sp., blackfoot daisy (Melampodium cinereum) and Ruda (Thamnosma texana). Zapata bladderpod was present at a relatively high frequency of 0.247 (42/170 intercepts). Another rare plant tracked by the Texas Natural Heritage Program, Chihuahua balloon-vine (Cardiospermum dissectum), is quite common here, occurring at a frequency of 0.165 (28/170 intercepts).

Comments: Also at this site: Cardiospermum dissectum 021 and Manfreda longiflora 018

Protection Comments: Best, 2003: Soil erosion appears to be the greatest threat to this site. Border Patrol is very active in this area, and we observed some sign that a vehicle may have driven through the vegetation at the top of the ridge. Of immediate management concern for the protection of this site is restriction of refuge, Border Patrol and other vehicles, including Border Patrol mountain bicycles, to existing roads. Foot traffic within the population itself, including monitoring activities, should be kept to an absolute minimum.

Management Comments:

Data:

EO Data: 04 Oct 2002: Observer discovered the population while on contract for a seismic company. Oct 2002: there were about 2000 plants, some in flower and early fruit. 18 Feb- 5 Mar 2003: There were 1,706 individual plants, of which 535 were flowering and 284 were in fruit at the times of survey. On 19 Feb, 80 percent of the plants were vegetative, 19 percent had flowers and 1 percent had fruit. On 5 Mar, 42 percent of the plants were vegetative, 36 percent had flowers and 22 percent had fruit. 15 Apr 2004: Population was surveyed with 34 plots; each plot had a radius of 1 meter. 201 plants were found in the plots. 49.3 percent of the plants were vegetative, 31 percent had flowers, and 43.3 percent had fruit. 01 Mar 2006: Population was surveyed with the same methodology as in 2004. There were 57 plants in the survey plots. 75 percent of the plants were dormant and 25 percent were vegetative. It was extremely dry conditions; no reproductive plants or seedlings were observed. 16 June 2006: 41 Plants were observed, area was very dry. 16 Apr 2007: Population was surveyed with the same methodology as in 2004 and 2006. 460 plants were observed in survey plots. 34 percent of the plants were vegetative, 1 percent had flowers, 27 percent had fruit and 38 percent of the plants were seedlings. There were no dormant plants.

Managed Area:

Managed Area Name

Reference:

Citation:

Best, Chris. 2003. Summary of Zapata Bladderpod Population at Arroyo Ramírez Tract. Sent on 25 November, 2003.

Price, Dana. 2003. Field Trip to Lesquerella thamnophila sites in Starr and Zapata counties, February 18-20, 2003.

PATTERSON, THOMAS. 2002. E-MAIL TO DANA PRICE OF 7 OCTOBER 2002 RE: LESQUERELLA THAMNOPHILA.

BEST, CHRIS. NO DATE. PLANT ECOLOGIST, LOWER RIO GRANDE VALLEY NATIONAL WILDLIFE REFUGE, ROUTE 2, BOX 202A, ALAMO, TEXAS 78516; PHONE: 956-784-7580.

Best, Chris. 2003. Arroyo Ramirez Tract, LRGVNWR. Zapata Bladderpod Population Survey Data. February-March 2003.

Patterson, Tom. 2002. E-mail of 04 October to Dana Price, Texas Parks & Wildlife Dept. Wildlife Diversity Program botanist, concerning a new population of Physaria thamnophila on the Arroyo Ramirez Tract of the Lower Rio Grande Valley National Wildlife Refuge.

Price, Dana. 2007. Excel spreadsheet with data from Physaria thamnophila surveys on the Ramirez tract of the Lower Rio Grande Valley National Wildlife Refuge in 2004, 2006 and 2007.

Price, Dana. 2002. Field notebook with raw data on wild plant populations observed throughout Texas from 17 September 2002 to 29 October 2003. 122 pp.

Price, Dana. 2006. Shapefiles of rare plant observations in Hidalgo, Kenedy, and Starr counties during surveys of February and March.

Specimen:

Element Occurrence Record

Scientific Name: Physaria thamnophila

Common Name: Zapata bladderpod

Global Rank: G1 **State Rank:** S1

Occurrence #: 13 **Eo Id:** 8926

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name:

Starr

State:

TX

Mapsheet:

26098-D8, Roma-Los Saenz East

Directions:

Approx. 8 kilometers N of Hwy 83 on N San Julian Rd. Directions were created by database staff.

Survey Information:

First Observation: 2007-02-23 **Survey Date:** 2007-04-12 **Last Observation:** 2007-04-12

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2007-04-12

Observed Area:

Comments:

General Description: Not described

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: 23 Feb 2007: Approx. 300 plants were documented on a private ranch. 12 Apr 2007: 71 Plants were found along San Julian Rd. 21 of the plants had fruit. The rest were vegetative or seedlings.

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

Price, Dana. 2006. Field notebook with raw data on wild plant populations observed throughout Texas from 7 November 2006 until 31 July 2007. 98 pp.

Price, Dana. 2007. Shapefiles of rare plant observations at the Martinez Ranch in Starr County and Siesta Shores in Zapata County during surveys of February-April.

Specimen:

Element Occurrence Record

Scientific Name: Physaria thamnophila

Common Name: Zapata bladderpod

Global Rank: G1 **State Rank:** S1

Occurrence #: 17 **Eo Id:** 8930

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Federal Status: LE

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26099-D1, Roma-Los Saenz West

Directions:

Along a proposed powerline about 4 miles N of Roma. Directions were created by database staff.

Survey Information:

First Observation: 1994-05-02 **Survey Date:** 1994-05-02 **Last Observation:** 1994-05-02

Eo Type: **Eo Rank:** E **Eo Rank Date:** 1994-05-02

Observed Area:

Comments:

General Description: Uncut proposed powerline.

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: 2 and 5 May, 1994: A survey of a proposed powerline found scattered occurrences of Zapata Bladderpod

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

U.S. Fish and Wildlife Service. 1999. 50 CFR Part 17, RIN 1018-AE54, Endangered and threatened wildlife and plants; determination of endangered status for the plant Lesquerella thamnophila (Zapata bladderpod). Final rule. U.S. Dept. of the Interior Fish and Wildlife Service, Federal Register 64(224):63745-63752. 22 November 1999.

Green, C. 1994. Letter to Central Power and Light Company, Corpus Christi, Dated 18 May 1994. Espey, Huston & Associates, Inc., Austin. EH&A Document #940411. 8 pp. + Large Aerial Photo.

Specimen:

Element Occurrence Record

Scientific Name: Pithecellobium ebano-ehretia anacua series

Occurrence #: 13 **Eo Id:** 3271

Track Status: Track all extant and selected historical EOs

Common Name: Texas Ebony-anacua Series

TX Protection Status:

Global Rank: G2 **State Rank:** S1

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26098-D8, Roma-Los Saenz East

Directions:

0.3 MILE SOUTHWEST OF GARCENO (JUNCTION 649 WITH 83); MUST GO THROUGH LOCKED GATES

Survey Information:

First Observation: 1985 **Survey Date:** 1985-04-02 **Last Observation:** 1985-04-02

Eo Type: **Eo Rank:** BC **Eo Rank Date:**

Observed Area: 110.00

Comments:

General Description: SUGARBERRY-EBONY-ANACUA-MESQUITE; VIEWED FROM THE ROAD ONLY; FAIRLY GOOD

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

DIAMOND, D. D. 1985. FIELD SURVEY TO THE LOWER RIO GRANDE VALLEY OF APRIL 1-5, 1985.

2012-04-19

Specimen:

Element Occurrence Record

Scientific Name: Rhinophrynus dorsalis

Common Name: Mexican Burrowing Toad

Global Rank: G5 **State Rank:** S2

Occurrence #: 1 **Eo Id:** 8217

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26098-E8, El Chapote Creek

26098-E7, El Sauz

26098-D8, Roma-Los Saenz East

Directions:

East, south, and southwest of El Sauz. The directions are generalized as this record consists of multiple observations.

Survey Information:

First Observation: 1967-05-24 **Survey Date:** 2002-07-16 **Last Observation:** 2002-07-16

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2002-07-16

Observed Area:

Comments:

General Description:

Comments: Other species heard at the listening stations included: <i>Gastrophryne</i> sp., <i>Bufo speciosus</i>, and <i>B</i>. <i>marinus</i>. Mr. Martin had observed tadpoles in the small impoundment a 1.0-1.5 miles south-southwest of El Sauz which has since been bulldozed.

Protection Comments:

Management Comments:

Data:

EO Data: 24 May 1967: Nine specimens collected (tadpoles). 10 July 2002: Two choruses of perhaps 3 and 6-7 individuals were heard. 11 July 2002: Two choruses, one of which had 10 individuals, were heard. 16 July 2002: Three choruses of various sizes were heard

Managed Area:

Managed Area Name

Reference:

Citation:

Martin, Dave. 2002. Map depicting listening stations of an anuran road survey on 10 July strecthing from Roma-Los Saenz to El Sauz, Starr County, TX.

Gottfried, Bob. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database Manager on 2 February concerning observations of Leptodactylus fragilis and Rhinophrynus dorsalis at multiple sites from Roma-Los Saenz to El Sauz, Starr County, TX.

Martin, Dave. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database manager, on 9 February concerning observations of Hypopachus variolosus, Smilisca baudini, Leptodactylus fragilis, and Rhinophrynus dorsalis in South Texas (Starr, Hidalgo, and Cameron counties).

Martin, Dave. 2002. Audio file of Rhinophrynus dorsalis chorusing recorded on 11 July 1.1 miles west of El Sauz, Starr County, TX.

Linam, Lee Ann. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database manager, on 6 February concerning observations of Hypopachus variolosus and Rhinophrynus dorsalis near El Sauz in Starr County, TX.

Gottfried, Bob. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database Manager on 2 February concerning observations of Rhinophrynus dorsalis, Leptodactylus fragilis, and Hypopachus variolosus at multiple sites south and east of El Sauz and approximately 10.5 air miles southeast of El Sauz, Starr County, TX.

Martin, Dave. 2002. Map depicting listening stations of an anuran road survey on 16 July just south and east of El Sauz and approximately 10.5 air miles southeast of El Sauz, Starr County, TX.

Specimen:

University of Michigan, Museum of Zoology. 1967. D.E. Hahn, Catalog # 131026 UMMZ. 24 May 1967.

Element Occurrence Record

Scientific Name: Rhinophrynus dorsalis

Common Name: Mexican Burrowing Toad

Global Rank: G5 **State Rank:** S2

Occurrence #: 4 **Eo Id:** 5982

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

13080003 - International Falcon Reservoir

County Name:	State:	Mapsheet:
Starr	TX	26099-E1, Salineno
		26099-E2, Falcon Village
		26099-D1, Roma-Los Saenz West
		26098-E8, El Chapote Creek

Directions:

RANCH ABOUT 12 MILES NORTH OF ROMA

Survey Information:

First Observation: **Survey Date:** **Last Observation:** 1966-11-08

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: NEWLY METAMORPHOSED, FROM A STOCK TANK, 8 NOVEMBER 1966

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Element Occurrence Record

Reference:

Citation:

JAMES, P. 1966. THE MEXICAN BURROWING TOAD, RHINOPHRYNUS DORSALIS, AN ADDITION TO THE VERTEBRATE FAUNA OF THE UNITED STATES. TX. J. SCI. 18:272-276.

Specimen:

Element Occurrence Record

Scientific Name: Rhinophrynus dorsalis

Common Name: Mexican Burrowing Toad

Global Rank: G5 **State Rank:** S2

Occurrence #: 5 **Eo Id:** 4060

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet:

26099-D1, Roma-Los Saenz West
26099-E1, Salineno
26098-D8, Roma-Los Saenz East
26098-C8, Los Garzas
26098-C7, Rio Grande City South
26098-D7, Rio Grande City North

Directions:
BETWEEN RIO GRANDE CITY AND JUNCTION OF U.S. HIGHWAY 83 AND FR 2098

Survey Information:

First Observation: **Survey Date:** **Last Observation:** 1966-05-20

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: CALLING ON BOTH SIDES OF THE RIO GRANDE, 20 MAY 1966

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

JAMES, P. 1966. THE MEXICAN BURROWING TOAD, RHINOPHRYNUS DORSALIS, AN ADDITION TO THE VERTEBRATE FAUNA OF THE UNITED STATES. TX. J. SCI. 18:272-276.

Specimen:

Element Occurrence Record

Scientific Name: Rhinophrynus dorsalis

Common Name: Mexican Burrowing Toad

Global Rank: G5 **State Rank:** S2

Occurrence #: 8 **Eo Id:** 8825

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name: Starr

State: TX

Mapsheet: 26098-D8, Roma-Los Saenz East

Directions:
North of Hwy 83 in Roma-Los Saenz.

Survey Information:

First Observation: 2002-07-10 **Survey Date:** 2002-07-10 **Last Observation:** 2002-07-10

Eo Type: **Eo Rank:** E **Eo Rank Date:** 2002-07-10

Observed Area:

Comments:

General Description:

Comments: Other species heard at this location included <i>Bufo valliceps</i>.

Protection Comments:

Management Comments:

Data:

EO Data: 10 July 2002: 6-7<i> R</i>. <i>dorsalis</i> were heard calling. Two were located in thick grass.

Managed Area:

Managed Area Name

Reference:

2012-04-19

Element Occurrence Record

Citation:

Martin, Dave. 2002. Photo of a Rhinophrynus dorsalis taken on 10 July 2002 while completing an anuran road survey that went from Roma-Los Saenz to El Sauz, Starr County, TX.

Gottfried, Bob. 2007. E-mail to Sandy Birnbaum, Natural Diversity Database Manager on 2 February concerning observations of Leptodactylus fragilis and Rhinophrynus dorsalis at multiple sites from Roma-Los Saenz to El Sauz, Starr County, TX.

Martin, Dave. 2002. Map depicting listening stations of an anuran road survey on 10 July strecthing from Roma-Los Saenz to El Sauz, Starr County, TX.

Specimen:

Element Occurrence Record

Scientific Name: Ulmus crassifolia-celtis laevigata series

Occurrence #: 6 **Eo Id:** 3601

Track Status: Track all extant and selected historical EOs

Common Name: Cedar Elm-sugarberry Series

TX Protection Status:

Global Rank: G4 **State Rank:** S4

Federal Status:

Location Information:

Watershed:

13090001 - Los Olmos

County Name:	State:	Mapsheet:
Starr	TX	26099-D1, Roma-Los Saenz West

Directions:

ALONG RIO GRANDE RIVER, 2.0 MILES SOUTH OF SANTA MARGARITA

Survey Information:

First Observation: 1985-04-02 **Survey Date:** 1985-04-02 **Last Observation:** 1985-04-02

Eo Type: **Eo Rank:** BC **Eo Rank Date:** 1985-04-02

Observed Area: 25.00

Comments:

General Description: GOOD SUGARBERRY-ASH-WILLOW GALLERY FOREST; NO ELMS; THIS RIPARIAN FOREST IS INTERMITTENT NORTH TO FALCON DAM

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

DIAMOND, D. D. 1985. FIELD SURVEY TO THE LOWER RIO GRANDE VALLEY OF APRIL 1-5, 1985.

Specimen:

06/29/2011 Version Date

Office Use Only

Date Received: ____________________(yyyy-mm-dd)

Sourcecode: U____________________TXUS

EOR transcribed/updated by:__________(initials)__________(date)

Scientist Reviewer:__________(initials) EO id:__________

Texas Natural Diversity Database Reporting Form

Wildlife Diversity Program
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744 (512) 389-8111

We Need Your Help. If you have information on the location of a rare plant or animal and would like to help us build the Texas Natural Diversity Database, please complete the form below. Thank you!

It is assumed that data submitted to the TXNDD were obtained while in compliance with all Texas laws, including obtaining landowner permission before entering private property.

Instructions:

1. Complete this form for first hand field observations only.
2. DO NOT COMPLETE THIS FORM if the source of your information is a report, letter, conversation or other document. Send us the documentation.
3. Rare Birds: Complete this form only for observations during the breeding season or at large concentration areas during migration or in winter.
4. Attach a copy of a map (USGS 1:24,000 topographic map preferred) and mark the location of the rare species or its boundary (if known). Note, you may print copies of topo maps from the internet at http://www.topozone.com . Please use 1:24,000 or 1:25,000 scale only.

Source of Your Information: (check one of the following)

☐ Firsthand field observation Does the identification need to be confirmed? ☐yes ☐ no

☐ Other: Please do not complete this form; send us a copy of the documentation instead. If source is a conversation with someone, send us a note.

Form Completed By:

Name	Date	Phone

Identification:

Complete **only one form per rare plant or animal per site.** If you need a list of rare species we are currently tracking, contact our office.

Name of the rare plant or animal:	

Method of ID: (Source of key, photo, name of expert, other):	

Date First Observed:		Date Last Observed:	

Observer:

Name:	Address:	Phone:

Location:

GPS data:	Latitude:		Longitude:	
	Accuracy:		GPS Brand:	

Survey Site Name (locale or place name):	

Directions (describe in detail the precise location of the species or community; begin with an easily identifiable starting point, include nearby landmarks, street names, and mileages):

County:		Town:	
Name of USGS 7.5' topo (if known)			

06/29/2011 Version Date

Observation Data:

For Animals: Indicate the number of adults, juveniles, nests, etc.

For Plants: Indicate 1) the number of flowering plants and/or sterile stems, 2) the number of separate plant groupings, 3) the health of the plants, etc.

Size:
Please indicate the estimated area occupied by the plant or animal:

	Acres or		sq. meters

If the area occupied is long and narrow (less than 12.5 meters wide), please indicate:

Length (meters):		Width (meters):	

Habitat Description: Write a description of the habitat for the species at this location. Include ecological communities, dominants, associated species, substrates, soils, aspect, slope, hydrology, etc.

Managed Area (Name of the state or federally owned area):

Landscape (Describe the current landscape surrounding the plant or animal (i.e. farmland, residential, forest,etc.))

Current and Potential Threats:

Management Comments:

Specimen: Was a specimen taken? ☐ yes ☐ no

If yes, indicate the herbarium, collector(s) name(s) and number(s), accession #, and date collected:

Photograph: Was a photo taken? ☐ yes ☐ no If yes, ☐ slide ☐ print ☐ digital If possible, please submit a copy of the photo.

Is a copy included with the form? ☐ yes ☐ no

General Comments:

TEXAS NATURAL DIVERSITY DATABASE
Data System, Source Types, Utility, Limitations

The Texas Natural Diversity Database (TXNDD), established in 1983, is the Texas Parks and Wildlife Department's (TPWD) most comprehensive source of information on rare, threatened, and endangered plants, animals, invertebrates, exemplary natural communities, and other significant features. The TXNDD is continually updated, providing current or additional information on statewide status and locations of these unique elements of natural diversity. However, the data is not all-inclusive, as there are gaps in coverage and species data, due to the lack of access to land or data, and a lack of staff and resources to collect and process data on all rare and significant resources.

The TXNDD gathers biological information from public information sources, such as: museum and herbarium collection records, peer-reviewed publications, experts in the scientific community, organizations, qualified individuals, and on-site field surveys conducted by TPWD staff on public lands or private lands with written permission. TPWD staff botanists, zoologists, and ecologists perform field surveys to locate and verify specific occurrences of high-priority biological elements and collect accurate information on their condition, quality, and management needs.

The TXNDD can be used to help evaluate environmental impacts of routing and siting options for development projects, environmental review, and permit review, as well as for natural resource management, scientific research, and educational applications. Appropriate use of the TXNDD requires both interpretation and extrapolation because of the many data gaps across the state from current and historic lack of access to private lands, the restriction of data extraction from only public information sources, species and geographic coverage skewed towards listed and the most rare species and ecosystems, and the lack of precise locality data in many secondary sources.

Given the small proportion of public versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. Although it is based on the best data available to TPWD regarding rare species, these data cannot provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in any area. Nor can these data substitute for on-site evaluation by qualified biologists. The TXNDD information is intended to assist users in avoiding harm to rare species or significant ecological features. Refer all requests back to the TXNDD to obtain the most current information.

GRANK – Global Conservation Status Rank; for element's entire global range, factors together abundance, total range size, distribution, trends, threats, fragility, and number of adequately protected occurrences within global range

SRANK – State Conservation Status Rank; for element's state range, factors together abundance, state range size, distribution, trends, threats, fragility, and number of adequately protected occurrences within state range

LASTOBS – Last Observed; date a particular occurrence was last observed as noted in the source(s); **refers only to species occurrence as noted in source and does not imply the last date the species was present**

DATA SENSITIVE flag – a "Y" indicates the species or location is sensitive due to threat from collection, disturbance, or illegal trespass onto private lands

LAT – Latitude of occurrence record point, or polygon link point located in upper right corner of polygon

LONG – Longitude of occurrence record point, or polygon link point located in upper right corner of polygon

PRECISION – Mapping Precision of occurrence record; lat/long coordinates of point or polygon link point; mapping precision of record determined by preciseness of locality information provided in source(s)

S - Second: For point records, accuracy within 3-second radius, or approximately 1000 foot radius margin-of-error from lat/long of point on map; for boundary/polygon records, accuracy within 3-second radius of drawn polygon as represented in the source(s), not the lat/long of the polygon link point

M - Minute: For point records, accuracy within 1-minute radius, or approximately 2 kilometers or 1.5 miles radius margin-of-error from lat/long of point on map; for records with a boundary/polygon, the polygon should be considered marginally uncertain based on inferred extent of record as stated in the source(s), not the lat/long of the polygon link point

G - General: For point records, accuracy general to locale, quad(s), or place name precision, or default of approximately 8 kilometers or 5 miles radius margin-of-error from lat/long of point on map; for records with a boundary/polygon, the polygon should be considered somewhat imprecise or generalized based on implied extent of record as stated in the source(s), not the lat/long of the polygon link point

U - Unmappable: Records with little to no locality information provided in the source(s), such as noting only county name or generalized region of state

STARR COUNTY LISTS OF RARE SPECIES
TEXAS PARKS AND WILDLIFE DEPARTMENT

STARR COUNTY

AMPHIBIANS

		Federal Status	State Status
Black-spotted newt	*Notophthalmus meridionalis*		T

can be found in wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods; Gulf Coastal Plain south of the San Antonio River

Mexican burrowing toad	*Rhinophrynus dorsalis*		T

roadside ditches, temporary ponds, arroyos, or wherever loose friable soils are present in which to burrow; generally underground emerging only to breed or during rainy periods

Mexican treefrog	*Smilisca baudinii*		T

subtropical region of extreme southern Texas; breeds May-October coinciding with rainfall, eggs laid in temporary rain pools

Sheep frog	*Hypopachus variolosus*		T

predominantly grassland and savanna; moist sites in arid areas

South Texas siren (large form)	*Siren sp 1*		T

wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods, but does require some moisture to remain; southern Texas south of Balcones Escarpment; breeds February-June

White-lipped frog	*Leptodactylus fragilis*		T

grasslands, cultivated fields, roadside ditches, and a wide variety of other habitats; often hides under rocks or in burrows under clumps of grass; species requirements incompatible with widespread habitat alteration and pesticide use in south Texas

BIRDS

		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Audubon's Oriole	*Icterus graduacauda audubonii*		

scrub, mesquite; nests in dense trees, or thickets, usually along water courses

Brown Jay	*Cyanocorax morio*		

STARR COUNTY

BIRDS		Federal Status	State Status

woodlands and mesquite along the Rio Grande; dense brushy woods, open woods, forest edge, second-growth woodland, clearings, plantation; nests in tree or shrub often far out on limb, usually 7-21 meters above ground

Brownsville Common Yellowthroat	*Geothlypis trichas insperata*		

tall grasses and bushes near ponds, marshes, and swamps; breeding April to July

Cactus Ferruginous Pygmy-Owl	*Glaucidium brasilianum cactorum*		T

riparian trees, brush, palm, and mesquite thickets; during day also roosts in small caves and recesses on slopes of low hills; breeding April to June

Common Black-Hawk	*Buteogallus anthracinus*		T

cottonwood-lined rivers and streams; willow tree groves on the lower Rio Grande floodplain; formerly bred in south Texas

Gray Hawk	*Asturina nitida*		T

locally and irregularly along U.S.-Mexico border; mature riparian woodlands and nearby semiarid mesquite and scrub grasslands; breeding range formerly extended north to southernmost Rio Grande floodplain of Texas

Hook-billed Kite	*Chondrohierax uncinatus*		

dense tropical and subtropical forests, but does occur in open woodlands; uncommon to rare in most of range; accidental in south Texas

Interior Least Tern	*Sterna antillarum athalassos*	LE	E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Mexican Hooded Oriole	*Icterus cucullatus cucullatus*		

scrub, mesquite; nests in dense trees, or thickets, usually along water courses

Northern Beardless-Tyrannulet	*Camptostoma imberbe*		T

mesquite woodlands; near Rio Grande frequents cottonwood, willow, elm, and great leadtree; breeding April to July

Peregrine Falcon	*Falco peregrinus*	DL	T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

STARR COUNTY

BIRDS		Federal Status	State Status

Rose-throated Becard *Pachyramphus aglaiae* — State Status: T

riparian trees, woodlands, open forest, scrub, and mangroves; breeding April to July

Sennett's Hooded Oriole *Icterus cucullatus sennetti*

often builds nests in and of Spanish moss (Tillandsia unioides); feeds on invertebrates, fruit, and nectar; breeding March to August

Sprague's Pipit *Anthus spragueii* — Federal Status: C

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

Tropical Parula *Parula pitiayumi* — State Status: T

dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July

Western Burrowing Owl *Athene cunicularia hypugaea*

open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

White-tailed Hawk *Buteo albicaudatus* — State Status: T

near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May

Wood Stork *Mycteria americana* — State Status: T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

Zone-tailed Hawk *Buteo albonotatus* — State Status: T

arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions

FISHES		Federal Status	State Status

Rio Grande shiner *Notropis jemezanus*

Rio Grande and upper Pecos River basins; large, open, weedless rivers or large creeks with bottom of rubble, gravel and sand, often overlain with silt

Rio Grande silvery minnow *Hybognathus amarus* — Federal Status: LE — State Status: E

STARR COUNTY

FISHES	Federal Status	State Status

extirpated; historically Rio Grande and Pecos River systems and canals; reintroduced in Big Bend area; pools and backwaters of medium to large streams with low or moderate gradient in mud, sand, or gravel bottom; ingests mud and bottom ooze for algae and other organic matter; probably spawns on silt substrates of quiet coves

INSECTS		Federal Status	State Status
A tiger beetle	*Tetracha affinis angustata*		

most tiger beetles diurnal, open sandy areas, beaches, open paths or lanes, or on mudflats; larvae in hard-packed ground in vertical burrows

Cazier's tiger beetle *Cicindela cazieri*

most tiger beetles are active, usually brightly colored, and found in open, sunny areas; adult tiger beetles are predaceous and feed on a variety of small insects; larvae of tiger beetles are also predaceous and live in vertical burrows in soil of dry paths, fields, or sandy beaches

Neojuvenile tiger beetle *Cicindela obsoleta neojuvenilis*

bare or sparsely vegetated, dry, hard-packed soil; typically in previously disturbed areas; peak adult activity in Jul

MAMMALS		Federal Status	State Status
Cave myotis bat	*Myotis velifer*		

colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore

Coues' rice rat	*Oryzomys couesi*		T

cattail-bulrush marsh with shallower zone of aquatic grasses near the shoreline; shade trees around the shoreline are important features; prefers salt and freshwater, as well as grassy areas near water; breeds April -August

Ghost-faced bat *Mormoops megalophylla*

colonially roosts in caves, crevices, abandoned mines, and buildings; insectivorous; breeds late winter-early spring; single offspring born per year

Jaguarundi	*Herpailurus yaguarondi*	LE	E

thick brushlands, near water favored; 60 to 75 day gestation, young born sometimes twice per year in March and August, elsewhere the beginning of the rainy season and end of the dry season

Mexican long-tongued bat *Choeronycteris mexicana*

deep canyons where uses caves and mine tunnels as day roosts; also found in buildings and often associated with big-eared bats (Plecotus spp.); single TX record from Santa Ana NWR

Ocelot	*Leopardus pardalis*	LE	E

STARR COUNTY

MAMMALS		Federal Status	State Status
dense chaparral thickets; mesquite-thorn scrub and live oak mottes; avoids open areas; breeds and raises young June-November			
Plains spotted skunk	*Spilogale putorius interrupta*		
catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie			
White-nosed coati	*Nasua narica*		T
woodlands, riparian corridors and canyons; most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade			
Yuma myotis bat	*Myotis yumanensis*		
desert regions; most commonly found in lowland habitats near open water, where forages; roosts in caves, abandoned mine tunnels, and buildings; season of partus is May to early July; usually only one young born to each female			

MOLLUSKS		Federal Status	State Status
False spike mussel	*Quadrula mitchelli*		T
possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins			
Salina mucket	*Potamilus metnecktayi*		T
lotic waters; submerged soft sediment (clay and silt) along river bank; other habitat requirements are poorly understood; Rio Grande Basin			
Texas hornshell	*Popenaias popeii*	C	T
both ends of narrow shallow runs over bedrock, in areas where small-grained materials collect in crevices, along river banks, and at the base of boulders; not known from impoundments; Rio Grande Basin and several rivers in Mexico			

REPTILES		Federal Status	State Status
Northern cat-eyed snake	*Leptodeira septentrionalis septentrionalis*		T
Gulf Coastal Plain south of the Nueces River; thorn brush woodland; dense thickets bordering ponds and streams; semi-arboreal; nocturnal			
Reticulate collared lizard	*Crotaphytus reticulatus*		T
requires open brush-grasslands; thorn-scrub vegetation, usually on well-drained rolling terrain of shallow gravel, caliche, or sandy soils; often on scattered flat rocks below escarpments or isolated rock outcrops among scattered clumps of prickly pear and mesquite			
Spot-tailed earless lizard	*Holbrookia lacerata*		

STARR COUNTY

REPTILES — Federal Status — State Status

central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground

		Federal Status	State Status
Texas horned lizard	*Phrynosoma cornutum*		T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

		Federal Status	State Status
Texas indigo snake	*Drymarchon melanurus erebennus*		T

Texas south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated croplands if not molested or indirectly poisoned; requires moist microhabitats, such as rodent burrows, for shelter

		Federal Status	State Status
Texas tortoise	*Gopherus berlandieri*		T

open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November

PLANTS — Federal Status — State Status

		Federal Status	State Status
Ashy dogweed	*Thymophylla tephroleuca*	LE	E

Texas endemic; grasslands with scattered shrubs; most sites on sands or sandy loams on level or very gently rolling topography over Eocene strata of the Laredo Formation; flowering March-May depending to some extent on rainfall

		Federal Status	State Status
Chihuahua balloon-vine	*Cardiospermum dissectum*		

Thorn shrublands or low woodlands on well to excessively well drained, calcareous, sandy to gravelly soils in drier uplands of the Lower Rio Grande Valley, in areas underlain by the Goliad formation, Catahoula and Frio formations undivided, Jackson Group, and other Eocene formations; during drought conditions the normally inconspicuous slender twining vine turns a more conspicuous deep reddish-purple; flowering (April-) July-September, probably throughout the growing season in response to rainfall.

		Federal Status	State Status
Gregg's wild-buckwheat	*Eriogonum greggii*		

sparingly vegetated openings in thorn shrublands in shallow soils on xeric ridges along the Rio Grande; also on excessively drained, sandy soil over caliche and calcareous sandstone of the Goliad Formation and over sandstone or fossiliferous layers of the Jackson Group; flowering February-July, probably opportunistically during the growing season

		Federal Status	State Status
Johnston's frankenia	*Frankenia johnstonii*	LE-PDL	E

dwarf shrublands on strongly saline, highly alkaline, calcareous or gypseous, clayey to sandy soils of valley flats or rocky slopes; mapped soils at many sites are of the Catarina and/or Maverick Series, other mapped soils include Copita, Brennan, Zapata, and Montell series; most sites are underlain by Eocene sandstones and clays of the Jackson Group or the Yegua and Laredo formations; a few are underlain by El Pico clay or the Catahoula and Frio formations shrublands; flowering throughout the growing season depending upon rainfall

STARR COUNTY

PLANTS		Federal Status	State Status
Kleberg saltbush	*Atriplex klebergorum*		

Texas endemic; usually occurs in sparsely vegetated saline areas, including flats and draws; in light sandy or clayey loam soils with other halophytes; occasionally observed on scraped oil pad sites; observed flowering in late August-early September, but may vary with rainfall, fruits are usually present in fall; because of its annual nature, populations fluctuate widely from year to year

Prostrate milkweed *Asclepias prostrata*

grasslands or openings in shrublands on loamy fine sands and fine sandy loams of the Copita, Hebbronville, and possibly other soil series occurring over the Laredo, Yegua, and other Eocene formations; also in Loreto caliche sand plain in Tamaulipas; flowering April-October, but may be sporadic and dependent on rainfall

Runyon's cory cactus *Coryphantha macromeris var runyonii*

gravelly to sandy or clayey, calcareous, sometimes gypsiferous or saline soils, often over the Catahoula and Frio formations, on gentle hills and slopes to the flats between, at elevations ranging from 10 to 150 m (30 to 500 ft); ?late spring or early summer, November, fruit has been collected in August

Shinners' rocket *Thelypodiopsis shinnersii*

mostly along margins of Tamaulipan thornscrub on clay soils of the Rio Grande Delta, including lomas near the mouth of the river; Tamaulipas, Mexico specimens are from mountains, with no further detail; flowering mostly March-April, with one collection in December

St. Joseph's staff *Manfreda longiflora*

thorn shrublands on clays and loams with various concentrations of salt, caliche, sand, and gravel; rossettes are often obscured by low shrubs; flowering September-October

Star cactus *Astrophytum asterias* LE E

gravelly clays or loams, possibly of the Catarina Series (deep, droughty, saline clays), over the Catahoula and Frio formations, on gentle slopes and flats in sparsely vegetated openings between shrub thickets within mesquite grasslands or mesquite-blackbrush thorn shrublands; plants sink into or below ground during dry periods; flowering from mid March-May, may also flower in warmer months after sufficient rainfall, flowers most reliably in early April; fruiting mid April-June

Walker's manioc *Manihot walkerae* LE E

periphery of native brush in sandy loam; also on caliche cuestas?; flowering April-September (following rains?)

Zapata bladderpod *Physaria thamnophila* LE E

open, thorn shrublands on shallow, well-drained sandy loams and sandstone outcrops of Eocene origin, including the Jackson Group and Yegua and Laredo formations; the known sites' soils are mapped as Zapata, Maverick, Catarina, or Copita Series; flowering usually February-April, but also summer or fall depending on rainfall

U.S. FISH & WILDLIFE
STARR COUNTY INFORMATION

Luci English

From: Craig_Giggleman@fws.gov
Sent: Thursday, April 12, 2012 11:56 AM
To: luci.english@e-ht.com
Subject: Starr County

Ms. English,

Following is the list for for federally listed species in Starr County. For state listed species you will need to contact TPWD.

Starr County
Ashy dogweed (E) *Thymophylla (=Dyssodia) tephroleuca*
Gulf Coast jaguarundi (E) *Herpailurus yagouaroundi cacomitli*
Johnston's frankenia (E) *Frankenia johnstonii*
Least tern (E ~) *Sternula antillarum*
Ocelot (E) *Leopardus pardalis*
Star cactus (E) *Astrophytum (=Echinocactus) asterias*
Walker's manioc (E) *Manihot walkerae*
Zapata bladderpod (E w/CH) *Lesquerella thamnophila*
Mountain Plover (P/T) *Charadrius montanus*

Hope this helps,

Craig Giggleman

Craig Giggleman
Fish & Wildlife Biologist
Corpus Christi, TX Field Office
(361) 994-9005

CITY OF ROMA

WATER CONSERVATION
AND
DROUGHT CONTINGENCY PLAN

PWSID 2140007

August, 2012

Prepared by:

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PG Firm Registration No. 50103

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CITY OF ROMA, TEXAS
WATER CONSERVATION PLAN

Section I Declaration of Policy, Purpose and Intent

The purpose of the Water Conservation Plan (Plan) is to: promote the wise and responsible use of water by implementing structural programs that result in quantifiable water conservation results; develop, maintain, and enforce water conservation policies and ordinances; and support public education programs that educate customers about water and wastewater facilities operations, water quantity and quality, water conservation and non-point source protection. This document provides an update to the Water Conservation and Emergency Water Demand Management Plan for the City of Roma, Texas and replaces a preexisting version previously adopted by the City.

The adoption of the updated plan is a requirement of the Texas Water Development Board (TWDB) for financial assistance provided to the City for a regional water planning study. In addition this plan is required pursuant to two sections of 30 Texas Administrative Code (TAC) Chapter 288. Per §288.30(1) a water conservation plan is required since the City holds certificates of adjudication for the appropriation of surface water in the amount of 1,000 acre-feet a year or more for municipal, industrial, and other non-irrigation uses. In addition per §288.30(10)(A), the TWBD requires a water conservation plan for retail public water suppliers providing water service to 3,300 or more connections, a water conservation plan. The City has also incorporated the requirements of 31 TAC §363.15, §355, and §371 and Section 16.054 of the Texas Water Code into this plan.

The history of drought affecting the watershed of the middle and lower Rio Grande has underscored the importance of water conservation and drought contingency planning to the City of Roma. Water conservation and drought preparedness are essential if the City is to continue to meet its responsibility to provide adequate future water supplies for its citizens. This Water Conservation and Emergency Water Demand Management Plan serves to extend the City's available water supply, decrease water losses and waste, and provide procedures for responding to and coping with drought and other water supply emergencies.

Section II Utility Profile Summary

The City of Roma water system is owned and operated by the City of Roma, Texas. The City Council sets policy and rates for the water system. The system is operated under the direction of the Mayor with the support of six other directors and the Mayor.

The City of Roma sits in an area that is arid in climate and is without significant sources of surface water other than the Rio Grande River. Roma is located in the southern portion of Starr County directly across from *Ciudad Miguel Aleman, Tamaulipas, Mexico* and approximately 50 miles northwest of McAllen, Texas.

The Roma water system serves the city proper and the outlying rural communities of Fronton, Escobares, Garceno, Los Barreras, La Rosita, and Remolino. Approximately two-thirds of the water services are in these colonias, which are small, relatively poor communities that depend upon the City of Roma for a source of potable water.

The City of Roma holds CCN number 12803. The service area for the Roma water system encompasses approximately 2.9 square miles (sq mi) of land within the city proper and approximately an additional 3.0 sq mi within the extraterritorial jurisdiction (ETJ) area. The service area is depicted in the service area map in Appendix A.

A. Population

The current water user base for the City of Roma as discussed previously is the incorporated city area along with its ETJ. The 2012 Regional Water Planning Study (Study) provides water system regionalization scenarios for Study participants. Study participants include the City of Roma, Falcon Water Supply Corporation (WSC), El Sauz WSC, El Tanque WSC and Rio WSC. Population projections, connection counts, as well as water demands, etc. are provided in detail for the City of Roma and for Study participants. Although no regionalization scenario within the Study adds participants to the City of Roma's water system within the next five years, the data gathered from the Study is included in this Water Conservation Plan (WCP). The City of Roma data is shown in bold on all data tables since the City of Roma is the only active participant of this WCP until Study participants are connected to Roma's water system.

Current City of Roma customers consist of a mixture of single family residential, multi-family residential, commercial, and public connections in the distribution system. Table 1 depicts the number of retail users for the City of Roma potable water system and the Study participants over the most recent five year period.

Table 1
Historic Water Users / Population

Participant	2007	2008	2009	2010	2011
City of Roma	**17,660**	**17,925**	**18,194**	**18,467**	**18,744**
Falcon WSC	2,450	2,499	2,549	2,600	2,652
El Sauz WSC	1,408	1,441	1,475	1,510	1,545
El Tanque WSC	1,819	1,862	1,905	1,950	1,996
Rio WSC	3,633	3,720	3,809	3,900	3,993
Total Projected Population	26,970	27,447	27,932	28,427	28,930

While the 2010 Census data and the 2011 Region M Water Plan (RWP) provide population counts for the City of Roma and Starr County, neither of these sources provides accurate data for the water users served by the City within both the City and within its ETJ. The Texas Commission on Environmental Quality (TCEQ) Water Utility Database (WUD) provides the population served by the entire water system; however, the population served listed as 17,839 is the same population served as in the 2007 version and does not appear current based on information provided by the City of Roma.

Growth projections for each area from historical planning studies reflected an annual growth rate of 1.0% or less, though growth in Roma has approached 1.5-2.0% annually over the past 10 years. The 2011 Region M RWP reflected an annual growth rate of 1.25% for Roma, and a rate of 3.0% or greater for the rural areas in Starr County. As the WSC service areas do not currently provide centralized wastewater service, it is not likely that those areas will grow at a rate exceeding the smaller cities such as Roma and Rio Grande City. Also, while it appears more conservative to use the projected growth rates from the Region M RWP for each participant in the Study, the City of Roma did not agree with the lower anticipated growth rate for the City; therefore, the respective growth rates utilized in this plan are as follows:

- City of Roma Annual Growth Rate – 1.50%
- Falcon WSC Annual Growth Rate – 2.00%
- El Sauz WSC Annual Growth Rate – 2.35%
- El Tanque WSC Annual Growth Rate – 2.35%
- Rio WSC Annual Growth Rate – 2.39%

Household population density factors were developed from utility data for each study participant, dividing the population at a given time by the number of connections at that time. The population density ranged from as low as 2.13 people per household for Falcon WSC to as high as 4.08 for El Sauz WSC, with an average of roughly 3.1. Because there is such a large variance in population density, the historical population density factor is applied individually for each utility in this plan, as shown below:

- City of Roma Household Population Density Factor – 2.93
- Falcon WSC Household Population Density Factor – 2.13
- El Sauz WSC Household Population Density Factor – 4.08
- El Tanque WSC Household Population Density Factor – 3.12
- Rio WSC Household Population Density Factor – 3.00

Table 2 presents population projections for the Study participants. These populations reflect the projected number of system users. Note that only the City of Roma is anticipated to be connected to this water system in the next five years (highlighted in bold). It is unclear the additional participants that will be connected to a regional system in the future, although all Study participants are listed below.

Table 2 Population Projections							
Participant	**2010**	**2015**	**2020**	**2030**	**2040**	**2050**	**2060 (Buildout)**
City of Roma	**18,467**	**19,852**	**21,341**	**24,662**	**28,500**	**32,775**	**37,050**
Falcon WSC	2,600	2,860	3,146	3,807	4,606	5,527	6,448
El Sauz WSC	1,510	1,687	1,886	2,355	2,941	3,632	4,323
El Tanque WSC	1,950	2,179	2,435	3,041	3,798	4,690	5,583
Rio WSC	3,900	4,366	4,888	6,126	7,677	9,512	11,347
Total Projected Population	28,427	30,944	33,696	39,990	47,522	56,137	64,751

The population listed for the City of Roma based on City data reflects 18,467 water users in 2010, accounting for the population served both within the city limits and in the City's ETJ.

B. Customer Data and Water Use Data

City water customers consist of a mixture of single family residential, multi-family residential, commercial, industrial and public connections in the distribution system. The current water user base for the City of Roma as discussed previously is the incorporated city area along with its ETJ. The 2012 Regional Water Planning Study (Study) provides water system regionalization scenarios for Study participants. Study participants include the City of Roma, Falcon Water Supply Corporation (WSC), El Sauz WSC, El Tanque WSC and Rio WSC. Population projections, connection counts, as well as water demands, etc. are provided in detail for the City of Roma and for Study participants. Although no regionalization scenario within the Study adds participants to the City of Roma's water system within the next five years, the data gathered from the Study is included in this Water Conservation Plan (WCP). The City of Roma data is shown in bold on all data tables since the City of Roma is the only active participant of this WCP until Study participants are connected to Roma's water system.

During the initial development of this Study, the current number of connections for each utility district was taken from TCEQ WUD data and utility-specific data. When current connection counts were provided by the utilities, the up-to-date utility connection totals were used in place of the TCEQ WUD data. Table 3 shows the projected connection counts for each utility in five-year increments.

Table 3 Current and Projected Connection Counts								
Data	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	**6,300**	**6,773**	**7,280**	**7,826**	**8,413**	**9,044**	**9,723**	**12,640**
Falcon WSC	1,219	1,341	1,475	1,622	1,785	1,963	2,160	3,023
El Sauz WSC	370	413	462	516	577	645	721	1,059
El Tanque WSC	625	698	781	872	975	1,089	1,217	1,789
Rio WSC	1,300	1,455	1,629	1,824	2,042	2,286	2,559	3,782
Total Estimated Connections	9,814	10,681	11,627	12,661	13,792	15,028	16,379	22,294

Data on existing water usage was collected from several sources to form the basis of the projections for future demand. Data from the TCEQ WUD was used along with additional data acquired from the utilities, to prepare the existing and projected water demands within the Study area.

The average water demand per connection in each of the utilities has been observed historically to be somewhat less than the TCEQ's standard requirements of 0.6 gpm per connection. Therefore, to determine actual current and future demand, the current daily water demand was multiplied by 365 to determine the annual demand required for each utility. In addition, the average usage per connection was also calculated based on current connections. The current and projected daily water demands are included in Table 4.

Table 4 Current and Projected Daily Water Demand									
Participant	**Current Daily Usage Per Connection (gallons)**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2060 (Buildout)**
City of Roma	**437**	**2.75**	**2.96**	**3.18**	**3.42**	**3.67**	**3.95**	**4.24**	**5.52**
Falcon WSC	320	0.39	0.53	0.58	0.64	0.70	0.77	0.85	1.19
El Sauz WSC	595	0.22	0.25	0.27	0.31	0.34	0.38	0.43	0.63
El Tanque WSC	432	0.27	0.30	0.34	0.38	0.42	0.47	0.53	0.77
Rio WSC	431	0.56	0.63	0.70	0.79	0.88	0.98	1.10	1.63
TOTAL	2,214	4.19	4.66	5.07	5.52	6.02	6.56	7.15	9.74
Notes									
1 - WTP demand in mgd									
2 - Connections based on historical number of persons per household									
3 - Growth based on utility-specific annual growth									

Table 5 presents water use and population figures summarized in the TWDB format using the data presented previously.

Table 5 Population and Water Use Projections (2010-2060)						
Participant	**Population (persons)**	**Water Use (acre feet)**	**Per Capita Use (gpcd)**	**Population (persons)**	**Water Use (acre feet)**	**Per Capita Use (gpcd)**
2010				**2020**		
City of Roma	**18,467**	**3,080**	**149**	**21,341**	**3,562**	**149**
Falcon WSC	2,600	437	150	3,146	650	184
El Sauz WSC	1,510	246	146	1,886	302	143
El Tanque WSC	1,950	302	138	2,435	381	140
Rio WSC	3,900	627	144	4,888	784	143
TOTAL	28,427	4,693	147	33,696	5,679	150
2030				**2040**		
City of Roma	**24,662**	**4,111**	**149**	**28,500**	**4,749**	**149**
Falcon WSC	3,807	784	184	4,606	952	185
El Sauz WSC	2,355	381	144	2,941	482	146
El Tanque WSC	3,041	470	138	3,798	594	140
Rio WSC	6,126	986	144	7,677	1,232	143
TOTAL	39,990	6,743	151	47,522	8,009	150
2060 (Buildout)						
City of Roma	**37,050**	**6,183**	**149**			
Falcon WSC	6,448	1,333	185			
El Sauz WSC	4,323	706	146			
El Tanque WSC	5,583	863	138			
Rio WSC	11,347	1,826	144			
TOTAL	64,751	10,910	150			
Notes						
1 - Population includes City of Roma and its ETJ.						
2 - Water Use in acre-feet per year						

C. Water Supply System

1. Water Sources

Currently, the City of Roma and all of the Study participants utilize water from the Rio Grande River, either directly for treatment for the City of Roma and Falcon WSC, or via an intermediary wholesale water supplier for El Sauz WSC, El Tanque WSC and Rio WSC.

Anticipated actual water demand through the planning period (based on current average utility water demands) is shown in Table 6.

Table 6
Current and Projected Required Water Rights (Or Alternative Supplies)

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	**3,081**	**3,312**	**3,560**	**3,827**	**4,114**	**4,423**	**4,754**	**6,181**
Falcon WSC	437	591	651	716	787	866	953	1,334
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	627	702	786	880	985	1,103	1,235	1,825
Total Estimated Necessary Water Rights	4,694	5,219	5,682	6,189	6,743	7,348	8,011	10,911
Notes								
1 - Water demand in acre-feet.								
2 - Projected demand based on current water usage per utility.								

2. Water Treatment

There are currently two existing WTPs operating within the Study area that provide water directly to customers in the service area (Roma and Falcon Rural WSC. The other participants are served by a WTP outside of the Study area. In addition to these plants, Rio WSC is currently in the design/construction phase to develop a new WTP. This plant is anticipated to begin operations in 2012 or 2013. The physical addresses and representative treatment capacities of the WTPs within the Study area are shown in Table 7.

Table 7 Existing Water Treatment Plants		
Name	Location	Current Permitted Capacity
City of Roma WTP	**803 N Portscheller St.**	**5.15 mgd**
Falcon Rural WSC WTP	439 River Rd.	1.3 mgd
Total Permitted Capacity = 6.45 mgd		

Both of the existing WTPs (and the proposed new Rio WSC WTP) in the Study area use conventional treatment technology, which consists of coagulation, flocculation, sedimentation and filtration. Conventional treatment technology is intended to remove suspended particulate matter from the raw water and to reduce total organic carbon (TOC) from the water.

The Roma Water Treatment Plant (WTP) has a rated production capacity of 5.15 million gallons per day (MGD). The plant treats surface water drawn from the Rio Grande River As raw water enters the water treatment plant the water is dosed with chlorine dioxide for pre-disinfection. Raw water is then chloraminated ahead of the flocculators and undergoes coagulation, flocculation, sedimentation, and filtration. After water is processed at the treatment plant, it is temporarily stored in an onsite ground storage tank with a storage capacity of 0.152 million gallons. Treated water is pumped from the onsite ground storage tank to the distribution system main ground storage tank via transfer pumps.

3. Water Distribution

The City of Roma water distribution system provides economical and compatible facilities capable of furnishing sufficient water at suitable pressures to Roma's retail users. The Roma distribution system consists of underground water mains, pumping stations, ground storage tanks, elevated storage tanks, valves, fire hydrants, and approximately 6,092 metered service connections. Total storage capacity in the distribution system storage tanks amounts to 1.568 million gallons of which 0.800 million gallons is elevated storage. Pumping stations are located in the system to pump water, maintain uniform pressure and maintain storage tank levels.

Refer to Table 8 for the current storage capacity for each participant in the Study.

Table 8 Existing Storage Capacity			
Participant	**Current Elevated / Pressure Capacity (MG)**	**Current Ground Storage Capacity (MG)**	**Current Total Storage Capacity (MG)**
City of Roma	**0.800**	**0.768**	**1.568**
Falcon Rural WSC	0.095	0.318	0.413
El Sauz WSC	0.150	0.000	0.150
El Tanque WSC	0.089	0.210	0.299
Rio WSC	*0.003*	0.598	0.601
TOTAL	1.137	1.894	3.031
Notes			
1 - Size shown in italic reflect storage capacities that appear to be inadequate as compared to TCEQ §290.45 design criteria.			

D. Wastewater System

1. Wastewater Collection

The City of Roma wastewater collection system consists of a network of sewer lines, lift stations, and manholes serving Roma users. Sewage flows by gravity, aided when necessary by lift stations, through the collection system into the wastewater treatment plant (WWTP). No data on Study participants is available since the Study focused solely on water system regionalization.

2. Wastewater Treatment

The City of Roma owns and operates the wastewater treatment plant under TPDES Permit number 11212-002. The plant has a rated treatment capacity of 2.0 MGD. The operator in charge of the facility is employed by the City of Roma. Sewage undergoes treatment in the plant consisting of prescreening, grit removal, activated sludge process, sedimentation, and disinfection. Treated effluent is discharged into the Rio Grande River. Sewage biosolids are digested and dewatered on-site via use of a mechanical belt press prior to landfill disposal.

Section III Water Conservation Goals

The City of Roma will continue to practice water conservation policies to promote and continue the wise and responsible use of water by system users. The 5-year conservation goal for water use by the City of Roma water system users, as established by the City in conjunction with the Region M Water Planning Group, is to see annual per capita use remain at or below 127 gallons per capita per day (gpcd) by the end of 2017. The City's 10-year conservation goal is to see per capita use rate reduction of 5% to at or below 114 gpcd by the end of 2022.

The five year water loss goal for the City of Roma system users, as established by the City is to see annual per capita loss remain at or below 24 gpcd by the end of 2017. The City's 10 year water loss goal is to see per capita loss remain at or below 22 gpcd by the end of 2022. In order to achieve these goals the City has determined to:

A. Reduce unaccounted for water use through improved water use accounting and leak detection and repair by the end of Year 2022.

B. Reduce the peak day to average day ratio from 1.44 to 1.35 by the Year 2022.

C. Increase the beneficial reuse of effluent from the City's wastewater treatment facilities.

D. Continue the use of increasing block water and wastewater rates to discourage excessive usage.

E. Continue the meter testing, repair and replacement program as well as leak detection efforts in order to reduce unaccounted for water loss.

F. These goals are consistent with commonly accepted industry standards and with the projected Region M water demand projections for the City.

The City will adhere to the following schedule, to achieve the targets and goals for water conservation:

A. Meters will continue to be monitored for accuracy and replaced on an as-needed basis.

B. Water audits will be conducted annually.

C. Real water losses will be minimized by replacement of deteriorating water mains and appurtenances, as conducted by City staff on an on-going basis as budget permits.

D. Annually the City will make available to its water users water conservation literature.

The City staff will track targets and goals by utilizing the following procedures:

A. Records will be maintained for meter calibration, meter testing, and meter replacement activities.

B. Annual water audits will be documented and maintained in the City files.

C. City staff will keep a record of the number of information mail-outs when distributed.

D. Records of leak detection and repair efforts will be maintained by the City.

Section IV Water Conservation Program

The City of Roma utilizes a six-part water conservation program to conserve the City's available water resources. Details of the program components are as follows:

A. Public Education and Awareness: Public education and awareness is an essential component of the City's water conservation program. The objective is to communicate to the City's residents the need for and benefits of water conservation and to provide useful consumer-oriented information on water conservation practices and technologies. The City will obtain and disseminate such information through a variety of avenues including:

   1. Providing water conservation literature to new utility customers at the time they apply for service, to utility customers reporting high water use, and at the utility sales office on a continuing basis;

   2. Providing demonstrations and publicity of xeriscape landscaping and the use of native plants and grasses to reduce lawn water demands;

   3. Providing consumer tips on water conservation in a newsletter to be mailed periodically to all utility customers with monthly billing statements; and

   4. Presentations at schools and civic organizations.

   5. The City will also obtain video and radio public service announcements on water conservation from the TWDB and make these available to the local media. TWDB videos on state water resources issues and water conservation will also be provided to the Roma Independent School District for use on its cable TV channel.

   6. The City will also explore opportunities to implement the "*Learning to be Water Wise and Energy Efficient*" youth education program. This program combines a water and energy conservation curriculum with a home water conservation kit. Targeted at fifth-grade students, the program conveys

the conservation message through 10 lessons with hands-on activities. In addition, each student receives a kit containing a low-flow shower head and kitchen faucet aerator for installation in their homes. In this way, parents and sibling of the students are exposed to the conservation message and real water savings are achieved through the installation of water conservation devices. The cost of the program is $32 per student. The City of Roma will work with the school district, businesses, and civic organizations to obtain funding to implement the program.

B. Plumbing Standards: Since 1992 state law has prohibited the sale of certain plumbing fixtures that do not conform to specific water use efficiency standards. For example, water use by tank-type toilets sold within Texas is not to exceed 1.6 gallons per flush. Showerheads are limited to 2.5 gallons per minute flow rate. Similar water efficiency standards have also been adopted by the federal government. These state and federal water efficiency standards effectively supersede and replace local standards and eliminate the need for enforcement of plumbing code standards for water efficiency at the local level. In 1991, the Texas Legislature passed legislation requiring that plumbing fixtures sold in Texas after January 1, 1992, meet the following standards:

1. Shower Heads: No more than 2.75 gallons per minute at 80 pounds per square inch of pressure.

2. Laboratory/Sink Faucets and Aerators: No more than 2.2 gallons per minute at 60 pounds per square inch of pressure.

3. Wall Mounted, Flushometer Toilets: No more than 2.0 gallons per flush.

4. All other Toilets: No more than 1.6 gallons per flush.

5. Drinking Water Fountains: Must be self closing.

The above standards are enforced through requirements placed directly on the manufacturers, importers, and suppliers of new fixtures in Texas. In addition, the City encourages the following water conservation measures:

1. Hot Water Pipes: Hot water lines not in or under a concrete slab should be insulated.

2. Pressure Reduction Valves: Pressure reduction valves may be installed where system pressures exceed 80 pounds per square inch.

3. Swimming Pools: Swimming pools should have recirculating filtration equipment.

4. Automatic Dishwashers: Automatic dishwashers installed in residential dwellings should be a design that uses a maximum of six gallons of water per cycle.

5. Automatic Clothes washers: Automatic Clothes washers installed in residential dwellings should be a design that uses a maximum of 14 gallons of water per cycle.

C. Plumbing Retrofit Program: New plumbing fixtures that replace or renovate existing plumbing fixtures must follow the City's residential and commercial construction requirements. The use of water efficient plumbing fixtures in new construction and as replacements in existing construction is expected to significantly reduce per capita water use and wastewater flows over time. Importantly, such savings will occur "passively" in that market penetration will occur as a consequence of new development and as older inefficient plumbing fixtures wear out and are replaced. Also, water savings associated with high-efficiency plumbing fixtures are relatively predictable as the savings are not dependent on conscious effort by the consumer to modify water use behaviors. The City's plumbing code encourages the use of water conserving plumbing fixtures for residential and commercial construction. In May of 1998, the City of Roma adopted an ordinance providing for plumbing inspections and the adoption of the International Plumbing Code.

The City will encourage the retrofit and/or replacement of older, inefficient plumbing fixtures and appliances through the public education and awareness activities described above. Particular emphasis will be placed on the expected cost-savings and payback periods through reduced water, wastewater, and energy costs. Also, as previously indicated, retrofit kits will be provided through the "*Learning to be Water Wise and Energy Efficient*" program, if funding can be obtained to implement the program. In addition, the City will investigate the costs and benefits of replacing inefficient plumbing fixtures in all city-owned facilities.

D. Water-Conservation Landscaping: The City promotes water-conserving landscaping through its education and awareness activities. Through such activities the City encourages and supports the use of xeriscape landscaping techniques. Public Utilities staff distributes xeriscape literature and provide presentations at public meetings on water conserving landscaping and lawn watering methods. Particular emphasis is placed on providing such information in advance of and during the summer lawn water season.

E. Reuse: The City's Wastewater reuse program includes the following three major components; 1) use of treated wastewater at the wastewater treatment plant instead of using potable water for in-plant purposes, such as wash down, unit spray bars, and site irrigation; 2) evaluation of potential for use of treated wastewater to irrigate city parks and athletic fields, with implementation of those elements which can be demonstrated to be feasible; and 3) evaluating the feasibility of use of that portion of the City's highly treated wastewater that is discharged into the Rio Grande River.

F. Pressure Reduction/Management Standards: Pressure is the force which determines how much water can pass through a given faucet, valve, pipe or hole in a given time. Reducing system operating pressures to lower levels helps to save water by reducing the amount of water that will flow through an opened valve or faucet in a given time period. Pressure reduction also saves water by reducing excessive mechanical stress on plumbing fixtures and appliances and on distribution systems. Faucet seats and washers will last longer, washing machine and dishwasher valves will break less frequently, pipe joints will be less susceptible to failure, and leaks in the distribution system will lose less water at lower pressures. For these reasons, many utility plumbing codes and regulations require both minimum and maximum pressure standards for customer connections. The maximum acceptable pressure standard for system service connections in the Roma system is 80 psi at the service connection.

Section V Public Involvement

The City Council meets in a regular session each month. The agenda for each meeting is posted in accordance with the Texas Open Meetings Act, listing items for discussion and items to be acted upon by the Council. Meetings are open to the public and the public is given an opportunity to speak and voice their views and opinions.

Public Meetings will be held as needed for proposed projects, grant applications and other items. The public meetings will provide an opportunity for discussions and displays of citizen interest. Meetings may be held either during the regularly scheduled Council meetings or at special times established to maximize citizen input. Discussions will be informal to encourage public input.

Section VI Metering Devices

It is the City of Roma's policy to purchase meters that meet at least the minimum standards developed by the American Water Works Association. All metering devices used to meter water diverted from the source of supply are accurate to within plus or minus 5% to measure and account for water diverted from the source of supply. Meters at the City of Roma WTP that are used to measure water diverted from the source of supply and water discharged from the plant are calibrated annually and replaced as needed.

Section VII Universal Metering

Metering all water services is an effective means of improving and maintaining control of water system operations and provides the basis for efficient and equitable cost recovery. Metering provides a database for system performance monitoring, for planning future facilities, and for assessing the effects of water conservation measures. Metering also improves accountability for both water deliveries and for unaccounted for water losses. The City of Roma meters all water accounts, including those serving City facilities.

The City of Roma meters the quantity of water that is delivered to each residential and commercial customer, and to each public use, including City facilities. Meters are read and the quantities are recorded once per month, with billings made monthly to residential and commercial customers.

Section VIII Measures to Determine and Control Unaccounted-For Uses of Water

The City meters all water sales and public uses, and operates a meter replacement program with the objective to replace 15 percent of residential meters per year, and a goal to replace all residential meters every 7 to 8 years. All commercial meters are tested annually and replaced as necessary.

The City will also continue the practice of accounting for unmetered water losses resulting from the flushing of water mains, fire fighting, and main breaks. These procedures enable the City to better estimate actual water losses due to leakage and aids in evaluating the costs and benefits associated with leak detection and the repair or replacement of main waterlines.

The City's goal for unaccounted-for water use is 15% or less. It is City's policy to investigate customer complaints of low pressure and possible leaks. Additionally, City personnel monitor water consumption to detect meter readings that vary from previously established use patterns. Any meter found not to be functioning properly is identified for replacement.

The City utilizes a record management system which records water pumped, water delivered, water sales and water losses to track water transmission, distribution, and delivery to customers. This information is used to evaluate the integrity of the water delivery system from source to end user to control and minimize unaccounted-for uses of water. The record management system utilized by the City of Roma segregates water sales and users into user classes of residential, commercial, industrial and wholesale users. This information is used to evaluate the integrity of the water delivery system from source to end user to control and minimize unaccounted-for uses of water.

Section IX Leak Detection and Repair

The City of Roma practices a leak detection and repair program involving visual inspections of the system as well as a detailed record management system to detect unusual water delivery rates. City personnel visually inspect suspected leaks and make quick and timely repairs to those leaks when detected. Leaking pipelines or pipeline sections are repaired or replaced as they are detected.

Section X Water Rate Structure

The City of Roma utilizes a non-promotional water rate structure whereby the cost of water increases along with the amount of water used. The non-promotional water rate structure discourages excessive use of water.

Section XI Means of Implementation and Enforcement

This Water Conservation Plan has been adopted by the City of Roma. A copy of the resolution adopting this Plan is included in Appendix B. Any wholesale customers will receive written notification of Plan adoption and any subsequent Amendments. Adoption of this Plan by the City of Roma per 30 Texas Administrative Code (TAC) Rule §288.5 obligates wholesale customers as defined in 30 TAC Rule §288.1 to implement water conservation measures. A copy of the notification letter to wholesale users has been included in Appendix C. The City of Roma Water Conservation Plan is implemented and enforced via City Ordinance. The Mayor will have the primary responsibility for implementing the plan.

Section XII Additional Wholesale Water Contract Requirements

The City of Roma will require, through contractual agreement, that any political subdivision or public water supplies contracting with the City for wholesale water supply or wastewater services either adopt the provisions of the City's water conservation and emergency water demand management plan, or develop and implement a water conservation plan or water conservation measures using applicable elements in 30 TAC §288. If the wholesale customer intends to resell the water, then the contract between the City of Roma and the wholesale customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with 30 TAC §288.

Section XIII Coordination with Region M Water Planning Group

All of the customers served by the City of Roma are located within the Region M Water Planning Group. The City of Roma has provided a copy of this Plan to the Region M Water Planning Group.

Section XIV Reservoir Operations Plan

Currently, there are no raw water storage reservoirs associated with the City of Roma's WTP; however, raw water storage is being considered in the Study for raw water storage prior to the treatment processes at a new regional WTP. If implemented, the City will revise their existing *Plan of Operations* for the City of Roma WTP to include a detailed operating plan for the raw water storage reservoirs. The current *Plan of Operations* is available for review at the City of Roma WTP.

Section XVI Revisions to the Water Conservation Plan

The City of Roma will review and update this water conservation plan, as appropriate, based on new or updated information, such as the adoption or revision of the regional water plan. As a minimum the Plan will be updated every five (5) years.

Section XVII Severability

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

END

DROUGHT CONTINGENCY PLAN

Section I Declaration of Policy, Purpose and Intent

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

Section II Public Involvement

Opportunity for the public and all customers to provide input into the preparation of the Plan was provided by the City by means of regular City Council meetings.

Section III Public and Customer Education

The City will periodically provide the public with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of fliers distributed with or notices included on water bills and by posting information at City offices in public view, and by public announcements placed in local newspaper and television stations. Opportunity for the public and system users to provide input into the preparation of the Plan is provided by City by means of scheduling and providing public notice of a public meeting to accept input regarding the Plan.

Section IV Coordination with Regional Water Planning Group

The water service area of the City of Roma is located within the Region M Water Planning Group and the City has provided a copy of the Plan to the Region M Water Planning Group.

Section V Authorization

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

Section VI Application

The provisions of this Plan shall apply to all customers utilizing water provided by the City of Roma. The terms "person" and "customer" as used in the Plan include individuals, Cities, corporations, partnerships, associations, and all other legal entities.

Section VII Criteria for Initiation and Termination of Drought Response Stages

The City utilizes five (5) stages for responding to emergency water demand management conditions. In increasing order of severity, the stages are Mild Drought Condition, Drought Concern Condition, Moderate Drought Condition, Severe Drought Condition, and Extreme Drought Condition-Water Supply Emergency. Triggering criteria for entering into or rescinding each stage are established as follows:

A. Stage 1-Drought Concern:

1. Average daily water use reaches 4.65 mgd (90 percent of plant capacity) for five (5) consecutive days, or

2. Falcon and Amistad conservation level is between 26% and 51%.

3. Stage 1 may be rescinded when average daily water use falls below 4.65 mgd for five (5) consecutive days after declaring Stage 1 conditions to be in effect, and

4. Falcon and Amistad conservation level exceeds 51%.

B. Stage 2- Mild Drought Condition:

1. Average daily water use reaches 4.90 mgd (95 percent of plant capacity) for five (5) consecutive days, or;

2. Falcon and Amistad conservation level is between 20% and 25%;

3. Stage 2 may be rescinded when average daily water use falls below 4.90 mgd for five (5) consecutive days after declaring Stage 2 conditions to be in effect, and

4. Falcon and Amistad conservation level exceeds 25%;

5. Upon rescinding Stage 2, Stage 1 may be declared as conditions warrant.

C. Stage 3-Moderate Drought Condition:

1. Average daily water use reaches 5.15 mgd (100 percent of plant capacity) for five (5) consecutive days, or;

2. Falcon and Amistad conservation level is between 15% and 20%;

3. Stage 3 may be rescinded when average daily water use falls below 5.15 mgd for five (5) consecutive days after declaring Stage 3 conditions to be in effect, and

4. Falcon and Amistad conservation level exceeds 20%;

5. Upon rescinding Stage 3, Stage 1 or 2 may be declared as conditions warrant.

D. Stage 4-Severe Drought Condition:

1. Average daily water use reaches 5.15 mgd (100 percent of plant capacity) for five (5) consecutive days, or;

2. Falcon and Amistad conservation level is between 10% and 15%;

3. Stage 4 may be rescinded when average daily water use falls below 5.15 mgd for five (5) consecutive days after declaring Stage 4 conditions to be in effect, and

4. Falcon and Amistad conservation level exceeds 15%;

5. Upon rescinding Stage 4, Stage 1, 2, or 3 may be declared as conditions warrant.

E. Stage 5- Extreme Drought Condition -Water Supply Emergency:

1. Average daily water use reaches 5.15 mgd (100 percent of plant capacity) for five (5) consecutive days, or;

2. Falcon and Amistad conservation level is less than 10%, or;

3. The imminent or actual failure of a major component of the system, causes an immediate health or safety hazard, or;

4. Water supply contamination prevents delivery of treated water safe for public use, or;

5. Water levels in the distribution system storage tanks drop to levels such that service pumps cannot pump daily water demand;

6. Stage 5 may be rescinded when average daily water use falls below 5.15 mgd for five (5) consecutive days after declaring Stage 5 conditions to be in effect;

7. Falcon and Amistad conservation level exceeds 10%, and

8. When the disabling water production condition has been corrected and water production is restored to full capacity once again;

9. Upon rescinding Stage 5, Stage 1, 2, 3 or 4 may be declared as conditions warrant.

The Mayor, or his/her designee, shall monitor water supply and/or demand conditions on a weekly basis and shall determine when conditions warrant initiation or termination of each stage of the Plan. Customer notification of the initiation or termination of drought response stages will be made by email, mail or telephone. The news media will also be informed.

Section VIII: Drought Response Stages

The Mayor or his/her designee, shall monitor water supply and/or demand conditions and, in accordance with the triggering criteria set forth in Section VII, shall determine that mild, moderate, or severe water shortage conditions exist or that an emergency condition exists and shall implement the following actions:

A. Stage 1-Drought Concern:

1. Target Water Use: 2% reduction;

2. Water system users are requested to voluntarily limit water usage to that amount absolutely necessary for health, business and irrigation;

3. Notice of Stage 1 conservation condition shall be given by the City Manager and/or Mayor through appropriate circular, television, radio and newspaper media at the Mayor's discretion;

4. Under voluntary restrictions, the following uses of water constitute waste of water and are prohibited:

   a. Allowing irrigation water to run off into a gutter, ditch or drain.
   b. Failure to repair a controllable leak.

B. Stage 2-Mild Drought Condition:

1. Target Water Use: 4% reduction;

2. Demand management efforts under Stage 2 conditions consist of mandatory water use restrictions implemented for all City of Roma water system users;

3. Notice of such order shall be given by the City Manager and/or Mayor through appropriate circular, television, radio and newspaper media at the Mayor's discretion. All elements of Stage 1 shall remain in effect except that:

   a. Irrigation utilizing hose-end sprinklers or automatic sprinkler systems for lawns, gardens, landscaped areas, trees, shrubs and other plants is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to water between designated hours on Mondays, Wednesdays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water between designated hours on Tuesdays, Thursdays and Saturdays.

b. Irrigation of lawns, gardens, landscaped areas, trees, shrubs or other plants is permitted at any time if:

   (1) A continuously hand-held hose is used; or,
   (2) A drip irrigation system is used.

c. Commercial nurseries, commercial sod farmers and similarly situated establishments are exempt from Stage 2 mandatory irrigation restrictions, but will be asked to voluntarily curtail all nonessential water use.

d. The washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment is prohibited except on designated hours between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to wash mobile equipment between designated hours on Mondays, Wednesdays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to wash mobile equipment between designated hours on Tuesdays, Thursdays and Saturdays. Such washing, when allowed, shall be done with a hand-held bucket or a hand-held hose equipped with a positive shutoff nozzle for quick rinses.

e. Vehicle or equipment washing may be done at any time on the immediate premises of a commercial carwash or commercial service station. Further, such washing may be exempted from this division if the health, safety and welfare of the public is contingent upon frequent vehicle cleaning, such as garbage trucks and vehicles used to transport food and perishables.

f. The refilling or adding of water to residential swimming and/or wading pools is prohibited except on designated hours between the hour of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to use water for this purpose between designated hours on Mondays, Wednesdays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water for this purpose between designated hours on Tuesdays, Thursdays and Saturdays.

g. The operation of any ornamental fountain or other structure making similar use of water is prohibited except for those fountains or structures with a recycling system.

h. The use of water for irrigation for parks, plazas and squares is prohibited except on designated hours between the hours of 8:00 p.m. to 8:00 a.m. The irrigation of golf course fairway is absolutely prohibited. Provided, however, any above mentioned in this division utilizing wastewater effluent or well water is exempted from the provisions of this division.

i. Irrigation using hose-end sprinklers or automatic sprinkler systems for athletic fields is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to water between designated hours on Mondays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water between designated hours on Tuesdays and Saturdays.

j. No bulk water sales shall be made from the City or other sources for any purpose when such water will be transported by any tanker truck or similar type vehicle outside the Roma City Limits.

4. Essential and Utility Use:

a. Fire fighting: No restrictions.
b. Medical use by health care facilities: no restrictions.
c. Water utility use:

(1) Reduction of average system pressure to 60 psi is recommended.
(2) Increased leak detection and system repair efforts are undertaken pursuant to staffing levels and workload.
(3) Increased efforts to stabilize and equalize system pressure are undertaken pursuant to staffing levels and workload.
(4) Decreased levels of sewer line flushing are implemented.
(5) Decreased levels of hydrant flushing is implemented.
(6) Power generation facilities are asked to reduce process water use where feasible.

5. The following uses of water are defined as waste of water and are absolutely prohibited:

a. Allowing irrigation water to run off into a gutter, ditch or drain;
b. Failure to repair a controllable leak;
c. Washing sidewalks, streets, driveways, parking areas, tennis courts, or other paved areas, except to alleviate immediate fire hazards.

C. Stage 3-Moderate Drought Condition:

1. Target Water Use: 6% reduction;

2. Demand management efforts under Stage 3 conditions consist of mandatory water use restrictions implemented for all City of Roma water system users;

3. Notice of such order shall be given by the City Manager and/or Mayor through appropriate circular, television, radio and newspaper media at the Mayor's discretion. All elements of Stage 2 shall remain in effect except that:

   a. Irrigation utilizing hose-end sprinklers or automatic sprinkler systems for lawns, gardens, landscaped areas, trees, shrubs and other plants is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to use water for this purpose between designated hours on Mondays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water for this purpose between designated hours on Tuesdays and Saturdays. Irrigation by hand-held hoses or drip irrigation systems is exempt.

   b. Irrigation using hose-end sprinklers or automatic sprinkler systems for athletic fields is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to water between designated hours on Mondays and Fridays. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water between designated hours on Tuesdays and Saturdays.

   c. The watering of golf fairway areas is prohibited unless done with treated wastewater, reuse water, or well water.

4. A water use surcharge of $10.00 shall be levied against all customers that use over 8,000 gallons per month.

D. Stage 4-Severe Drought Condition:

1. Target Water Use: 8% reduction;

2. Demand management efforts under Stage 4 conditions consist of mandatory water use restrictions implemented for all City of Roma water system users;

3. Notice of such order shall be given by the City Manager and/or Mayor through appropriate circular, television, radio and newspaper media at the Mayor's discretion. All elements of Stage 3 shall remain in effect except that:

a. Irrigation utilizing hose-end sprinklers or automatic sprinkler systems for lawns, gardens, landscaped areas, trees, shrubs and other plants is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are allowed to use water only on Wednesdays of each week during designated hours. Customers with an address ending in an odd number (1,3,5,7,9) are allowed to water only on Saturdays of each week during designated hours. Irrigation with hand-held hoses or irrigation drip systems are exempt.

b. Irrigation using hose-end sprinklers or automatic sprinkler systems for athletic fields is prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are only allowed to water between designated hours on Wednesdays of each week. Customers with an address ending in an odd number (1,3,5,7,9) are only allowed to water between designated hours on Saturdays of each week.

c. The washing of automobiles, trucks, trailers, boats, airplanes, and other types of mobile equipment not occurring upon the immediate premises of commercial carwashes and commercial service stations, and not in the immediate interest of the public health, safety and welfare shall be prohibited except during designated hours which shall be between the hours of 8:00 p.m. to 8:00 a.m. and only on the owner's of such vehicles, etc. premises. Customers with an address ending in an even number (0,2,4,6,8) are allowed to wash mobile equipment only on Wednesdays of each week during designated hours. Customers with an address ending in an odd number (1,3,5,7,9) are allowed to wash mobile equipment only on Saturdays of each week during designated hours.

d. Commercial car washes and commercial service stations in the immediate interest of the public health, safety and welfare shall be limited to five (5%) percent of their monthly average usage based on the last twelve (12) billing periods for each of such customer. After such usage, the City Manager shall enforce this subsection by terminating water service.

e. Commercial nurseries, commercial sod farmers, and similarly situated establishments shall water only on designated days between the hours of 10:00 p.m. and 5:00 a.m. and shall use only hand-held hoses, drip irrigation systems, or hand-held buckets.

f. The filling, refilling or adding of water, except to maintain the structural integrity of the pool, to swimming and/or wading pools is prohibited.

g. The operation of any ornamental fountain or similar structure, with or without recirculating features, is prohibited.

h. A water use surcharge of $15.00 shall be levied against all customers that use over 8,000 gallons per month.

E. Stage 5-Extreme Drought Condition-Water Supply Emergency:

1. Target Water Use: 10% reduction;

2. Demand management efforts under Stage 5 conditions consist of mandatory water use restrictions implemented for all City of Roma water system users;

3. Notice of such order shall be given by the City Manager and/or Mayor through appropriate circular, television, radio and newspaper media at the Mayor's discretion. All elements of Stage 4 shall remain in effect except that:

a. No applications for new, additional, further expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or other water service facilities of any kind shall be allowed, approved or installed except as approved by the City Council.

b. All allocations of water use to non-essential Industrial and Commercial customers shall be reduced to amounts as established by the City Manager and/or the Water Advisory Council.

c. The maximum monthly water use allocation for residential customers may be established with revised rate schedules and penalties by the City upon recommendation by the City Manager and/or Water Advisory Council.

d. Irrigation by hose-end sprinklers or automatic sprinkler systems is prohibited. Irrigation is permitted only by continuously hand-held hoses or the use of drip irrigation systems which shall be between the hours of 8:00 p.m. to 8:00 a.m. Customers with an address ending in an even number (0,2,4,6,8) are allowed to use water only on Wednesdays of each week during designated hours. Customers with an address ending in an odd number (1,3,5,7,9) are allowed to water only on Saturdays of each week during designated hours.

e. Irrigation for athletic fields is prohibited.

f. The washing of automobiles, trucks, trailers, boats, airplanes, and other types of mobile equipment not occurring upon the immediate premises of commercial carwashes and commercial service stations and not in the immediate interest of the public health, safety and welfare shall be prohibited.

g. A water use surcharge of $20.00 shall be levied against all customers that use over 8,000 gallons per month.

Section IX: Pro Rata Water Allocation

In the event that the triggering criteria specified in Section VII of the Plan for Stage 3 – Severe Water Shortage Conditions or Stage 4 – Emergency Water Shortage Conditions have been met, the Mayor is hereby authorized initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code Section 11.039. Pro rata allocations for each wholesale customer will be based on a 36-month baseline of water use for each wholesale customer for the previous 36-month period. Where three years of water use information are not available, the baseline will be formulated for that user using available monthly consumption records.

In the event that triggering criteria have been met as defined in Section VII of this Plan and mandatory water use curtailment is imposed, the Mayor and his/her designee is hereby authorized to initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code Section 11.039 and according to the following water allocation policies and procedures:

A. A wholesale customer's monthly allocation shall be a percentage of the customer's water usage baseline. The percentage will be set by resolution of the City Council based on the Mayor's assessment of the severity of the water shortage condition and the need to curtail water diversions and/or deliveries and may be adjusted periodically by resolution of the Council as conditions warrant. Once pro rata allocation is in effect, water deliveries to each wholesale customer shall be limited to the allocation established for each month.

B. A monthly water usage allocation shall be established by the Mayor, or his/her designee, for each wholesale customer. The wholesale customer's water usage baseline will be computed on the average water usage by month for the most recent 36-month period as shown in the example given below. If the wholesale water customer's billing history is less than 3 years, the monthly average for the period for which there is a record shall be used for any monthly period for which no billing history exists.

C. The Mayor, or his/her designee, shall provide notice, by certified mail, to each wholesale customer informing them of their monthly water usage allocations and shall notify the news media and the executive director of the Texas Commission on Environmental Quality upon initiation of pro rata water allocation.

D. Upon request of the customer or at the initiative of the Mayor, the allocation may be reduced or increased if:

1. The designated period does not accurately reflect the wholesale customer's normal water usage;

2. The customer agrees to transfer part of its allocation to another wholesale customer or;

3. Other objective evidence demonstrates that the designated allocation is inaccurate under present conditions. A customer may appeal an allocation established hereunder to the City Council.

Section X: Enforcement

In the event of a violation of any part of this Plan, the City may in addition to other remedies institute any appropriate action or proceedings to prevent such violation, including the right to restrain, enjoin, correct or abate such violation, in any court of competent jurisdiction in accordance with the laws of the State.

Section XI: Variances

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

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

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

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

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

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

3. Description of the relief requested.

4. Period of time for which the variance is sought.

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

6. Other pertinent information.

Variances granted by the City Council of Roma shall be subject to the following conditions, unless waived or modified by the City Council of Roma or its designee:

1. Variances granted shall include a timetable for compliance.

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

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

Section XII: Severability

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

Appendix A

Service Area Map

Appendix B

Municipal Use Utility Profile

Appendix C

Resolution Adopting the Water Conservation Plan

Insert Future – Resolution Adopting the Water Conservation Plan

Appendix D

Plan Transmittal Letter to Region M Water Planning Group

Insert future cover letter

Appendix E

City of Roma Water Rate Structure

Insert Water Rate Structure

City of Roma, Texas
REGIONAL
WATER PLANNING STUDY

Kick-Off Presentation

City of Roma
Staff & Consultants
August, 2011

INTRODUCTION

Mayor
Honorable Jose Alfredo Guerra, Jr.

Roma City Council
Jaime Escobar, Jr.
Ruben R. Gonzalez
Jose Noel Saenz
Roberto A. Salinas
Juan Carlos Saenz

City Manager
Crisanto Salinas

eHT Project Managers
Keith Kindle, P.E.
Sage Diller, P.E.

BACKGROUND

- As outlined in the SB 1 Region M Plan, many water providers are facing rapid population growth and a shortage of water supply and treatment.

- The proximity of the numerous rural water supply corporations to the City of Roma offers a unique opportunity for Roma to become a regional provider and avoid the duplication of services and the inherent inefficiencies and additional cost of each system providing for itself.

BACKGROUND

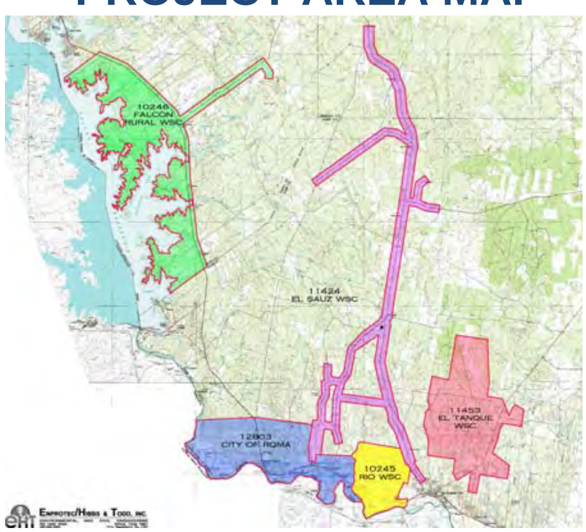
- The City of Roma has shown the capability to lead and manage large, complicated programs and projects, including the recent multi-phased $65 million water and wastewater improvement projects.

- The water treatment plant expansion is now over 10 years old and the existing site is landlocked and cannot be expanded for regional supply and treatment. Consequently, a major focus of this proposed regional study is the location and capacity of a new regional water treatment plant.

REGIONAL PLANNING PARTICIPANTS

- **City of Roma**
  - El Sauz WSC
  - Rio WSC
  - El Tanque WSC
  - Falcon WSC

PROJECT AREA MAP



PROJECT TASKS & BUDGET

Task	Description	Funding Amount	In-Kind	Total
I	Service Area Description	$10,000	$5,000	$15,000
II	Determination of Water System Demands	$10,000	$0	$10,000
III	Prepare Water Treatment System Alternatives	$35,000	$0	$35,000
IV	Prepare Water Distribution System Alternatives	$20,000	$5,000	$25,000
V	Water Operation Alternatives	$2,500	$2,500	$5,000
VI	Implementation Schedule	$5,000	$0	$5,000
VII	Determination of Costs and Recommendations	$25,000	$10,000	$35,000
VIII	Evaluation of Funding Options and Alternative District Consolidations/Regional Structure	$10,000	$0	$10,000
IX	Development of Regional Water Conservation and Drought Management Plans	$10,000	$0	$10,000
X	Reports	$15,000	$0	$15,000
XI	Environmental Assessment	$25,000	$0	$25,000
XII	Meetings	$7,500	$2,500	$10,000
TOTAL		**$175,000**	**$25,000**	**$200,000**

PROJECT SCHEDULE
9 MONTHS

- 2 Months for Review of Existing Information
- 1 Month for Determination of Water Demands
- 2 Months Evaluation of Alternatives
- 3 Months for Evaluation of Alternatives for Costs, Structures and Recommendations
- 1 Month for Final Report Preparation
- Completion of Study by June 2012

GOAL

- Perform a true engineering analysis on a comprehensive level to identify potential options for regionalization of water treatment and transmission and how the options might be accomplished through consideration of:
  - Technical Challenges
  - Identification of Duplication & Inefficiency
  - Cost Implications
  - Rate Impacts
  - Administration & Operational Considerations

OBJECTIVES

- Identify and Quantify Opportunities for Regional Water Treatment Facilities.
- Identify and Quantify Opportunities for Regional Water Distribution Facilities.
- Determine Costs and Recommendations for Regional Water Treatment/Distribution Opportunities.
- Develop an Implementation Schedule.
- Identify Funding Options
- Prepare a Report Summarizing the Findings.

PLANNING SCOPE
WATER SYSTEM DEMANDS

- Collect Information and develop Population / Water Demand Projections for each Entity in Planning Area.
- Prepare Average Day Water Demand and Peak Water Demands.
- Maps developed to include:
  - Water Pipelines
  - Water Treatment Facilities
  - Areas of Projected Population Growth
- Examine Effects of Proposed Infrastructure Growth in the Planning Area.

PLANNING SCOPE
DISTRIBUTION SYSTEM ALTERNATIVES

- Alternatives will be developed to connect existing distribution lines into regional or consolidated water distribution systems within Study Area.
- Draft Memorandum will be developed regarding Alternatives for 5-year increments through the year 2040.

PLANNING SCOPE
WATER TREATMENT SYSTEMS

- The proposed study will evaluate potential regional water treatment facilities, resulting in information about service areas, projected flows, potential impact on water quantity and quality, and opinions of probable costs.

PLANNING SCOPE
WATER OPERATION ALTERNATIVES

Study will examine various operation alternatives for each treatment facility option which will include operation of treatment facilities as:

- Independent Facility
- Regional System
- Multiple Independent Regional Facilities

PLANNING SCOPE
IMPLEMENTATION SCHEDULE

- An implementation plan will be developed for phased construction of recommended regional water distribution and water treatment for the study area through 2040.
- The plan will take into consideration the existing system capacities, water quality issues, future developments, anticipated growth, future annexation plans, and costs.
- Development of the implementation schedule will be based on trigger points, such as regional cost/administrative benefits, population growth, water demand and available capacity.

PLANNING SCOPE
COSTS AND RECOMMENDATIONS

- Estimates of Capital and O&M costs for each Participating Entity will be compiled for those entities providing Water services independently to their respective Service Areas.
- Costs will include Water Distribution and Water Treatment expansion(s) needed to provide adequate water services.

PLANNING SCOPE
EVALUATION OF FUNDING OPTIONS AND ALTERNATIVE CONSOLIDATIONS/ REGIONAL STRUCTURES

- Examination of Advantages & Disadvantages of Organizational Alternatives, such as Establishment of Quasi-Governmental Entities and Inter-Local Agreements.
- Identification of Potential Funding Sources for Water Treatment and Water Infrastructure for the various Structures Identified.

PLANNING SCOPE
REGIONAL WATER CONSERVATION AND DROUGHT CONTINGENCY PLAN

- A Water Conservation Plan and a Drought Contingency Plan will be developed for the study area in accordance with TWDB and TCEQ Rules and Criteria.

PLANNING SCOPE
PREPARE ENVIRONMENTAL ASSESSMENT OF ALTERNATIVES

- Environmental Assessment of the Recommended Alternatives for Regional Facilities will be conducted and will include the associated impacts (ie. Regional Plant Site).

PLANNING SCOPE
PREPARATION OF REPORT

- The Results of the Study will be summarized initially in a Draft Report and distributed for the participants to review and comment.

- A Final Report will be prepared incorporating review comments from the City, Participants and TWDB.

Questions?

City of Roma, Texas
REGIONAL
WATER PLANNING STUDY

50% Status Presentation

City of Roma
Staff & Consultants
January, 2012

INTRODUCTION

Mayor
Honorable Jose Alfredo Guerra, Jr.

Roma City Council
Jaime Escobar, Jr.
Ruben R. Gonzalez
Jose Noel Saenz
Roberto A. Salinas
Juan Carlos Saenz

City Manager
Crisanto Salinas

eHT Project Director
Keith Kindle, P.E.

eHT Project Manager
Sage Diller, P.E.

eHT Project Engineer
Josh Berryhill, P.E.

BACKGROUND

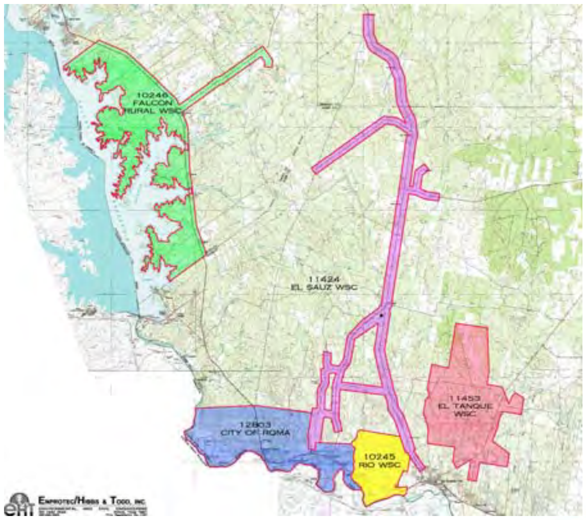
- ❖ As outlined in the SB 1 Region M Plan, many water providers are facing rapid population growth and a shortage of water supply and treatment.
- ❖ The proximity of the numerous rural water supply corporations to the City of Roma offers a unique opportunity for Roma to become a regional provider and avoid the duplication of services and the inherent inefficiencies and additional cost of each system providing for itself.

REGIONAL PLANNING PARTICIPANTS

❖**City of Roma**

- ❖El Sauz WSC
- ❖Rio WSC
- ❖El Tanque WSC
- ❖Falcon Rural WSC

PROJECT AREA MAP



PLANNING STUDY GOAL

- Perform a true engineering analysis on a comprehensive level to identify potential options for regionalization of water treatment and transmission and how the options might be accomplished through consideration of:
  - Technical Challenges
  - Identification of Duplication & Inefficiency
  - Cost Implications
  - Rate Impacts
  - Administration & Operational Considerations

OBJECTIVES

- Identify and Quantify Opportunities for Regional Water Treatment/Distribution/Operation Facilities.
  - **Task completed.**
- Determine Costs and Recommendations for Regional Water Treatment/Distribution/Operation Opportunities.
  - **Task in progress.**
- Identify Funding Options and Implementation Schedule
  - **To be developed in February/March.**
- Prepare a Report Summarizing the Findings.
  - **Task in progress.**

EXISTING CONDITIONS

EXISTING CONDITIONS

- Current Population
- Projected Population
- Current Connections
- Projected Connections
- Current & Projected Water Demands
- Existing WTP Conditions
- Existing Distribution System Conditions
- Water Quality
- Potential Future Regulatory Requirements
- Anticipated Future Treatment Requirements

CURRENT POPULATION

- The current population of the planning study area was determined initially by reviewing the 2011 Region M Regional Water Plan (RWP).
- Issues with the 2011 Region M RWP data:
  - 2010 population values for the City of Roma only reflect incorporated territory and do not account for population served within the City's ETJ.
  - Specific population data was not included in the RWP for Falcon WSC
  - Specific population data was not included in the RWP for El Sauz WSC
  - Specific population data was not included in the RWP for El Tanque WSC
  - 2010 population values for Rio WSC provided in the RWP are substantially lower than data reported in the most recent TCEQ system inspection

CURRENT POPULATION

- Projected annual growth rate from the RWP varies from utility to utility:
  - City of Roma – 1.25%
  - Falcon WSC – 2.00%
  - El Sauz WSC – 3.10%
  - El Tanque WSC – 3.00%
  - Rio WSC – 2.39%
  - **Average - 2.35%, discussed further**

REGION M RWP GROWTH PROJECTIONS

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	11,989	12,890	13,791	14,726	15,661	16,610	**17,559**	18,504	19,449	20,363	21,277
Falcon WSC	2,600	2,911	3,222	3,533	3,845	4,138	**4,432**	4,432	4,432	4,432	4,432
El Sauz WSC	1,510	1,751	1,993	2,241	2,489	2,738	**2,988**	2,988	2,988	2,988	2,988
El Tanque WSC	2,462	2,856	3,249	3,654	4,058	4,465	**4,872**	4,872	4,872	4,872	4,872
Rio WSC	2,942	3,405	3,868	4,345	4,821	5,302	**5,782**	5,782	5,782	5,782	5,782
Total	**21,503**	**23,813**	**26,123**	**28,499**	**30,874**	**33,253**	**35,633**	**36,578**	**37,523**	**38,437**	**39,351**

GROWTH PROJECTIONS BASED ON 2.5% GROWTH

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	18,467	20,775	23,372	26,294	29,581	33,278	**37,438**	42,118	47,382	53,305	59,968
Falcon WSC	2,600	2,925	3,291	3,702	4,165	4,685	**5,271**	5,930	6,671	7,505	8,443
El Sauz WSC	1,510	1,699	1,911	2,150	2,419	2,721	**3,061**	3,444	3,874	4,358	4,903
El Tanque WSC	2,462	2,770	3,116	3,505	3,944	4,437	**4,991**	5,615	6,317	7,106	7,995
Rio WSC	3,900	4,388	4,936	5,553	6,247	7,028	**7,906**	8,895	10,007	11,257	12,665
Total	**28,939**	**32,557**	**36,626**	**41,204**	**46,356**	**52,149**	**58,667**	**66,001**	**74,251**	**83,532**	**93,974**

GROWTH PROJECTIONS BASED ON 5.0% GROWTH

Participant	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**2055**	**2060**
City of Roma	18,467	23,084	28,855	36,068	45,085	56,357	**70,446**	88,058	110,072	137,590	171,987
Falcon WSC	2,600	3,250	4,063	5,078	6,348	7,935	**9,918**	12,398	15,497	19,371	24,214
El Sauz WSC	1,510	1,888	2,359	2,949	3,687	4,608	**5,760**	7,200	9,000	11,250	14,063
El Tanque WSC	2,462	3,078	3,847	4,809	6,011	7,513	**9,392**	11,740	14,675	18,344	22,930
Rio WSC	3,900	4,875	6,094	7,617	9,521	11,902	**14,877**	18,597	23,246	29,057	36,322
Total	**28,939**	**36,175**	**45,218**	**56,521**	**70,652**	**88,315**	**110,393**	**137,992**	**172,490**	**215,612**	**269,515**

RECOMMENDED GROWTH PROJECTIONS FOR PLANNING STUDY

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	18,467	20,775	23,372	26,294	29,581	33,278	**37,438**	42,118	47,382	53,305	59,968
Falcon WSC	2,600	2,925	3,291	3,702	4,165	4,685	**5,271**	5,930	6,671	7,505	8,443
El Sauz WSC	1,510	1,699	1,911	2,150	2,419	2,721	**3,061**	3,444	3,874	4,358	4,903
El Tanque WSC	2,462	2,770	3,116	3,505	3,944	4,437	**4,991**	5,615	6,317	7,106	7,995
Rio WSC	3,900	4,388	4,936	5,553	6,247	7,028	**7,906**	8,895	10,007	11,257	12,665
Total	**28,939**	**32,557**	**36,626**	**41,204**	**46,356**	**52,149**	**58,667**	**66,001**	**74,251**	**83,532**	**93,974**

CURRENT CONNECTIONS

- Population density (persons per household) varies from utility to utility:
  - City of Roma – 2.93
  - Falcon WSC – 2.13
  - El Sauz WSC – 4.08
  - El Tanque WSC – 3.12
  - Rio WSC – 2.26
  - **Average - 2.91**

PROJECTED CONNECTIONS BASED ON RECOMMENDED GROWTH PROJECTIONS

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	6,346	7,139	8,032	9,036	10,165	11,436	**12,865**	14,473	16,283	18,318	20,608
Falcon WSC	893	1,005	1,131	1,272	1,431	1,610	**1,811**	2,038	2,292	2,579	2,901
El Sauz WSC	519	584	657	739	831	935	**1,052**	1,183	1,331	1,498	1,685
El Tanque WSC	846	952	1,071	1,204	1,355	1,525	**1,715**	1,930	2,171	2,442	2,747
Rio WSC	1,340	1,508	1,696	1,908	2,147	2,415	**2,717**	3,057	3,439	3,869	4,352
Total	**9,945**	**11,188**	**12,586**	**14,159**	**15,930**	**17,921**	**20,161**	**22,681**	**25,516**	**28,705**	**32,293**

CURRENT AND PROJECTED WATER DEMANDS

- The expected water demand was obtained by multiplying the number of service connections by the average daily usage per connection.
- The average daily usage per connection was calculated by dividing the annual average daily system water demand by the connection count.
- The current and projected water demand results are presented in the following table.

CURRENT AND PROJECTED WATER DEMANDS

Study Participant	Current Daily Usage Per Connection	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	395	2.74	3.08	3.47	3.90	4.39	4.94	**5.56**	6.25	7.03	7.91	8.90
Falcon WSC	554	0.39	0.43	0.49	0.55	0.62	0.70	**0.78**	0.88	0.99	1.11	1.25
El Sauz WSC	397	0.22	0.25	0.28	0.32	0.36	0.40	**0.45**	0.51	0.58	0.65	0.73
El Tanque WSC	305	0.37	0.41	0.46	0.52	0.59	0.66	**0.74**	0.83	0.94	1.05	1.19
Rio WSC	510	0.58	0.65	0.73	0.82	0.93	1.04	**1.17**	1.32	1.49	1.67	1.88
TOTAL	**2,160**	**4.30**	**4.83**	**5.44**	**6.12**	**6.88**	**7.74**	**8.71**	**9.80**	**11.02**	**12.40**	**13.95**

Notes
1 - WTP demand in mgd
2 - Connections based on historical number of persons per household
3 - Growth based on 2.5% annual growth
4 - Demand based on historical usage

ANTICIPATED WTP SIZING

- The anticipated water treatment plant (WTP) sizing required for each utility was obtained by multiplying the number of service connections by the standard Texas Commission on Environmental Quality (TCEQ) treatment design criteria of 0.6 gallons per minute (gpm) per connection.
- It should be noted that the anticipated plant sizes are roughly twice the projected future water demands, which allows for sufficient treatment capacity during peak demand periods.
- The anticipated WTP sizing results are presented in the following table.

ANTICIPATED WTP SIZING

Study Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	5.48	6.17	6.94	7.81	8.78	9.88	**11.12**	12.51	14.07	15.83	17.81
Falcon WSC	0.77	0.87	0.98	1.10	1.24	1.39	**1.56**	1.76	1.98	2.23	2.51
El Sauz WSC	0.45	0.50	0.57	0.64	0.72	0.81	**0.91**	1.02	1.15	1.29	1.46
El Tanque WSC	0.73	0.82	0.93	1.04	1.17	1.32	**1.48**	1.67	1.88	2.11	2.37
Rio WSC	1.16	1.30	1.47	1.65	1.85	2.09	**2.35**	2.64	2.97	3.34	3.76
TOTAL	**8.59**	**9.67**	**10.87**	**12.23**	**13.76**	**15.48**	**17.42**	**19.60**	**22.05**	**24.80**	**27.90**

Notes
1 - WTP demand in mgd
2 - Connections based on historical number of persons per household
3 - Growth based on 2.5% annual growth
4 - WTP capacity based on TCEQ standard 0.6 gpm per connection

EXISTING WTP CONDITIONS

Number	Name	Current Permitted Capacity
1	City of Roma WTP	5.15 mgd
2	Falcon Rural WSC WTP	1.30 mgd
Total Permitted Capacity = 6.45 mgd		

EXISTING DISTRIBUTION SYSTEM CONDITIONS

Participant	Current Elevated / Pressure Capacity (MG)	Current Ground Storage Capacity (MG)	Current Total Storage Capacity (MG)
City of Roma	0.800	0.768	1.568
Falcon Rural WSC	0.095	0.318	0.413
El Sauz WSC	0.150	0.000	0.150
El Tanque WSC	0.089	0.210	0.299
Rio WSC	*0.003*	0.598	0.601
TOTAL	1.137	1.894	3.031

Notes

1 - Sizes shown in red reflect storage capacities that appear to be inadequate as compared to TCEQ 290.45 design criteria.

ANTICIPATED TOTAL STORAGE NEEDED

Study Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	1.269	1.428	1.606	1.807	2.033	2.287	**2.573**	2.895	3.257	3.664	4.122
Falcon WSC	0.179	0.201	0.226	0.254	0.286	0.322	**0.362**	0.408	0.458	0.516	0.580
El Sauz WSC	0.104	0.117	0.131	0.148	0.166	0.187	**0.210**	0.237	0.266	0.300	0.337
El Tanque WSC	0.169	0.190	0.214	0.241	0.271	0.305	**0.343**	0.386	0.434	0.488	0.549
Rio WSC	0.268	0.302	0.339	0.382	0.429	0.483	**0.543**	0.611	0.688	0.774	0.870
TOTAL	**1.989**	**2.238**	**2.517**	**2.832**	**3.186**	**3.584**	**4.032**	**4.536**	**5.103**	**5.741**	**6.459**

Notes
1 - Water storage tank size in million gallons (MG)
2 - Connections based on historical number of persons per household
3 - Growth based on 2.5% annual growth
4 - Storage capacity based on TCEQ required total storage of 200 gallons per connection

ANTICIPATED ADDITIONALSTORAGE NEEDED

Study Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	0.000	0.000	0.038	0.239	0.465	0.719	**1.005**	1.327	1.689	2.096	2.554
Falcon WSC	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.045	0.103	0.167
El Sauz WSC	0.000	0.000	0.000	0.000	0.016	0.037	**0.060**	0.087	0.116	0.150	0.187
El Tanque WSC	0.000	0.000	0.000	0.000	0.000	0.006	**0.044**	0.087	0.135	0.189	0.250
Rio WSC	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.010	0.087	0.173	0.269
TOTAL	**0.000**	**0.000**	**0.038**	**0.239**	**0.481**	**0.762**	1.109	**1.511**	**2.072**	**2.710**	**3.428**

Notes
1 - Water storage tank size in million gallons (MG)
2 - Connections based on historical number of persons per household
3 - Growth based on 2.5% annual growth
4 - Storage capacity required based on TCEQ required total storage of 200 gallons per connection, less existing storage in each system

EXISTING ISSUES

- Treatment Capacity
  - **Roma**
    - Additional treatment capacity is needed to continue City growth, water treatment plant (WTP) site is landlocked, cannot be expanded further
  - **Falcon Rural WSC**
    - Additional treatment capacity is needed to continue City growth, cost to expand limited by capability to increase water rates
  - **Rio WSC**
    - No treatment capacity (purchasing treated water from Rio Grande City), currently working toward constructing their own WTP, needs to evaluate options for treatment capacity to maintain continued service area growth
  - **El Sauz WSC**
    - No treatment capacity (purchasing treated water from Rio Grande City), needs to evaluate options for treatment capacity to maintain continued service area growth
  - **El Tanque WSC**
    - No treatment capacity (purchasing treated water from Rio Grande City), needs to evaluate options for treatment capacity to maintain continued service area growth

EXISTING ISSUES

- TCEQ Compliance
  - **Roma**
    - Approaching limit of WTP capacity due to high growth
  - **Falcon Rural WSC**
    - High water losses, age and condition of existing WTP
  - **Rio WSC**
    - Task in progress
  - **El Sauz WSC**
    - Task in progress
  - **El Tanque WSC**
    - Insufficient storage, insufficient water supply, water losses

WATER QUALITY

- Primary raw water source for the participants is the Rio Grande River
- Primary Drinking Water Standards (PDWS) - such as turbidity, total organic carbon (TOC), lead and copper - can be met by most conventional treatment systems, which use coagulation, flocculation, sedimentation and granular media filtration
- Secondary Drinking Water Standards (SDWS) – such as total dissolved solids (TDS), chloride and sulfate – cannot be met using conventional treatment systems
- Secondary contaminant concentrations for TDS, chloride and sulfate in the Rio Grande River are continuing to increase above the TCEQ's SDWS limits in drinking water
- It is likely that the TCEQ or EPA will begin enforcing SDWS limits for drinking water in the Rio Grande Valley within the next 10-20 years (enforcement is already starting in other parts of Texas)

POTENTIAL FUTURE REGULATORY REQUIREMENTS

- Current water treatment requirements follow the EPA's Long Term 2 Enhanced Surface Water Treatment Rule (LT2)
  - LT2 followed LT1 by roughly 10 years, with the goal of reducing finished water turbidity from 1.0 NTU to 0.5 NTU to 0.3 NTU
  - The ultimate goal is to get as close to 0.0 NTU as possible
  - It has been almost 10 years since LT2 was promulgated
- TCEQ is currently collecting data on filtration performance at WTPs to determine the lowest turbidity that can be maintained
  - Conventional filtration can typically maintain 0.15-0.30 NTU
  - Membrane filtration can maintain 0.01-0.02 NTU
- TCEQ is already enforcing SDWS limits for TDS and chloride in drinking water in Texas
  - As secondary contaminant concentrations continue to increase in surface water supplies, the likelihood of widespread enforcement of SDWS limits increases

ANTICIPATED FUTURE TREATMENT REQUIREMENTS

- The recommended filtration process for a future WTP is to implement a membrane filtration system
  - Membrane filters can easily meet LT2 requirements of 0.3 NTU
  - Membrane filters would also be able to meet reduced future turbidity limits of 0.1-0.2 NTU, a limit that conventional filtration cannot consistently meet
- If the TCEQ and/or EPA starts enforcing SDWS limits in the future, future WTPs in the Rio Grande Valley will likely require RO treatment
  - Plan for RO addition to WTP in the future
  - Conventional filtration does not provide sufficient pretreatment for RO
  - Membrane filtration is normally required for RO pretreatment
- Cost comparisons
  - Conventional treatment WTP construction ranges from $2-6 per gallon
  - Membrane filtration WTP construction ranges from $2-3 per gallon

DEVELOPMENT OF ADDITIONAL WATER SUPPLIES

DEVELOPMENT OF ADDITIONAL WATER SUPPLIES

- Existing and Future Water Rights
- Converted Water Rights
- Potential Water Rights
- Development of Additional Water Supplies
- Purchase/Lease Additional Water Rights
- Implement Bed and Banks Reuse
- Implement Direct/Indirect Reuse
- Develop Brackish Groundwater Supply

EXISTING AND FUTURE WATER RIGHTS

- Existing surface water rights for each utility were determined by researching the TCEQ's active water rights database.
- Some of the study participants were observed to own a mixture of municipal, Class A irrigation and Class B irrigation water rights, while some of the utilities did not own any water rights at all.
- The existing owned water rights are presented in the following table.

EXISTING WATER RIGHTS

Study Participant	Municipal Water Rights (acre-ft)	Class A Irrigation Water Rights (acre-ft)	Class B Irrigation Water Rights (acre-ft)
City of Roma	2,841.18	551.40	588.25
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Falcon Rural WSC	249.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**

Notes

1 - Water rights based on TCEQ Water Rights Database, as of November 2011.

CONVERTED WATER RIGHTS

- While municipal water rights are reserved for use even during droughts, Class A and Class B irrigation rights can be refused by the Rio Grande Rivermaster during periods of excessive drought (when Amistad Reservoir and Falcon Reservoir are operating at less than 50% capacity).
- To protect availability of water use, Class A and Class B irrigation rights should be converted to municipal use.
  - Class A conversion rate to Municipal – 0.5 : 1
  - Class B conversion rate to Municipal – 0.4 : 1
- The potential water rights if all converted to municipal are presented in the following table.

POTENTIAL WATER RIGHTS IF CONVERTED TO MUNICIPAL

Study Participant	Current Municipal Water Rights (acre-ft)	Converted from Class A Irrigation Water Rights (acre-ft)	Converted from Class B Irrigation Water Rights (acre-ft)	Total Potential Municipal Water Rights (acre-ft)
City of Roma	2,841.18	275.70	235.30	3,352.18
El Sauz WSC	0.00	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00	0.00
Falcon Rural WSC	249.00	0.00	0.00	249.00
Rio WSC	527.11	0.00	197.80	724.91
Total	**3,617.29**	**275.70**	**433.10**	**4,326.09**

Notes

1 - Water rights based on TCEQ Water Rights Database, as of November 2011.

2 - Water right conversion rates per Rio Grande River Watermaster.

PROJECTED ACTUAL WATER DEMANDS (IN ACRE-FT)

Study Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
City of Roma	3,071	3,455	3,887	4,373	4,919	5,534	**6,226**	7,004	7,880	8,865	9,973
Falcon WSC	432	486	547	616	693	779	**877**	986	1,109	1,248	1,404
El Sauz WSC	251	283	318	358	402	453	**509**	573	644	725	815
El Tanque WSC	409	461	518	583	656	738	**830**	934	1,050	1,182	1,330
Rio WSC	649	730	821	923	1,039	1,169	**1,315**	1,479	1,664	1,872	2,106
TOTAL	**4,813**	**5,414**	**6,091**	**6,852**	**7,709**	**8,672**	**9,756**	**10,976**	**12,348**	**13,891**	**15,628**

Notes
1 - WTP capacity based on acre-ft per year
2 - Water rights based on actual current demand (approximately half of TCEQ required capacity)

DEVELOPMENT OF ADDITIONAL WATER SUPPLIES

- Regardless of the recommended regionalization scenario, additional water supplies will be needed by most, if not all of the study participants.
- Multiple potential water supply alternatives were evaluated in this study including:
  - Purchase of additional water rights
  - Lease of additional water rights
  - Acquisition of additional water rights through a bed and banks reuse permit
  - Increasing available raw water supply via a direct/indirect reuse system
  - Development of a potential brackish groundwater supply

PURCHASE ADDITIONAL WATER RIGHTS

- Current average market price - $2,500 per acre-ft
  - Cost of converting Class A irrigation rights to municipal - $5,000 per acre-ft
  - Cost of converting Class B irrigation rights to municipal - $6,250 per acre-ft
- Advantages
  - Simpler than other water supply alternatives to accomplish
- Disadvantages
  - May not be able to find sufficient water rights to purchase when needed
  - Does not provide an improvement in water quality

LEASE ADDITIONAL WATER RIGHTS

- Current average market price - $50-100 per acre-ft
- Advantages
  - Simplest of the water supply alternatives to accomplish
- Disadvantages
  - May not be able to find sufficient water rights to lease when needed
  - Leased water availability must be renegotiated each year and is not guaranteed
  - Does not provide an improvement in water quality

IMPLEMENT BED AND BANKS REUSE

- **Reuse** - The use of surface water which has already been beneficially used once under a water right
- **Bed and Banks Reuse -** When a WWTP discharges effluent into a stream and either the discharger or another person or entity diverts the effluent further downstream to use again
- A bed and banks authorization under the Texas Water Code Section 11.042 is required for the use of the watercourse to transport the water for reuse
- Only cost is engineering and regulatory efforts to obtain permit

IMPLEMENT BED AND BANKS REUSE

- **Advantages**
  - Can provide a certain amount of water rights almost for free
- **Disadvantages**
  - May have significant opposition downstream preventing approval of permit
  - Does not provide an improvement in water quality

IMPLEMENT INDIRECT REUSE

- **Indirect Reuse** - Where municipal wastewater is highly treated and discharged directly into surface water sources with the intent of augmenting raw water supplies
- Requires the blending of the highly treated effluent into a raw water supply, such as a raw water reservoir
- The blended water is then treated again at the WTP
- Requires membrane treatment and disinfection, such as reverse osmosis (RO) and ultraviolet (UV) disinfection

IMPLEMENT INDIRECT REUSE

- Advantages
  - Provide additional raw water without purchasing additional water rights
  - Can reduce salt concentrations in blended raw water, improving finished water quality from WTP
  - Benefit of RO treatment on reuse system could eliminate the need for RO treatment at the WTP in the future
- Disadvantages
  - Community opposition due to "yuck" factor
  - Disposal of membrane treatment system wastewater (RO concentrate)

IMPLEMENT DIRECT REUSE

- **Direct Reuse** - Where municipal wastewater is highly treated and discharged directly into the finished water distribution system
- Requires the blending of the highly treated effluent directly into a finished water supply
- Requires membrane treatment and disinfection, such as reverse osmosis (RO) and ultraviolet (UV) disinfection
- **Due to regulatory and environmental concerns, direct reuse is not recommended at this time**

IMPLEMENT DIRECT REUSE

- Advantages
  - Provide additional treated water without purchasing additional water rights
  - Can reduce salt concentrations in blended finished water, improving finished water quality in the distribution system
  - Benefit of direct treatment on reuse system would eliminate the need for expanding treatment at the WTP in the future
  - Benefit of RO treatment on reuse system could eliminate the need for RO treatment at the WTP in the future
- Disadvantages
  - Community opposition due to “yuck” factor
  - Reduction of protection barriers increases risk to consumers
  - Disposal of membrane treatment system wastewater (RO concentrate)

DEVELOP BRACKISH GROUNDWATER SUPPLY

- **Brackish Groundwater** - Groundwater supplies with a total dissolved solids (TDS) of 1,000 to 15,000 mg/L
- Requires membrane treatment, such as RO
- Creates highly aggressive RO treated water, must be blended either with untreated groundwater or raw water to re-mineralize treated water
- Can either be utilized as a standalone treatment system putting treated water into the distribution system or can send RO water to blend with raw surface water to improve overall quality of raw water (requires re-treatment at a WTP)

DEVELOP BRACKISH GROUNDWATER SUPPLY

- Advantages
  - Provide additional raw water without purchasing additional water rights
  - Can reduce salt concentrations in blended raw water, improving finished water quality from WTP
  - Benefit of RO treatment on brackish groundwater system could eliminate the need for RO treatment at the WTP in the future
- Disadvantages
  - Limited groundwater data in Starr County increases risk of drilling a “dry hole”
  - Disposal of membrane treatment system wastewater (RO concentrate)

REGIONALIZATION ALTERNATIVES

REGIONALIZATION ALTERNATIVES

- Regionalization Goals
- Regionalization Alternatives
- Multiple Independent Non-Regional Facilities
- Multiple Independent Regional Facilities
- City-Owned Regional System
- Regional Water Authority
- Potential Regionalization Scenarios
- Primary Regionalization Scenarios Evaluated
- Regional Facility Serving One Utility
- Regional Facility Serving Two Utilities
- Regional Facility Serving Three Utilities
- Regional Facility Serving All Five Utilities
- Impacts of Potential Funding Options to Project

REGIONALIZATION GOALS

- The study includes an evaluation of potential regional water treatment facilities, resulting in information about service areas, projected flows, potential impact on water quantity and quality, and opinions of probable costs.
- Alternatives have been developed to connect existing distribution lines into regional or consolidated water distribution systems within Study Area.
- The study will also include the examine of various operation alternatives for each utility.

REGIONALIZATION ALTERNATIVES

- Regionalization alternatives to be evaluated in this study:
  - Multiple Independent Non-Regional Facilities
  - Multiple Independent Regional Facilities
  - City-Owned Regional System
  - Regional Water Authority

MULTIPLE INDEPENDENT NON-REGIONAL FACILITIES

- Similar to current conditions
  - How this could be accomplished
    - City of Roma – New WTP, serves only Roma
    - Falcon WSC – Upgraded/expanded WTP, serves only Falcon WSC
    - Rio WSC – New WTP, serves only Rio WSC
    - El Tanque WSC – Continues to purchase water from RGC only
    - El Sauz WSC – Continues to purchase water from RGC only

MULTIPLE INDEPENDENT REGIONAL FACILITIES

- Builds on current conditions to regionalize supply and demand
  - How this could be accomplished
    - City of Roma – New WTP, with interconnections to other systems
    - Falcon WSC – Upgraded/expanded WTP, with interconnections to other systems
    - Rio WSC – New WTP, with interconnections to other systems
    - El Tanque WSC – Continues to purchase water from RGC only, but also interconnected to other systems
    - El Sauz WSC – Continues to purchase water from RGC only, but also interconnected to other systems

CITY-OWNED REGIONAL SYSTEM

- ❖Similar in concept to how North Alamo WSC operates
  - ❖How this could be accomplished
    - ❖City of Roma – New WTP owned and operated solely by the City, designed to treat water for the other participants in this Study
    - ❖Falcon WSC – Continue to operate existing WTP, buying capacity from the new Roma Regional WTP as needed
    - ❖Rio WSC – Continue to operate new WTP, buying capacity from the new Roma Regional WTP as needed
    - ❖El Tanque WSC – Purchase water either from Roma or RGC
    - ❖El Sauz WSC – Purchase water either from Roma or RGC

CITY-OWNED REGIONAL SYSTEM EXAMPLE – NORTH ALAMO WSC

- ❖How it works:
  - ❖North Alamo WSC supplies treated water to approximately 37,000 connections over three different counties
- ❖ Advantages
  - ❖ Centralized treatment, allows for reduced O&M costs per 1,000 gallons treated due to economies of scale
  - ❖ Reduced permitting and reporting efforts for purchasing utilities
  - ❖ Regional concept appeals to funding and regulatory agencies, allowing for improved funding options (better opportunity for grants and/or loan forgiveness)
- ❖Disadvantages
  - ❖ Purchasing utilities can only negotiate price of finished water sold to each utility

REGIONAL WATER AUTHORITY (RWA)

- Similar in concept to how the Southmost Regional Water Authority (SRWA) operates
  - How this could be accomplished
    - Regional Water Authority WTP – Owned in part by all Study participants who want to purchase a percentage of capacity
    - City of Roma – The new WTP could be operated by City staff
    - Falcon WSC – Continue to operate existing WTP, buying capacity from the new RWA WTP as needed
    - Rio WSC – Continue to operate new WTP, buying capacity from the new RWA WTP as needed
    - El Tanque WSC – Purchase water either from RWA or RGC
    - El Sauz WSC – Purchase water either from RWA or RGC

REGIONAL WATER AUTHORITY EXAMPLE – SRWA

- How it works:
  - SRWA supplies treated water to six different utilities, including Brownsville PUB
- Advantages
  - Each participant in SRWA is on the Board of Directors and has a direct impact on how the regional system is managed
  - Centralized treatment, allows for reduced O&M costs per 1,000 gallons treated due to economies of scale
  - Reduced permitting and reporting efforts for purchasing utilities
  - Regional concept appeals to funding and regulatory agencies, allowing for improved funding options (better opportunity for grants and/or loan forgiveness)
- Disadvantages

POTENTIAL REGIONALIZATION SCENARIOS

- Potential regionalization scenarios are based on five basic alternatives:
  - Construction of a regional WTP to serve one utility
    - Based on providing service to the City of Roma
  - Construction of a regional WTP to serve two utilities
  - Construction of a regional WTP to serve three utilities
  - Construction of a regional WTP to serve four utilities
  - Construction of a regional WTP to serve all five utilities

POTENTIAL REGIONALIZATION SCENARIOS

Scenario	City of Roma	Falcon WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

Notes
1 - Implementation of any of the scenarios would likely require the construction of a new regional WTP.
2 - Existing WTPs would likely remain online for their respective remaining useful life to serve as a backup to a regional WTP.

PRIMARY REGIONALIZATION SCENARIOS EVALUATED

- Construction of a regional WTP to serve one utility
  - Serves the City of Roma
- Construction of a regional WTP to serve two utilities
  - Serves the City of Roma and Falcon WSC
- Construction of a regional WTP to serve three utilities
  - Serves the City of Roma, Falcon WSC and El Tanque WSC
- Construction of a regional WTP to serve all five utilities
  - Serves the City of Roma, Falcon WSC, El Sauz WSC, El Tanque WSC and Rio WSC

REGIONAL FACILITY SERVING ONE UTILITY

- This alternative (Scenario No. 1) would provide for a new WTP serving only the City of Roma
- Project would include:
  - New 13.1 MGD membrane filtration WTP
  - 1.5 MG of elevated storage
  - 44,100 LF of new pipeline for system looping
- Project Construction Options
  - Completed in multiple phases (recommended to keep cost of service lower)

REGIONAL FACILITY SERVING TWO UTILITIES

- This alternative (Scenario No. 2) would provide for a new WTP serving the City of Roma and Falcon Rural WSC
- Project would include:
  - New 15.0 MGD membrane filtration WTP
  - 2.0 MG of elevated storage
  - 99,600 LF of new pipeline for system looping
- Project Construction Options
  - Completed in multiple phases (recommended to keep cost of service lower)

REGIONAL FACILITY SERVING THREE UTILITIES

- This alternative (Scenario No. 7) would provide for a new WTP serving the City of Roma, Falcon Rural WSC and El Tanque WSC
- Project would include:
  - New 16.7 MGD membrane filtration WTP
  - 2.5 MG of elevated storage
  - 151,200 LF of new pipeline for system looping
- Project Construction Options
  - Completed in multiple phases (recommended to keep cost of service lower)

REGIONAL FACILITY SERVING ALL FIVE UTILITIES

- This alternative (Scenario No. 16) would provide for a new WTP to serve all five Study participants
- Project would include:
  - New 16.7 MGD membrane filtration WTP
  - 2.5 MG of elevated storage
  - 151,200 LF of new pipeline for system looping
- Project Construction Options
  - Completed in multiple phases (recommended to keep cost of service lower)

POTENTIAL FUNDING OPTIONS TO PROJECT – NEW WTP – 2 PHASES

Project Alternative	Debt Service to be Financed at 0% Grant	Debt Service to be Financed at 15% Grant	Debt Service to be Financed at 30% Grant	Debt Service to be Financed at 50% Grant	Debt Service to be Financed at 75% Grant
One Utility - Phase I	$43,082,400.00	$36,620,040.00	$30,157,680.00	$21,541,200.00	$10,770,600.00
Two Utilities - Phase I	$56,022,300.00	$47,618,955.00	$39,215,610.00	$28,011,150.00	$14,005,575.00
Three Utilities - Phase I	$72,382,400.00	$61,525,040.00	$50,667,680.00	$36,191,200.00	$18,095,600.00
Five Utilities - Phase I	$88,421,000.00	$75,157,850.00	$61,894,700.00	$44,210,500.00	$22,105,250.00
One Utility - Phase II	$26,454,400.00	$22,486,240.00	$18,518,080.00	$13,227,200.00	$6,613,600.00
Two Utilities - Phase II	$40,350,300.00	$34,297,755.00	$28,245,210.00	$20,175,150.00	$10,087,575.00
Three Utilities - Phase II	$30,790,700.00	$26,172,095.00	$21,553,490.00	$15,395,350.00	$7,697,675.00
Five Utilities - Phase II	$44,407,100.00	$37,746,035.00	$31,084,970.00	$22,203,550.00	$11,101,775.00

POTENTIAL FUNDING OPTIONS TO PROJECT – NEW WTP – 3 PHASES

Project Alternative	Debt Service to be Financed at 0% Grant	Debt Service to be Financed at 15% Grant	Debt Service to be Financed at 30% Grant	Debt Service to be Financed at 50% Grant	Debt Service to be Financed at 75% Grant
One Utility - Phase I	$31,795,300.00	$27,026,005.00	$22,256,710.00	$15,897,650.00	$7,948,825.00
Two Utilities - Phase I	$39,724,000.00	$33,765,400.00	$27,806,800.00	$19,862,000.00	$9,931,000.00
Three Utilities - Phase I	$50,148,000.00	$42,625,800.00	$35,103,600.00	$25,074,000.00	$12,537,000.00
Five Utilities - Phase I	$55,866,400.00	$47,486,440.00	$39,106,480.00	$27,933,200.00	$13,966,600.00
One Utility - Phase II	$18,166,100.00	$15,441,185.00	$12,716,270.00	$9,083,050.00	$4,541,525.00
Two Utilities - Phase II	$19,205,100.00	$16,324,335.00	$13,443,570.00	$9,602,550.00	$4,801,275.00
Three Utilities - Phase II	$36,329,900.00	$30,880,415.00	$25,430,930.00	$18,164,950.00	$9,082,475.00
Five Utilities - Phase II	$37,335,000.00	$31,734,750.00	$26,134,500.00	$18,667,500.00	$9,333,750.00
One Utility - Phase III	$15,157,100.00	$12,883,535.00	$10,609,970.00	$7,578,550.00	$3,789,275.00
Two Utilities - Phase III	$19,205,100.00	$16,324,335.00	$13,443,570.00	$9,602,550.00	$4,801,275.00
Three Utilities - Phase III	$15,051,800.00	$12,794,030.00	$10,536,260.00	$7,525,900.00	$3,762,950.00
Five Utilities - Phase III	$26,525,500.00	$22,546,675.00	$18,567,850.00	$13,262,750.00	$6,631,375.00

POTENTIAL FUNDING OPTIONS TO PROJECT – CONTINUED OPERATION – 3 PHASES

Project Alternative	Debt Service to be Financed at 0% Grant	Debt Service to be Financed at 15% Grant	Debt Service to be Financed at 30% Grant	Debt Service to be Financed at 50% Grant	Debt Service to be Financed at 75% Grant
One Utility - Phase I	$21,634,100.00	$18,388,985.00	$15,143,870.00	$10,817,050.00	$5,408,525.00
Two Utilities - Phase I	$30,042,600.00	$25,536,210.00	$21,029,820.00	$15,021,300.00	$7,510,650.00
Three Utilities - Phase I	$38,283,000.00	$32,540,550.00	$26,798,100.00	$19,141,500.00	$9,570,750.00
Five Utilities - Phase I	$41,007,400.00	$34,856,290.00	$28,705,180.00	$20,503,700.00	$10,251,850.00
One Utility - Phase II	$27,665,400.00	$23,515,590.00	$19,365,780.00	$13,832,700.00	$6,916,350.00
Two Utilities - Phase II	$28,886,400.00	$24,553,440.00	$20,220,480.00	$14,443,200.00	$7,221,600.00
Three Utilities - Phase II	$32,341,000.00	$27,489,850.00	$22,638,700.00	$16,170,500.00	$8,085,250.00
Five Utilities - Phase II	$42,427,300.00	$36,063,205.00	$29,699,110.00	$21,213,650.00	$10,606,825.00
One Utility - Phase III	$24,656,400.00	$20,957,940.00	$17,259,480.00	$12,328,200.00	$6,164,100.00
Two Utilities - Phase III	$28,886,400.00	$24,553,440.00	$20,220,480.00	$14,443,200.00	$7,221,600.00
Three Utilities - Phase III	$26,202,700.00	$22,272,295.00	$18,341,890.00	$13,101,350.00	$6,550,675.00
Five Utilities - Phase III	$29,382,400.00	$24,975,040.00	$20,567,680.00	$14,691,200.00	$7,345,600.00

OUTSTANDING TASKS

OUTSTANDING TASKS

- Final Costs and Recommendations
- Implementation Schedule
- Preparation of Report
- Remaining Schedule

FINAL COSTS AND RECOMMENDATIONS

- Estimates of Capital and O&M costs for each Participating Entity will continue to be revised for those entities providing Water services independently to their respective Service Areas.
- Costs will include Water Distribution and Water Treatment expansion(s) needed to provide adequate water services.

IMPLEMENTATION SCHEDULE

- An implementation plan will be developed for phased construction of recommended regional water distribution and water treatment for the study area through 2040.
- The plan will take into consideration the existing system capacities, water quality issues, future developments, anticipated growth, future annexation plans, and costs.
- Development of the implementation schedule will be based on trigger points, such as regional cost/administrative benefits, population growth, water demand and available capacity.

PREPARATION OF REPORT

- The Results of the Study will be summarized initially in a Draft Report and distributed for the participants to review and comment.
- A Final Report will be prepared incorporating review comments from the City, Participants and TWDB.
- A Final Public Meeting will be held to present the results of the Study.

REMAINING SCHEDULE

Date	Task
Mid – Late January	Receive comments from Public Meeting
Early – Mid January	Work to address comments received
Mid – Late February	95% Draft Technical Memorandums sent to City and WSCs
Mid – Late March	Receive comments on 95% Draft TMs
Early – Late April	Work to address comments received
Mid – Late May	100% Report to TWDB
July 2012	Final Report Public Meeting

DISCUSSION

City of Roma, Texas
REGIONAL
WATER PLANNING STUDY

Final Public Meeting

City of Roma
Staff & Consultants
September 12, 2012

INTRODUCTION

Mayor
Honorable Jose Alfredo Guerra, Jr.

Roma City Council
Jaime Escobar, Jr.
Ruben R. Gonzalez
Jose Noel Saenz
Roberto A. Salinas
Juan Carlos Saenz

City Manager
Crisanto Salinas

eHT Project Managers
Keith Kindle, P.E.
Sage Diller, P.E.

eHT Project Engineer
Josh Berryhill, P.E.

PRESENTATION GOALS

Review and Discuss

- Final Draft Regional Planning Study Report
- Key Issues Identified During Development of Report
- Regionalization Project Alternatives
- Recommended Regionalization Project Concept
- Impacts of Funding to Anticipated Cost of Service
- Potential Phasing of Project Improvements
- Anticipated Timeline for Improvements
- Path Forward

FINAL DRAFT PLANNING STUDY REPORT

Regional Planning Participants

- **City of Roma**
  - Falcon Rural WSC
  - El Sauz WSC
  - El Tanque WSC
  - Rio WSC

FINAL DRAFT PLANNING STUDY REPORT

Population Projections

- 2010 Population – Total – 28,427
  - City of Roma – 18,467
  - Falcon WSC – 2,600
  - El Sauz WSC – 1,510
  - El Tanque WSC – 1,950
  - Rio WSC – 3,900
- 2040 Projected Population – Total – 47,522
  - City of Roma – 28,500 (334 people / yr)
  - Falcon WSC – 4,606 (67 people / yr)
  - El Sauz WSC – 2,941 (48 people / yr)
  - El Tanque WSC – 3,798 (62 people / yr)
  - Rio WSC – 7,677 (126 people / yr)

*Data from TM No. 1, Table 1-7

FINAL DRAFT PLANNING STUDY REPORT

Connection Projections

- 2010 Connections – Total – 9,814
  - City of Roma – 6,300
  - Falcon WSC – 1,219
  - El Sauz WSC – 370
  - El Tanque WSC – 625
  - Rio WSC – 1,300
- 2040 Projected Connections – Total – 16,379
  - City of Roma – 9,723 (114 connections / yr)
  - Falcon WSC – 2,160 (31 connections / yr)
  - El Sauz WSC – 721 (12 connections / yr)
  - El Tanque WSC – 1,217 (20 connections / yr)
  - Rio WSC – 2,559 (42 connections / yr)

*Data from TM No. 1, Table 1-9

FINAL DRAFT PLANNING STUDY REPORT

Projected Recommended Water Treatment Capacity

- 2010 Recommended WTP Capacity – Total - 9.98 MGD
  - City of Roma – 6.40
  - Falcon WSC – 1.24
  - El Sauz WSC – 0.38
  - El Tanque WSC – 0.64
  - Rio WSC – 1.32
- 2040 Recommended WTP Capacity – Total – 16.65 MGD
  - City of Roma – 9.88
  - Falcon WSC – 2.20
  - El Sauz WSC – 0.73
  - El Tanque WSC – 1.24
  - Rio WSC – 2.60

***Data from TM No. 1, Table 1-13, based on TCEQ 0.6 gpm/connection, includes compliance with 85% Capacity Rule.**

FINAL DRAFT PLANNING STUDY REPORT

Projected Recommended Elevated Water Storage Capacity

- 2010 Recommended Elevated Storage Capacity – 2.309 MG
  - City of Roma – 1.482
  - Falcon WSC – 0.287
  - El Sauz WSC – 0.087
  - El Tanque WSC – 0.147
  - Rio WSC – 0.306
- 2040 Recommended Elevated Storage Capacity – Total – 3.854 MG
  - City of Roma – 2.288
  - Falcon WSC – 0.508
  - El Sauz WSC – 0.170
  - El Tanque WSC – 0.286
  - Rio WSC – 0.602

***Based on 200 gallons per connection, alternative TCEQ design criteria, includes compliance with TCEQ 85% Capacity Rule.**

FINAL DRAFT PLANNING STUDY REPORT

Projected Required Water Rights (acre-ft)

- 2010 Required Water Rights – Total – 4,694
  - City of Roma – 3,081
  - Falcon WSC – 437
  - El Sauz WSC – 246
  - El Tanque WSC – 302
  - Rio WSC – 627
- 2040 Required Water Rights – Total – 8,011
  - City of Roma – 4,754
  - Falcon WSC – 953
  - El Sauz WSC – 480
  - El Tanque WSC – 589
  - Rio WSC – 1,235

***Based on current actual usage, data from TM No. 1, Table 1-14.**

FINAL DRAFT PLANNING STUDY REPORT

Additional Water Rights Needed With Conversion to Guaranteed Municipal Water Rights

Participant	2010	2015	2020	2025	2030	2035	2040	2060 (Buildout)
City of Roma	-	-	208	475	762	1,070	1,402	2,828
Falcon WSC	188	342	402	467	538	617	704	1,085
El Sauz WSC	246	275	308	344	384	430	480	706
El Tanque WSC	302	338	378	422	472	527	589	866
Rio WSC	-	-	61	155	260	378	510	1,100
Total Estimated Necessary Water Rights	**737**	**956**	**1,356**	**1,863**	**2,417**	**3,022**	**3,685**	**6,585**

***Based on actual current usage per utility.**

FINAL DRAFT PLANNING STUDY REPORT

- Regardless of the recommended regionalization scenario, additional water supplies will be needed by most, if not all of the Study participants.
- Multiple potential water supply alternatives were evaluated in this study including:
  - Purchase of additional irrigation water rights
  - Lease of additional water rights
  - Acquisition of additional water rights through a bed and banks reuse permit
  - Increasing available raw water supply via a direct/indirect reuse system
  - Development of a potential brackish groundwater supply

FINAL DRAFT PLANNING STUDY REPORT

- Purchase of additional irrigation water rights - $2,500 per acre-ft
  - If purchased as Class A, cost of converting to municipal - $5,000 per acre-ft
  - If purchased as Class B, cost of converting to municipal - $6,250 per acre-ft
- Lease of additional water rights - $50-100 per acre-ft
- Acquisition of additional water rights through a bed and banks reuse permit - $500-1,000 per acre-ft if approved
- Increasing available raw water supply via a direct/indirect reuse system - $7,000-$9,000 per acre-ft
- Development of a potential brackish groundwater supply - $7,500 per acre-ft

FINAL DRAFT PLANNING STUDY REPORT

- Environmental Assessment
  - Define Environmental Setting of the Study area
  - Identify potential geologic, wetland and flooding compliance issues with proposed project sites
  - Identify potential ecological and socioeconomic impacts as a result of proposed project

FINAL DRAFT PLANNING STUDY REPORT WATER CONSERVATION PLAN

- Goals
  - Develop anticipated water conservation measures for the City of Roma
  - Identify potential additional water conservation measures depending on level of regionalization

FINAL DRAFT PLANNING STUDY REPORT

- Public Meetings
  - Kick-Off Meeting – August 18, 2011
  - 50% Status Meeting – January 18, 2012
  - 95% Status Meeting – June 27, 2012
  - 100% Draft Report Submittal to TWDB – End of July 2012
  - Completion of TWDB Report Review – End of August 2012
  - Final Meeting – September 12, 2012
  - Project Close-Out – October 31, 2012

FINAL DRAFT PLANNING STUDY REPORT

- Regionalization Scenarios

Scenario	City of Roma	Falcon WSC	El Sauz WSC	El Tanque WSC	Rio WSC
Scenario 1	Included	-	-	-	-
Scenario 2	Included	Included	-	-	-
Scenario 3	Included	-	Included	-	-
Scenario 4	Included	-	-	Included	-
Scenario 5	Included	-	-	-	Included
Scenario 6	Included	Included	Included	-	-
Scenario 7	Included	Included	-	Included	-
Scenario 8	Included	Included	-	-	Included
Scenario 9	Included	-	Included	Included	-
Scenario 10	Included	-	Included	-	Included
Scenario 11	Included	-	-	Included	Included
Scenario 12	Included	Included	Included	Included	-
Scenario 13	Included	Included	Included	-	Included
Scenario 14	Included	Included	-	Included	Included
Scenario 15	Included	-	Included	Included	Included
Scenario 16	Included	Included	Included	Included	Included

FINAL DRAFT PLANNING STUDY REPORT

- Primary Regionalization Scenarios Evaluated
- Construction of a regional WTP to serve one utility
  - Serves the City of Roma
- Construction of a regional WTP to serve two utilities
  - Serves the City of Roma and Falcon WSC
- Construction of a regional WTP to serve three utilities
  - Serves the City of Roma, Falcon WSC and El Tanque WSC
- Construction of a regional WTP to serve all five utilities
  - Serves the City of Roma, Falcon WSC, El Sauz WSC, El Tanque WSC and Rio WSC

FINAL DRAFT PLANNING STUDY REPORT

- Regional Facility Serving One Utility
- This alternative (Scenario No. 1) would provide for a new WTP serving only the City of Roma
- Project would include:
  - New 9.9 MGD membrane filtration WTP
  - 1.5 MG of elevated storage
- Costs (2012 dollars)
  - Anticipated Capital Cost - $50,734,300
  - Anticipated Annual O&M Cost - $1,506,275
  - 30-yr Life Cycle Cost - $78,438,000

FINAL DRAFT PLANNING STUDY REPORT

- Regional Facility Serving Two Utilities
- This alternative (Scenario No. 2) would provide for a new WTP serving the City of Roma and Falcon Rural WSC
- Project would include:
  - New 12.1 MGD membrane filtration WTP
  - 2.0 MG of elevated storage
  - 55,500 LF of new pipeline
- Costs (2012 dollars)
  - Anticipated Capital Cost - $67,162,000
  - Anticipated Annual O&M Cost - $1,834,073
  - 30-yr Life Cycle Cost - $100,895,000

FINAL DRAFT PLANNING STUDY REPORT

- Regional Facility Serving Three Utilities
- This alternative (Scenario No. 7) would provide for a new WTP serving the City of Roma, Falcon Rural WSC and El Tanque WSC
- Project would include:
  - New 13.4 MGD membrane filtration WTP
  - 2.5 MG of elevated storage
  - 107,100 LF of new pipeline
- Costs (2012 dollars)
  - Anticipated Capital Cost - $85,451,000
  - Anticipated Annual O&M Cost - $2,081,897
  - 30-yr Life Cycle Cost - $123,742,000

FINAL DRAFT PLANNING STUDY REPORT

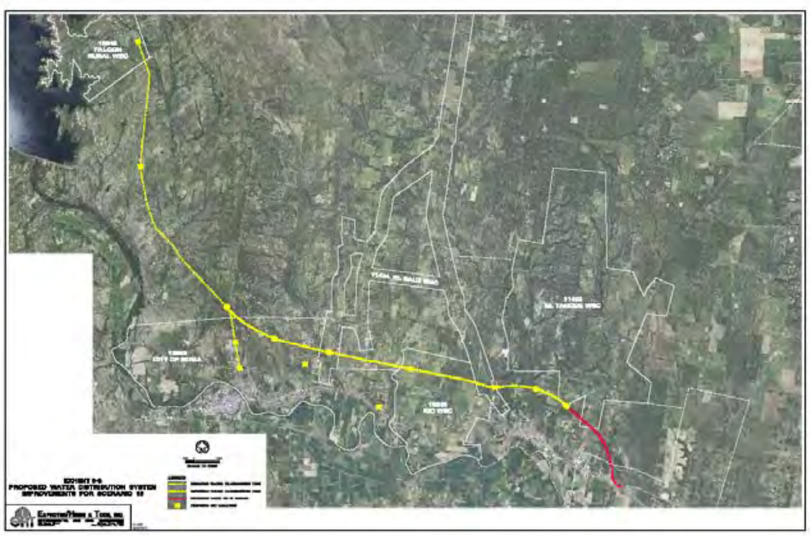
- Regional Facility Serving All Five Utilities

- This alternative (Scenario No. 16) would provide for a new WTP to serve all five Study participants

- Project would include:
  - New 16.7 MGD membrane filtration WTP
  - 2.5 MG of elevated storage
  - 107,100 LF of new pipeline

- Costs (2012 dollars)
  - Anticipated Capital Cost - $104,823,900 — Non-Regional - $131,644,700
  - Anticipated Annual O&M Cost - $2,582,959 — Non-Regional - $3,252,713
  - 30-yr Life Cycle Cost - $152,330,000 — Non-Regional - $191,469,000

FINAL DRAFT PLANNING STUDY REPORT



FINAL DRAFT PLANNING STUDY REPORT

❖Impacts of Funding on Anticipated Cost of Service

Scenario	Cost Per 1,000 Gallons (100% Loan, 0% Grant)	Cost Per 1,000 Gallons (75% Loan, 25% Grant)	Cost Per 1,000 Gallons (50% Loan, 50% Grant)	Cost Per 1,000 Gallons (25% Loan, 75% Grant)
1	$2.53	$2.11	$1.68	$1.26
2	$2.70	$2.23	$1.76	$1.30
3	$2.71	$2.24	$1.78	$1.31
4	$3.13	$2.57	$2.00	$1.44
5	$2.91	$2.39	$1.88	$1.37
6	$2.78	$2.30	$1.81	$1.33
7	$3.03	$2.49	$1.94	$1.40
8	$2.90	$2.39	$1.87	$1.36
9	$3.03	$2.49	$1.95	$1.41
10	$2.87	$2.37	$1.86	$1.36
11	$3.02	$2.48	$1.93	$1.39
12	$3.07	$2.52	$1.97	$1.42
13	$2.91	$2.39	$1.88	$1.36
14	$3.03	$2.48	$1.94	$1.40
15	$3.03	$2.49	$1.95	$1.41
16	$2.99	$2.45	$1.92	$1.38

FINAL DRAFT PLANNING STUDY REPORT

❖Recommended Project – Scenario 16

- ❖ New 16.7 MGD membrane filtration WTP
- ❖ 2.5 MG of elevated storage
- ❖ 107,100 LF of new pipeline

❖Costs (2012 dollars)

- ❖ Anticipated Capital Cost - $104,823,900
- ❖ Anticipated Annual O&M Cost - $2,582,959
- ❖ 30-yr Life Cycle Cost - $152,330,000

❖Problems with Scenario

- ❖ When does new Rio WSC WTP come online…how much water does Rio WSC really need?
- ❖ Are El Sauz WSC and El Tanque WSC willing to join into a regional System?

FINAL DRAFT PLANNING STUDY REPORT

- Recommended Project Phasing
  - Impacts to Proposed Project Phasing
    - Completion of regionalization agreements
    - Actual and projected 5-10 year water demand
    - Progress on proposed TxDOT US 83 Bypass
  - Project Years
    - Phase I – 2011-2015
    - Phase II – 2016-2020
    - Phase III – 2021-2025
    - Phase IV – 2026-2030
    - Phase V – 2031-2035

FINAL DRAFT PLANNING STUDY REPORT

- Phase I – 2011-2015

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Construct new river pump station and reservoir raw water pump station	LS	1	$4,539,225	$4,539,300
2	Construct new 36-inch RW transmission main	LF	9,100	$293	$2,666,300
3	Construct new 184 MG reservoir adjacent to Rio Grande River	LS	1	$2,180,400	$2,180,400
4	Phase I WTP - 3 mgd	LS	1	$6,000,000	$6,000,000
5	Construct one new 0.5 MG 180-ft EST at start of regional transmission pipeline	EA	1	$1,500,000	$1,500,000
6	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,136,000
				Contingencies (20%)	$3,427,200
				TOTAL ESTIMATED CONSTRUCTION COST	$20,563,200
				Engineering & Testing (18%)	$3,701,400
				TOTAL ESTIMATED CAPITAL COST	**$24,264,600**
				Annual Escalation	$2,547,800
				TOTAL ESTIMATED CAPITAL COST BY 2015	**$26,812,400**

FINAL DRAFT PLANNING STUDY REPORT

❖Phase II – 2016-2020

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase II WTP - 6 mgd	LS	1	$6,000,000	$6,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from Roma to TxDOT Bypass	EA	1	$750,000	$750,000
4	Construct one new 0.25 MG standard EST at TxDOT Bypass	EA	1	$625,000	$625,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	30-inch transmission main from Roma to TxDOT US 83 Bypass connection point	LF	13,985	$150	$2,097,800
7	Construct one new 0.1 MG standard EST along transmission main from TxDOT Bypass to Falcon WSC service connection	EA	1	$250,000	$250,000
8	Construct one new 0.1 MG standard EST at Falcon WSC service connection	EA	1	$250,000	$250,000
9	Site improvements for new ESTs	EA	2	$250,000	$500,000
10	16-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	26,277	$75	$1,970,800
11	20-inch transmission main from TxDOT US 83 Bypass connection point to Falcon WSC service connection	LF	7,286	$100	$728,600
				subtotal	$14,050,500
				Contingencies (20%)	$2,810,100
				TOTAL ESTIMATED CONSTRUCTION COST	$16,860,600
				Engineering & Testing (18%)	$3,035,000
				TOTAL ESTIMATED CAPITAL COST	**$19,895,600**
				Annual Escalation	$5,570,800
				TOTAL ESTIMATED CAPITAL COST BY 2020	**$25,466,400**

FINAL DRAFT PLANNING STUDY REPORT

❖Phase III – 2021-2025

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase III WTP - 9 mgd	LS	1	$6,000,000	$6,000,000
4	Construct one new 0.25 MG standard EST along transmission main from TxDOT Bypass to El Sauz WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Sauz WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from TxDOT US 83 Bypass connection point to El Sauz WSC service connection	LF	26,329	$100	$2,632,900
8	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
9	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$13,351,400
				Contingencies (20%)	$2,670,300
				TOTAL ESTIMATED CONSTRUCTION COST	$16,021,700
				Engineering & Testing (18%)	$2,884,000
				TOTAL ESTIMATED CAPITAL COST	**$18,905,700**
				Annual Escalation	$8,602,100
				TOTAL ESTIMATED CAPITAL COST BY 2025	**$27,507,800**

FINAL DRAFT PLANNING STUDY REPORT

❖Phase IV – 2026-2030

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Phase IV WTP - 13 mgd	LS	1	$8,000,000	$8,000,000
3	Construct one new 0.25 MG 180-ft EST along transmission main from El Sauz WSC service connection to Rio WSC service connection	EA	1	$750,000	$750,000
4	Construct one new 0.5 MG standard EST at Rio WSC service connection	EA	1	$1,250,000	$1,250,000
5	Site improvements for new ESTs	EA	2	$250,000	$500,000
6	24-inch transmission main from El Sauz WSC service connection to Rio WSC service connection	LF	38,074	$125	$4,759,300
7	Construct one new 0.5 MG standard EST in Roma	EA	1	$1,250,000	$1,250,000
8	Site improvements for new EST	EA	1	$250,000	$250,000
				subtotal	$17,137,600
				Contingencies (20%)	$3,427,600
				TOTAL ESTIMATED CONSTRUCTION COST	$20,565,200
				Engineering & Testing (18%)	$3,701,800
				TOTAL ESTIMATED CAPITAL COST	**$24,267,000**
				Annual Escalation	$15,288,300
				TOTAL ESTIMATED CAPITAL COST BY 2030	**$39,555,300**

FINAL DRAFT PLANNING STUDY REPORT

❖Phase V – 2031-2035

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
1	Expand RWPS	LS	1	$378,269	$378,300
2	Expand reservoir capacity	LS	1	$1,090,200	$1,090,200
3	Phase V WTP - 16.7 mgd	LS	1	$7,400,000	$7,400,000
4	Construct one new 0.25 MG standard EST along transmission main from Rio WSC service connection to El Tanque WSC service connection	EA	1	$625,000	$625,000
5	Construct one new 0.25 MG standard EST at El Tanque WSC service connection	EA	1	$625,000	$625,000
6	Site improvements for new ESTs	EA	2	$250,000	$500,000
7	20-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	12,250	$100	$1,225,000
8	16-inch transmission main from Rio WSC service connection to El Tanque WSC service connection	LF	6,789	$75	$509,200
				subtotal	$12,352,700
				Contingencies (20%)	$2,470,600
				TOTAL ESTIMATED CONSTRUCTION COST	$14,823,300
				Engineering & Testing (18%)	$2,668,200
				TOTAL ESTIMATED CAPITAL COST	**$17,491,500**
				Annual Escalation	$14,080,700
				TOTAL ESTIMATED CAPITAL COST BY 2035	**$31,572,200**

FINAL DRAFT PLANNING STUDY REPORT

- Recommended Project
  - Complete Entire Project at One Time – Serves All 5 Participants
    - Anticipated project cost - $104,823,900
  - Phase I from Planning Study – Serves City of Roma
    - Anticipated project cost - $26,812,400
  - Phase I for All 5 Participants (Transmission System First)
    - Anticipated project cost - $63,861,600
  - Combine Phase I and II from Planning Study – Serves City of Roma and Falcon WSC
    - Anticipated project cost - $52,278,800

FINAL DRAFT PLANNING STUDY REPORT

- Potential Funding Agencies and Programs
  - Texas Water Development Board
    - Drinking Water State Revolving Fund (DWSRF)
    - Economically Distressed Areas Program (EDAP)
    - Rural Water Assistance Fund (RWAF)
    - State Participation Program
  - Border Environment Cooperation Commission (BECC)
    - Project Development Assistance Program (PDAP)
    - Technical Assistance Fund
  - North American Development Bank (NADB)
    - Loan Program

FINAL DRAFT PLANNING STUDY REPORT

- Regionalization Hurdles to Overcome
  - Regionalization is optional
  - Lack of Financial Incentives
  - Individual Control
  - Occupational Resistance

FINAL DRAFT PLANNING STUDY REPORT
Path Forward

- What are the next steps?
  - Proceed with Regional WTP Project
    - Hold coordination meeting with Study participants to determine realistic regionalization involvement
    - Coordinate with funding agencies to determine recommended type(s) of funding and whether project should be completed in phases or all at once
    - Complete site visits to new conventional and membrane WTPs
    - Consider site visit to SRWA facility for tour and presentation on regional authority concept
    - Update overall Project OPCC and Phase I Project OPCC
    - Apply for funding for either overall Project or only Phase I Project

FINAL DRAFT PLANNING STUDY REPORT
Path Forward

- What are the next steps?
  - Funding Options?

RECAP OF PRESENTATION GOALS

Review and Discuss

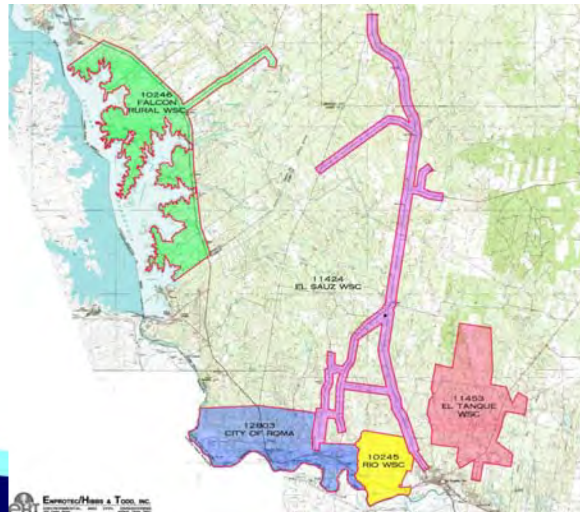
- ✓ Final Draft Regional Planning Study Report
- ✓ Key Issues Identified During Development of Report
- ✓ Regionalization Project Alternatives
- ✓ Recommended Regionalization Project Concept
- ✓ Impacts of Funding to Anticipated Cost of Service
- ✓ Potential Phasing of Project Improvements
- ✓ Anticipated Timeline for Improvements
- ✓ Path Forward

Questions?

Supporting Documentation

FINAL DRAFT PLANNING STUDY REPORT

Project Area Map



BACKGROUND

- As outlined in the SB 1 Region M Plan, many water providers are facing rapid population growth and a shortage of water supply and treatment.
- The proximity of the numerous rural water supply corporations to the City of Roma offers a unique opportunity for Roma to become a regional provider and avoid the duplication of services and the inherent inefficiencies and additional cost of each system providing for itself.

BACKGROUND

- The City of Roma has shown the capability to lead and manage large, complicated programs and projects, including the recent multi-phased $65 million water and wastewater improvement projects.

- The City's water treatment plant expansion is now over 10 years old and the existing site is landlocked and cannot be expanded for regional supply and treatment. Consequently, a major focus of this proposed regional study is the location and capacity of a new regional water treatment plant.

STUDY GOAL

- Perform a true engineering analysis on a comprehensive level to identify potential options for regionalization of water treatment and transmission and how the options might be accomplished through consideration of:
  - Technical Challenges
  - Identification of Duplication & Inefficiency
  - Cost Implications
  - Rate Impacts
  - Administration & Operational Considerations

FINAL DRAFT PLANNING STUDY REPORT

Population Projection Basis

- Growth Rates
  - City of Roma Annual Growth Rate – 1.50%
  - Falcon WSC Annual Growth Rate – 2.00%
  - El Sauz WSC Annual Growth Rate – 2.35%
  - El Tanque WSC Annual Growth Rate – 2.35%
  - Rio WSC Annual Growth Rate – 2.39%
- Population Density
  - City of Roma Household Population Density Factor – 2.93
  - Falcon WSC Household Population Density Factor – 2.13
  - El Sauz WSC Household Population Density Factor – 4.08
  - El Tanque WSC Household Population Density Factor – 3.12
  - Rio WSC Household Population Density Factor – 3.00

FINAL DRAFT PLANNING STUDY REPORT

Actual Usage Water Demand Projections (MGD)

- 2010 Water Demand – Total – 4.19 MGD
  - City of Roma – 2.75
  - Falcon WSC – 0.39
  - El Sauz WSC – 0.22
  - El Tanque WSC – 0.27
  - Rio WSC – 0.56
- 2040 Projected Water Demand – Total – 7.15 MGD
  - City of Roma – 4.24 (0.05 MGD / yr)
  - Falcon WSC – 0.85 (0.02 MGD / yr)
  - El Sauz WSC – 0.43 (0.01 MGD / yr)
  - El Tanque WSC – 0.53 (0.01 MGD / yr)
  - Rio WSC – 1.10 (0.02 MGD / yr)

*Based on maximum monthly usage, data from TM No. 1, Table 1-10.

FINAL DRAFT PLANNING STUDY REPORT

Projected Minimum Required Water Treatment Capacity

- 2010 Minimum Required WTP Capacity – Total – 8.48 MGD
  - City of Roma – 5.44
  - Falcon WSC – 1.05
  - El Sauz WSC – 0.32
  - El Tanque WSC – 0.54
  - Rio WSC – 1.12
- 2040 Minimum Required WTP Capacity – Total – 14.15 MGD
  - City of Roma – 8.40
  - Falcon WSC – 1.87
  - El Sauz WSC – 0.62
  - El Tanque WSC – 1.05
  - Rio WSC – 2.21

*Data from TM No. 1, Table 1-12, based on TCEQ 0.6 gpm/connection, does not include compliance with 85% Capacity Rule.

FINAL DRAFT PLANNING STUDY REPORT

Projected Minimum Elevated Water Storage Capacity

- 2010 Minimum Elevated Storage Capacity – Total – 0.981 MG
  - City of Roma – 0.630
  - Falcon WSC – 0.122
  - El Sauz WSC – 0.037
  - El Tanque WSC – 0.063
  - Rio WSC – 0.13
- 2040 Minimum Elevated Storage Capacity – Total – 1.638 MG
  - City of Roma – 0.972
  - Falcon WSC – 0.216
  - El Sauz WSC – 0.072
  - El Tanque WSC – 0.122
  - Rio WSC – 0.256

*Based on 100 gallons per connection, standard TCEQ design criteria.

FINAL DRAFT PLANNING STUDY REPORT

Current Distribution Capacity

Participant	Current Elevated / Pressure Capacity (MG)	Current Ground Storage Capacity (MG)	Current Total Storage Capacity (MG)
City of Roma	0.800	0.768	1.568
Falcon Rural WSC	0.095	0.318	0.413
El Sauz WSC	0.150	0.000	0.150
El Tanque WSC	0.089	0.210	0.299
Rio WSC	0.003	0.598	0.601
TOTAL	1.137	1.894	3.031

FINAL DRAFT PLANNING STUDY REPORT

Current Participant-Owned Water Rights

Study Participant	Municipal Water Rights (ac-ft)	Class A Irrigation Water Rights (ac-ft)	Class B Irrigation Water Rights (ac-ft)
City of Roma	2,841.18	551.40	588.25
Falcon Rural WSC	249.00	0.00	0.00
El Sauz WSC	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00
Rio WSC	527.11	0.00	494.50
Total	**3,617.29**	**551.40**	**1,082.75**

*From TCEQ Water Rights Database as of November 2011.

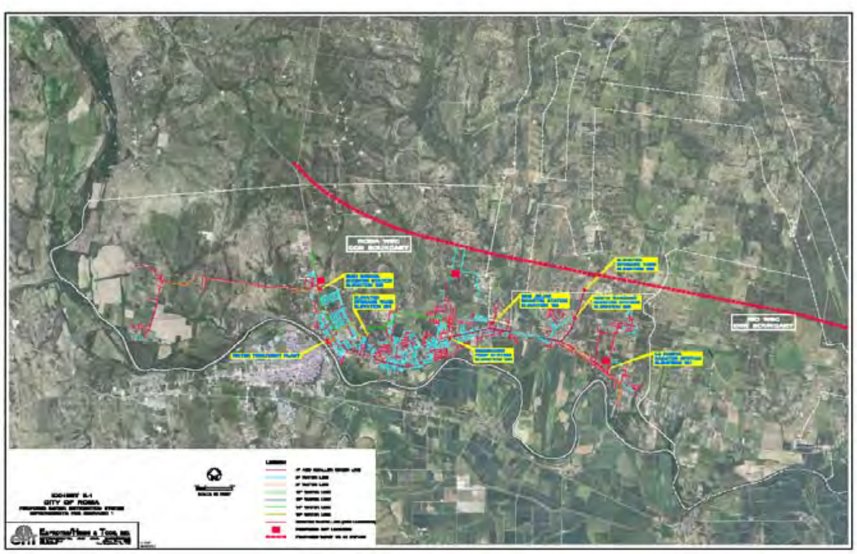
FINAL DRAFT PLANNING STUDY REPORT

Potential Total Municipal Water Rights

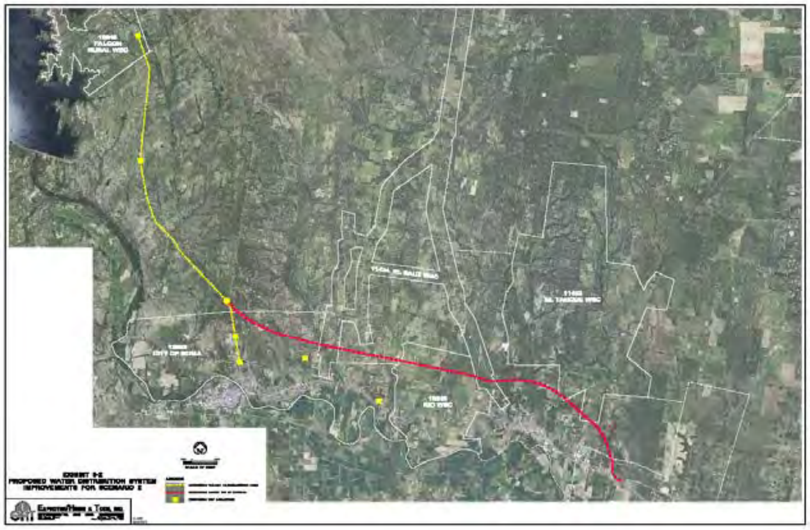
Study Participant	Current Municipal Water Rights (ac-ft)	Converted from Class A Irrigation Water Rights (ac-ft)	Converted from Class B Irrigation Water Rights (ac-ft)	Total Potential Municipal Water Rights (ac-ft)
City of Roma	2,841.18	275.70	235.30	3,352.18
Falcon Rural WSC	249.00	0.00	0.00	249.00
El Sauz WSC	0.00	0.00	0.00	0.00
El Tanque WSC	0.00	0.00	0.00	0.00
Rio WSC	527.11	0.00	197.80	724.91
Total	**3,617.29**	**275.70**	**433.10**	**4,326.09**

***From TCEQ Water Rights Database as of November 2011. Conversion rates per Rio Grande Rivermaster.**

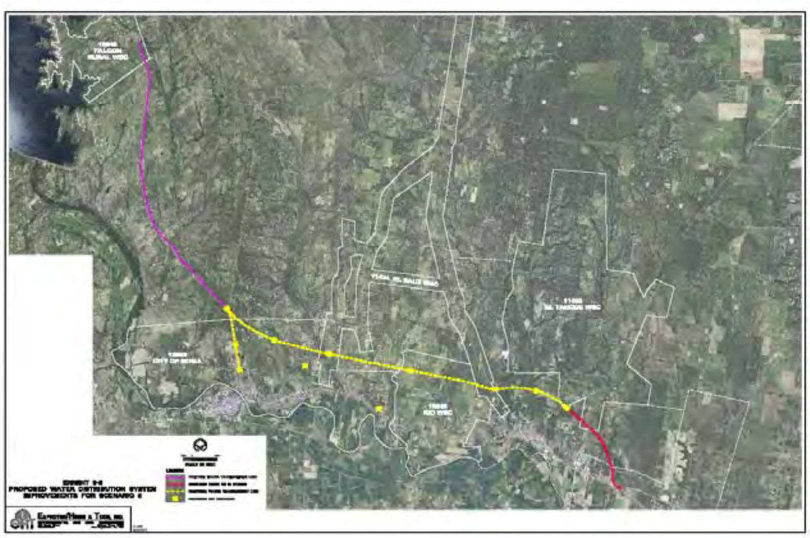
FINAL DRAFT PLANNING STUDY REPORT



FINAL DRAFT PLANNING STUDY REPORT



FINAL DRAFT PLANNING STUDY REPORT



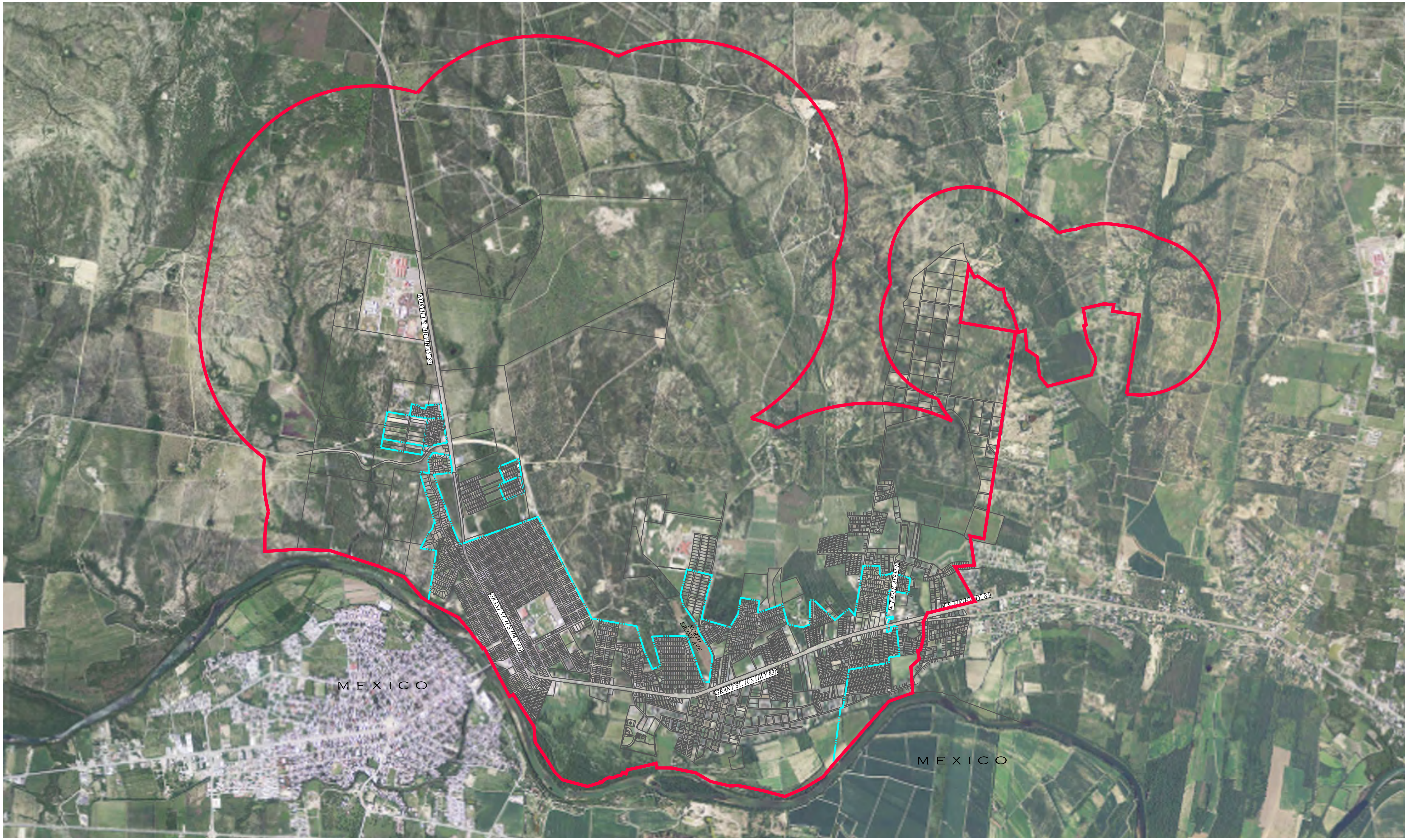
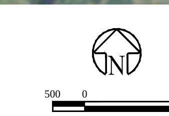


EXHIBIT E-1
CITY OF ROMA EXISTING CITY LIMITS
AND ETJ BOUNDARY



ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
10/26/2012

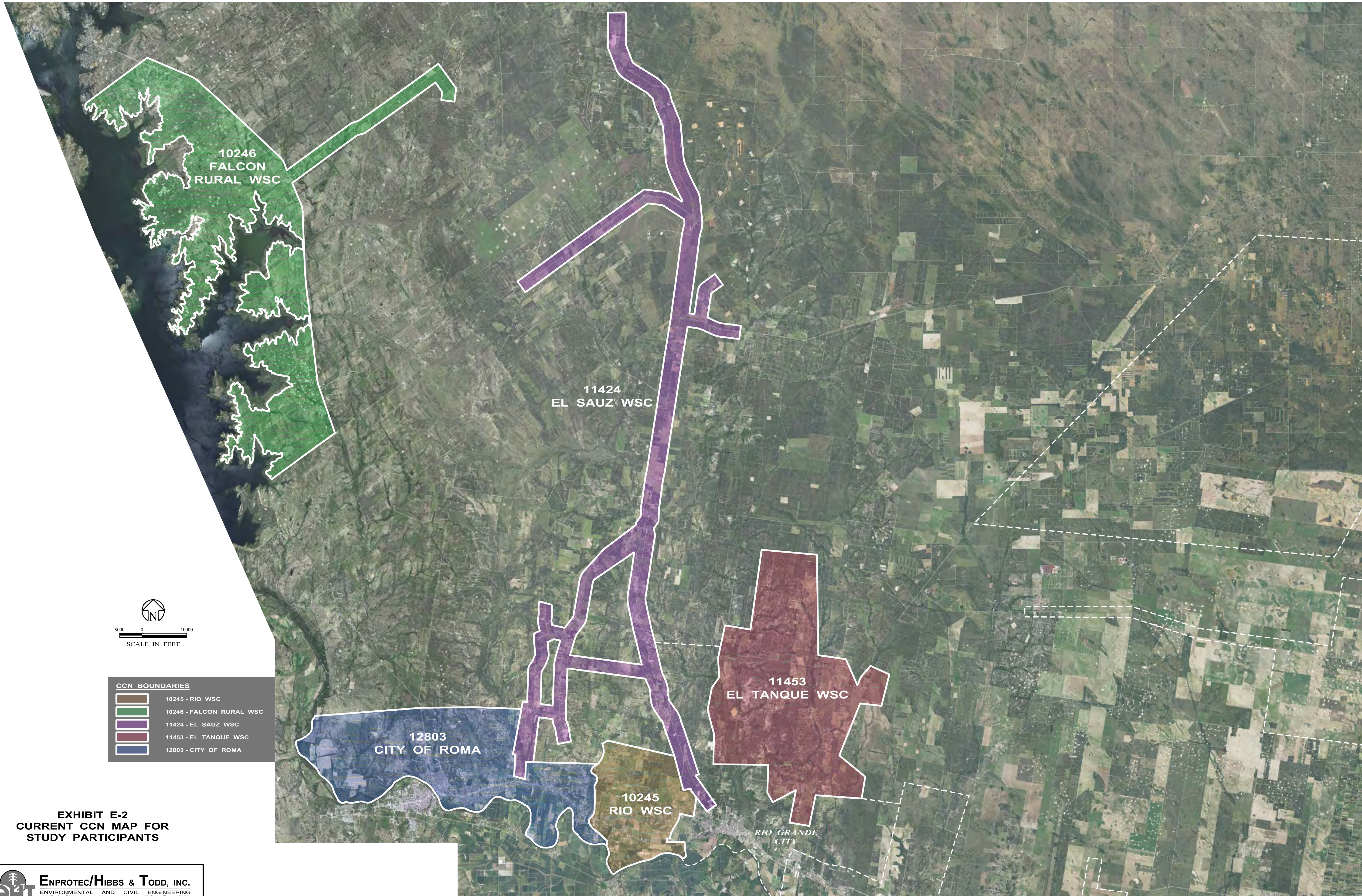


EXHIBIT E-2
CURRENT CCN MAP FOR
STUDY PARTICIPANTS

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

11-5287
10/26/2012

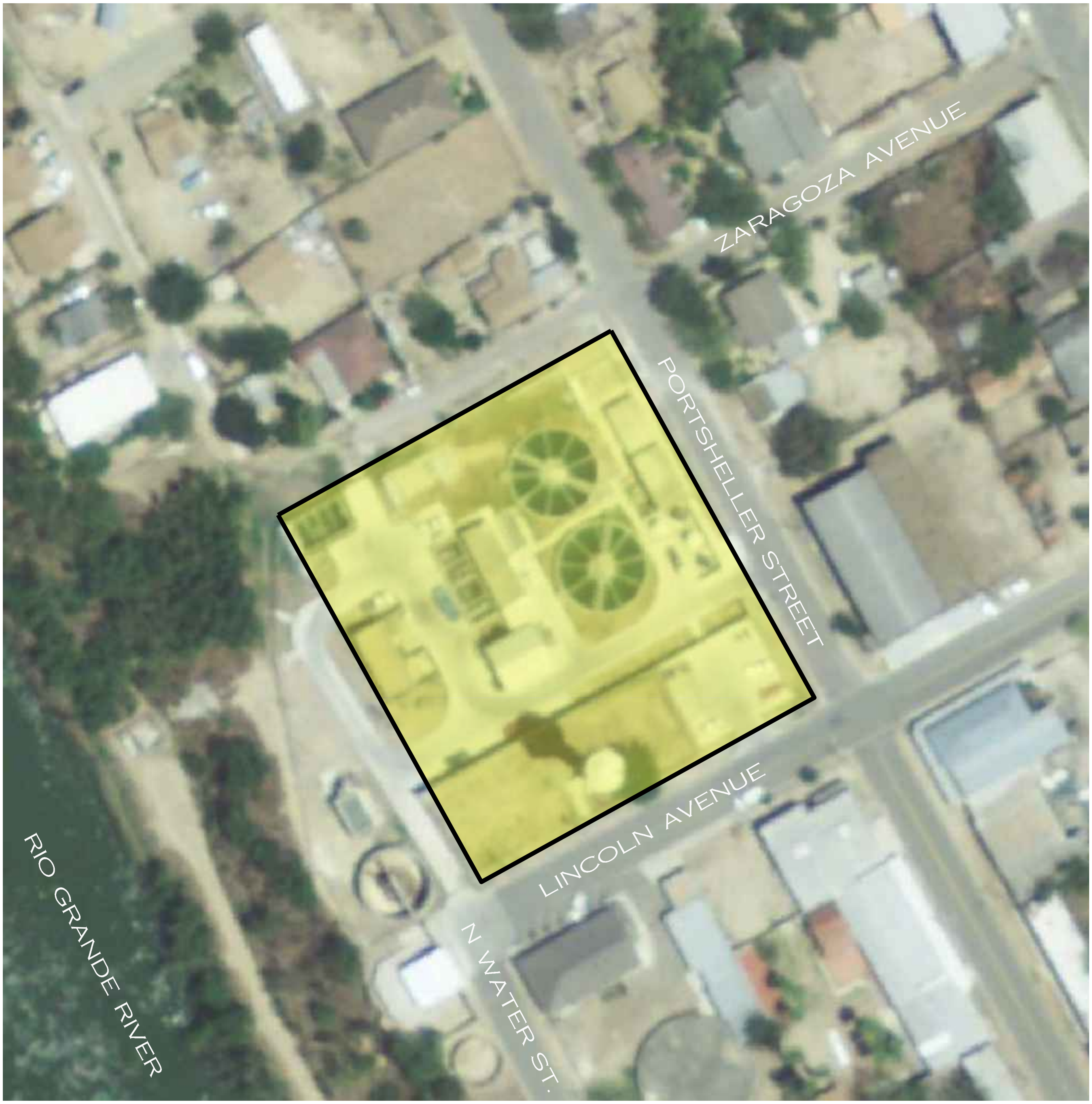


EXHIBIT E-3
CITY OF ROMA
EXISTING WATER TREATMENT PLANT

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street, Abilene, Texas 79601
325-698-5560, Firm Registration No. 1151

11-5287

10/26/2012

MATCH LINE "A"

1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT E-4
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
10/26/2012

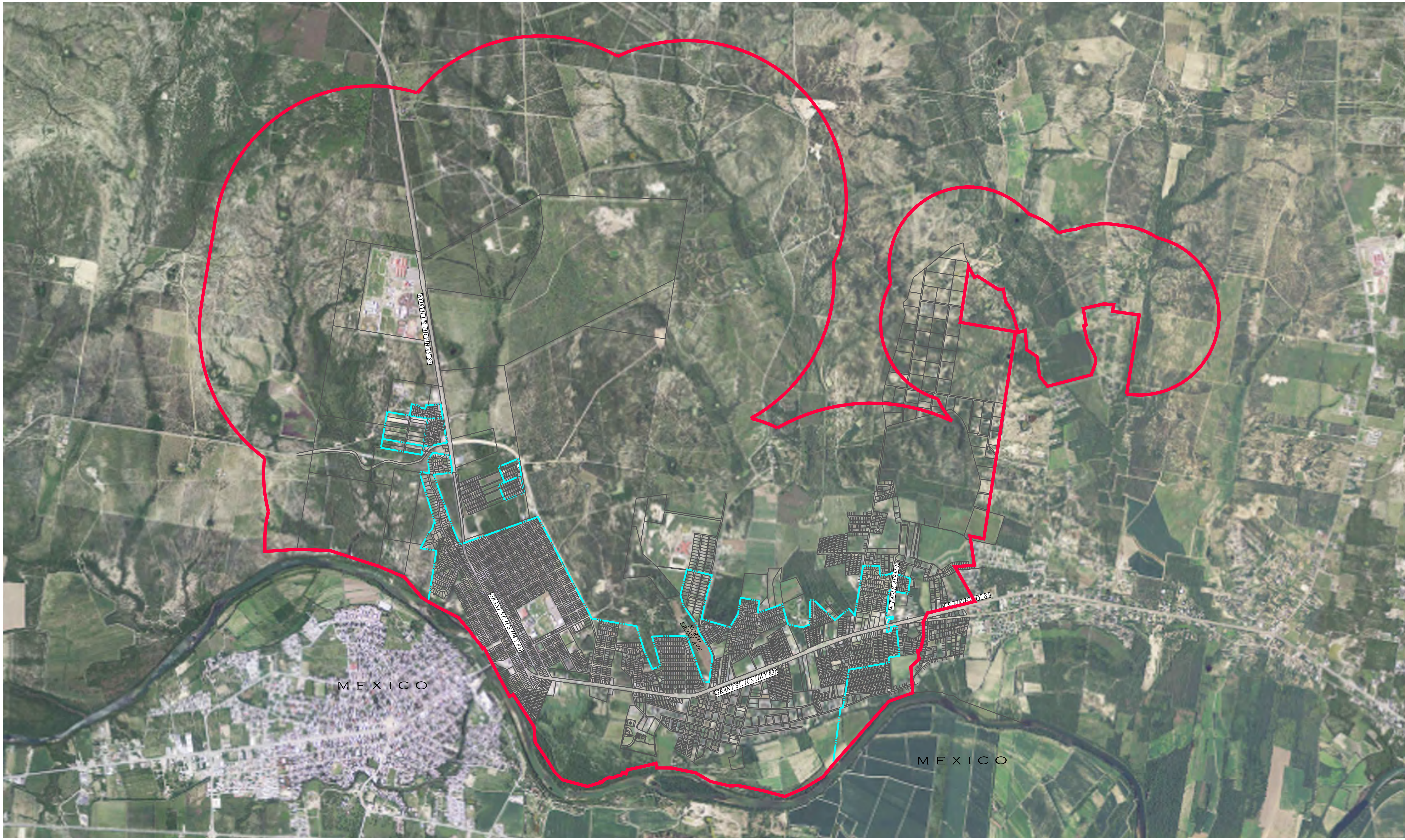


EXHIBIT 1-1
CITY OF ROMA EXISTING CITY LIMITS
AND ETJ BOUNDARY

N
500 0 1500
SCALE IN FEET

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
06/21/2012

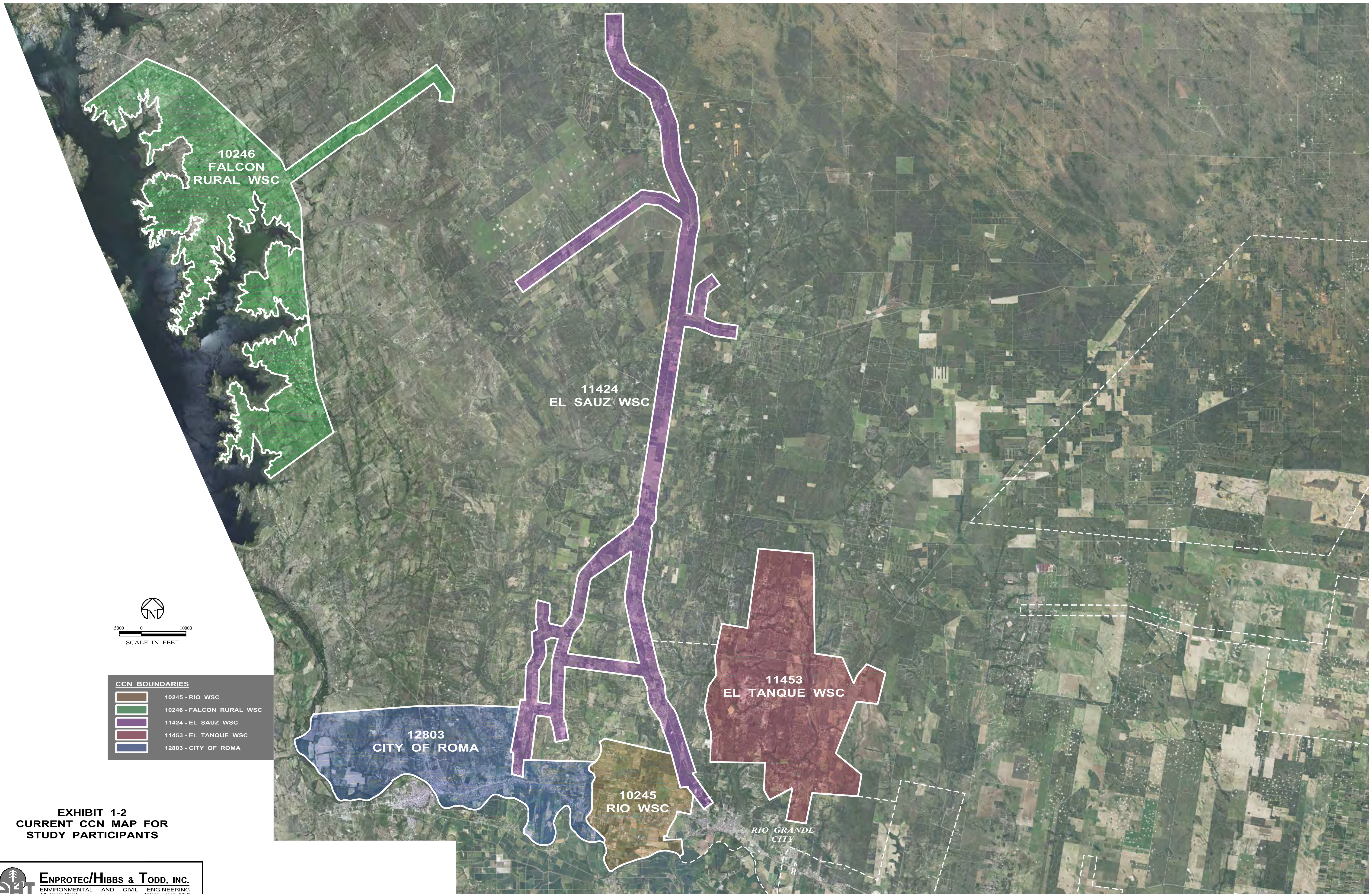
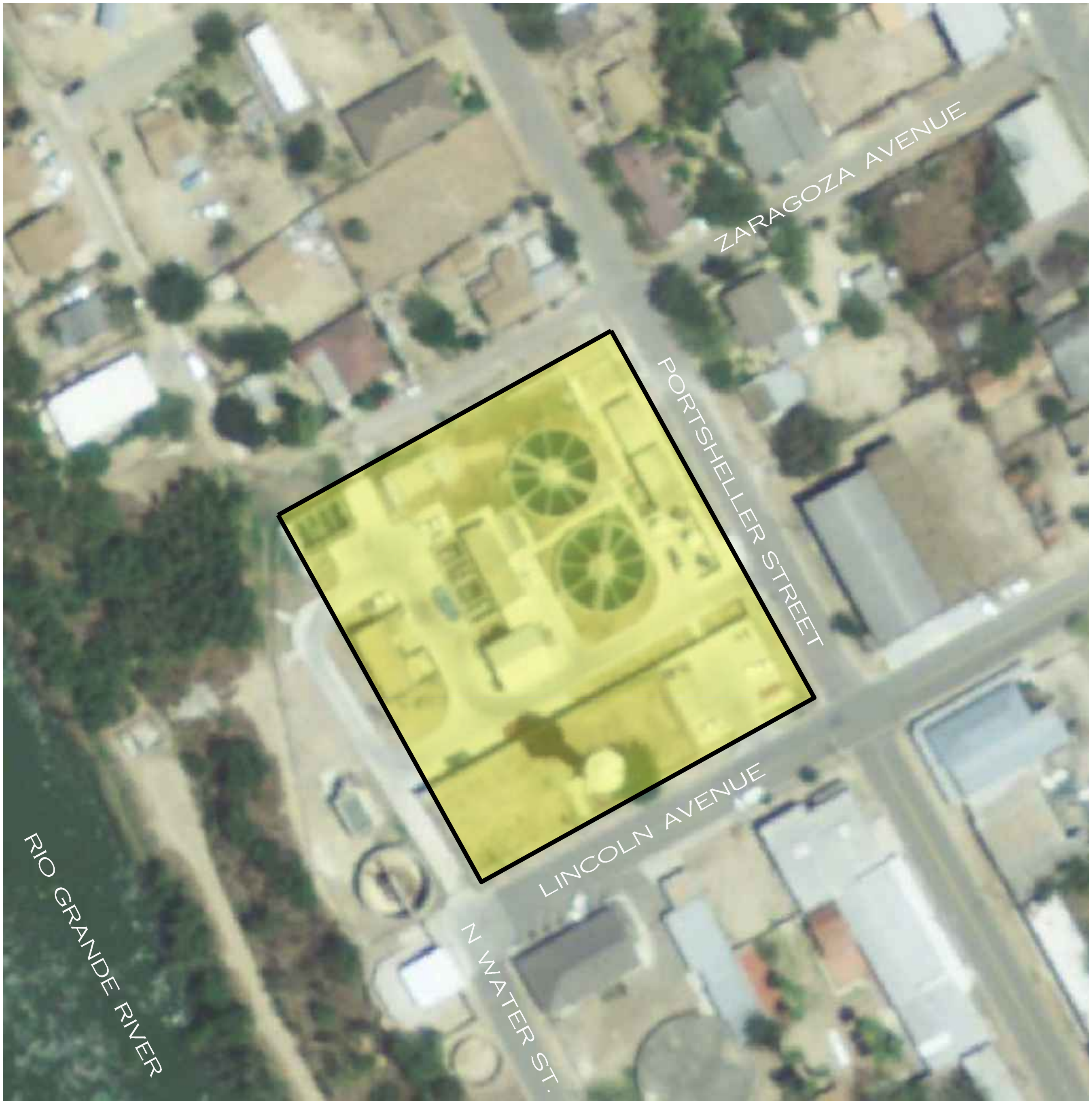


EXHIBIT 1-2
CURRENT CCN MAP FOR
STUDY PARTICIPANTS

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012



N

50 0 100

SCALE IN FEET

EXHIBIT 1-3
CITY OF ROMA
EXISTING WATER TREATMENT PLANT

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287

06/21/2012

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-4
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM
(1 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-5
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM
(2 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
06/21/2012

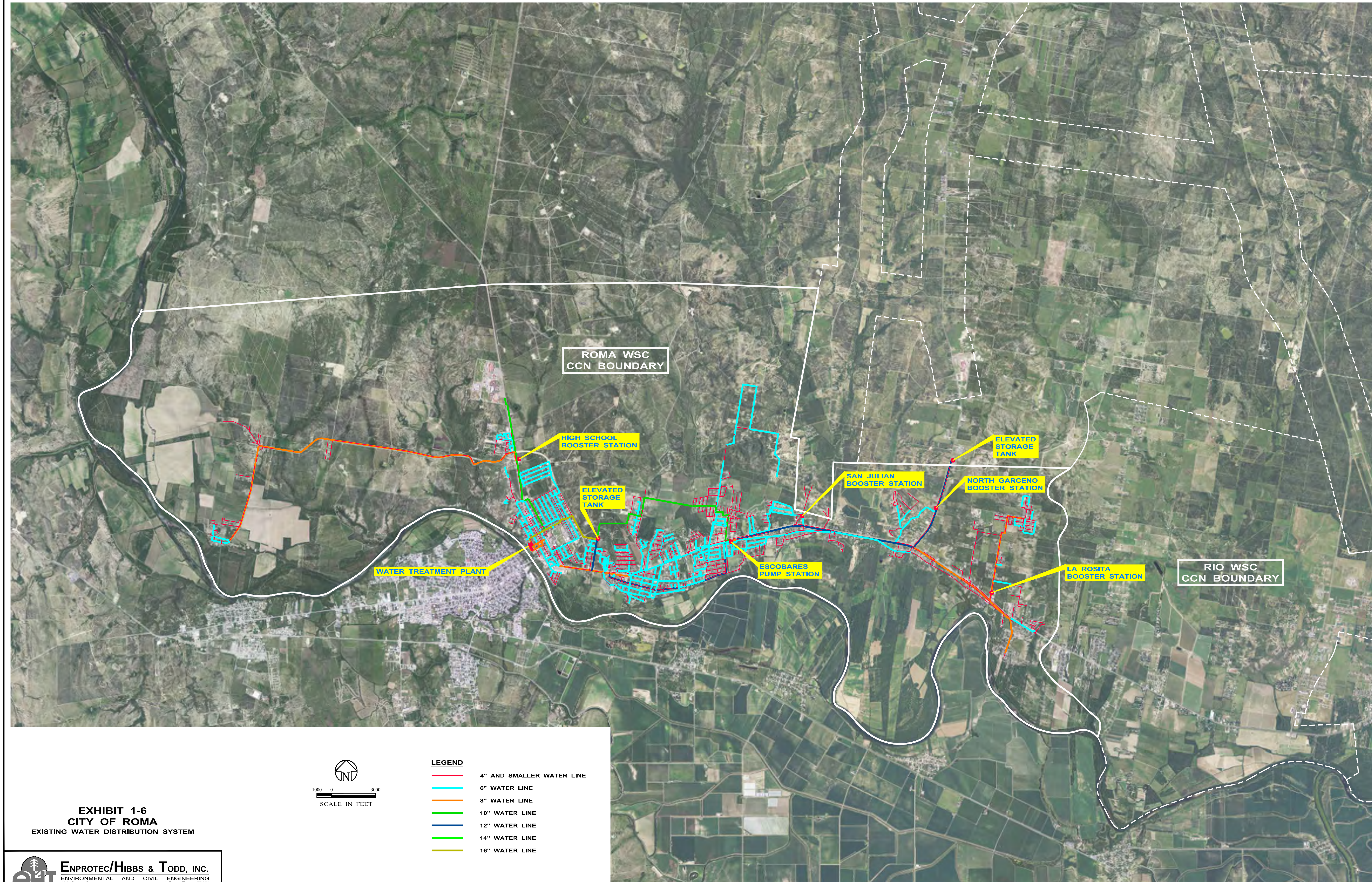


EXHIBIT 1-6
CITY OF ROMA
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

EXHIBIT 1-7
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM
(1 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE

EXHIBIT 1-8
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM
(2 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

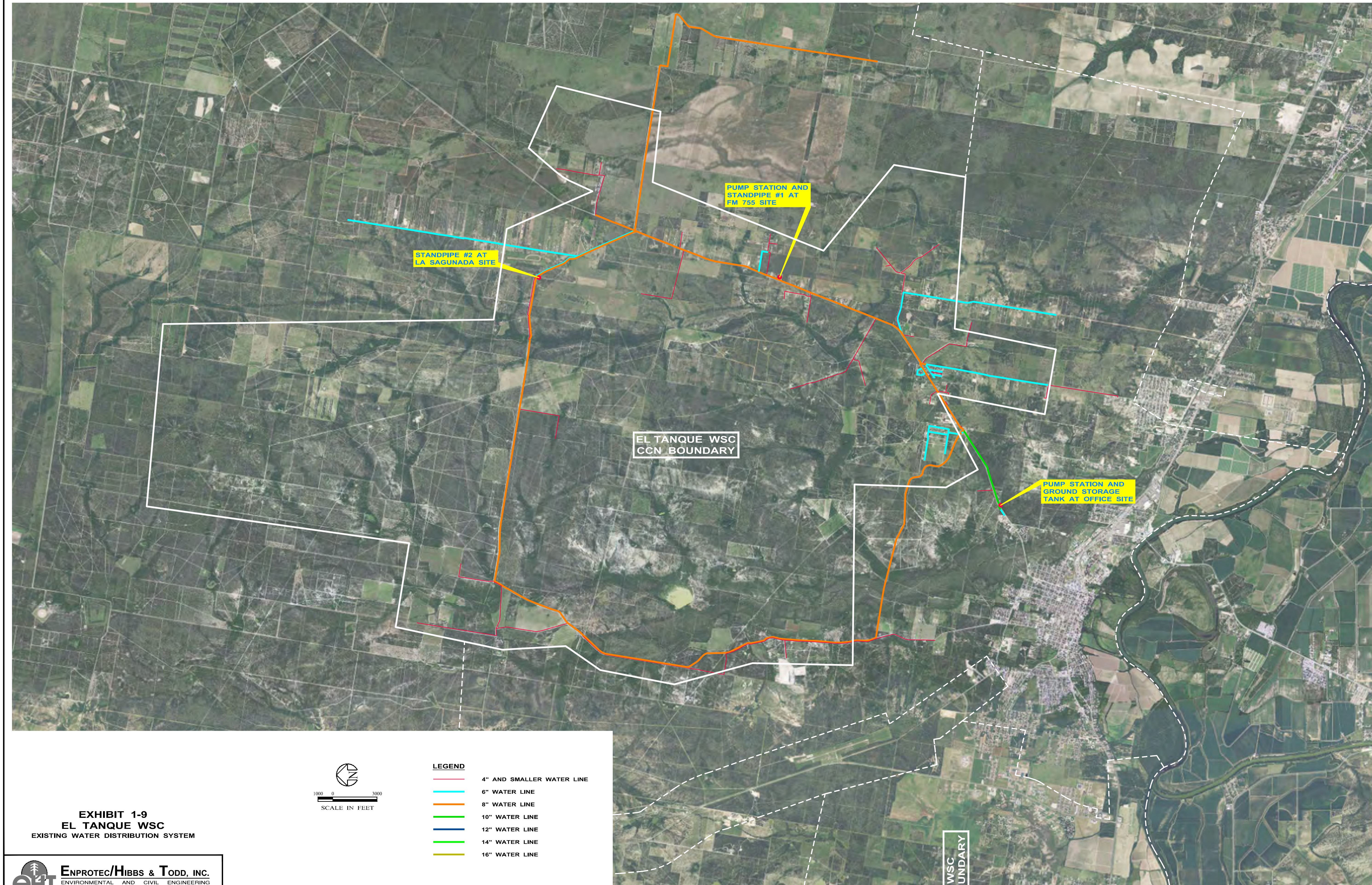


EXHIBIT 1-9
EL TANQUE WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

EXHIBIT 1-10
RIO WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/21/2012

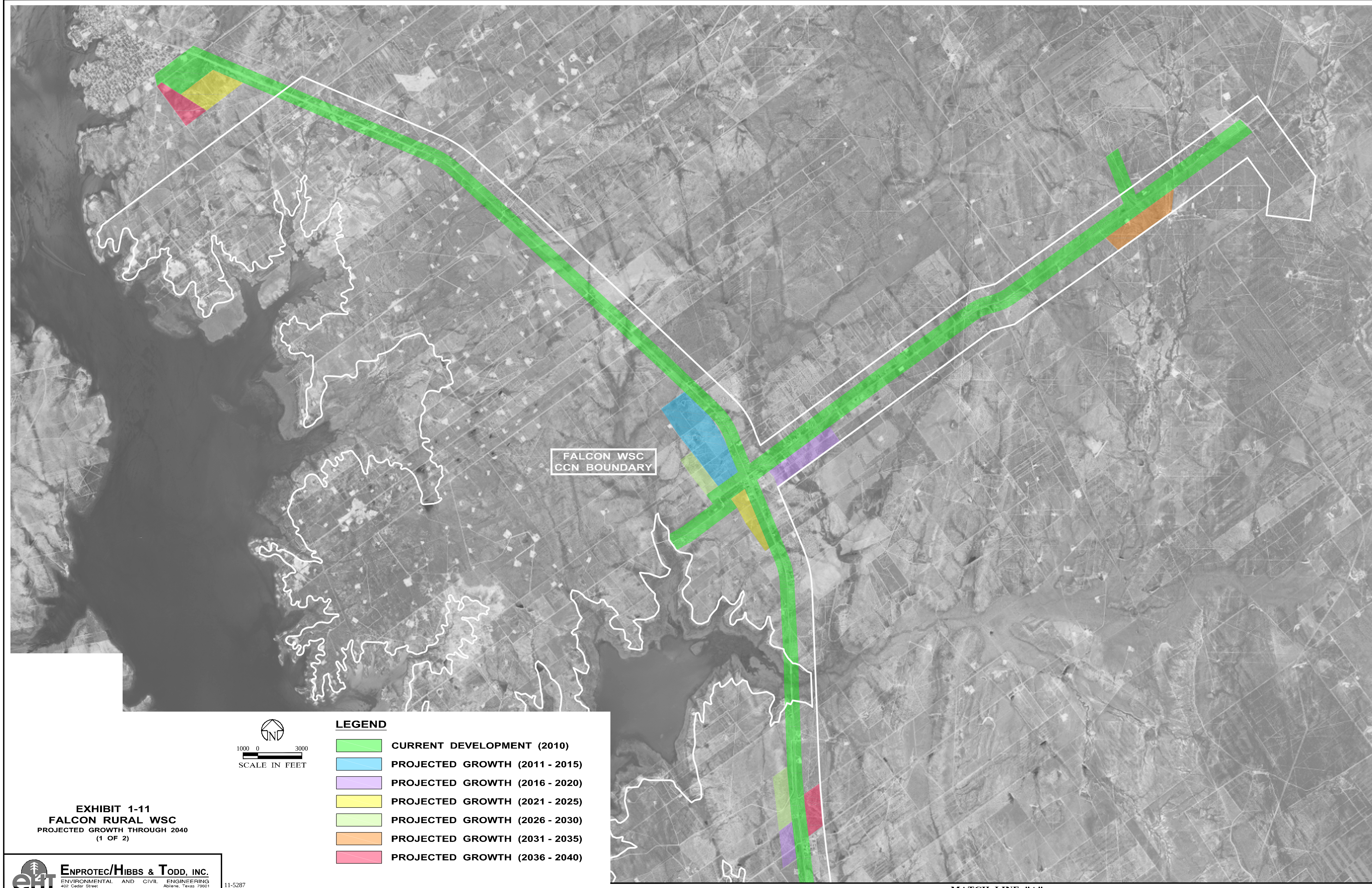
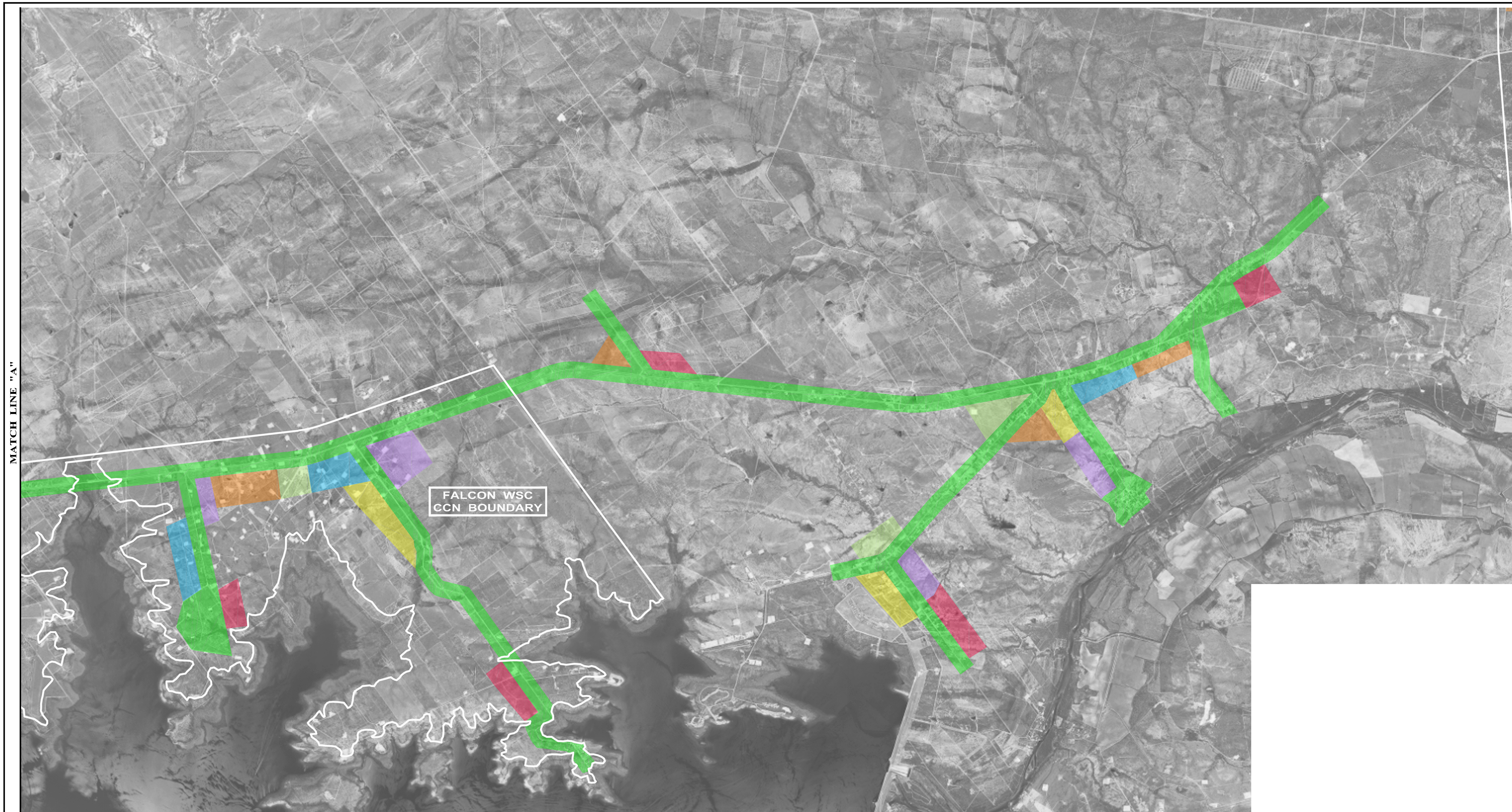


EXHIBIT 1-11
FALCON RURAL WSC
PROJECTED GROWTH THROUGH 2040
(1 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
08/03/2012



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SCALE IN FEET

LEGEND

- CURRENT DEVELOPMENT (2010)
- PROJECTED GROWTH (2011 - 2015)
- PROJECTED GROWTH (2016 - 2020)
- PROJECTED GROWTH (2021 - 2025)
- PROJECTED GROWTH (2026 - 2030)
- PROJECTED GROWTH (2031 - 2035)
- PROJECTED GROWTH (2036 - 2040)

EXHIBIT 1-12
FALCON RURAL WSC
PROJECTED GROWTH THROUGH 2040
(2 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
08/03/2012

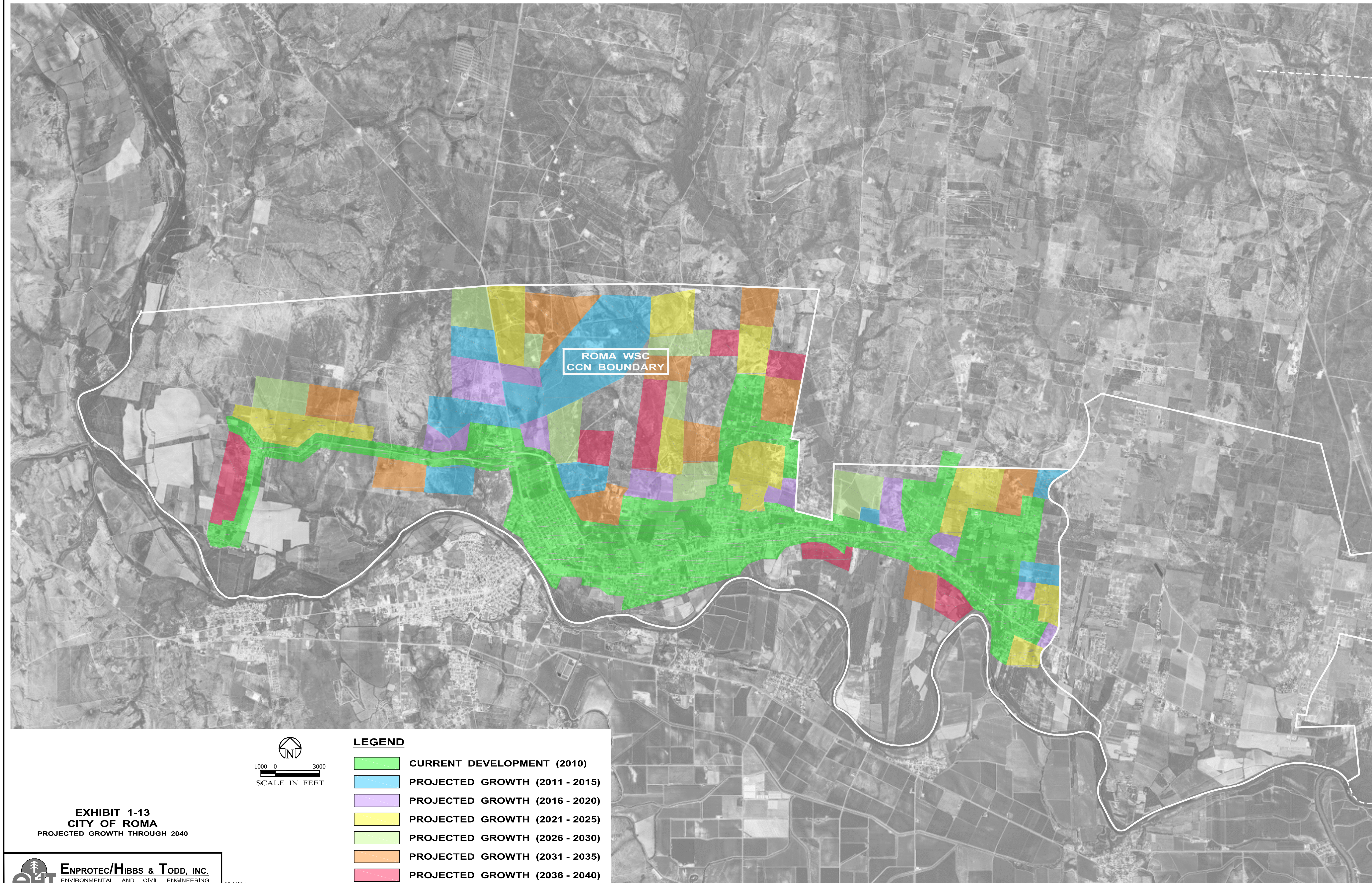

EXHIBIT 1-13
CITY OF ROMA
PROJECTED GROWTH THROUGH 2040

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

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LEGEND

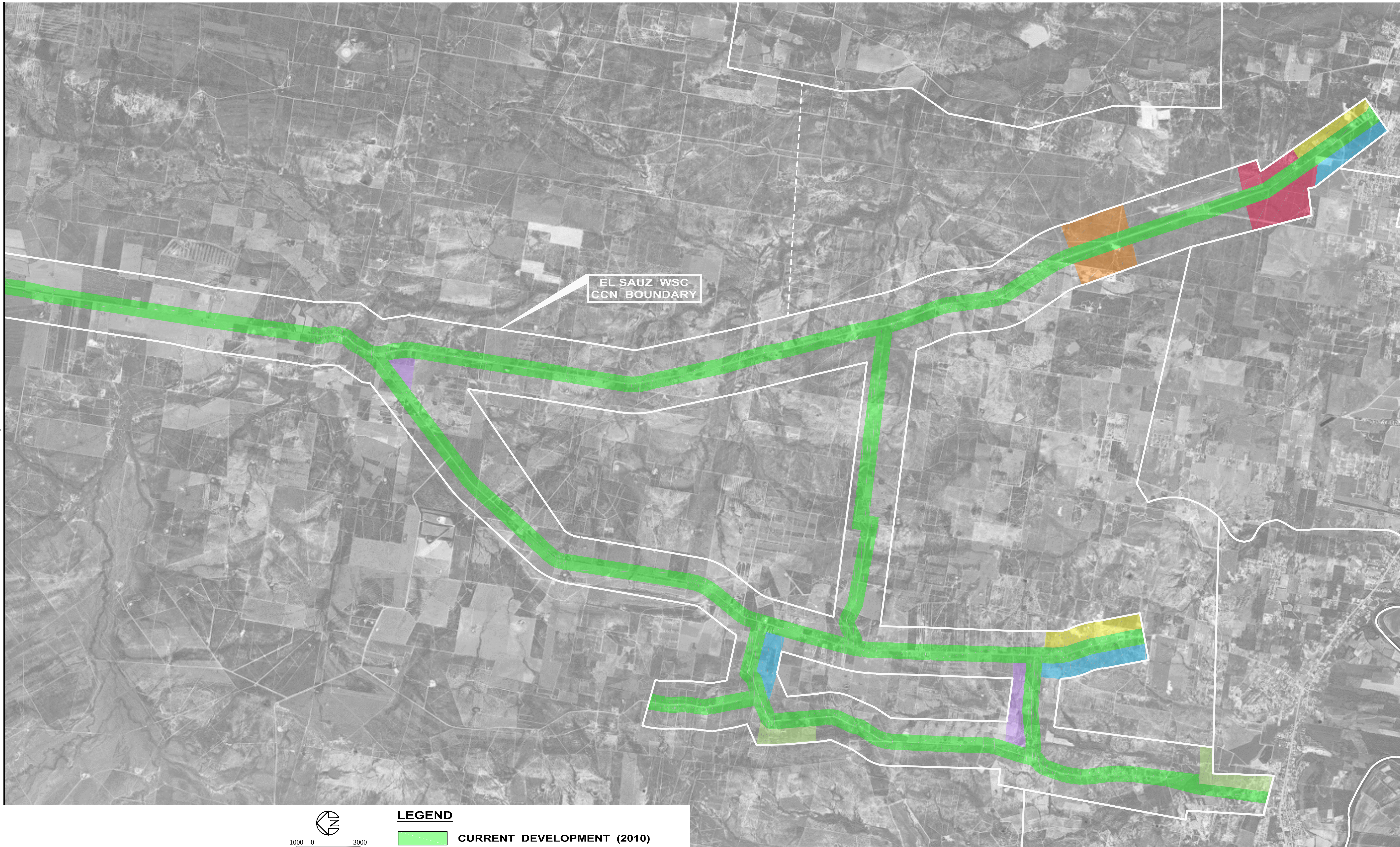
- CURRENT DEVELOPMENT (2010)
- PROJECTED GROWTH (2011 - 2015)
- PROJECTED GROWTH (2016 - 2020)
- PROJECTED GROWTH (2021 - 2025)
- PROJECTED GROWTH (2026 - 2030)
- PROJECTED GROWTH (2031 - 2035)
- PROJECTED GROWTH (2036 - 2040)

EXHIBIT 1-14
EL SAUZ WSC
PROJECTED GROWTH THROUGH 2040
(1 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
08/03/2012

MATCH LINE "A"



LEGEND

- CURRENT DEVELOPMENT (2010)
- PROJECTED GROWTH (2011 - 2015)
- PROJECTED GROWTH (2016 - 2020)
- PROJECTED GROWTH (2021 - 2025)
- PROJECTED GROWTH (2026 - 2030)
- PROJECTED GROWTH (2031 - 2035)
- PROJECTED GROWTH (2036 - 2040)

EXHIBIT 1-15
EL SAUZ WSC
PROJECTED GROWTH THROUGH 2040
(2 OF 2)

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
08/03/2012

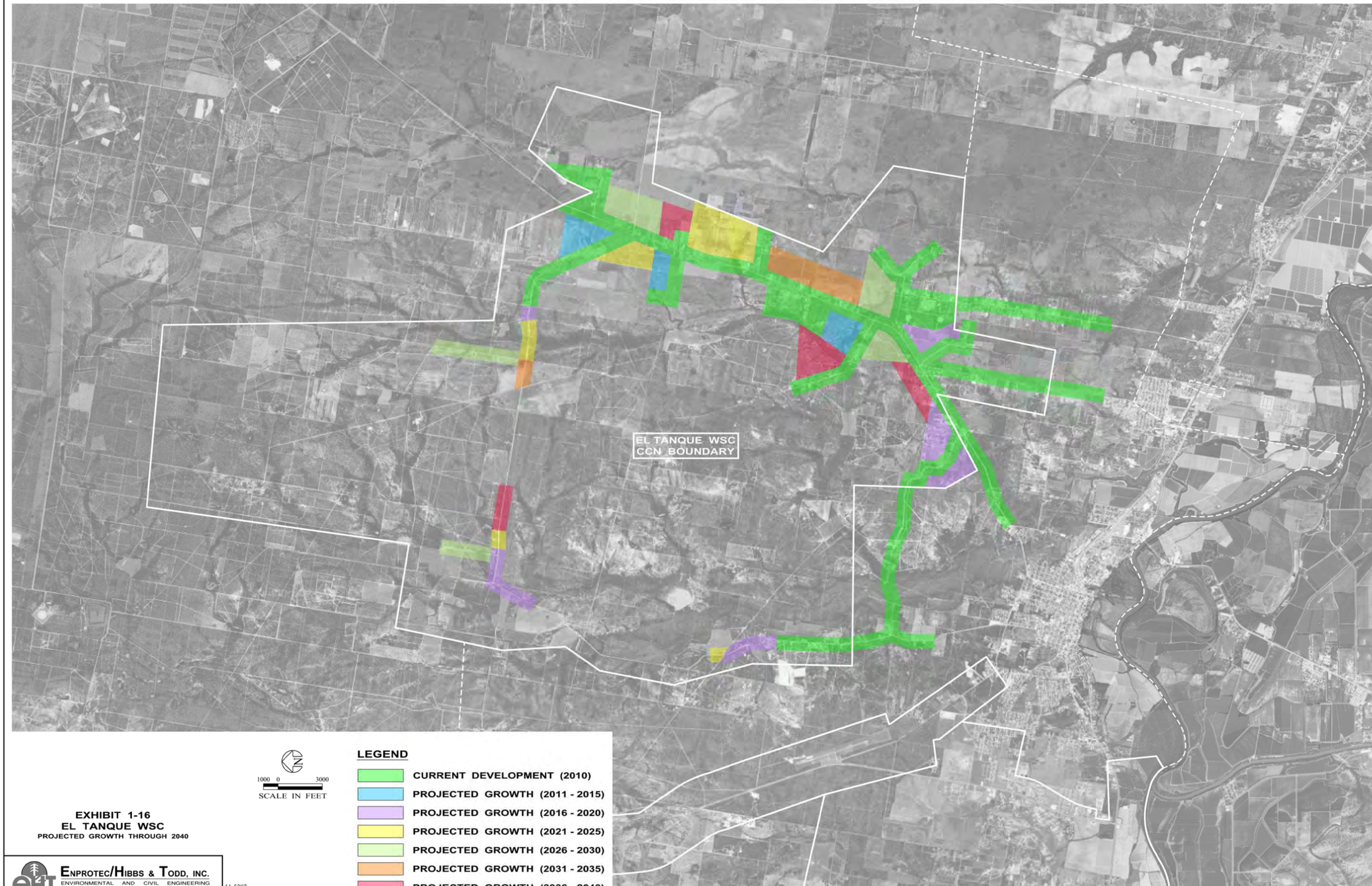


EXHIBIT 1-16
EL TANQUE WSC
PROJECTED GROWTH THROUGH 2040

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
08/03/2012

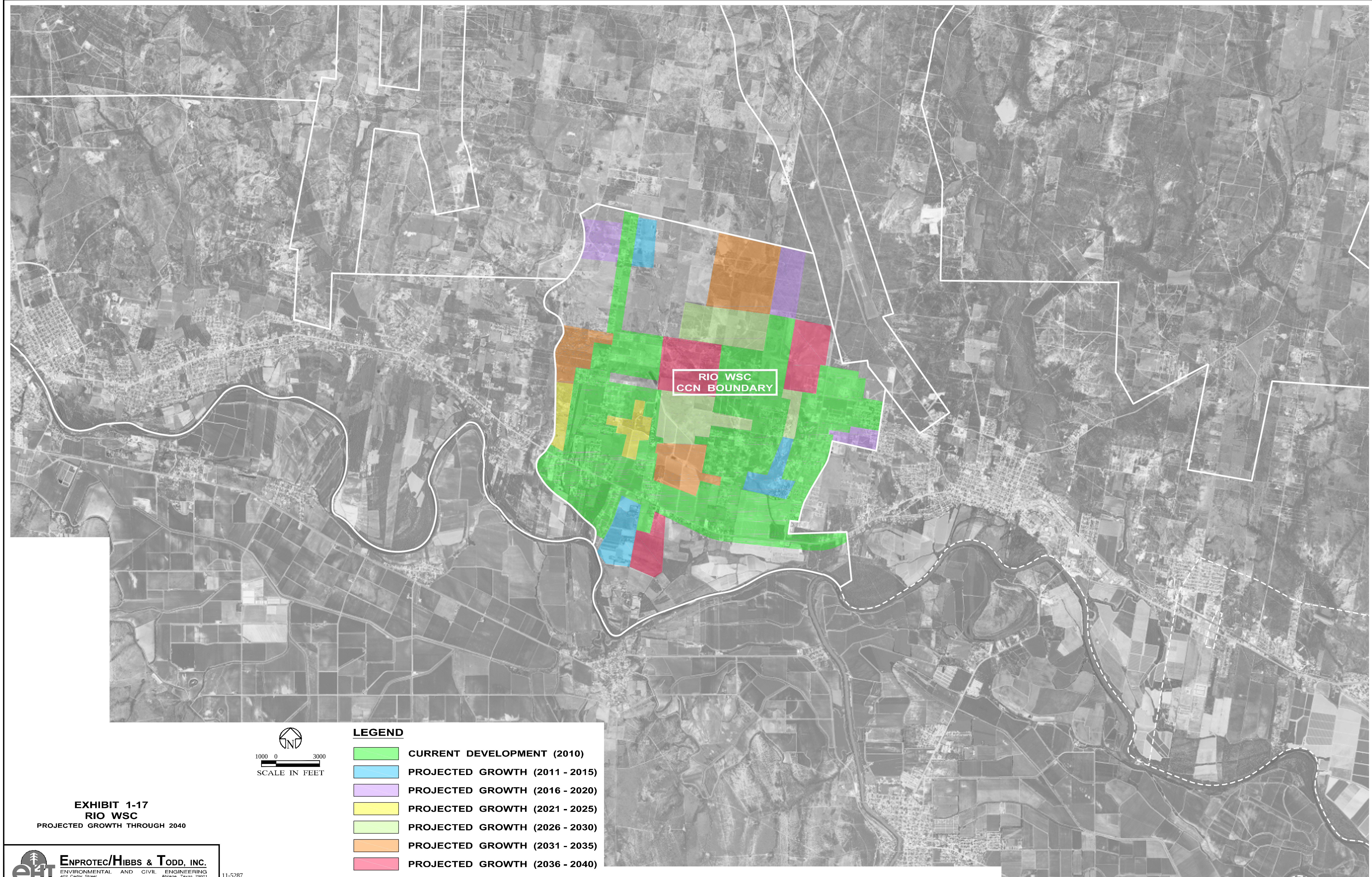


EXHIBIT 1-17
RIO WSC
PROJECTED GROWTH THROUGH 2040

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
08/03/2012

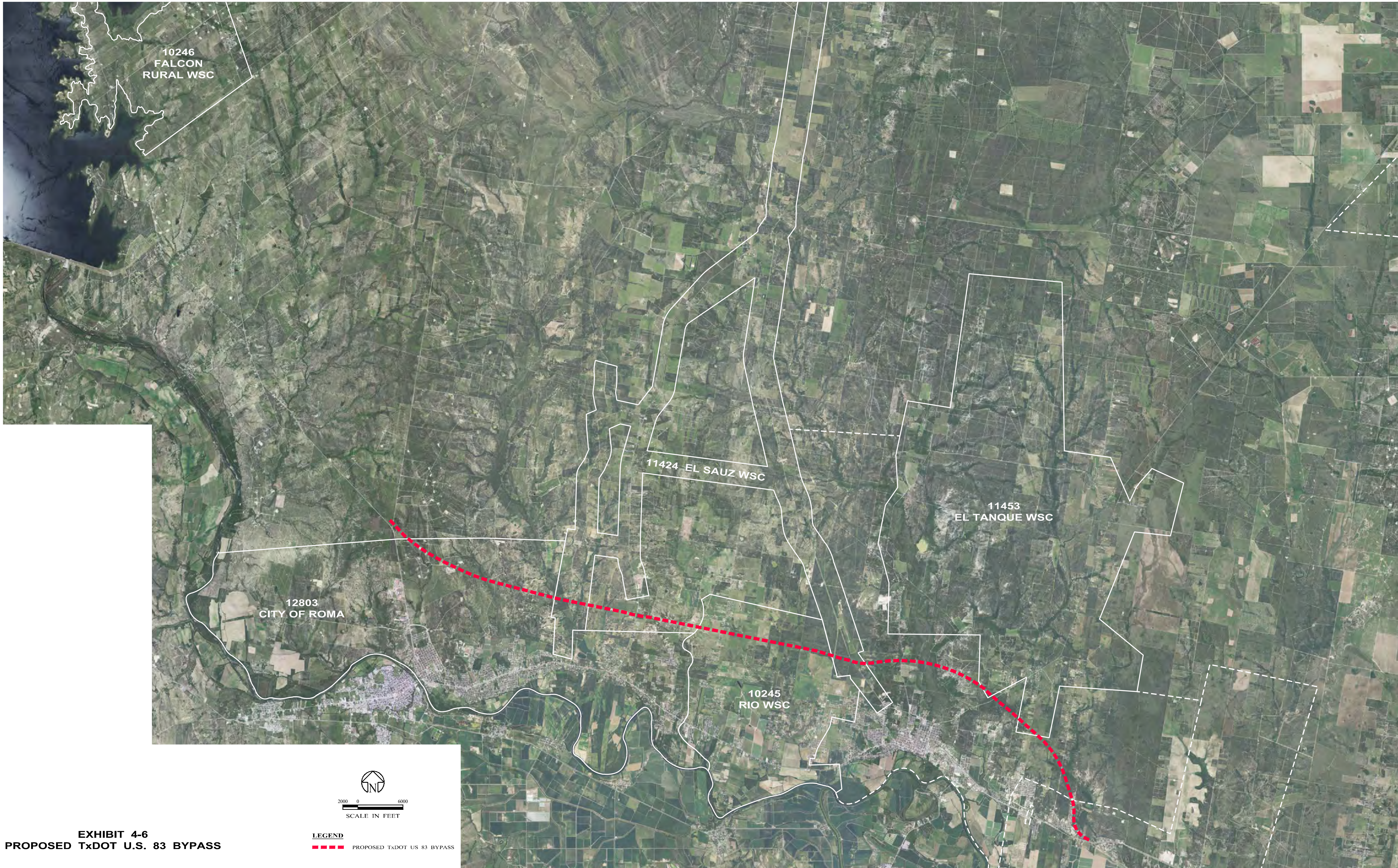


EXHIBIT 4-6
PROPOSED TxDOT U.S. 83 BYPASS

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012

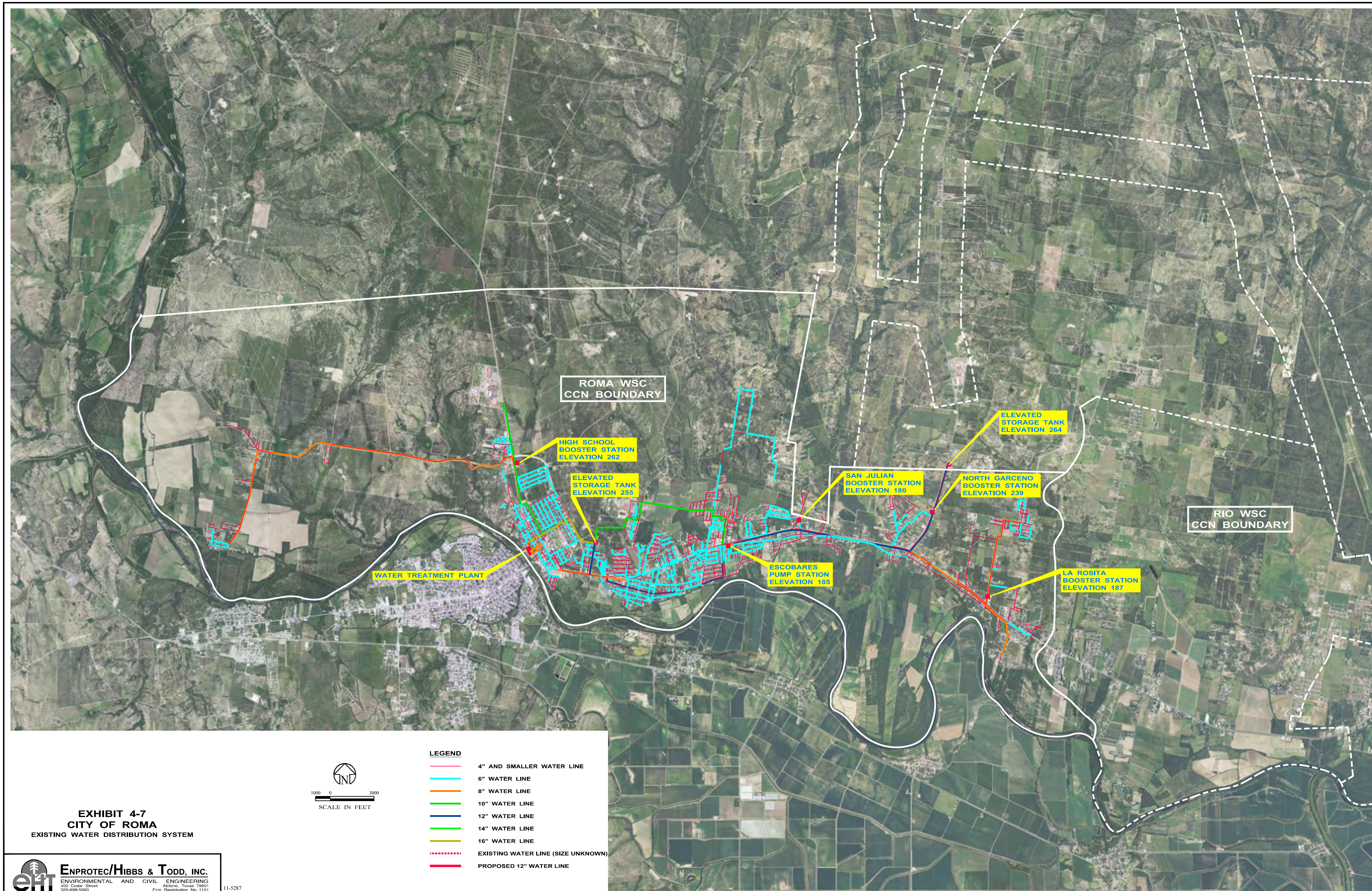


EXHIBIT 4-7
CITY OF ROMA
EXISTING WATER DISTRIBUTION SYSTEM

1000 0 3000
SCALE IN FEET

LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE

EXHIBIT 4-8
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

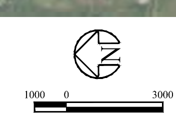
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

11-5287
04/23/2012

EXHIBIT 4-9
FALCON RURAL WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012



LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE

EXHIBIT 4-10
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
04/23/2012

4" AND SMALLER WATER LINE
6" WATER LINE
8" WATER LINE
10" WATER LINE
12" WATER LINE
14" WATER LINE
16" WATER LINE
EXISTING WATER LINE (SIZE UNKNOWN)
PROPOSED 12" WATER LINE

EXHIBIT 4-11
EL SAUZ WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012

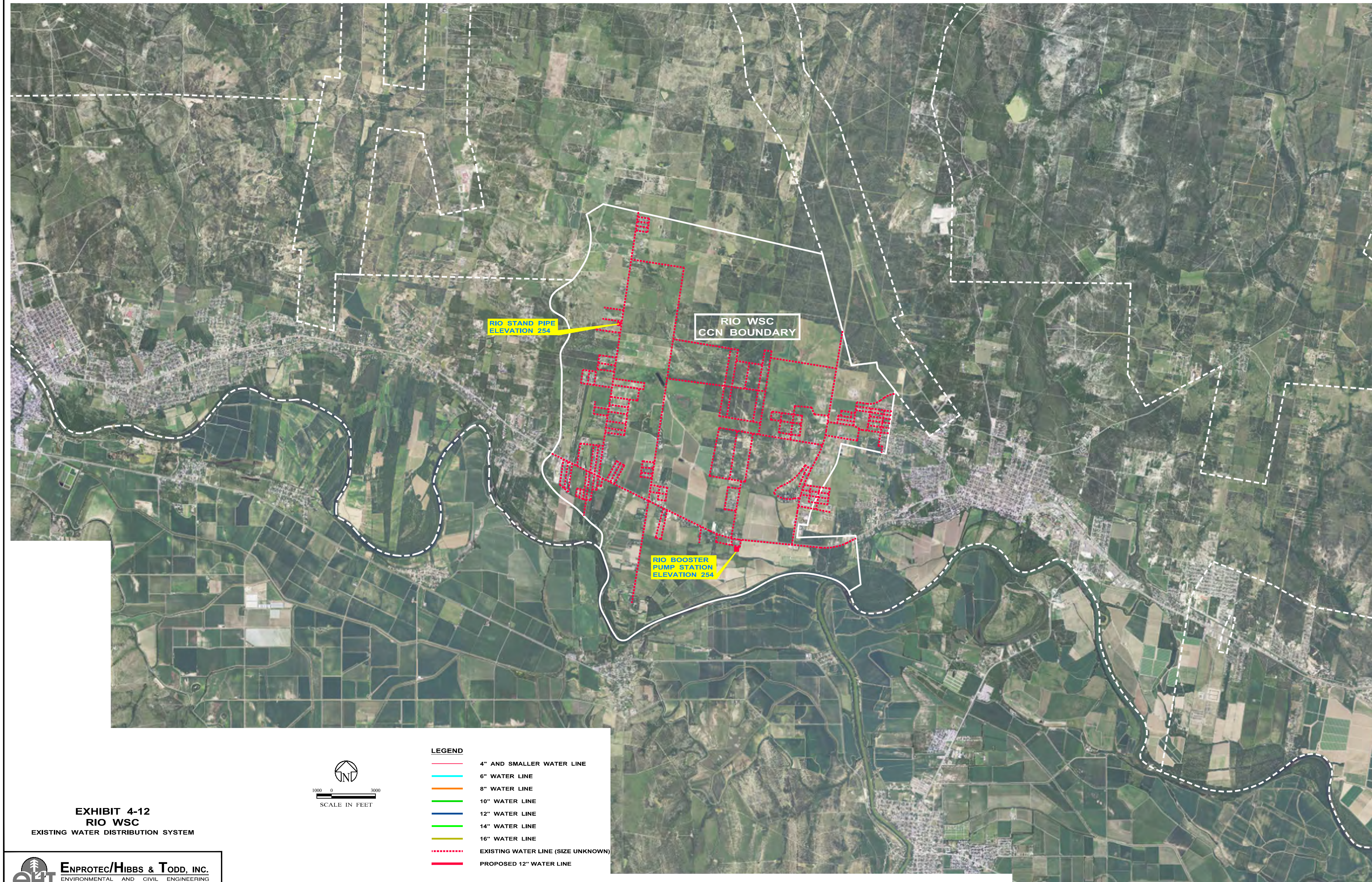


EXHIBIT 4-12
RIO WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012

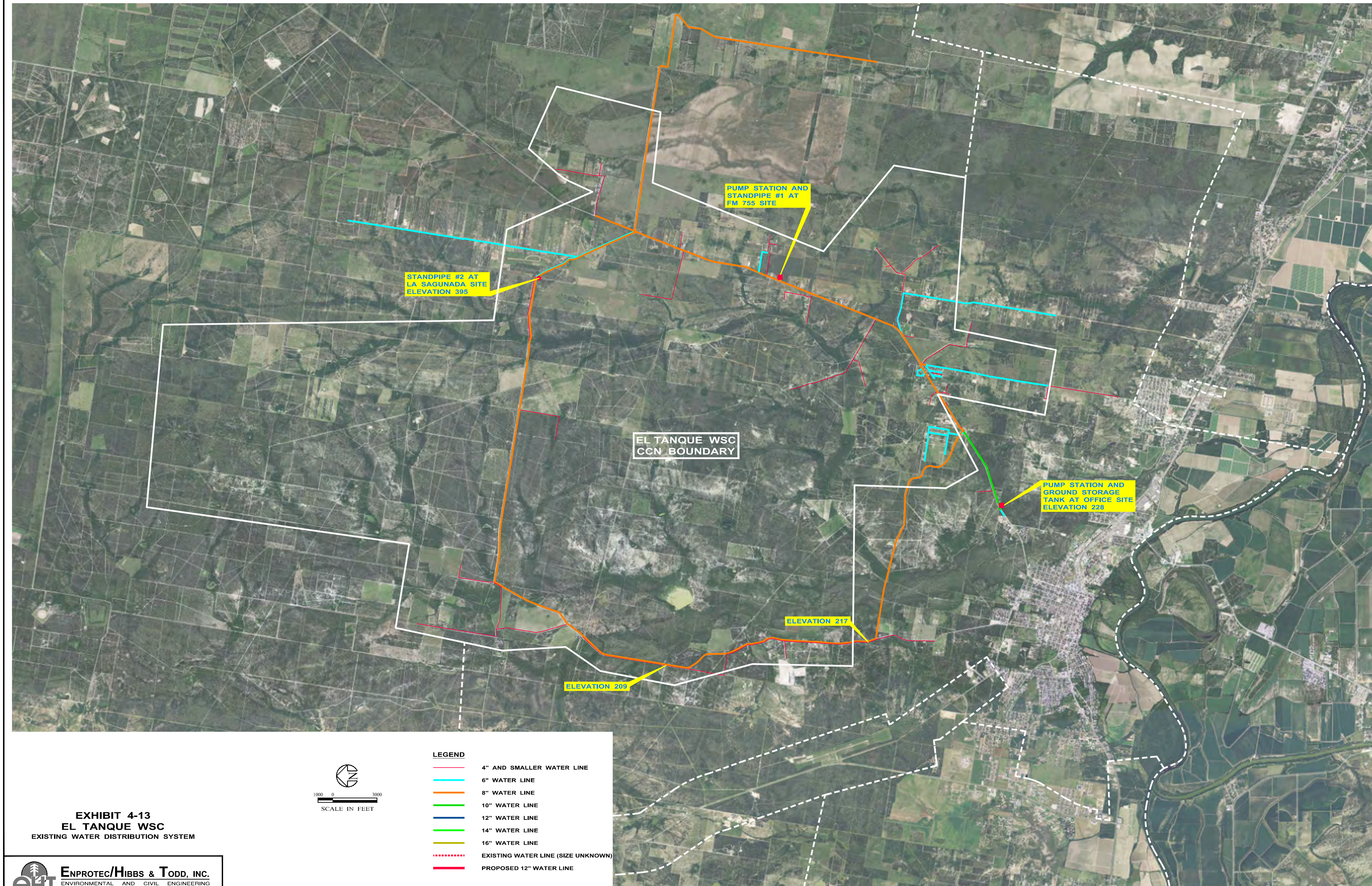
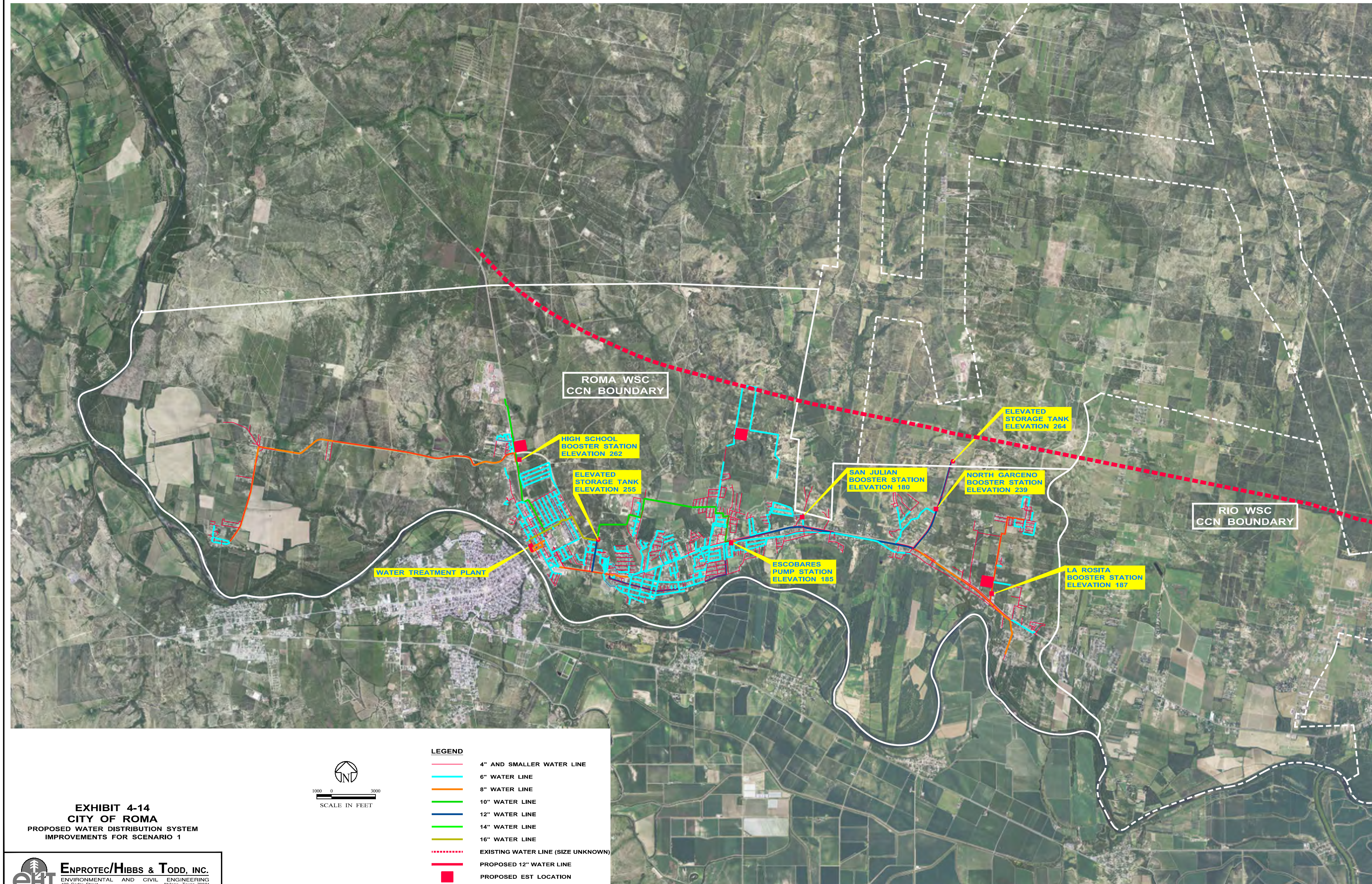


EXHIBIT 4-13
EL TANQUE WSC
EXISTING WATER DISTRIBUTION SYSTEM

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012



LEGEND

- 4" AND SMALLER WATER LINE
- 6" WATER LINE
- 8" WATER LINE
- 10" WATER LINE
- 12" WATER LINE
- 14" WATER LINE
- 16" WATER LINE
- EXISTING WATER LINE (SIZE UNKNOWN)
- PROPOSED 12" WATER LINE
- PROPOSED EST LOCATION
- PROPOSED TxDOT US 83 BYPASS

EXHIBIT 4-14
CITY OF ROMA
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 1

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012

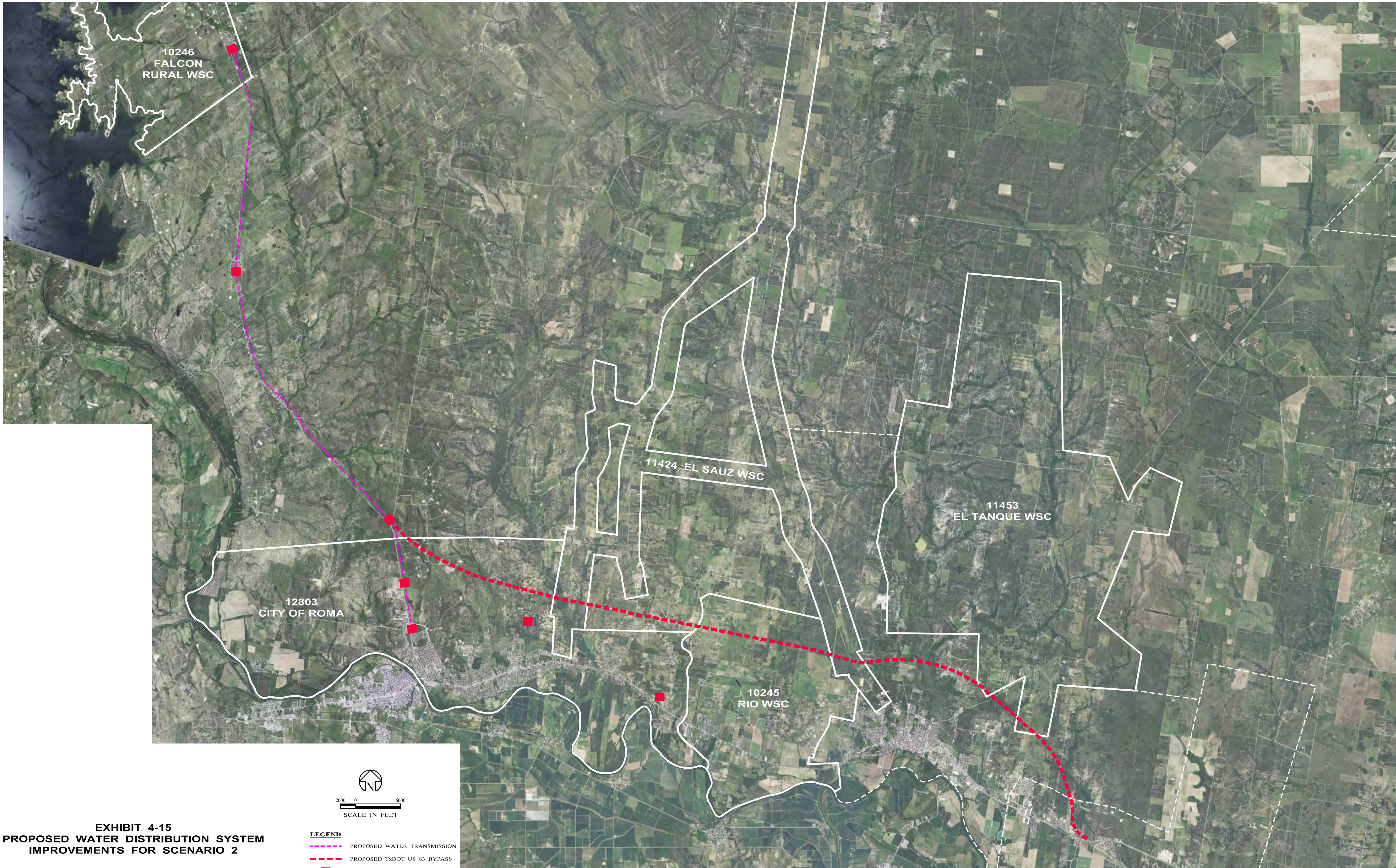


EXHIBIT 4-15
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 2

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
04/23/2012

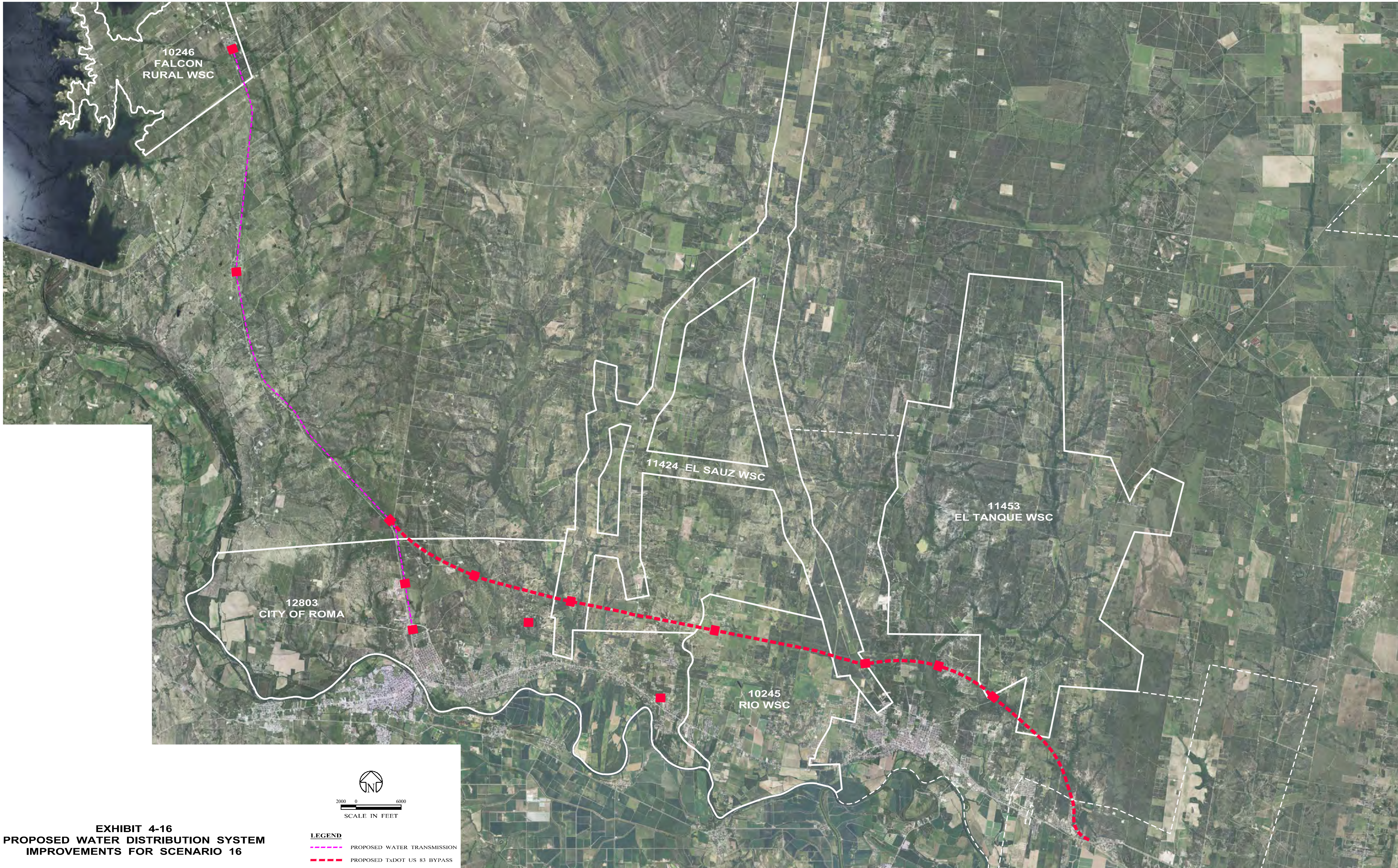


EXHIBIT 4-16
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 16

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

11-5287
04/23/2012

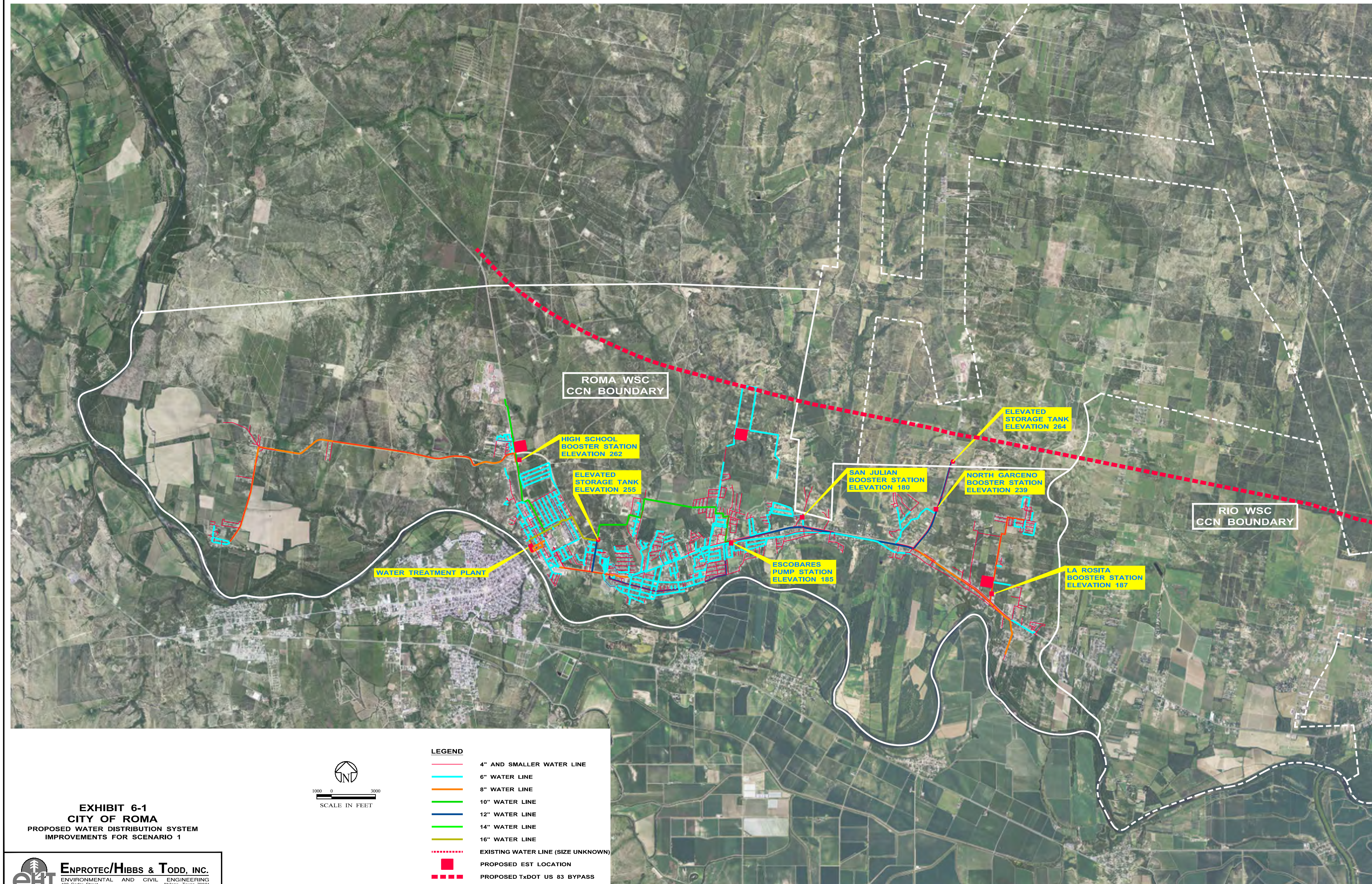


EXHIBIT 6-1
CITY OF ROMA
PROPOSED WATER DISTRIBUTION SYSTEM
IMPROVEMENTS FOR SCENARIO 1

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/04/2012

EXHIBIT 6-2
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 2

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/04/2012

EXHIBIT 6-3
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 3

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/04/2012

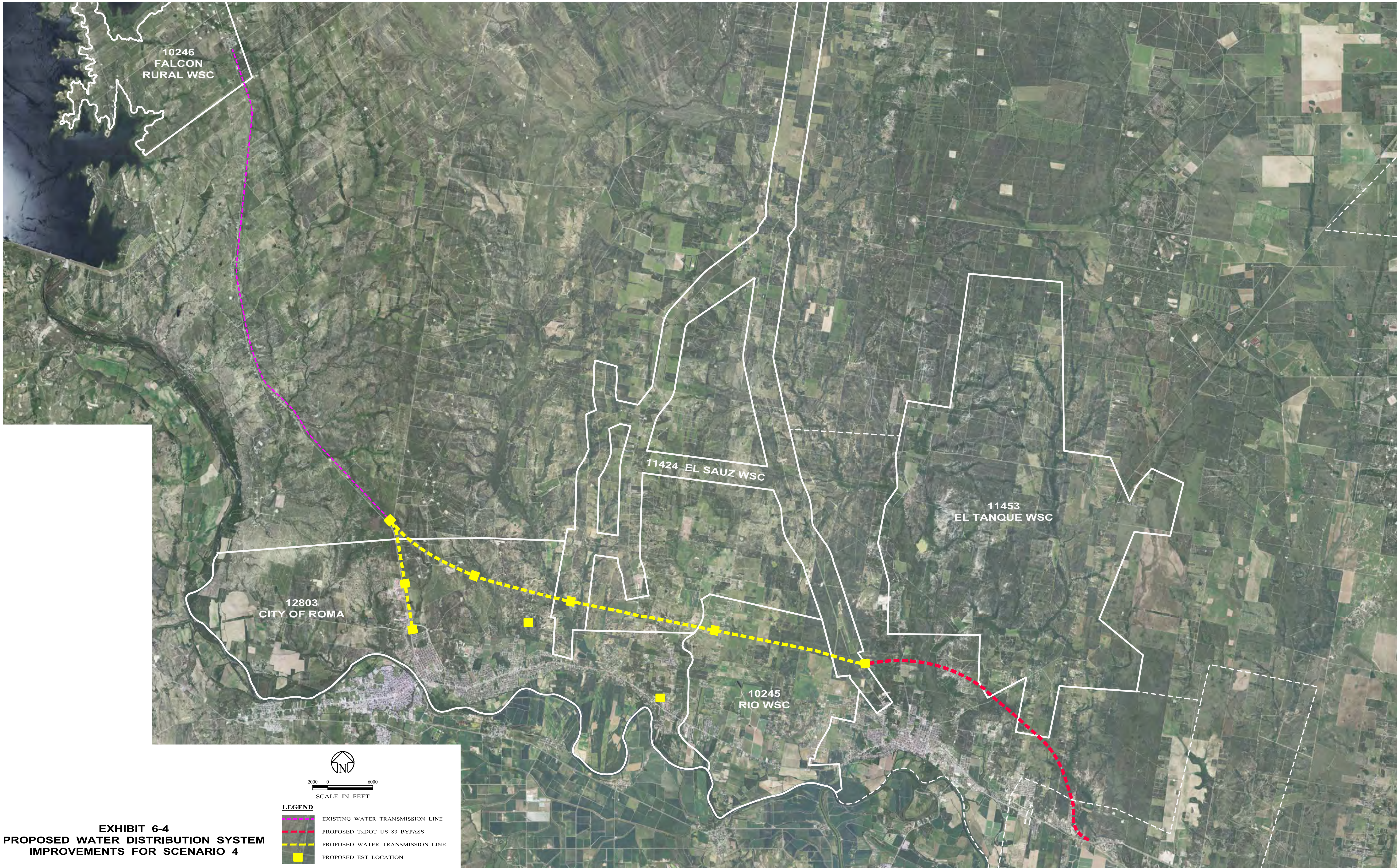


EXHIBIT 6-4
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 4

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

11-5287
06/04/2012

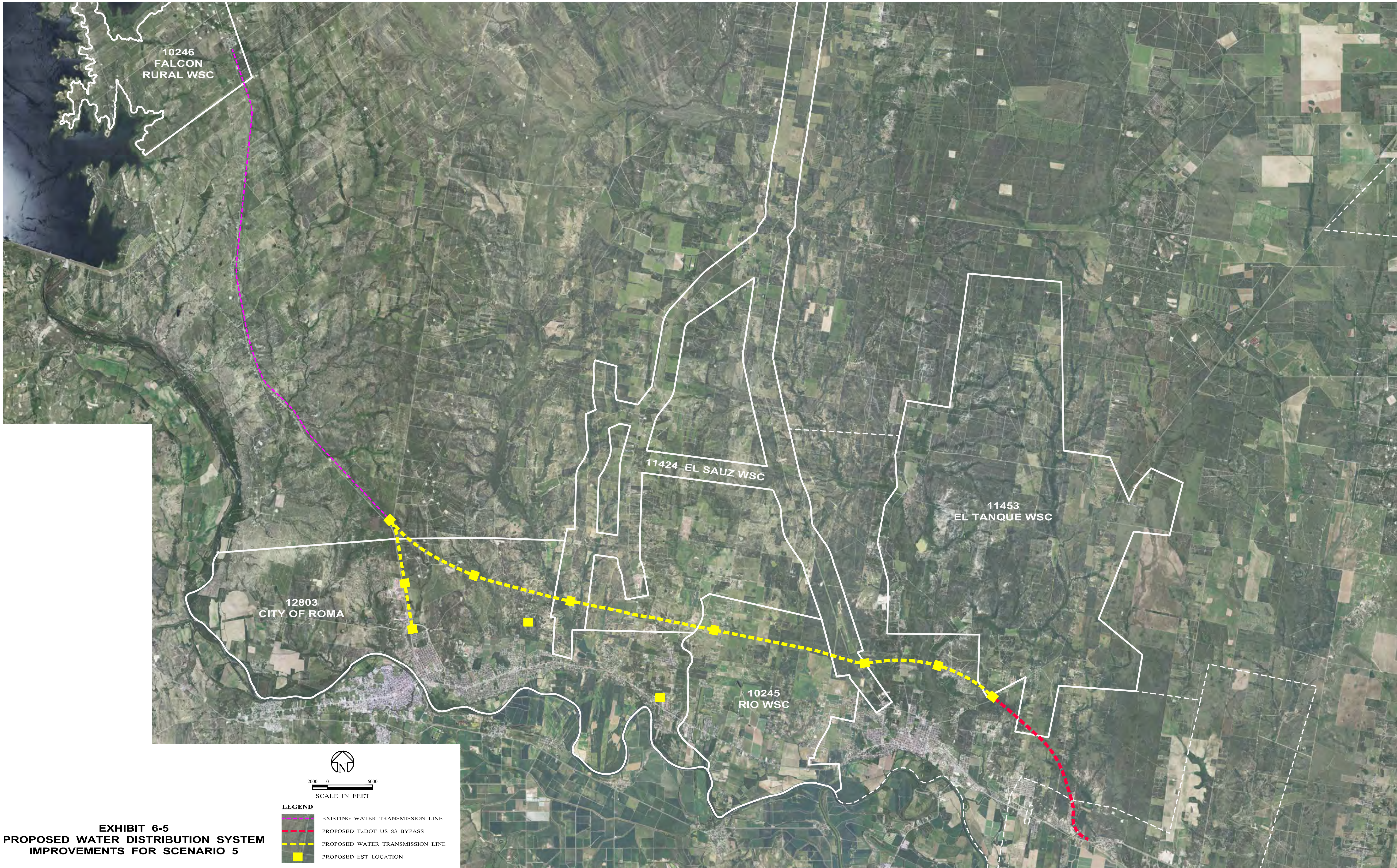


EXHIBIT 6-5
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 5

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

11-5287
06/04/2012

LEGEND

- PROPOSED WATER TRANSMISSION LINE
- PROPOSED WATER TRANSMISSION LINE
- PROPOSED TxDOT US 83 BYPASS
- PROPOSED EST LOCATION

EXHIBIT 6-6
PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS FOR SCENARIO 16

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

11-5287
06/04/2012

Texas Water Development Board

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

September 24, 2012

Crisanto Salinas
City Manager
City of Roma
P.O. Box 947
Roma, Texas 78584-0947

RE: Regional Water Facility Planning Grant Contract between the Texas Water Development Board (TWDB) and the City of Roma (City); TWDB Contract No. 1148311260, Draft Report Comments

Dear Mr. Salinas:

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

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

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

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

Sincerely,

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

Enclosures
c: Angela Kennedy, TWDB

Attachment I

City of Roma - Regional Water Planning Study
TWDB Contract No. 1148311260
Draft Report Review Comments

1. The Executive Summary should be a stand-alone section containing its own figures and tables rather than referencing exhibits from other chapters of the report. Figures and tables in the Executive Summary should also have a consistent naming convention. For example on page ES-ii the first table of this section is titled "Table 1-2" followed by a second table titled "Table E-1".

2. Page ES-iv & ES-v, SECTION 2 (& TM-2): Please consider defining "Class A" and "Class B" irrigation water rights and their relationship to surface water "firm yield". Also, consider clarifying that one of the benefits of conversion from irrigation to municipal water rights is that, in Region M, all municipal water rights are senior to all irrigation water rights. This is not the case in other parts of the state where prior appropriation or "first in time first in right" is the convention regardless of the water use category.

3. Please consider listing the five participating entities in the same order in data tables throughout the report for consistency and clarity. Example is page ES-v, "Table 2-2" and "Table 2-3".

4. It appears that the title of tables "Table 1-14" and "Table 2-3" should be Water "Demands" rather than Water "Rights (or Alternative Supplies)" as is described in the last sentence on page 1-40. Please consider including information that more clearly delineates between the concepts of water "demands" and water "supplies" throughout the report.

5. Page ES-xvi, Table 7-6 (& TM-7): There are no costs associated with some tasks listed in Projects 3 & 4. Please consider noting that costs presented are for infrastructure only.

6. Task II of the Scope of Work states: "Based upon the population projections and the historic data that is collected, the Consultant will prepare average day water demand and peak water demands." It does not appear that the report discusses peak water demand. Please include this information in the final report.

7. In estimating water demand for the entities, it would be beneficial for the analysis to take into consideration data from the TWDB's annual Water Use Survey. Please consider using this data or explain why this information was not used.

8. TM-3, page 31: The recommended alternatives are Scenarios 2, 3, and 16. The reasons listed for choosing these alternatives are lowest annual debt service and costs. However, Scenarios 4 and 9 have equally low debt service and treatment costs but are not recommended. Please consider including additional explanation/analysis of the reasons for choosing the recommended alternatives.

9. TM-4, page 39: The statement is made that "While Scenario 16 2040 minimum required distribution design capacity is anticipated to be 16.7 mgd, based on current demand, it is anticipated that the average water demand would actually be roughly half of the 2040 WTP capacity, or 8.85 mgd." Please explain the rationale behind recommending that the WTP will operate at 50% capacity (or recommending the WTP be built with twice the capacity of the average demand).

10. TM-5, page 3: In the Section titled "Development of O&M Costs" replacing the membrane units is not discussed specifically as an O&M cost. This can be one of the largest maintenance costs associated with membranes. Please indicate whether the O&M costs for membrane filtration includes replacement of the membrane units.

11. TM-7, Tables 7-1 and 7-2: Table 7-1 has costs for installation of a 36-inch water main as $293 per foot and Table 7-2 has costs for a 30-inch line as $150. The unit cost for the 36-inch water main appears to be disproportionately high. Please consider including an explanation in the report.

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

Enprotec / Hibbs & Todd

October 22, 2012

Texas Water Development Board
P.O. Box 13231
Austin, TX 78711-3231
Attn: Mrs. Angela Kennedy

Re: City of Roma Regional Water Planning Study
Response to TWDB Draft Report Comments

Dear Mrs. Kennedy:

On August 3, 2012, Enprotec / Hibbs & Todd, Inc. (eHT) submitted (on the City of Roma's [City] behalf) the Draft Final Report for the City of Roma Regional Water Planning Study to the Texas Water Development Board (TWDB) for review and comment. In accordance with the Contract Scope of Work, the report included an evaluation of long-term water supply and treatment capacities for the Study Area, potential locations of future regional treatment facilities and distribution points for wholesale water delivery, anticipated costs of potential regional improvements, and the associated potential environmental impacts.

On September 24, 2012, the TWDB provided comments and questions regarding several items in the Draft Final Report (included in the Final Report as Appendix F). The TWDB review comments have been considered and appropriate responses have been prepared to address each comment in this letter. While some comments can be addressed via this letter alone, the majority of the comments require modifications to the Final Report. The response letter from eHT (included in the Final Report as Appendix G) addresses each TWDB comment and references the location of report modifications (if necessary). The goal of this letter is to reflect consideration of the TWDB comments and discuss what changes (if necessary) were made to the Final Report.

TWDB Comment No. 1:

The Executive Summary should be a stand-alone section containing its own figures and tables rather than referencing exhibits from other chapters of the report. Figures and tables in the Executive Summary should also have a consistent naming convention. For example on page ES-ii the first table of this section is titled "Table 1-2" followed by a second table titled "Table E-1".

eHT Response:
The Executive Summary has been modified to reflect the comments stated above. Tables and figures have been included and re-labeled to reflect the "E-#" naming convention. Please refer to the Executive Summary for revisions.

TWDB Comment No. 2:
Page ES-iv & ES-v, SECTION 2 (& TM-2): Please consider defining "Class A" and "Class B" irrigation water rights and their relationship to surface water "firm yield". Also, consider clarifying that one of the benefits of conversion from irrigation to municipal water rights is that, in Region M, all municipal water rights are senior to all irrigation water rights. This is not the case in other parts of the state where prior appropriation or "first in time first in right" is the convention regardless of the water use category.

eHT Response:
The Executive Summary and TM-2 have been modified to reflect the comments stated above. The relationship between "Class A" and "Class B" irrigation water rights was previously discussed in TM-2, but was not included in the Executive Summary; the Executive Summary has been revised to reflect the information in TM-2. In addition, a discussion has been included in both the Executive Summary and TM-2 with regard to the "first in time first in right" issue that is in force in other parts of the state as opposed to Region M. Please refer to the Executive Summary and TM-2 for revisions.

TWDB Comment No. 3:
Please consider listing the five participating entities in the same order in data tables throughout the report for consistency and clarity. Example is page ES-v, "Table 2-2" and "Table 2-3".

eHT Response:
The tables in the report have been modified to reflect the comments stated above. Please refer to the Final Report for revisions.

TWDB Comment No. 4:
It appears that the title of tables "Table 1-14" and "Table 2-3" should be Water "Demands" rather than Water "Rights (or Alternative Supplies)" as is described in the last sentence on page 1-40. Please consider including information that more clearly delineates between the concepts of water "demands" and water "supplies" throughout the report.

eHT Response:
The tables in the report have been modified to reflect the comments stated above. The report includes discussion of the difference between "water demands" (actual water usage) as opposed to "water supplies" (necessary infrastructure capacity). Please refer to the Final Report for revisions.

TWDB Comment No. 5:
Page ES-xvi, Table 7-6 (& TM-7): There are no costs associated with some tasks listed in Projects 3 & 4. Please consider noting that costs presented are for infrastructure only.

eHT Response:
The tables in the report have been modified to reflect the comments stated above. Please refer to the Final Report for revisions.

TWDB Comment No. 6:
Task II of the Scope of Work states: "Based upon the population projections and the historic data that is collected, the Consultant will prepare average day water demand and peak water demands." It does not appear that the report discusses peak water demand. Please include this information in the final report.

eHT Response:
The tables in the report have been modified to reflect the comments stated above, including peak water demand information. Peak water demand reflects a 1.25 peaking factor over average day demand, which was previously discussed in TM-4. Please refer to the Final Report for revisions.

TWDB Comment No. 7:
In estimating water demand for the entities, it would be beneficial for the analysis to take into consideration data from the TWDB's annual Water Use Survey. Please consider using this data or explain why this information was not used.

eHT Response:
The TWDB's Water Use Survey data was not readily available for all of the Study participants during the data collection phase of the project. As a result, water use information was drawn from historical planning study reports in the Study Area, the Texas Commission on Environmental Quality's (TCEQ) Water Utility Database and the 2011 Region M Regional Water Plan.

TWDB Comment No. 8:
TM-3, page 31: The recommended alternatives are Scenarios 2, 3, and 16. The reasons listed for choosing these alternatives are lowest annual debt service and costs. However, Scenarios 4 and 9 have equally low debt service and treatment costs but are not recommended. Please consider including additional explanation/analysis of the reasons for choosing the recommended alternatives.

eHT Response:
TM-3 has been modified to reflect the comments stated above. The recommended alternative in TM-3 was revised to reflect Scenario 16 as the recommended alternative as it is the lowest cost of the evaluated alternatives. However, it was noted that treatment cost alone could not justify the project, so all aspects (treatment, distribution and O&M) were taken into account prior to making a final recommendation in TM-6. Please refer to TM-3 for revisions.

TWDB Comment No. 9:
TM-4, page 39: The statement is made that "While Scenario 16 2040 minimum required distribution design capacity is anticipated to be 16.7 mgd, based on current demand, it is anticipated that the average water demand would actually be roughly half of the 2040 WTP capacity, or 8.85 mgd." Please explain the rationale behind recommending that the WTP will operate at 50% capacity (or recommending the WTP be built with twice the capacity of the average demand).

eHT Response:
This statement was taken out of context and was previously discussed in the report. In TM-1, TM-3 and TM-4, it was discussed that the TCEQ requires that infrastructure capacity be based at a minimum, on its standard design criteria of 0.6 gallons per minute (gpm) per connection. As an example, it was discussed that with the City of Roma's current number of connections (approximately 6,300), TCEQ states that the City provide a minimum system capacity of 5.45 mgd, even though the average daily demand is typically about half of the required system capacity. Since the makeup of the Study area is not expected to change significantly over the next 30 years, it is anticipated that the average demand will continue to be roughly half of the TCEQ-required capacity. Please refer to TM-4 for revisions.

TWDB Comment No. 10:
TM-5, page 3: In the Section titled "Development of O&M Costs" replacing the membrane units is not discussed specifically as an O&M costs. This can be one of the largest maintenance costs associated with membranes. Please indicate whether the O&M costs for membrane filtration includes replacement of the membrane units.

eHT Response:
TM-5 has been modified to reflect the comments stated above. Depending on the type of membrane filtration system used (MF or UF), the brand of membrane filtration system used (Pall, GE, Siemens, etc.), the operating flux of the membrane filtration system (30-70 gallons per square foot per day [gfd]) and the operating pressure (either under pressure or under vacuum), the typical replacement cost changes significantly. To be conservative, an annual budget allotment of $420,000 per year was included in the annual O&M cost for a 16.7 mgd membrane filtration WTP, though this is based on a pressure system operating at roughly 30 gfd. Pending completion of a pilot study, the operating flux can be much higher (typically in the range of 60-70 gfd for systems like Pall), which would reduce the annual membrane replacement budget to less than $200,000. Please refer to TM-5 for revisions.

TWDB Comment No. 11:
TM-7, Tables 7-1 and 7-2: Table 7-1 has costs for installation of a 36-inch water main as $293 per foot and Table 7-2 has costs for a 30-inch line as $150. The unit cost for the 36-inch water main appears to be disproportionately high. Please consider including an explanation in the report.

eHT Response:
TM-7 has been modified to reflect the comments stated above. It is anticipated in the project that additional property acquisition will be required for the pipe alignment; in addition, since there is no clear, undisturbed pathway from the Rio Grande River (raw water supply) to the proposed WTP site, it is anticipated that the majority of the piping will need to be installed via either boring or directional drilling to cross US Highway 83 and to minimize utility conflicts throughout the developed sections of the City of Roma. However, the cost for distribution piping is reduced, as the proposed alignment of the piping is intended to parallel US Highway 83, and the piping is anticipated to be installed via typical open-cut trenching within TxDOT ROW outside of the road, which will significantly reduce the unit cost for installation of the distribution piping. Please refer to TM-7 and the Executive Summary for revisions.

TWDB Comment No. 12:
Please include documentation of the required public meetings in an appendix of the report.

eHT Response:
The report has been modified to reflect the comments stated above. Documentation of the required public meetings has been included as Appendix D of the report. Please refer to the Final Report for revisions.

The City of Roma and eHT greatly appreciate the TWDB's guidance in the development and completion of the Regional Water Planning Study. If you have any questions, comments and/or suggestions, please contact me at (325) 698-5560 or at sage.diller@e-ht.com. In addition, please feel free to contact either Keith Kindle or Joshua Berryhill as necessary.

Sincerely,

Enprotec / Hibbs & Todd, Inc.

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