CITY OF CANTON

PWS #2340001

LONG-TERM WATER STUDY
SURFACE WATER SUPPLY

December 2008

STATE OF TEXAS
GARY L. BURTON, III
56643
LICENSED
PROFESSIONAL ENGINEER

Prepared By: Gary L Burton, III 1/20/09

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CITY OF CANTON
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TABLE OF CONTENTS

CITY OF CANTON
LONG-TERM WATER STUDY
SURFACE WATER SUPPLY

I. INTRODUCTION

A. AUTHORIZATION AND ORGANIZATION

The City of Canton retained Gary Burton Engineering, Inc. (GBEI) to perform a Long-Term Water Supply Study including the feasibility of constructing a water supply reservoir in Van Zandt County. GBEI was assisted in the study by Joe Harle, P.E. of East Texas Engineers and Brandy Smart, Senior Project Manager of PBS&J. Mr. Harle assisted with reservoir site selection and yield analysis. Ms. Smart assisted with the environmental screening of potential reservoir sites. Funding for the study was provided by the City of Canton.

B. SCOPE AND OBJECTIVES OF STUDY

The Canton City Council recognized the need to plan for the future water demand for the City and surrounding areas. Due to concerns about local ground water availability from individual wells, the City does not feel secure with the reliability of groundwater only to meet future demand.

The scope and objective of this study was to investigate the most technically feasible alternative to provide a reliable surface water supply for the City to meet increasing future demand in the most economical and sustainable manner. This involved the evaluation of purchasing either raw or treated water from existing reservoirs versus the construction of a new reservoir near the City in Van Zandt County. The different sources of water that have been considered are as follows:

1. The construction of a new reservoir:
   A. On Mill Creek north of the City in the Sabine River Basin.
   B. On Kickapoo Creek south of the City in the Neches River Basin.

2. The purchase of treated water from the City of Tyler, Texas with water from Lake Palestine.

3. The purchase of raw water from:
   A. City of Tyler with water from Lake Bellwood.
   B. Upper Neches River Municipal Water Authority with water from Lake Palestine.
   C. Sabine River Authority with water from Lake Tawakoni.

C. CONTENTS OF REPORT

The contents of this report have been prepared by Gary Burton Engineering, Inc., Environmental/Civil Engineers in conjunction with other consultants. The consultants and the Sections involved are as follows:

1. East Texas Engineers, Inc., Joe Harle, P.E.

Section IV - Identification of Potential Reservoir Sites Including Yields and Downstream Flows.

2. PBS&J, Brandy Smart, Senior Project Manager

Section V - Environmental Considerations.

II. EXISTING CONDITIONS

A. REGION D ADOPTED PLAN

Van Zandt County is in the state of Texas Regional Water Planning Area D. The current regional plan shows the City of Canton as meeting its long-term water needs with additional water wells only. In addition, it shows Canton's existing water supply reservoir to have a safe yield of 706 acre-feet per year. Since preparation of the plan, the City has constructed an additional well so that it now has two existing water wells with a combined capacity of 468 acre-feet per year.

B. DESCRIPTION OF STUDY AREA

1. GEOGRAPHY

The proposed reservoir sites are located in Northeast Texas within the Gulf Coastal Plain Region. The land surface is generally flat along the flood plains of the major streams, but is gently rolling otherwise. A heavy cover of soft (pine) and hardwoods are predominant in this area.

2. CLIMATOLOGY

The study area has a warm, humid, subtropical climate and heavy rains. The change in Winter, Spring, Summer, and Fall season is gradual with a mild winter. Based on records from 1950-1979 of the Climatic Atlas of Texas, the average annual temperature is 64° F, with mean temperatures ranging from 36°F - 58°F in December and 71°F - 97°F in July. The annual average precipitation is approximately 41 inches. The prevailing wind direction is from the south and southeast, occurring almost 40 percent of the time.

3. HYDROLOGY

The normal annual average runoff is approximately 10 inches per year or 550 acre-feet per square mile of basin drained. The annual average gross lake surface evaporation rate from 1950 - 1979 was approximately 54 inches, and the monthly average equaled or exceeded rainfall 5 months out of the year as presented in Exhibit 1. The major aquifers are the Carrizo and Wilcox as shown in Exhibit 2. The Queen City is a minor

aquifer underlying the region. Groundwater recharge is from the infiltration of rainfall and runoff on the outcrop areas and direct charging from the streams and lakes. The groundwater is discharged naturally and artificially. Natural processes include springs, seeps, evaporation or movement of perched (shallow) ground water, and transpiration by trees and plants whose roots reach the water table. Artificial processes include pumping from water wells. The artificial processes are usually several times the natural processes. The surrounding lakes are Lake Fork, Lake Tawakoni, Lake Palestine, and Cedar Creek Lake as shown in Exhibit 3.

C. LAND USE PATTERNS

1. HISTORICAL TRENDS

The land use for the study area consists of developed and undeveloped areas. The developed areas are primarily low density residential, with some light commercial and light industrial. Land use in the undeveloped areas includes agriculture (improved pasture), forestry, tree farming, and oil and gas production. The developed and undeveloped areas are both within and outside of the City limits.

Historical development and land use trends have been influenced by three primary factors:

1. the oil and gas industry
2. First Monday Trades Day
3. Dallas suburban expansion

2. PLANNING FOR FUTURE GROWTH

The City of Canton completed a comprehensive plan in 2004. It addressed land use, transportation, and population growth. This plan was used as a basis to project water demand, wastewater flows, and capital improvements for the purpose of developing impact fees. These two prior planning documents form the basis for the projections used in this report. The City constructed a 400 gpm water well near the dam of Mill Creek Lake in 2005. This well proved instrumental in seeing the City through the extended drought of 2006-07, especially when the only clarifier at the 20 year-old surface water treatment plant had to undergo extensive repairs. Research has begun to locate a site for another water well to meet short-term water needs.

D. FRESHWATER SOURCES

1. GROUND WATER

The major aquifers supplying all the public water for the study area are the Carrizo Formation and the Wilcox Group as shown on Exhibit 2. Even though they are separate aquifers, they are hydrologically interrelated. Therefore, they are often considered as one aquifer referred to as the Carrizo-Wilcox. The Carrizo aquifer

overlies the Wilcox aquifer. Exhibit 4 shows the location and technical data for all public wells in the area with capacities over 100 gpm. The public water supply wells in the study area produce from 60 to 400 gpm, with an average capacity per well of 186 gpm.

2. SURFACE WATER

a. CITY OF CANTON

The City of Canton owns a water supply reservoir known as Mill Creek Lake. Its location relative to the City limits is presented in Exhibit 5. The water rights certificate of adjudication for the reservoir is included as Exhibit 6. The technical data for the reservoir are as follows:

Year Constructed:	1975
Watershed Area:	6208 acres (9.7 sq. miles)
Surface Area at normal pool:	256 acres
Volume at normal pool:	5830 acre-feet
Yield:	1500 ac-ft/year

In addition to Mill Creek Reservoir, the City has 50 acre-feet per year available from the Old City Lake. However, the use of this small amount for water supply needs is not practical due to recreational uses and cost of access.

Note that the water rights certificate of adjudication shows a yield for the Mill Creek Reservoir of 1,500 acre-feet per year, but the Region D plan reduced the available yield to 706 acre-feet per year. The reason for this reduction is apparently based on recent water availability modeling results by the TCEQ.

b. UPPER NECHES RIVER MUNICIPAL WATER AUTHORITY

The UNRMWA maintains a total water right of 238,110 acre-feet/year for diversions from Lake Palestine and a downstream location at Rocky Point Dam. The UNRMWA operates these rights as a system. Available supply using the modified Neches WAM Run 3 is estimated at 222,200 acre-feet per year in year 2000, decreasing to 214,600 acre-feet per year by 2060. The Authority has existing water supply contracts with the cities of Dallas, Tyler and Palestine, and a small amount to other local water users.

Presently, the City of Dallas does not have transmission facilities to transport water from Lake Palestine. The city of Tyler recently completed a 30 mgd treatment and transmission facility from the lake, and is now using water from this source.

The City of Dallas is currently in the early planning stages of exploring alternatives to access its portion of the water in Lake Palestine. In a cooperative effort with the

Tarrant Regional Water District, alternative pipeline routes and cost-sharing options for delivering raw water from Lake Palestine, Cedar Creek Reservoir, and Richland – Chambers Reservoir to the Dallas/Fort Worth metroplex are being evaluated. Projections show that Dallas will need the additional water supply by 2015.

c. CITY OF TYLER

The City of Tyler supplies treated surface water from Lake Tyler, Lake Tyler East, and Lake Palestine to its customers. It also has 12 water wells to supplement its surface water supply. The City of Tyler currently has ample water supply and treatment capacity to supply Canton's long-term needs with treated water. In addition, it has 33,600 acre-feet per year from Lake Palestine and 2,200 acre-feet per year from Lake Bellwood possibly available for sale to Canton.

d. SABINE RIVER AUTHORITY (SRA)

SRA has a joint use permit for Lake Fork and Lake Tawakoni for a total permitted water supply of 426,760 acre-feet per year. The City of Dallas is SRA's largest single customer under contract for this water. Many other entities near the study region are also either under contract with or have submitted requests to SRA for use of this water. Current commitments and requests are tabulated in Exhibit 7. Note that the total quantity committed and requested exceeds the quantity available.

The SRA completed a study in 2008 regarding the reuse of Lake Tawakoni water. The project would involve pumping water from the Trinity River just downstream of the Dallas Southside Water Reclamation Facility to a constructed wetland in the Lake Tawakoni watershed. The study concluded that the water available from Lake Tawakoni could potentially be increased by 100,000 to 125,000 acre-feet per year. Of this amount, SRA would have 20%, or 20,000-25,000 acre-feet per year, available for the requests in Exhibit 7.

E. WATER TREATMENT FACILITIES

1. EXISTING FACILITIES

The City of Canton Water Treatment Plant was constructed in 1986. A new clarifier mechanism, new filter underdrains and media, electric operators on backwash valves, and air scour was added in 2006. All filter drain, backwash, and isolation valves are scheduled for replacement in 2009. The plant is rated for 2.17 MGD.

2. EXPANSION POTENTIAL

There is ample land available at the plant site to expand it to meet projected demands. However, the existing plant capacity exceeds the reservoir yield by more than 3:1. Therefore, if the reservoir yield could be increased by an additional supply

of raw water, the City could meet its long-term treated water needs without having to acquire additional land for a treatment plant.

F. WATER DISTRIBUTION SYSTEM

The existing distribution system including the locations of the water storage tanks and line sizes are presented in Exhibit 8. A distribution system computer analysis was recently performed to identify expansion needs and elevated storage tank locations. The analysis results are presented in a separate report.

III. POPULATION AND FLOW PROJECTIONS

A. POPULATION PROJECTIONS

A realistic and defensible long-term population projection for the City of Canton was developed in the 2004 Comprehensive Plan and the 2006 Impact Fee Program report. This projection resulted in an ultimate (year 2065) population for the City of Canton of 34,268. This is very different from the projection in the 2006 Region D Water Plan of 4,613 in 2060. However, the City can document a population in excess of 5,000 in 2007, a growth rate that is more in agreement with the 2004 Comprehensive Plan than the 2006 Region D Plan. This more accelerated population growth rate is further justified by the recent population growth rates experienced in nearby cities of Forney and Terrell, whose growth is being fueled by Dallas work force commuters.

The ultimate population projection was based on ultimate development within the Canton city limits and its ETJ. Therefore, some of the projected growth may actually occur outside the city limits. Surrounding Water Supply Corporations and neighboring cities would likely participate in any surface water supply project that Canton pursues to the benefit of the region.

B. PROJECTING WATER DEMAND NEED

The projected annual average water demand is 7.4 MGD or 8, 288 acre-feet per year, as shown in Exhibit 9. The existing Mill Creek Reservoir has an available water supply of 706 acre-feet per year. The two existing wells have a combined capacity of 580 gallons per minute (gpm). During peak demands, a water well cannot be expected to operate more than 12 hours per day to allow time for the ground water level to recover. Therefore, the water supply safe yield from a well is ½ its capacity, or 468 acre-feet per year for Canton. Due to the time required to develop and implement a surface water project, it is expected that the City will have to construct two additional wells at capacities of 400 gpm each to meet short-term system demands. This results in a long-term surface water need (shortage) of 6,468 acre-feet per year (or 5.78 MGD), as follows:

CITY OF CANTON
LONG-TERM WATER STUDY
SURFACE WATER SUPPLY

	MGD	Acre-Feet/Year
Ultimate Need	7.4	8,288
Available from Mill Creek Reservoir	0.63	706
Available from existing wells	0.42	468
Supplied by proposed wells	0.58	646
Surface water need	**5.78**	**6,468**

This projected need assumes the two existing wells will maintain their yield over time. If the yield of the existing water wells drop due to declining ground water tables, then the projected surface water need will be more than expected.

IV. IDENTIFICATION OF POTENTIAL RESERVOIR SITES

A. ALTERNATIVE RESERVOIR SITES

A total of five alternative reservoir sites, all within a seven mile radius of Canton, were initially identified as possibly appropriate water supply reservoir sites based on adequacy of drainage area and site topography for dam construction. Exhibit 10, Potential Van Zandt County Dam Sites, shows these five dam sites. Following preliminary evaluations, the two sites southwest of Canton were eliminated from further consideration due to lack of available water rights. These two sites are located in the Trinity River Basin above the existing Cedar Creek Reservoir which has rights to all available upstream flows during drought conditions. The remaining three potential dam sites consist of a site on Mill Creek approximately five miles north of Canton, a site on Grand Saline Creek approximately seven miles northeast of Canton and a site on Kickapoo Creek approximately seven miles southeast of Canton, as shown on Exhibit 10 and in more detail on Exhibit 14, Option C Map – Potential Reservoir Locations. Three optional dam sites on Grand Saline Creek were investigated and eliminated from further consideration based on excessive relocation costs for gas wells and pipelines.

The two remaining dam sites on Mill Creek and Kickapoo Creek were further evaluated to determine expected reservoir yield of each dam site based on reservoir yield computations using TWDB computer program RESOP III. Both of these dam sites were found capable of providing 5 to 6 million gallons per day (mgd) of firm yield (i.e., complete reservoir drawdown during the drought of record). However, due to the difference in drainage area of these two sites (41.7 square miles for the Mill Creek dam site and 21.6 square miles for the Kickapoo Creek dam site), the Mill Creek dam site will provide a reservoir which is full and

Kickapoo Creek dam site), the Mill Creek dam site will provide a reservoir which is full and spills more frequently than the Kickapoo Creek dam site. The RESOP III computer models show that, at a firm yield of 5 mgd, the Mill Creek reservoir site would experience reservoir spills (i.e., the lake water level rises to such a level that flow occurs through the spillway) in approximately 82% of the years of the 50-year record studied while the Kickapoo Creek reservoir site spills in only 32% of the years of the 50-year record. Also, the most recent TCEQ water availability data, as shown on Exhibit 11, indicates that availability of water rights is more favorable for the Mill Creek dam site in the Sabine River Basin than for the Kickapoo Creek dam site in the Neches River Basin. Based on these primary considerations of expected reservoir water levels and water rights availability, the Mill Creek site is considered the preferred dam site and was further examined for purposes of determining expected development costs.

B. PROPOSED MILL CREEK RESERVOIR SITE

The proposed Mill Creek Dam and Reservoir site is located in Van Zandt County approximately five miles north of Canton and immediately east of State Highway 19, as shown on Exhibits 10 and 14. The proposed Mill Creek Reservoir site is shown in more detail on Exhibit 15, Proposed Reservoir and Pipeline Map.

Mill Creek is a tributary of the Sabine River. Its watershed is generally undeveloped consisting primarily of farm and ranch land and forest but also includes Canton and adjacent developed areas. Mill Creek flows into the Sabine River about 10 miles north of the proposed reservoir site at a point approximately nine miles downstream of the Lake Tawakoni dam site.

The drainage area upstream of the proposed reservoir site covers approximately 26,700 acres (41.7 square miles). At the confluence of Mill Creek with the Sabine River, the drainage area controlled by the proposed reservoir represents approximately 0.7 percent of the drainage area of the Sabine River, and at the mouth of the Sabine River, it represents approximately 0.4 percent of the total drainage area.

The watershed above the proposed reservoir site is primarily pasture land and forest. A small portion of the watershed (~ 0.8 %) lies within the City of Canton. The existing City of Canton surface water supply is provided by a City reservoir, referred to as Mill Creek Reservoir, which is located approximately 1 mile southeast of Canton on Mill Creek. This existing reservoir controls an area of Mill Creek of approximately 8.9 square miles or approximately 21% of the total drainage area at the proposed dam site.

C. HISTORICAL MILL CREEK STREAMFLOWS AT PROPOSED DAM SITE

Historical streamflows of Mill Creek at the proposed dam site, with a drainage area of 41.7 square miles, were developed from runoff data of the Sabine River Basin provided by the TCEQ. This streamflow data was developed for the TCEQ Sabine River water availability computer model. The monthly runoff in acre-feet at the proposed Mill Creek

dam site was computed as follows: 1) the monthly runoff of the 601 square mile portion of the Sabine River Basin between the Sabine River near Mineola streamflow gage (USGS Gage 08018500) and the Sabine River near Wills Point streamflow gage (USGS Gage 08017410), which includes Mill Creek, was computed by subtracting the Wills Point gage flow from the Mineola gage flow and 2) to obtain the monthly runoff at the proposed Mill Creek dam site, the monthly runoff for the 601 square mile drainage area determined above was multiplied by a factor of 0.0546 which represents the 32.8 square mile portion of the 601 square mile drainage area which is downstream of the existing City of Canton Mill Creek Lake and upstream of the proposed Mill Creek Reservoir site. This is a conservative approach (estimates runoff on the low side) since the 8.9 square mile drainage area above the existing Mill Creek Lake is not considered to produce runoff at the proposed Mill Creek dam site (total drainage area of 41.7 square mile). The monthly runoff at the proposed Mill Creek dam site was developed for the 50-year historical period of 1949 through 1998.

D. FIRM YIELD COMPUTATION FOR PROPOSED DAM SITE

The firm yield for the proposed Mill Creek Reservoir site was computed using TWDB computer program RESOP III. The RESOP III computer model includes the following data:

1) monthly runoff in acre-feet for the 50-year period 1942 through 1998 as previously described,

2) monthly evaporation data developed from TWDB records for the period 1942 through 1998, and

3) reservoir elevation-area-storage data developed from USGS Quadrangle maps (scale of 1:24,000 with 10-feet contour interval).

Using the RESOP III computer model, the firm yield for the Mill Creek Reservoir site was computed for various normal pool elevations. The firm yield of the reservoir site varies from 3.1 mgd at normal pool elevation 420 feet msl to 6.5 mgd at normal pool elevation 435 feet msl. The firm yield is computed to be 5.7 mgd at normal pool elevation 432 feet msl which is approximately the water supply capacity desired.

E. PRELIMINARY DESIGN OF DAM AND SPILLWAYS

A preliminary dam and spillways design was developed for the proposed Mill Creek Reservoir to allow development of project construction costs. The earthen dam and spillways were sized in accordance with TCEQ document "Hydrologic and Hydraulic Guidelines for Dams in Texas" (TCEQ, January 2007). Corps of Engineers computer program HMR-52 was used to compute Probable Maximum Precipitation. Corps of Engineers computer program HEC-1 was used to compute the Probable Maximum Flood and rout this flood through the proposed reservoir and spillways. Exhibit 16, Proposed Dam Plan and Profile, shows the preliminary layout for the proposed dam and spillways.

Exhibit 17, Option C – Proposed Mill Creek Reservoir, shows an Opinion of Probable Cost for the proposed reservoir. Pertinent data for the preliminary design of the dam and spillways is as follows:

- reservoir normal pool elevation 432 feet msl, surface area 1,460 acres and conservation storage 18,911 acre-feet
- service spillway of reinforced concrete with 100 feet crest length at crest elevation 432 feet msl
- emergency spillway of vegetated earth with 1000 feet crest length at crest elevation 437 feet msl
- earthen dam with top-of-dam elevation 448 feet msl, approximately 2,400 feet crest length, 18 feet crest width, 3.5H:1V side slopes and maximum dam height approximately 50 feet

V. ENVIRONMENTAL CONSIDERATIONS

PBS&J was contracted by Gary Burton Engineering to perform a desktop assessment of the proposed sites for potential wetlands, threatened and endangered (T&E) species, and cultural resources. The following summarizes the results of the assessment:

PBS&J

An employee-owned company

September 30, 2008

Mr. Gary Burton
Gary Burton Engineering, Inc.
14531 State Hwy 155 South
Tyler, TX 75703-6745

Re: Desktop Assessment for Wetlands, Threatened and Endangered Species and Cultural Resources
City of Canton Environmental Lake Siting Analysis
Van Zandt County, Texas
PBS&J No. 100004523

Dear Mr. Burton:

The City of Canton is conducting an analysis of two sites for a proposed lake, Site 1 Mill Creek and Site 3 Kickapoo Creek. Each of the sites are located in Van Zandt County, Texas.

Introduction

PBS&J was contracted by Gary Burton Engineering to perform a desktop assessment of the proposed sites for potential wetlands, threatened and endangered (T&E) species, and cultural resources. Maps of each of these sites were provided to PBS&J by Gary Burton Engineering.

The purpose of the desktop assessment was to:

- Evaluate the potential for waters of the United States (including wetlands) to occur within the footprint of each proposed site that may be subject to the Fort Worth District of the U.S. Army Corps of Engineers (USACE), pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;

- Evaluate the potential for high probability areas for cultural resource locations. Additionally, a Texas Archeological Research Laboratory (TARL) review was conducted to identify known cultural locations within the vicinity of each site; and

- Interpret Texas Parks and Wildlife Department's (TPWD) National Diversity Database (NDD) for known T&E and rare species within the vicinity of each site, which are protected under the Endangered Species Act.

Waters of the United States

Site 1 Mill Creek

As identified on available maps provided by Mr. Burton, Site 1 will impact Mill Creek, Mustang Creek, Caney Creek, Sandy Creek and their associated tributaries. In addition, aerial photographic interpretation indicates there are forested and emergent wetlands adjacent to these water bodies that

are associated primarily with the floodplains of these streams. At least fifty percent of Site 1 has the potential to contain wetland communities.

Mill Creek, Mustang Creek, Caney Creek, Sandy Creek and their associated tributaries identified on available maps are considered waters of the United States, as defined in Chapter 33 of the Code of Federal Regulations Part 328.3(a) and are subject to jurisdiction of the USACE. Therefore, coordination with the USACE would be necessary to obtain a Clean Water Act, Section 404 permit if this site were chosen as the preferred alternative.

Site 3 Kickapoo Creek

As identified on available maps provided by Mr. Burton, Site 3 will impact Kickapoo Creek, Sand Branch and their associated tributaries. Aerial photographic interpretation indicates there may be some forested and emergent wetlands adjacent to these water bodies that are associated primarily with the floodplains of these streams. Site 3 has the potential to contain wetland communities but in limited amounts compared to Site 1.

Kickapoo Creek and Sand Branch and their associated tributaries identified on available maps are considered waters of the United States, as defined in Chapter 33 of the Code of Federal Regulations Part 328.3(a) and are subject to jurisdiction of the USACE. Therefore, coordination with the USACE would be necessary to obtain a Clean Water Act, Section 404 permit if this site were chosen as the preferred alternative.

Cultural Resources

According to the TARL database, the majority of the Sites 1 and 3 have been identified as having a high probability for containing previously unrecorded archaeological sites. However, there are no known sites located within either of the sites.

However, based on the lack of information for the project area, an on-the-ground survey of the high probability areas (HPA's) throughout the sites would need to occur to determine resources either of the sites.

Threatened and Endangered Species

According to Dorinda Scott of TPWD, there is no information from the NDD review available for the USGS quadrangle that the project corridor crosses. However, this does not mean there is an absence of occurrence for Threatened, Endangered, and Rare species within the project area.

According to Dorinda Scott of the TPWD, there is little public information data in the area of Sites 1 and 3 concerning threatened and endangered species and their habitats. The lack of data does not imply lack of occurrence, but simply lack of knowledge or possibly access.

Native prairie remnants and bottomland hardwood communities within the vicinity of Sites 1 and 3 were noted as a result of the NDD review. While neither natural community type has any legal protection, they both are important ecosystems that have declined. The native prairie remnants are very rare native grasslands and grassland habitat identified from native hay meadows to highway, railroad, and other rights-of-way. The bottomland hardwood communities serve as habitat, migration corridors, and even water management during flooding events.

Based on the TPWD annotated county list of rare species for Van Zandt County, there is the potential for the project area to contain T&E species and their respective critical habitat(s), especially the species listed in Table 1.

Table 1, Threatened & Endangered Species Potentially Occurring Within Project Area According to the NDD File Review for Van Zandt County, Texas

Common Name	Scientific Name	Status[s]	
		Federal	State
American Peregrine Falcon	*Falco peregrinus anatum*	DL	E
Artic Peregrine Falcon	*Falco peregrinus tundrius*	DL	T
Bachman's Sparrow	*Aimophila aestivalis*	--	T
Bald Eagle	*Haliaeetus leucocephalus*	DL	T
Henslow's Sparrow	*Ammodramus henslowii*	--	--
Interior Least Tern	*Sterna antillarum athalassos*	LE	E
Peregrine Falcon	*Falco peregrinus*	DL	E T
Piping Plover	*Charadrius melodus*	LT	T
Wood Stork	*Mycteria americana*	--	T
Creek chubsucker	*Erimyzon oblongus*	--	T
Ironcolor shiner	*Notropis chalybaeus*	--	--
Orangebelly darter	*Etheostoma radiosum*	--	--
Paddlefish	*Polyodon spathula*	--	T
Western sand darter	*Ammocrypta clara*	--	--
Black bear	*Ursus americanus*	T/SA; NL	T
Plains spotted skunk	*Spilogale putorius interrupta*	--	--
Red wolf	*Canis rufus*	LE	E
Southeastern myotis bat	*Myotis austroriparius*	--	--
Creeper (squawfoot)	*Strophitus undulatus*	--	--
Fawnsfoot	*Truncilla donaciformis*	--	--

Common Name	Scientific Name	Status[5]	
		Federal	State
Little spectaclecase	*Villosa lienosa*	--	--
Louisiana pigtoe	*Pleurobema riddellii*	--	--
Pistolgrip	*Tritogonia verrucosa*	--	--
Rock pocketbook	*Arcidens confragosus*	--	--
Sandbank pocketbook	*Lampsilis satura*	--	--
Southern hickorynut	*Obovaria jacksoniana*	--	--
Texas heelsplitter	*Potamilus amphichaenus*	--	--
Texas pigtoe	*Fusconaia askewi*	--	--
Wabash pigtoe	*Fusconaia flava*	--	--
Wartyback	*Quadrula nodulata*	--	--
Alligator snapping turtle	*Macrochelys temminckii*	--	T
Northen scarlet snake	*Cemophora coccinea copei*	--	T
Sabine map turtle	*Graptemys ouachitensis sabinensis*	--	T
Texas horned lizard	*Phrynosoma cornutum*	--	T
Timber rattlesnake	*Crotalus horridus*	--	T
Carrizo leather flower	*Clematis carrizoensis*	--	--
Chapman's yellow-eyed grass	*Xyris chapmanii*	--	--
Rough-stem aster	*Symphyotrichum puniceum var scabricaule*	--	--
Small-headed pipewort	*Eriocaulon koernickianum*	--	--

T = Threatened;
LE = Federally Listed Endangered;
E = State Listed Endangered;
LE-PDL = Federally Listed Endangered/Proposed for Delisting;
T/SA = Federally Listed Endangered/Threatened by Similarity of Appearance
DL = Federally Delisted
NL = Not listed
Source: Texas Parks and Wildlife Department, Annotated County List of Rare Species, Van Zandt County, Texas, (2008).

Conclusion

This investigation is considered sufficient in detail and scope to form a reasonable basis for the observations and conclusions presented herein as an initial desktop assessment.

Thank you for allowing PBS&J to assist with this project. If there are questions or comments, please contact me at (817) 372-0100 or blsmart@pbsj.com.

Sincerely,

PBSJ

Brandy Smart
Sr. Project Manager

cc: File

VI. SURFACE WATER ALTERNATIVES

A. INTRODUCTION

Van Zandt County is on the western boundary of Texas Water Planning Region D. It is bordered by Region C and I. As shown on Exhibit 3, Canton is located in relatively close proximity to four (4) major water supply reservoirs:

- Lake Tawakoni
- Lake Fork
- Lake Palestine
- Cedar Creek Lake

This geographical setting formed the basis for development of the potential alternatives to consider.

B. DETERMINING WATER DEMAND

The projected ultimate demand for the City of Canton as presented in Section III is 5.78 MGD. This is an annual average demand and is appropriate to use for reservoir sizing and calculating the cost to purchase raw or treated water. However, for the purpose of sizing treatment facilities and pipelines for development of capital costs, the following adjustments to the demand rate were applied:

Alternative/Item	*Demand Type*	*Factor*	*Design Flowrate (MGD)*
Raw Water	Maximum Month	1.25	7.23
Treated Water	Maximum Day	1.70	9.83
Reservoir Intake	Annual Average	1.0	5.78
Treatment Plant	Maximum Day	1.70	9.83

C. RESERVOIR SITE SELECTION

As discussed in Section IV, five (5) reservoir sites were considered. The five sites were reduced to three. Of the three, one emerged as the most feasible based on a number of considerations. Development of a reservoir in phases would not be economically attractive for this size project.

Reservoir sites are typically selected based on the following criteria:

- proximity to water demand location
- potential tributary drainage area
- close proximity of two elevated land masses on each side of the waterway
- minimal obstacles to development (pipelines, utilities, roadways, structures, etc.)

Each of these criteria prove favorable for the proposed location, which is approximately 3 miles north of the City of Canton as shown on Exhibit 15.

As discussed in Section I, the projected City of Canton annual average daily water demand needed to supplement current and future ground and surface water sources is 5.78 MGD or 6,468 acre-feet per year in 2066. Therefore, the proposed reservoir, with a firm yield of 6,400 acre-feet per year or 5.70 MGD will come very close to satisfying the ultimate need.

D. TREATMENT PLANT EXPANSION

The raw water quality in the proposed reservoir is expected to be typical of East Texas surface water, with the following characteristics:

- low alkalinity
- low hardness
- neutral pH
- variable turbidity (depending on rainfall)
- susceptible to seasonal "turnover" and stratification
- potential for presence of iron and manganese
- organic color due to decaying detritus
- presence of trihalomethane precursors
- potential for tastes and odors

Water softening treatment should not be necessary. Lime and/or caustic addition will be required for alkalinity addition and pH-adjustment. The intake structure should include provisions for varying the intake level to assist in treatment for turbidity, manganese, tastes, and odors. Chemical addition should also be provided at the intake for taste and odor control and to aid in coagulation. Color, turbidity, and iron can be effectively removed with alum as the primary treatment chemical. Short detention time for sedimentation should be avoided due to raw water quality variability. Manganese can be effectively removed by pH-adjustment ahead of dual media filters. Activated carbon should be available for seasonal use to treat for taste and odor. Trihalomethane formation can be avoided by chloramine disinfection. Newer technologies such as ozonation and membrane filtration should be investigated for possible long-term cost savings. Provisions for disposal of residuals and filter backwash water must be included. Demineralization processes such as reverse osmosis or ion exchange will not be required. A "conventional" surface water treatment plant with alum coagulation, and flocculation, 6-hour detention time sedimentation, dual media filtration, and sufficient clearwell storage to meet disinfectant contact time requirements was selected as the preferred treatment alternative upon which to base opinions of probable costs.

The existing plant is rated for 2.17 MGD, and the ultimate capacity needed is 9.83 MGD. For cost comparison purposes, the ultimate condition was used for all alternatives. Actually, the plant would probably be expanded in four phases over the next 40 years. Of course, for the "Purchase Treated Water" alternative, there would be no need for plant expansion.

E. OPTION A – PURCHASE TREATED WATER

The City of Tyler currently has surface water rights for 40,325 acre-feet per year (36 MGD) in Lake Tyler and Lake Tyler East. The City also has surface water rights for up to 67,200 acre-feet per year (60 MGD) from the Upper Neches River Municipal Water Authority which owns Lake Palestine. In addition to its surface water sources, the City of Tyler has 12 water wells with a total capacity of 11.1 MGD. These three sources amount to an available water supply capacity of 107.1 MGD or 119,957 acre-feet per year. The City's current use averages only 18 MGD, with peak demands of up to 36 MGD.

The possibility of delivering treated water at a rate of up to 5.78 MGD was discussed with the City of Tyler mayor and staff. A water purchase contract between the City of Tyler and potential wholesale customers was provided for this study. The purchase contract is very reasonable and fair. Its terms and conditions were used in the alternative cost comparisons presented in Section VII.

F. OPTION B – PURCHASE RAW WATER

Contact was made with representatives from Water Planning Regions D, C, and I to identify opportunities for purchasing or acquiring existing water rights from existing reservoirs and planned projects. Three possible opportunities emerged:

1. Lake Bellwood
   Due to the closure of the Kelly Springfield tire plant, the City of Tyler has a 2.0 MGD water right in Lake Bellwood. City of Tyler officials stated this water could possibly be made available to the City of Canton. However, since the amount was much less than Canton's long-term need, this option was not included as a feasible alternative.
2. Lake Palestine
   The UNRMWA has approximately 25,000 acre-feet per year unappropriated in Lake Palestine. The City of Dallas and the Tarrant Regional Water District have teamed to perform a feasibility study of a raw water pipeline system to transfer water from Lake Palestine to Cedar Creek Lake and from Cedar Creek Lake to the DFW metroplex lake system. Different pipeline routes are being evaluated, but the northern route would present an opportunity for Canton to possibly transfer raw water from Lake Palestine to Canton's existing Mill Creek Reservoir in a cooperative arrangement with UNRMWA / Dallas / TRWD. This option

has the potential to be a least-cost, long-term raw water purchase option for Canton. Therefore, it was included in this study as a feasible alternative to compare with the other two. However, this option will only be feasible if all three (3) of the following contingencies occur:

1) Willingness of UNRMWA Board to Enter Long-Term Water Contract
2) Willingness of Dallas and TRWD to Cooperate With Canton
3) Selection of the Northern Route

VII. OVERALL EVALUATION AND RECOMMENDATIONS
A. EVALUATION OF ALTERNATIVE SCENARIOS

1. ALTERNATIVE A – Purchase Treated Water

This alternative would supply treated water to the City of Canton by construction of a pump station and metering station near the City of Tyler's Noonday Road WTP. Also, a 39-mile treated water transmission pipeline would be needed from the pump station to a ground storage facility at the City of Canton's WTP. Only one pump station would be needed. Proposed improvements are shown in Exhibit 12, and associated costs are presented in Exhibit 17.

The pump station and proposed 30-inch diameter transmission main were sized for the ultimate maximum day demand of 9.83 MGD. Although the pipeline could be built in phases to reduce debt service costs, it would take two 24-inch lines or three 18-inch lines to provide the needed ultimate capacity. Basing the cost on a single 30-inch line was appropriate to achieve an equitable comparison with Alternatives B and C.

With this alternative, expansion of the existing treatment plant would not be necessary. The environmental impact would be only that associated with construction of the pipelines. In addition to debt service and O&M costs, this alternative has the additional cost component of purchase price of treated water.

2. ALTERNATIVE B – Purchase Raw Water

This alternative would supply untreated water to the City of Canton's existing reservoir by construction of a pump station and metering station near the proposed Dallas/TRWD pipeline north of Athens (assuming the northern route is selected). Also, a 20-mile raw water transmission pipeline would be needed from the pump station along Highway 19 to the nearest tributary to the reservoir. Only one pump station would be needed. Proposed improvements are shown in Exhibit 13, and associated costs are presented in Exhibit 17.

The pump station and proposed 24-inch diameter transmission main were sized for the ultimate maximum month average demand of 7.23 MGD. If built in phases to reduce debt service costs, it would take two 18-inch lines or three 14-inch lines to provide the needed ultimate capacity. Expansion of the treatment plant from 2.17 to 9.83 MGD would be needed. This would likely be accomplished in four phases over the next 40 years. Basing the cost on a single 24-inch line and a single plant expansion was appropriate to achieve an equitable comparison with Alternatives A and C.

With this alternative, the environmental impact would probably be less than for Alternative A due to the shorter length of pipeline. In addition to debt service and O&M costs, this alternative has the additional cost component of purchase price of raw or untreated water.

3. ALTERNATIVE C – Mill Creek Reservoir

This alternative would supply raw water to the City of Canton's existing reservoir by construction of the proposed reservoir downstream on Mill Creek, with an intake structure and 9.2-mile pipeline. Proposed improvements are shown in Exhibits 15 and 16 and associated costs are presented in Exhibit 17. The intake would have a capacity of 7.23 MGD to coincide with the maximum month ultimate need.

The proposed reservoir would have a 41.7 square mile drainage area. The proposed dam location would offer the opportunity to capture and reuse the City's WWTP effluent, resulting in an increased yield. [Note: The City has a pending application with TCEQ for securing a water right for these return flows.]

With this alternative, the environment would be impacted to a greater degree than with the other alternatives. A desktop assessment of potential environmental concerns was performed for this study. It is presented in Section V. The potential issues identified are typical ones encountered with reservoir construction. They are:

- Wetlands
- Section 404 permitting
- Archaeological sites
- Threatened and endangered species habitat

The yield of the reservoir would be sufficient to meet the needs of the City of Canton well into the future and might serve to enhance the economic diversity being sought for the region. This alternative presents the greatest risk due to unforeseen cost factors associated with State and Federal permitting, environmental mitigation, cultural resources, land acquisition, and potential for litigation.

4. COST COMPARISONS OF ALTERNATIVES

Opinions of probable costs for the three alternatives, including capital, operation and maintenance components, are presented in Exhibits 17 and 18. These costs for all three alternatives would be in addition to the current costs being experienced. The existing water wells, treatment plant, tanks, pumping facilities, and distribution systems would still need to be operated and maintained.

B. CONCLUSIONS

The least cost alternative for meeting the long-term water supply needs of the City of Canton is the construction of a new reservoir with intake pump station and pipeline. Although it has a higher capital cost and higher operation and maintenance costs than the other two alternatives, it has a lower overall cost due to not having to pay for the water. Of the other two alternatives, the overall cost to purchase treated water is more than the cost to purchase untreated water and expand the water treatment plant.

Potential environmental impacts of Alternatives A and B were not assessed. There could be significant environmental impacts associated with any of the pipeline projects. However, Alternative C will probably present the most significant impact. However, it is anticipated that any environmental impacts would be adequately mitigated. An allowance of $1 million is included in the opinion of probable cost for environmental mitigation.

C. RECOMMENDATIONS

For the purpose of domestic water supply to meet the population growth needs of the City of Canton and the region, it is recommended that a new reservoir be constructed on Mill Creek, downstream of the existing reservoir in the Sabine River Basin The first step is to prepare and submit a water right permit application to TCEQ to establish a priority date. It is not unusual for a reservoir project to take 10-20 years to complete. Therefore, in order to meet projected water needs during this process, it is recommended that the City plan and budget for constructing 2 or 3 additional water wells. A proposed location and opinion of probable cost for the next well is presented in Exhibit 19. The number and locations of additional wells will depend on the capacities obtained.

VIII. INSTITUTIONAL AND FUNDING CONSIDERATIONS

A. INSTITUTIONAL CONSIDERATIONS

1. RIGHT OF WAY AND LAND ACQUISITION

Right of Way and land required for the alternative projects can be acquired by all of the owner/operator options being considered. There are no jurisdictional conflicts with the reservoir site or pipeline routes. Land acquisition will pose no developmental problems for any of the alternatives.

2. WATER RIGHTS

There are no senior water right holders adversely affecting the proposed reservoir. There is no jurisdiction affecting ground water in the project area. Water provided by third parties may have trans basin (interbasin transfer) considerations or other legal impediments to providing service.

3. ISSUES RELATING TO OWNERSHIP AND MANAGEMENT OF THE SELECTED PROJECT ON A REGIONAL LEVEL

Should the City of Canton decide to pursue the Mill Creek Reservoir project on a regional level, a variety of entities, including political subdivisions and non-profit corporations, could be considered for utilization within the project area.

a. City

A City has all necessary authority to act as project sponsor and owner and to be a regional provider of treated and/or untreated water to project participants and other contracting entities. A sponsoring city should have a favorable bond rating and be in sound financial condition in order to minimize interest rates. If water is purchased from an existing surface supply, this option would offer fewer advantages when compared with the other options. Financing options would be more limited than found in option b. Other project participants would have limited input regarding project management.

b. Water District

A Water District created under Chapter 51 of the Texas Water Code and Article XVI, Section 59 of the Texas Constitution has all the powers and authority described in option a. above. This type of conservation and reclamation district has other broad authority to provide regional services. This type of district would have the most alternatives for financing of a project. This type of district could issue tax supported bonds and levy maintenance taxation with voter approval. Representation of the board of directors could be crafted to reflect equity of participating entities. This type of district would have the broadest authority available and could provide full service, operation and maintenance for all alternatives being considered in this study.

c. Special Utility District (SUD)

A SUD created by converting an existing Water Supply Corporation (WSC) could be used as project sponsor and owner. A SUD's powers and authority are almost as broad as a WCID. The principal, and most significant, difference is that a SUD

is prevented by law from levying ad valorem taxes or accepting revenue from other entities derived from taxation.

d. Water Supply Corporation

One of the existing Water Supply Corporations, or a newly organized WSC, could serve as project sponsor and owner. The powers, authority and financing options would be more limited than any of the options discussed above. A WSC is not a tax exempt entity and does not have access to some of the subsidized loan programs available to the cities and districts.

e. River Authority

With virtually all of the proposed service area being in the Sabine River basin the Sabine River Authority (SRA) could sponsor and own a regional project. Financing options would be more limited, and local control of the project might be jeopardized under this option.

f. Other

Other cities and districts providing service, such as the City of Tyler or the Upper Neches River MWA, can also provide service, sponsor, and own a regional system. Service from their existing projects would also require authorization for trans basin diversion. Local control would be sacrificed under this option. Financing options would also be more limited.

4. INTER-GOVERNMENTAL CONTRACTING METHODS

All of the owner/operator options presented above could be used for some or all of the alternatives being studied. The most preferred contracting option is a water purchase agreement and contract pledging revenue for debt service and operation and maintenance of the project(s). A "take or pay" contract can fully finance a project with revenues derived from rate payers. There are few if any limitations for contracting on any of the potential project participants.

5. REGIONAL WATER SUPPLY IMPLICATIONS

The principal benefit to be realized by a regional project is the shared cost of development. Lower unit costs should be realized through regional development and supply. More favorable treatment by regulatory authorities is also likely. Financing options are greater, and more favorable terms may be available. The State of Texas encourages cities, districts, and other utilities to develop regional solutions whenever and wherever possible.

B. FUNDING CONSIDERATIONS

Depending on the ownership and management option selected, the project could be funded by long-term debt secured by customer water rates, ad valorem taxes, or a combination of the two sources. Revenues secured from the levy of a tax supporting a general obligation issue can have the least effect on water rates.

If the Chapter 51 water district project owner and sponsor is selected, the participants will have available the passage of a general obligation bond issue or a combination general obligation/revenue issue. This will require voter approval but should result in the most favorable rating of bonds. Other funding programs, including those available through the Texas Water Development Board, for certain components of the preferred alternative may be available.

A pure revenue bond issue can be used to finance the project with or without participation by a third party (i.e., Texas Water Development Board or others). This option will result, most probably, in greater debt service cost to the participants. This option may be preferred if taxation, or the potential for taxation, is determined not to be viable.

Water purchase agreements with third party service providers can also finance a project without the issue of debt by the participants. Overall increase in cost and lack of control over water rates are issues of concern for this option.

IX. LIST OF EXHIBITS

Exhibit No.	Exhibit Description
1	Average Monthly Precipitation vs. Average Monthly Gross Lake Surface Evaporation Rate
2	Major and Minor Aquifers of Texas
3	Existing Regional Reservoirs
4	Existing Public Water Wells
5	Canton Reservoirs
6	Canton Certificate of Adjudication
7	Requests for Water in the Upper Sabine Basin
8	Canton Water Distribution System
9	Projected Water Demand
10	Potential Van Zandt County Dam Sites
11	TCEQ Water Availability Modeling Maps
12	Option A Map - Purchase Treated Water From Tyler
13	Option B Map - Purchase Raw Water
14	Option C Map - Potential Reservoir Locations
15	Proposed Reservoir and Pipeline Map
16	Proposed Dam Plan and Profile
17	Opinions of Probable Cost
18	Cost Comparison of Options
19	Proposed New Well Location Map and Opinion of Probable Cost

Exhibit 1
Average Monthly Precipitation
vs.
Average Monthly Gross Lake Surface Evaporation Rate

AVERAGE MONTHLY PRECIPITATION VS AVERAGE MONTHLY GROSS LAKE SURFACE EVAPORATION RATE 1950-1979

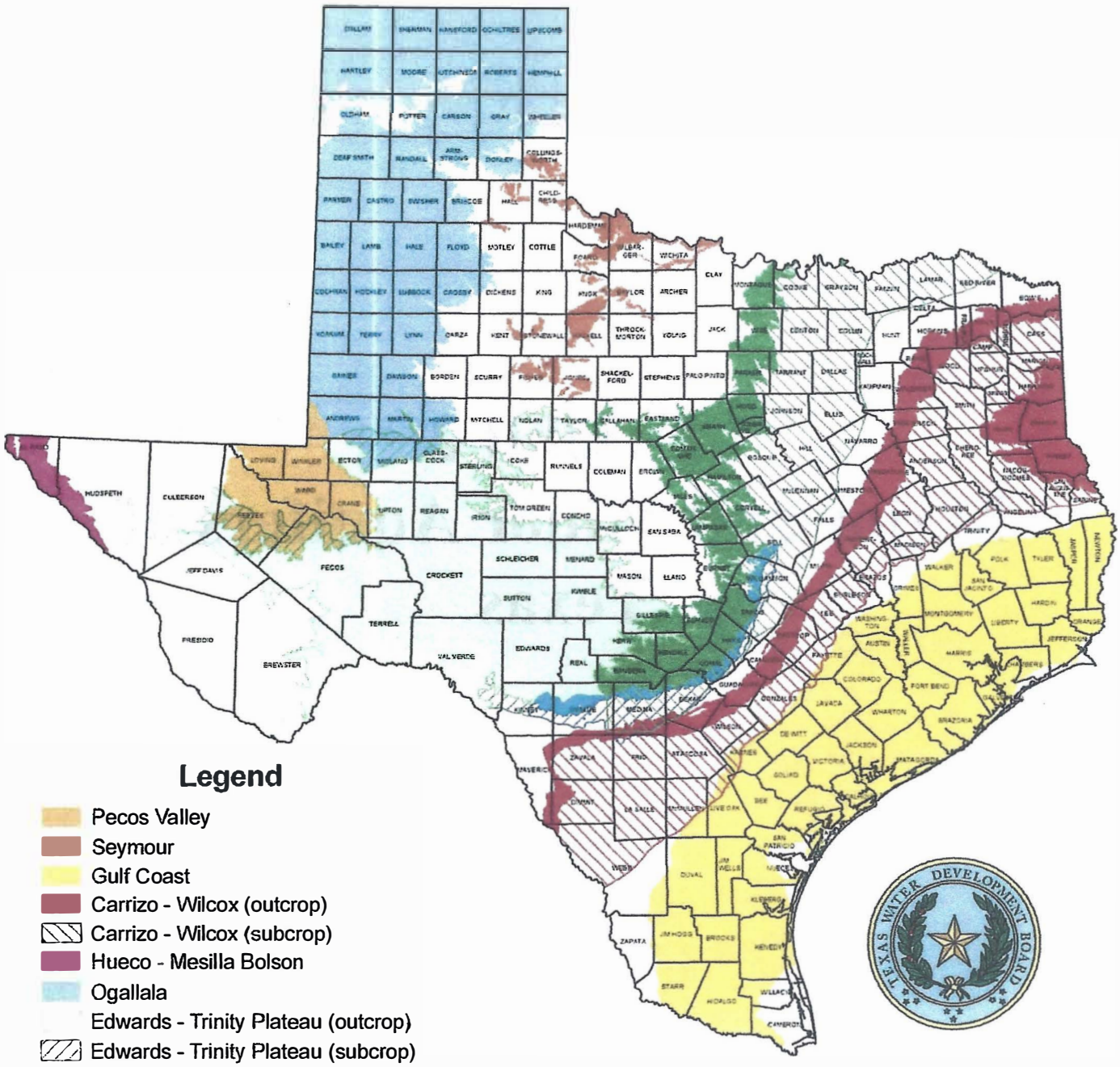
EXHIBIT 1

MONTHS	PRECIPITATION (INCHES)	EVAPORATION (INCHES)
January	3.0	2.0
February	3.2	2.1
March	3.5	2.9
April	5.9	3.2
May	5.8	4.1
June	3.7	5.1
July	2.2	6.5
August	2.0	6.9
September	3.2	5.7
October	3.6	4.7
November	3.8	3.5
December	3.5	2.2

Source: Texas Department of Water Resources, "Climatic Atlas of Texas", December 1983.

Exhibit 2
Major and Minor Aquifers of Texas

Major Aquifers of Texas



Legend

- Pecos Valley
- Seymour
- Gulf Coast
- Carrizo - Wilcox (outcrop)
- Carrizo - Wilcox (subcrop)
- Hueco - Mesilla Bolson
- Ogallala
- Edwards - Trinity Plateau (outcrop)
- Edwards - Trinity Plateau (subcrop)
- Edwards BFZ (outcrop)
- Edwards BFZ (subcrop)
- Trinity (outcrop)
- Trinity (subcrop)

NOTE: Chronology by Geologic age.

OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)

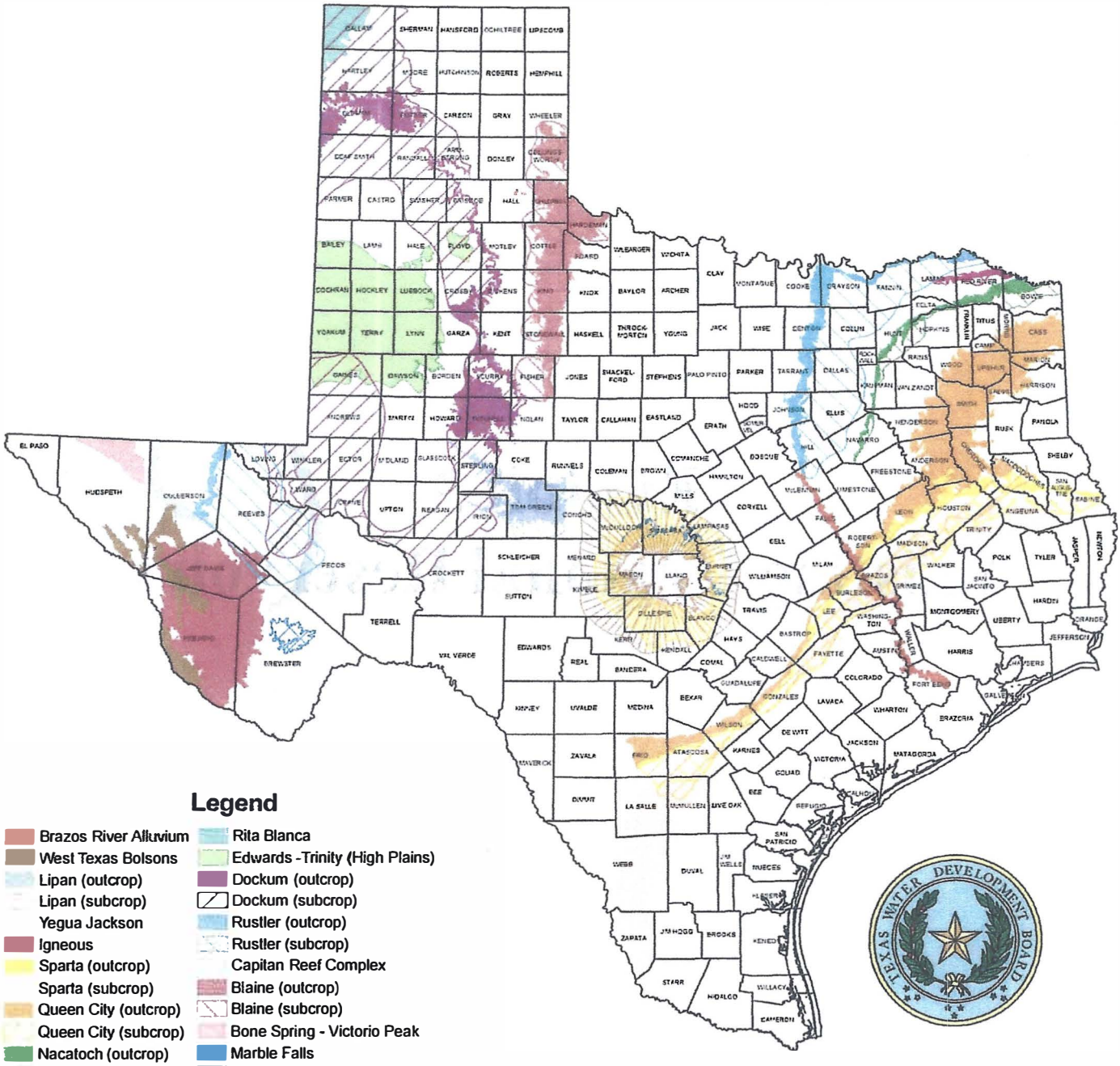
N
W E
S

0 25 50 100 150 200 Miles

DISCLAIMER
This map was generated by the Texas Water Development Board using GIS (Geographic Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate.

Map updated December 2006 by Mark Hayes, GISP

Minor Aquifers of Texas



Legend

- Brazos River Alluvium
- West Texas Bolsons
- Lipan (outcrop)
- Lipan (subcrop)
- Yegua Jackson
- Igneous
- Sparta (outcrop)
- Sparta (subcrop)
- Queen City (outcrop)
- Queen City (subcrop)
- Nacatoch (outcrop)
- Nacatoch (subcrop)
- Blossom (outcrop)
- Blossom (subcrop)
- Woodbine (outcrop)
- Woodbine (subcrop)
- Rita Blanca
- Edwards -Trinity (High Plains)
- Dockum (outcrop)
- Dockum (subcrop)
- Rustler (outcrop)
- Rustler (subcrop)
- Capitan Reef Complex
- Blaine (outcrop)
- Blaine (subcrop)
- Bone Spring - Victorio Peak
- Marble Falls
- Marathon
- Ellenburger - San Saba (outcrop)
- Ellenburger - San Saba (subcrop)
- Hickory (outcrop)
- Hickory (subcrop)

NOTE: Chronology by Geologic age.

OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)

N W E S

0 50 100 150 200 Miles

TEXAS WATER DEVELOPMENT BOARD

DISCLAIMER
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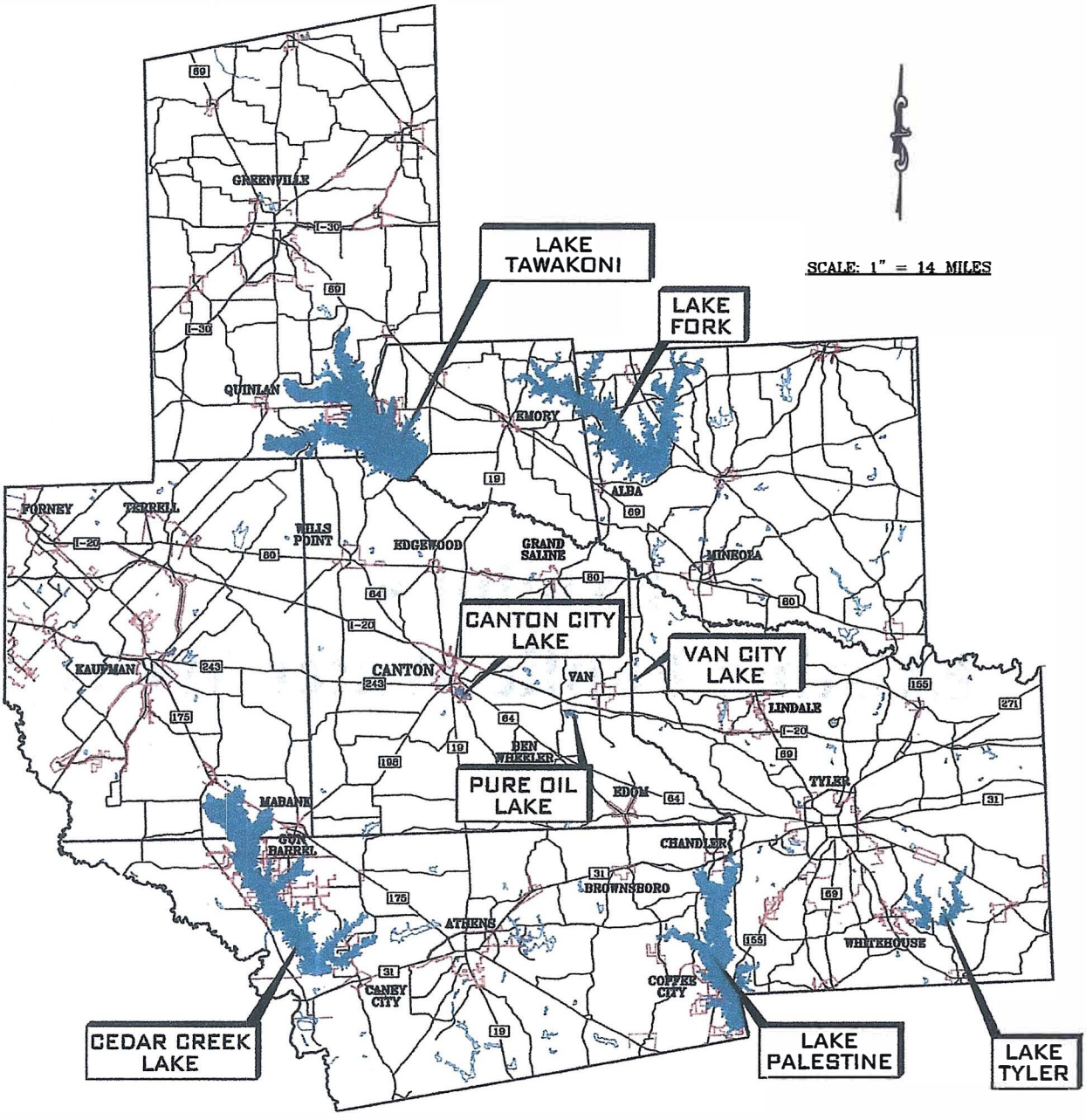
Map updated December 2006 by Mark Hayes, GISP

Exhibit 3
Existing Regional Reservoirs



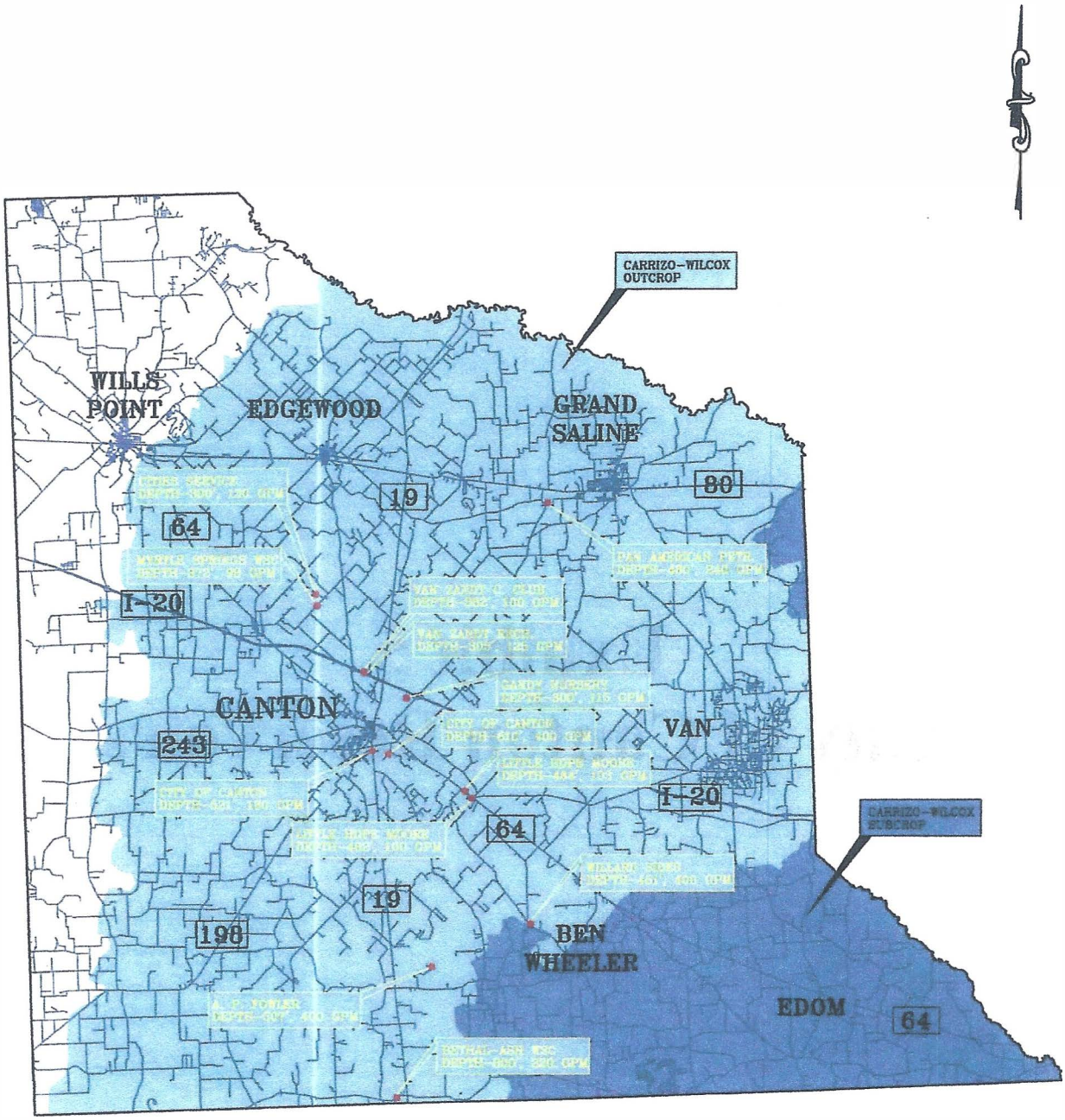
REGIONAL WATER MAP

BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj No. 014080101 Sht. No. EX 3	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, P.E. TEXAS P.E. NO. 56643 DATE: 01/13/09	**VAN ZANDT COUNTY** **LONG-TERM WATER SUPPLY STUDY**	**GARY BURTON ENGINEERING, INC.** CONSULTING – PLANNING – PERMITTING – DESIGN – MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6984 FAX (903) 561-6757

Exhibit 4
Existing Public Water Wells



WATER WELL LOCATION MAP

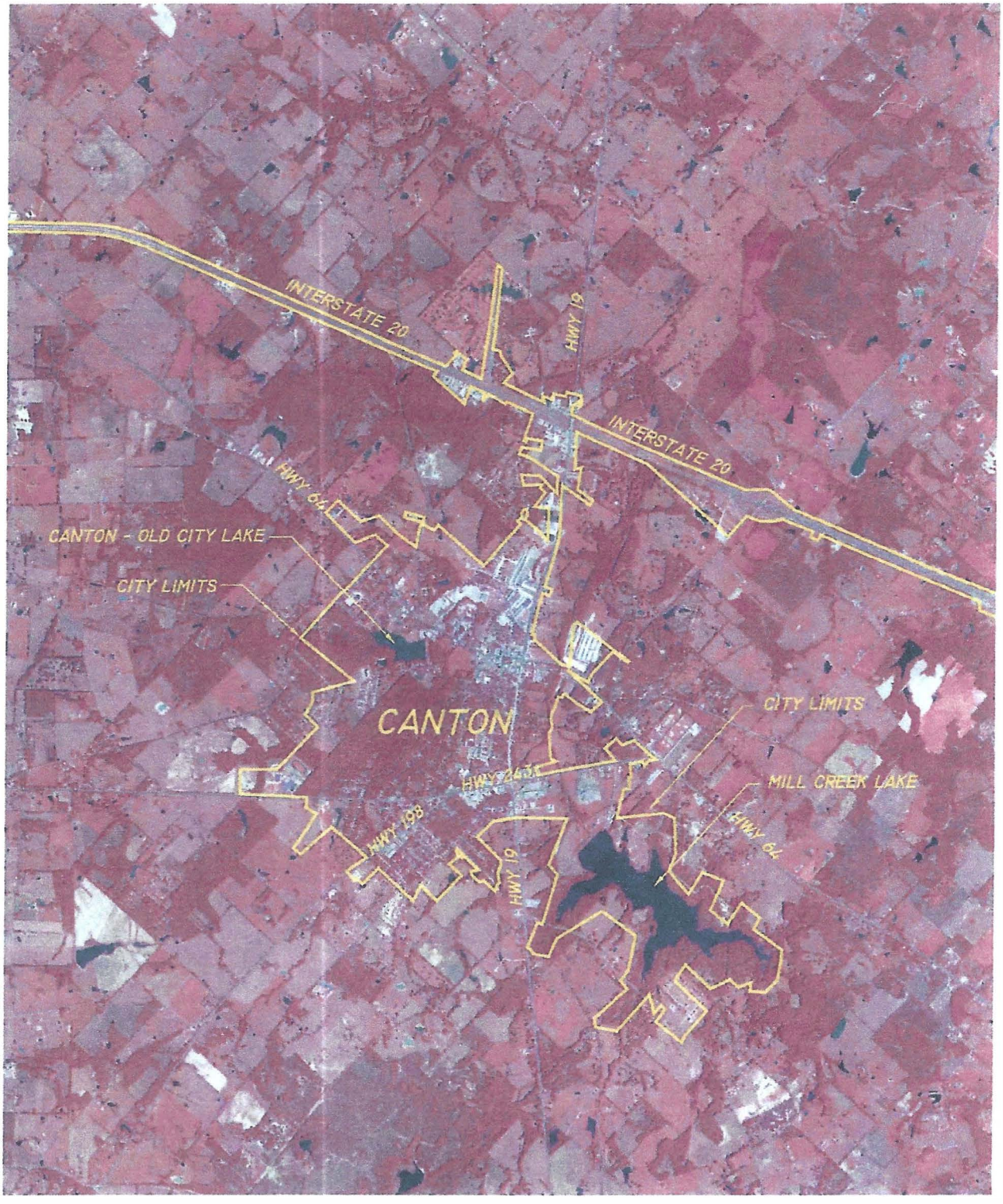
SCALE: 1" = 30,000'

BAR IS ONE INCH IN LENGTH
ON ORIGINAL DRAWING. CHECK
SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj. No. 014080101 Sht. No. EX 4	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, III TEXAS P.E. NO. 56643 DATE: 01/13/09	VAN ZANDT COUNTY LONG–TERM WATER SUPPLY STUDY	GARY BURTON ENGINEERING, INC. CONSULTING – PLANNING – PERMITTING – DESIGN – MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6984 FAX (903) 561-6757

Exhibit 5
City of Canton Reservoirs



CITY OF CANTON – EXISTING LAKES

SCALE : 1" = 5000'

BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj. No. 014080101 SHT. No. EX 5	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, III TEXAS P.E. NO. 56643 DATE: 01/13/09	**VAN ZANDT COUNTY** **LONG-TERM WATER SUPPLY STUDY**	**GARY BURTON ENGINEERING, INC.** CONSULTING – PLANNING – PERMITTING – DESIGN – MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6984 FAX (903) 561-6757

Exhibit 6
Canton Certificate of Adjudication

CERTIFICATE OF ADJUDICATION

CERTIFICATE OF ADJUDICATION: 05-4675

OWNER: City of Canton
P. O. Box 245
Canton, Texas 75103

COUNTY: Van Zandt

PRIORITY DATES: April 19, 1954 and
January 5, 1970

WATERCOURSE: Mill Creek, tributary of the Sabine River

BASIN: Sabine River

WHEREAS, by final decree of the 188th Judicial District Court of Gregg County, in Cause No. 86-255-A; In Re: The Adjudication of Water Rights in the Upper Sabine River Segment of the Sabine River Basin dated June 9, 1986, a right was recognized under Permit 1712 and Permit 2529A authorizing the City of Canton to appropriate waters of the State of Texas as set forth below;

NOW, THEREFORE, this certificate of adjudication to appropriate waters of the State of Texas in the Sabine River Basin is issued to the City of Canton, subject to the following terms and conditions:

1. IMPOUNDMENT

Owner is authorized to maintain an existing dam and reservoir on Mill Creek and impound therein not to exceed 2261 acre-feet of water. The dam is located in the James Douthit Survey, Abstract 198, Van Zandt County, Texas.

2. USE

Owner is authorized to divert and use not to exceed 1550 acre-feet of water per annum from the aforesaid reservoir and from Mill Creek for municipal purposes.

3. DIVERSION

A. Location:

(1) At a point on Mill Creek in the J. Stockwell Survey, Abstract 760, Van Zandt County, Texas.

(2) At the perimeter of the aforesaid reservoir.

B. Rate:

(1) Maximum rate from the aforesaid reservoir: 3.33 cfs (1500 gpm).

(2) Maximum rate from Mill Creek: 0.89 cfs (400 gpm).

4. PRIORITY

A. The time priority of owner's right is April 19, 1954 for the diversion and use of 50 acre-feet of water per annum from Mill Creek.

B. The time priority of owner's right is January 5, 1970 for the impoundment and the diversion and use of 1500 acre-feet of water per annum from the aforesaid reservoir.

5. SPECIAL CONDITION

Owner shall maintain a suitable outlet in the aforesaid dam authorized herein to allow the free passage of water that owner is not entitled to divert or impound.

The locations of pertinent features related to this certificate are shown on Page 4 of the Upper Sabine River Segment Certificates of Adjudication Maps, copies of which are located in the office of the Texas Water Commission, Austin, Texas.

This certificate of adjudication is issued subject to all terms, conditions and provisions in the final decree of the 188th Judicial District Court of Gregg County, Texas, in Cause No. 86-255-A, In Re: The Adjudication of Water Rights in the Upper Sabine River Segment of the Sabine River Basin dated June 9, 1986, and supersedes all rights of the owner asserted in that cause.

This certificate of adjudication is issued subject to the obligations of the State of Texas pursuant to the terms of the Sabine River Compact.

This certificate of adjudication is issued subject to senior and superior water rights in the Sabine River Basin.

Certificate of Adjudication 05-4675

This certificate of adjudication is issued subject to the Rules of the Texas Water Commission and its continuing right of supervision of State water resources consistent with the public policy of the State as set forth in the Texas Water Code.

TEXAS WATER COMMISSION

Paul Hopkins

Paul Hopkins, Chairman

DATE ISSUED

DEC 31 1986

ATTEST:

Mary Ann Hefner

Mary Ann Hefner, Chief Clerk

Exhibit 7
Requests for Water in the Upper Sabine Basin

A GOVERNMENT AGENCY
OF THE
State of Texas

SABINE RIVER AUTHORITY of Texas

(409) 746-2192
FAX (409) 746-3780

P.O. BOX 579
ORANGE, TEXAS
77630

RECEIVED OCT 17 2008

October 15, 2008

Andy McCuistion, City Manager
City of Canton
290 E. Tyler
Canton, Texas 75103

Re: Water Supply Planning for City of Canton

Dear Mr. McCuistion:

The Sabine River Authority of Texas (SRA-TX) has received the City of Canton's request for raw water supply dated February 8, 2008. We have also received an email from GBEI (Gary Burton Engineering, Inc., City Engineer for Canton) dated October 2, 2008, that indicates that the City of Canton is requesting 7,147 acre-feet per year (6.38 MGD). This request has been incorporated into the SRA-TX's Request for Water in the Upper Sabine Basin list (see attached).

As you are aware, in recent years the SRA-TX has received requests for water in the Upper Sabine River Basin which SRA-TX has been unable to supply since its permitted annual minimum firm yield of surface water from both Lake Tawakoni and Lake Fork Reservoirs has been totally committed under long-term water supply contracts. In an effort to address the growing demand for additional water supply needs in the upper Sabine River Basin service area, SRA-TX has completed the "Comprehensive Sabine Watershed Management Plan" dated December 1999 and the "Upper Sabine Basin Water Supply Study" dated March 2003. These reports are available on the SRA-TX website at www.sratx.org. These studies have evaluated a number of alternatives for meeting the long-term (50 year planning period) projected water demands. Please be assured that SRA-TX is continuing to examine every possible source of additional water to meet all of the upper basin area projected needs.

If you have any questions or comments concerning this issue, please contact me at (409) 746-2192.

Sincerely,

Jim Brown
Resource Management/ Project Development Division Manager

Attachment

CC: Gary Burton, P.E. City Engineer

REQUESTS FOR WAT[illegible]HE UPPER SABINE BASIN
AS O[illegible]/14/2008

REVIS[illegible]
10:12 am, Oct 14, 2008

MUNICIPAL REQUESTS

DATE REQUESTED	YEAR NEEDED Providers Survey	REQUESTER	County	Regional Planning Area	Currenlly SRA Customer	Contracted Amount (MGD)	TYPE OF USE	QUANTITY (MGD) Current Request	QUANTITY (MGD) USBWSS Providers Survey	NOTE
1998 (Oct. 20)		Combined Consumers WSC	Hunt/Kaufman/Van Zandt	C, D	LF (LT water)	2.000	Municipal	1.800	2.300	DECLINED 8/23/2004
1999 (Mar. 24)		City of Henderson	Rusk	I	LF (SR water)	4.500	Municipal	5.000	5.000	DECLINED 7/13/2005
1999 (May 13)		City of Kilgore	Gregg/Rusk	D, I	LF (SR water)	6.000	Municipal	4.500	4.500	DECLINED 7/27/2005
1999 (Jul.)		Ables Springs WSC	Hunt/Kaufman/Van Zandt	C, D	LF (LT water)	2.000	Municipal	2.000	3.000	DECLINED 8/27/2004
1999 (Jul. 30)	2002	Elmo Water Supply Corp	Kaufman	C			Municipal	1.000	1.000	DECLINED 10/12/2005
2000 (May 24)	2010	MacBee WSC	Hunt/Kaufman/Van Zandt	C, D	LF (LT water)	2.000	Municipal	2.000	2.000	DECLINED 8/11/2005
2000 (Sep.)	2005	City of Quitman	Wood	D	LF	1.000	Municipal	1.000	1.000	DECLINED 8/10/2005
2000 (Oct. 31)		City of East Tawakoni	Rains	D			Municipal	1.100	1.100	DECLINED 8/12/2005
					LT	1.000				
2000 (Nov. 1)	2015-2020	City of Emory	Rains	D	LF (LT water)	0.800	Municipal	3.000	4.000	DECLINED 1/1/2006
					LF (LT water)	1.000				
					Total	2.800				
2001 (Jan. 9)	2002	Poetry WSC	Hunt/Kaufman	C, D			Municipal	2.000	2.000	DECLINED 10/12/2005
2001 (Jan. 25)		College Mound WSC	Kaufman	C			Municipal	2.000	2.000	DECLINED 1/25/2006
2001 (Mar. 14)	ASAP	North Kaufman WSC	Kaufman	C			Municipal	1.100	1.100	
2001 (May 2)		Combined Consumers WSC	Hunt/Kaufman/Van Zandt	C, D	see above		Municipal	3.000	3.000	DECLINED 8/23/2004
2001 (May 8)		Golden WSC	Rains/Van Zandt/Wood	D			Municipal	1.000	1.000	DECLINED 10/25/2005
2002 (April 18)		City of Greenville	Hunt	D	LT	23.000	Municipal	4.800	8.800	
2002 (July 30)		City of Wills Point	Van Zandt	D	LT	2.000	Municipal	1.000	1.000	
	2012				LT	0.200				
2003 (April 29)		City of Point	Rains	D	LF (LT water)	0.200	Municipal	1.100	1.000	
					Total	0.400				
	2020							0.500		
2003 (April 29)	2050	City of Quinlan	Hunt	D			Municipal	0.200	no survey returned addillonal	
	TOTAL							0.700		
2004 (June 28)	2004	City of West Tawakoni	Hunt	D	LT	1.000	Municipal	1.000		
2004 (Oct. 20)		City of Lindale	Smith	D, I			Municipal	4.500		
2004 (Oct. 21)		Elmo Water Supply Corp	Kaufman	C			Municipal	2.000		
2004 (Oct. 25)		College Mound WSC	Kaufman	C			Municipal	3.000		
2005 (Oct. 21)		Rose Hill SUD	Kaufman	C			Municipal	5.000		
2005 (Oct.)		High Point WSC	Kaufman	C			Municipal	2.000		
2005 (Dec. 15)		Bright Star - Salem WSC	Rains/Wood	D	LF	0.750	Municipal	1.000	0.75	
2006 (Mar. 2)		South Rains WSC	Rains	D			Municipal	0.900		
2007 (Apr. 3)		City of Lone Oak	Hunt	D			Municipal	1.000		
2008 (Feb. 8)		City of Canton	Van Zandt	D			Municipal	6.380		
					TOTAL	46.700	SUB TOTAL	64.880	44.550	MGD

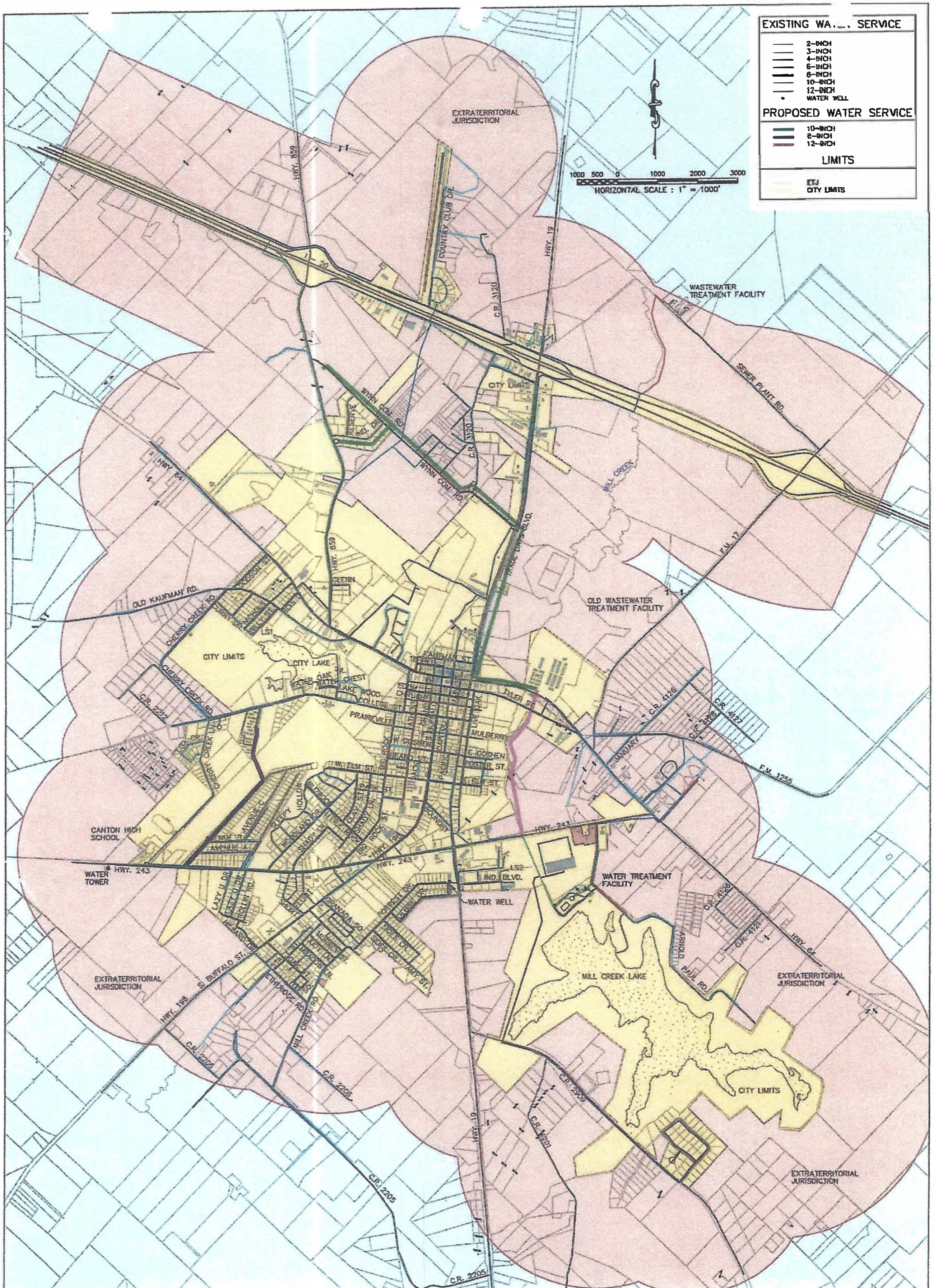
Totals by Regional Planning Area(s)	
Region C	16.100
Regions C,D	10.800
Region D	22.880
Regions D, I	9.000
Region I	5.000

OTHER REQUESTS

DATE REQUESTED	YEAR NEEDED	REQUESTER			TYPE OF USE	QUANTITY (MGD)	NOTE
2002 (July)	2020	Eastman Chemical Company	LF	3.124	Industrial	N/A	7.295
1996		Farms/Ranches - Lake Tawakoni and Lake Fork areas			Irrigation	1.000	1.000 estimated
1999 (May 17)	2010	Tawakoni Plant Farms	LF (LT water)	0.164	Irrigation	0.384	0.384
LT: Lake Tawakoni (Iron Bridge Division) Contract			TOTAL	3.288	SUB TOTAL	1.384	8.679 MGD
LF: Lake Fork Contract							
SR: Sabino River			TOTAL SUPPLY to entities on request list	49.988	TOTAL REQUESTS	66.264	53.229 MGD
					Difference		(13.036) MGD

USBWSS - Upper Sabine Basin Water Supply Study - March 2003 - KBR for SRA

Exhibit 8
Canton Water Distribution System



BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

EX 8

CITY OF CANTON WATER DISTRIBUTION SYSTEM

CITY OF CANTON

LONG-TERM SURFACE WATER SUPPLY OPTIONS STUDY

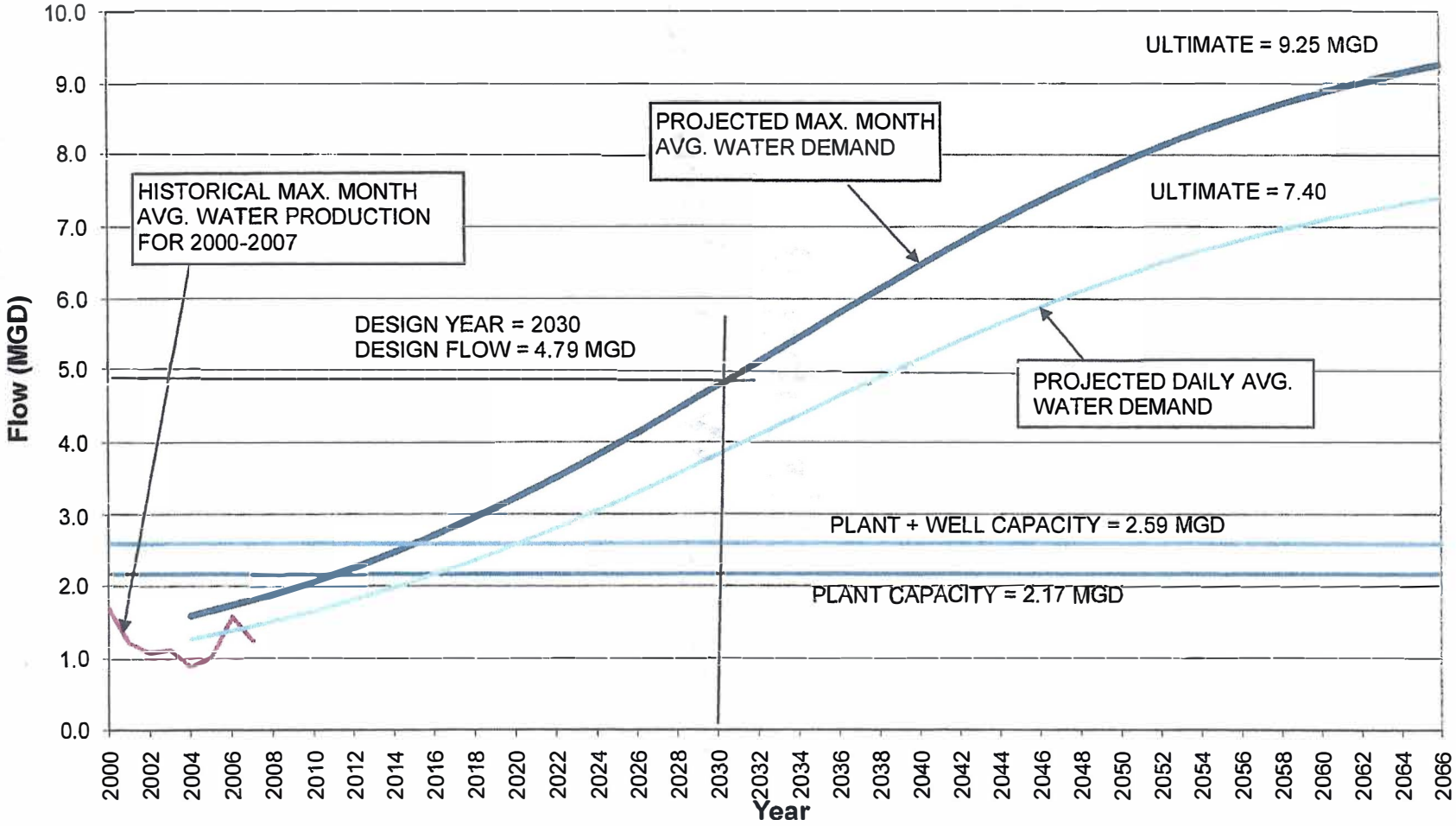
DESIGNED BY CDH CHECKED BY GB
DRAWN BY CDH REVIEWED BY GB

NO.	DATE	REVISION

GARY BURTON ENGINEERING, INC.
CONSULTING – PLANNING – PERMITTING – DESIGN – MANAGEMENT
14531 HWY. 155 S TYLER, TEXAS 75703
PHONE (903) 561-8984 FAX (903) 581-6757

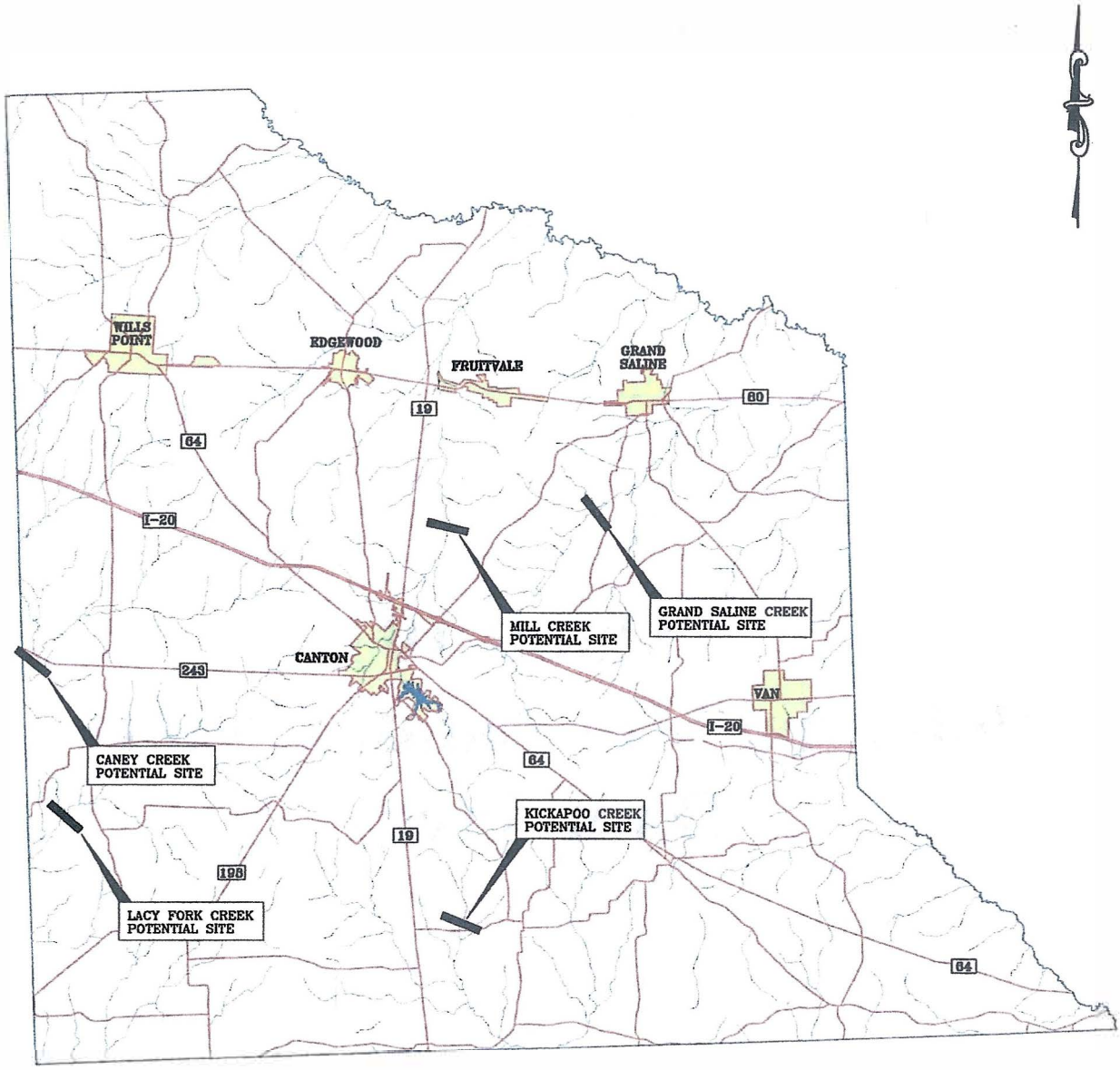
Exhibit 9
Projected Water Demand

Fig 2.3 - CITY OF CANTON PROJECTED WATER DEMAND



G:\Canton\014040401 Impact Fee Dev\Reports\Water-MAXMO[Water]

Exhibit 10
Potential Van Zandt County Dam Sites



POTENTIAL VAN ZANDT COUNTY DAM SITES

SCALE: 1" = 30,000'

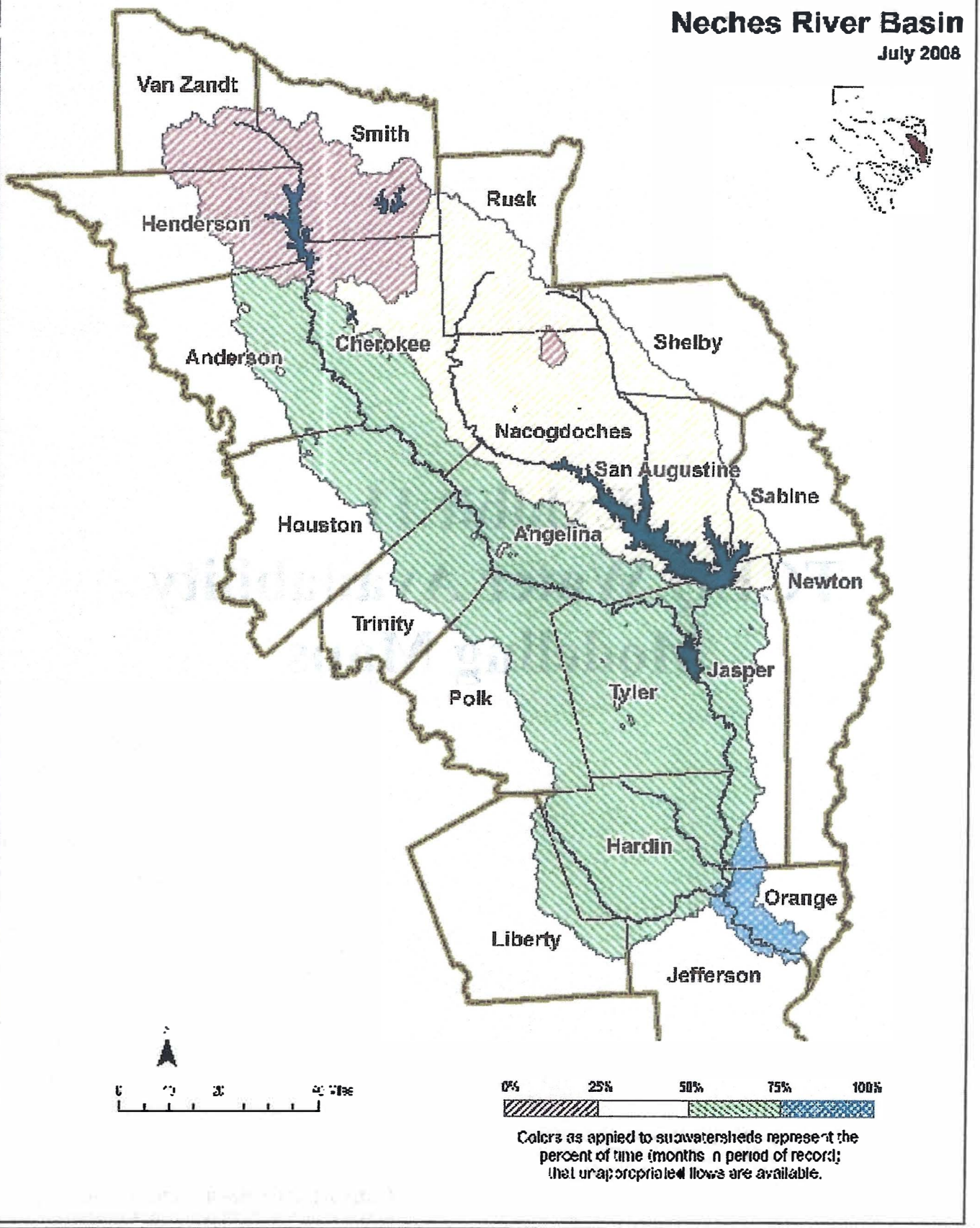
BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

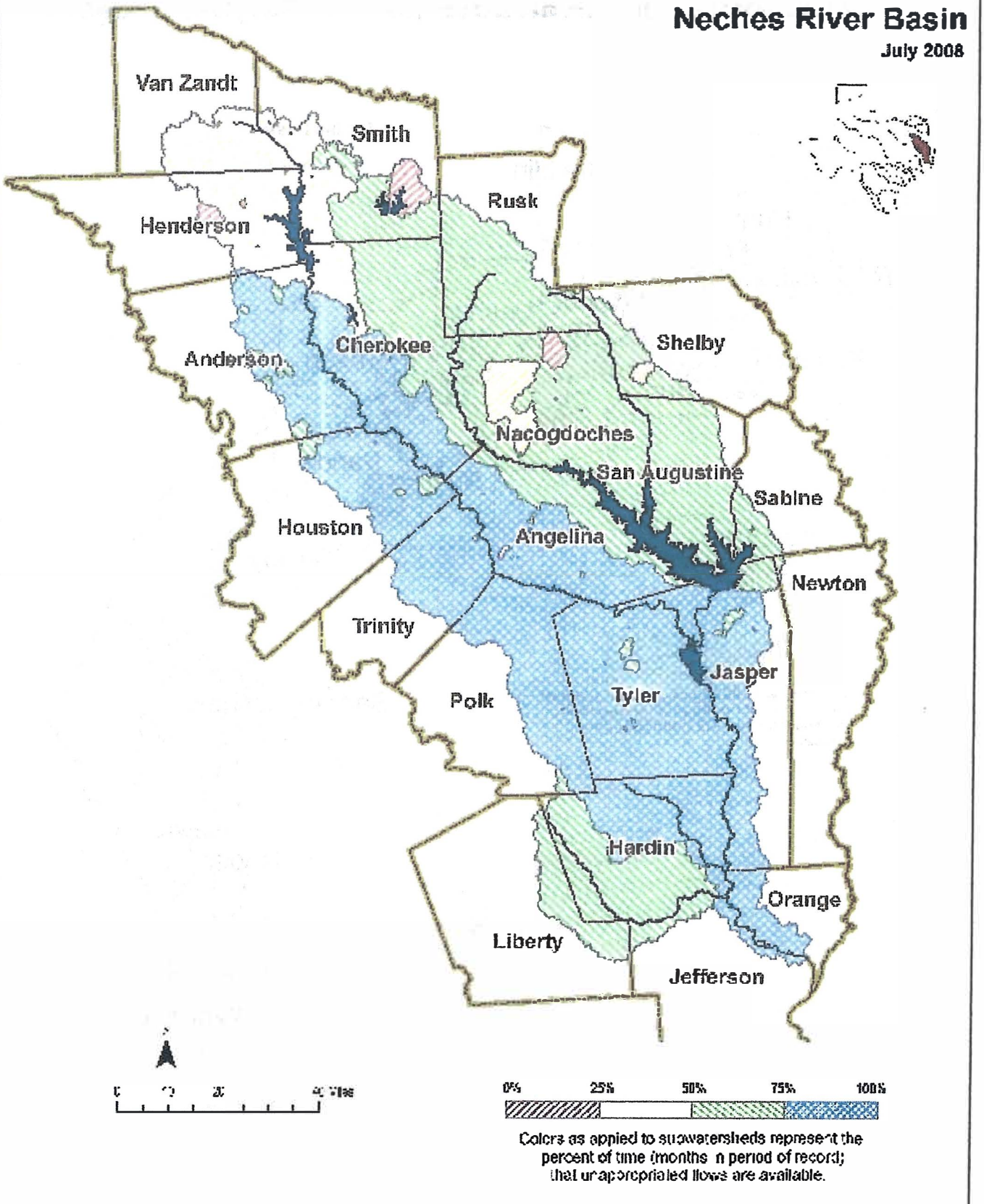
Proj. No. 014080101 Sht. No. EX 10	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, III TEXAS P.E. NO. 56643 DATE: 01/13/09	VAN ZANDT COUNTY LONG-TERM WATER SUPPLY STUDY	GARY BURTON ENGINEERING, INC. CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6984 FAX (903) 561-6757

Exhibit 11
TCEQ Water Availability Modeling Maps

Water Availability for NEW PERPETUAL RIGHTS



Water Availability for NEW TERM RIGHTS



Water Availability Evaluation for New Perpetual Rights

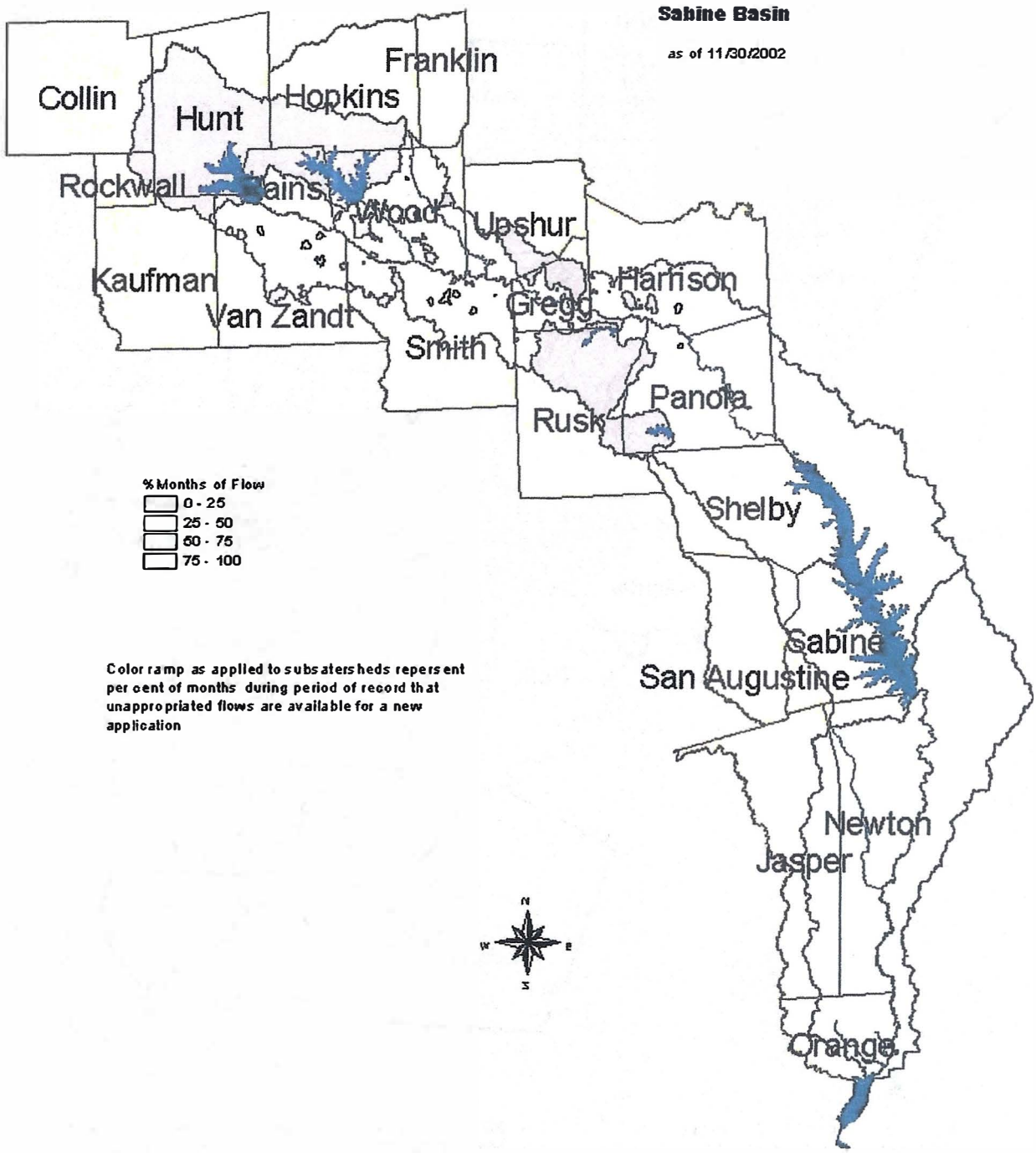
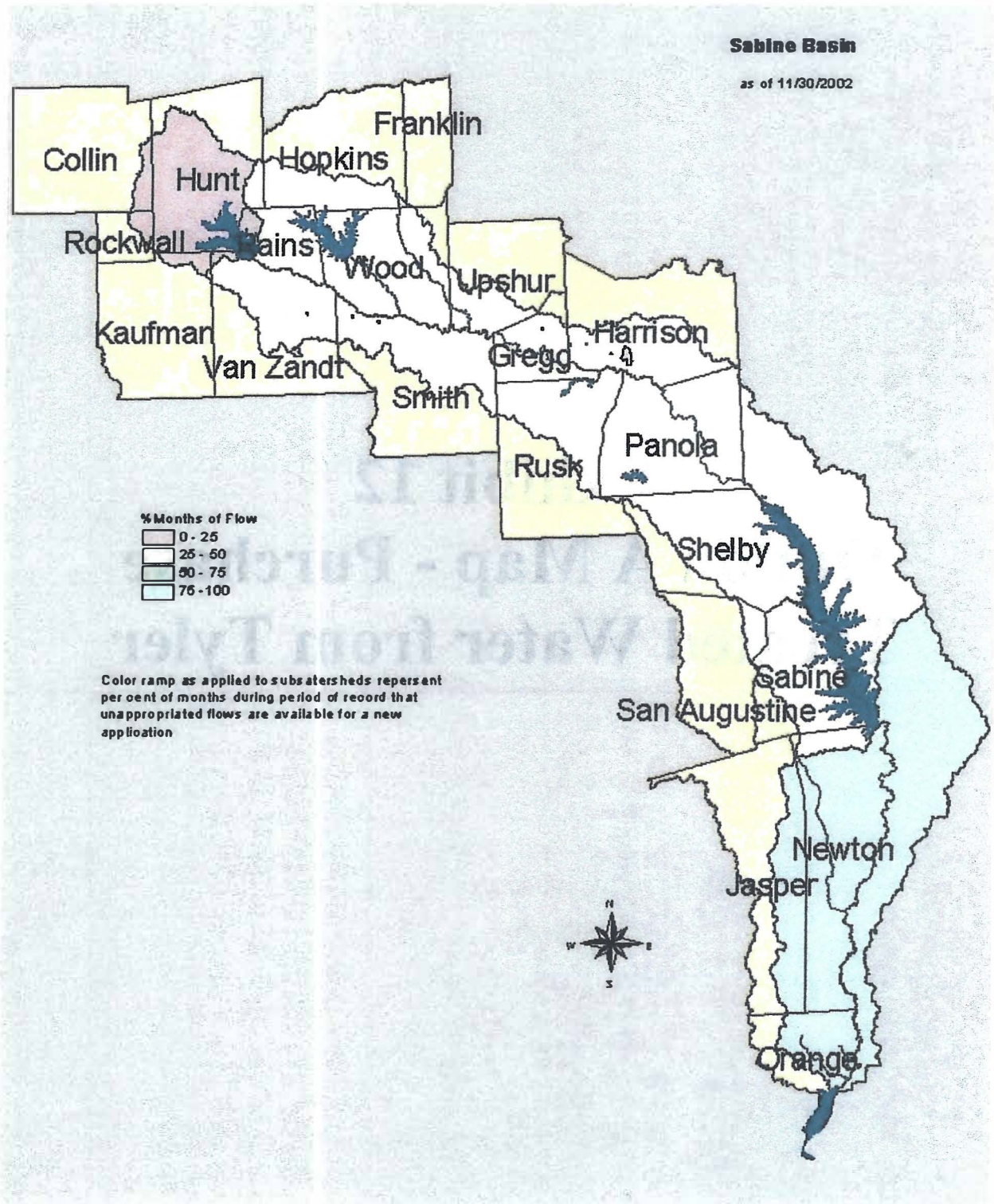


Exhibit 12
Option A Map - Purchase Treated Water from Tyler

Water Availability Evaluation for Term Rights



PROPOSED OPTION A PIPELINE ROUTE

SCALE : 1" = 1.5 MILES

BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. SCALE AND ADJUST ACCORDINGLY.

ONE INCH

PROPOSED OPTION A LOCATION MAP AND PIPELINE ROUTE

CITY OF CANTON

LONG-TERM SURFACE WATER SUPPLY OPTIONS STUDY

DESIGNED BY GBH CHECKED BY GBH

DRAWN BY GBH REVIEWED BY GBH

NO. DATE REVISION

GARY BURTON ENGINEERING, INC.

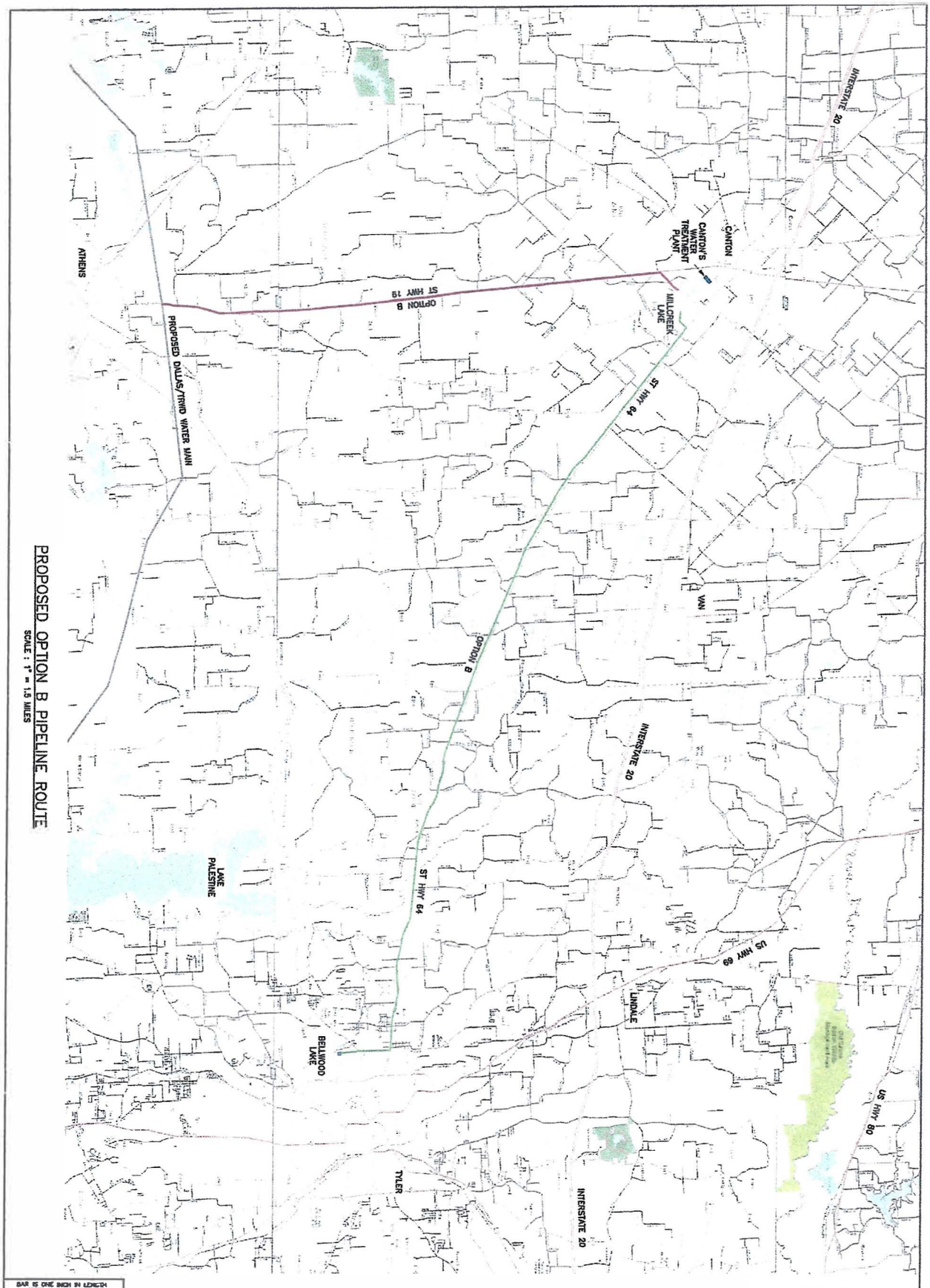
CONSULTING – PLANNING – PERMITTING – DESIGN – MANAGEMENT

1601 HWY. 155 S TYLER, TEXAS 75703

PHONE (903) 581-8844 FAX (903) 581-0757

EX 12

Exhibit 13
Option B Map - Purchase Raw Water



PROPOSED OPTION B PIPELINE ROUTE

SCALE: 1" = 1.5 MILES

BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj. No. 014080101

Dwg. No. EX 13

PROPOSED OPTION B
LOCATION MAP AND
PIPELINE ROUTES

CITY OF CANTON
LONG-TERM SURFACE WATER SUPPLY
OPTIONS STUDY

DESIGNED BY	CDH	CHECKED BY	GLB
DRAWN BY	CDH	REVIEWED BY	GLB

NO.	DATE	REVISION

GARY BURTON ENGINEERING, INC.
CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT
1455D HWY 155 S TYLER, TEXAS 75703
PHONE (903) 581-6364 FAX (903) 581-6757

Exhibit 14
Option C Map - Potential Reservoir Sites

BAR IS ONE INCH IN LENGTH
ON ORIGINAL DRAWING. CHECK
SCALE AND ADJUST ACCORDINGLY.

ONE INCH

POTENTIAL RESERVOIR SITES

SCALE: 1" = 5000'

GARY BURTON ENGINEERING, INC.
CONSULTING - PLANNING - DESIGN - MANAGEMENT
14631 HIGHWAY 155 SOUTH TYLER, TEXAS 75703

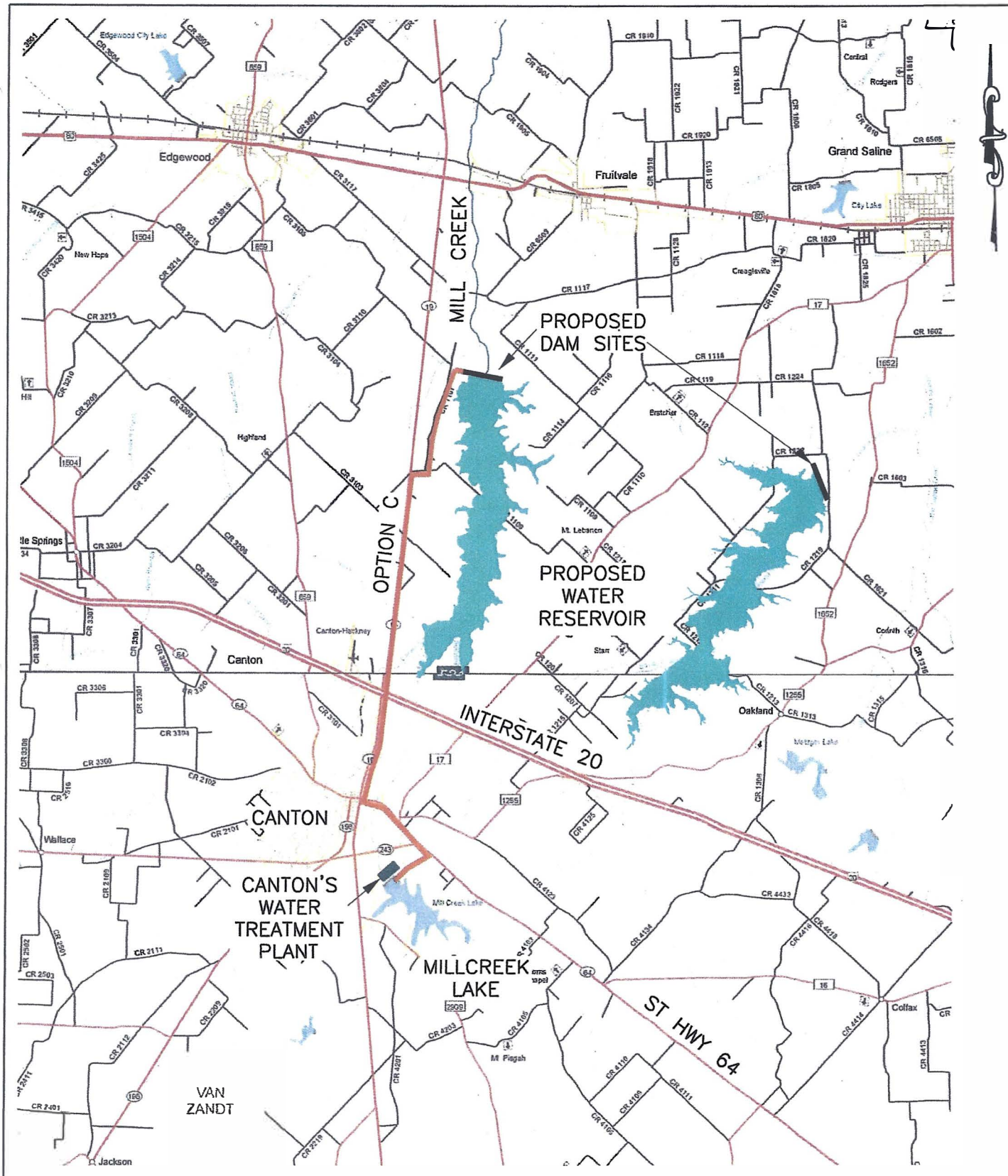
DESIGNED BY: GBE
DRAWN BY: JDH
CHECKED BY: GBE
APPROVED BY: GBE

CITY OF CANTON
LONG-TERM SURFACE WATER

PROPOSED OPTION C
POTENTIAL RESERVOIR SITES

Job No. 014080
Sheet No. E1

Exhibit 15
Proposed Reservoir and Pipeline Map



PROPOSED RESERVOIR AND PIPELINE MAP

SCALE: 1" = 2 MILES

BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

014080101

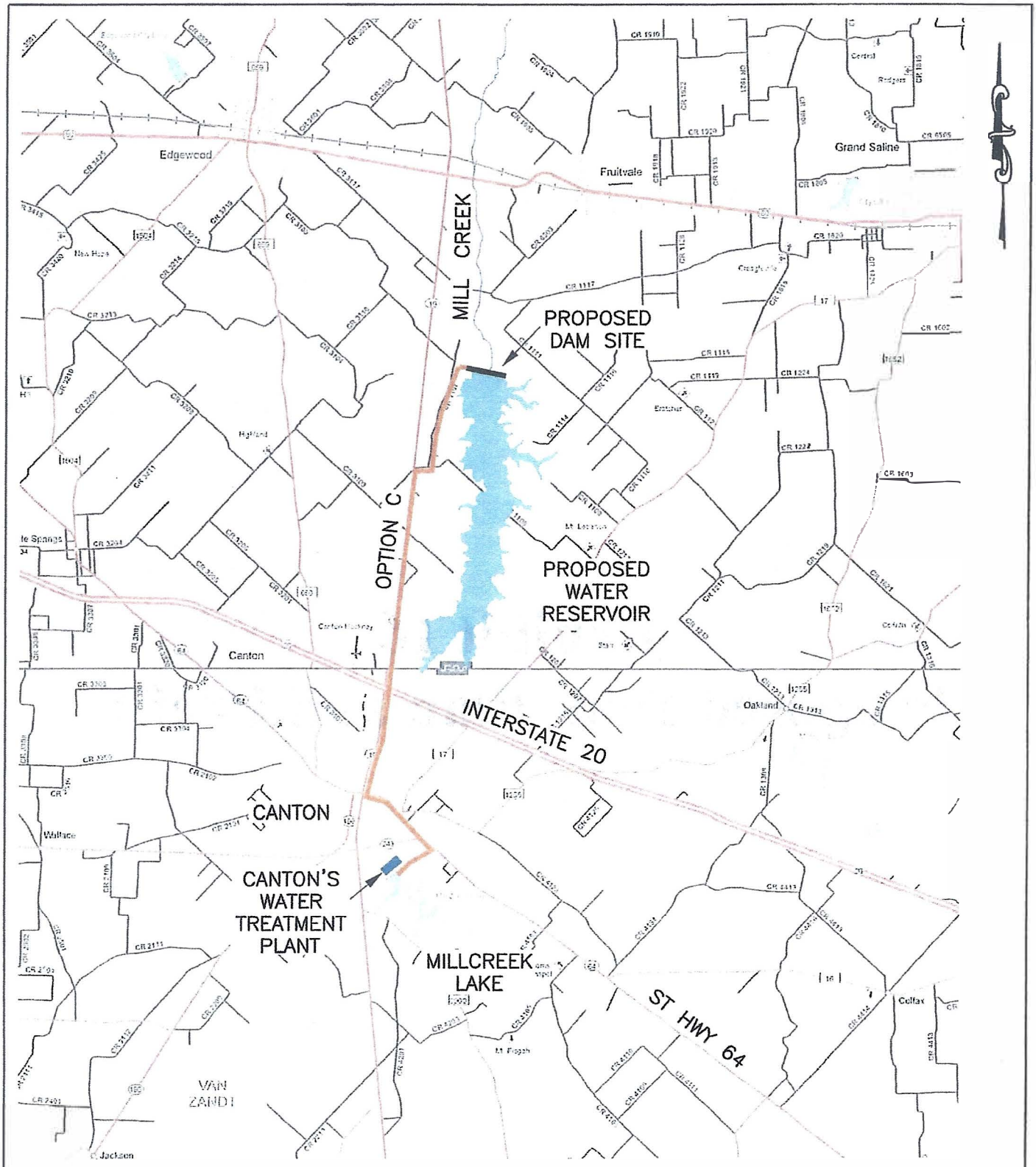
EX 15

THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES

GARY L. BURTON, III
TEXAS P.E. NO. 56643
DATE: 01/03/09

VAN ZANDT COUNTY
LONG-TERM WATER SUPPLY STUDY

GARY BURTON ENGINEERING, INC.
CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT
14531 HWY. 155 S TYLER, TX 75703
PHONE (903) 561-6984 FAX (903) 561-6757



PROPOSED RESERVOIR AND PIPELINE MAP

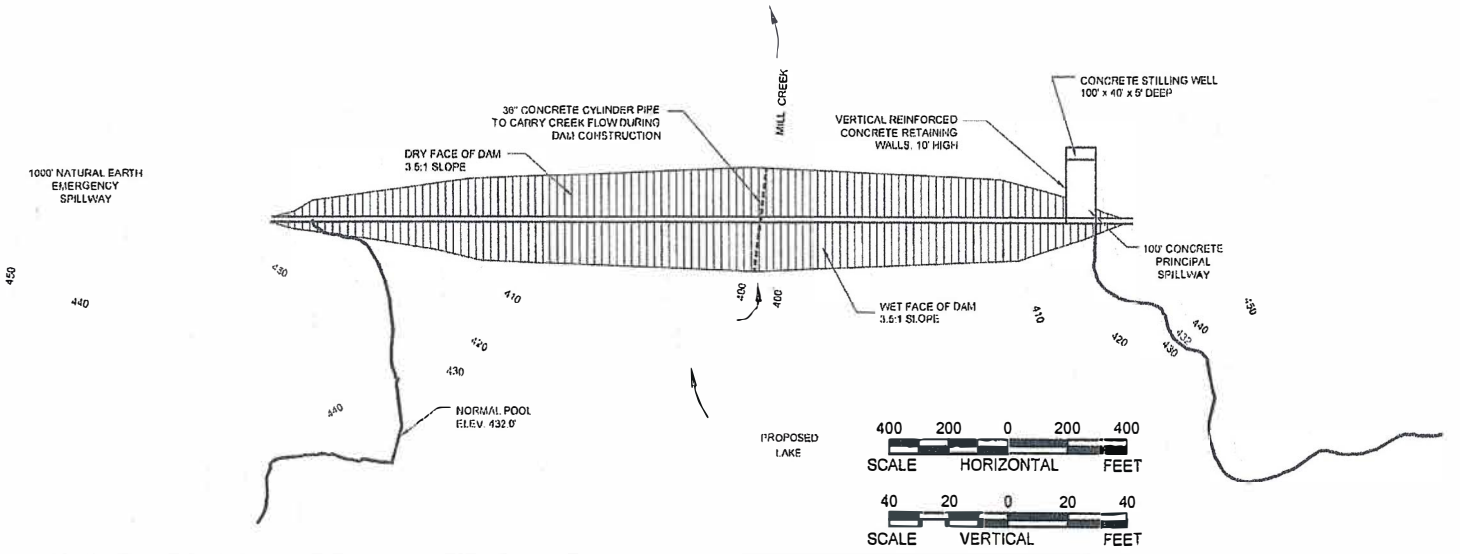
SCALE: 1" = 2 MILES

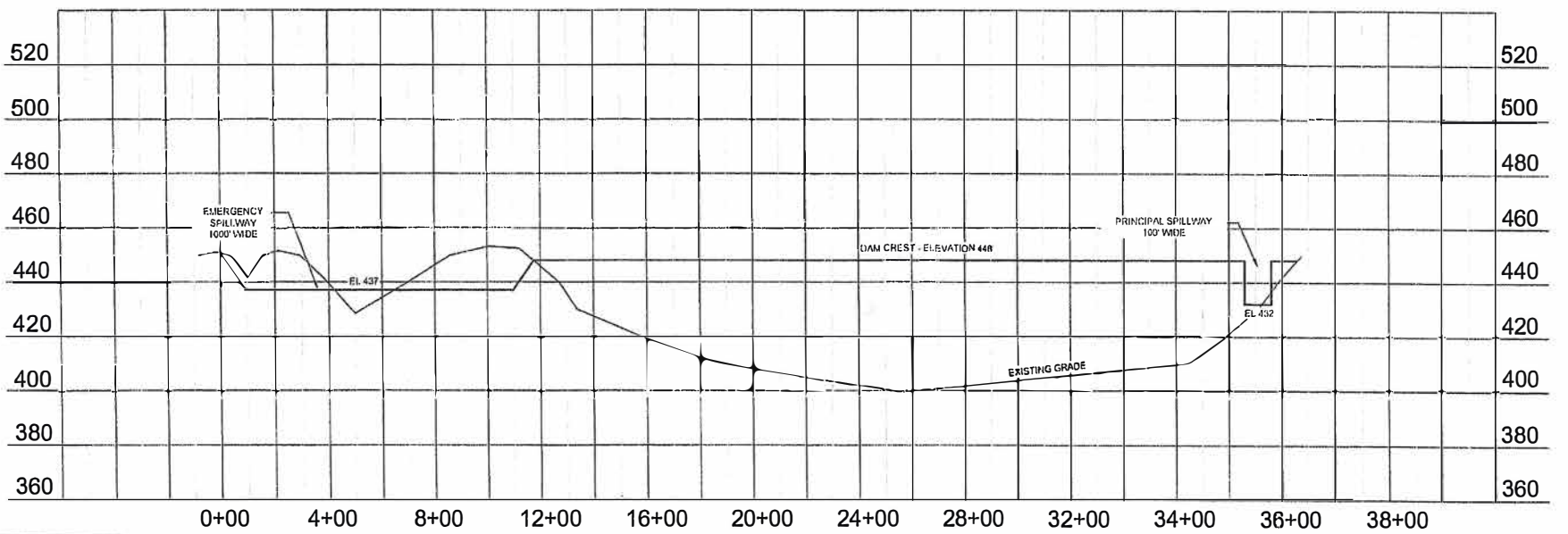
BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj. No. 014080101 SHT. No. EX 15	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, III TEXAS P.E. NO. 56843 DATE: 01/03/08	VAN ZANDT COUNTY LONG-TERM WATER SUPPLY STUDY	GARY BURTON ENGINEERING, INC. CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6564 FAX (903) 561-6757

Exhibit 16
Proposed Dam Plan and Profile





BAR IS ONE INCH IN LENGTH ON ORIGINAL DRAWING. CHECK SCALE AND ADJUST ACCORDINGLY.

ONE INCH

GARY BURTON ENGINEERING, INC.
CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT
1435 HIGHWAY 155 SOUTH TYLER, TEXAS 75703

DESIGNED BY JBH
DRAWN BY CDH
CHECKED BY GB
REVIEWED BY GB

CITY OF CANTON
LONG-TERM SURFACE WATER SUPPLY OPTIONS STUDY

PROPOSED MILL CREEK RESERVOIR DAM PLAN AND

01400010

E16

Exhibit 17
Opinions of Probable Cost

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option A - Purchase Treated Water from the City of Tyler
Opinion of Probable Costs
as of 1/16/2009

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
CONSTRUCTION OF METERING STATION AT THE CITY OF TYLER - LAKE PALESTINE WTP					
1	Mobilization & Bonds	1	LS	$15,000.00	$15,000.00
2	Metering Station	1	LS	$385,000.00	$385,000.00
3	Surveying and Easement Preparation	1	LS	$5,000.00	$5,000.00
	SUBTOTAL OF METERING STATION CONSTRUCTION COST				**$405,000**
CONSTRUCTION OF PUMP STATION NEAR THE CITY OF TYLER - LAKE PALESTINE WTP					
4	Mobilization & Bonds	1	LS	$15,000.00	$15,000.00
5	Access Drive	100	SY	$50.00	$5,000.00
6	Earthwork	1000	CY	$15.00	$15,000.00
7	Pump Station Structure	1	LS	$350,000.00	$350,000.00
8	Pumps, Starters, & Controls Package (incl SCADA)	4	EA	$45,000.00	$180,000.00
9	Piping & Valves	1	LS	$100,000.00	$100,000.00
10	Gates & Fencing	1	LS	$30,000.00	$30,000.00
11	3 Phase Power	1	LS	$50,000.00	$50,000.00
12	Sitework / Landscaping	1	LS	$10,000.00	$10,000.00
13	Surveying and Easement Preparation	1	LS	$5,000.00	$5,000.00
	SUBTOTAL OF PUMP STATION CONSTRUCTION COST				**$760,000**
CONSTRUCTION OF TRANSMISSION LINE FROM LAKE PALESTINE WTP TO CANTON WTP					
14	Mobilization & Bonds	1	LS	$500,000.00	$500,000.00
15	Trench Safety	204,083	LF	$1.00	$204,083.00
16	30" C905 PVC-Water Main	204,083	LF	$150.00	$30,612,450.00
17	Fittings and Valves (3%)	1	LS	$918,373.50	$918,373.50
18	River Crossing	1	EA	$25,000.00	$25,000.00
19	Creek Crossings	44	EA	$5,000.00	$220,000.00
20	Road Crossings	71	EA	$7,500.00	$532,500.00
21	Highway Crossings	3	EA	$15,000.00	$45,000.00
22	Railroad Crossing	1	EA	$25,000.00	$25,000.00
23	Seeding, Sodding, and Fertilizer	204,083	LF	$1.75	$357,145.25
24	Temporary Sediment Control (Silt Fence / Hay Bales)	204,083	LF	$1.00	$204,083.00
25	SWPPP, NOI Storm Water Permitting Compliance	1	LS	$50,000.00	$50,000.00
26	Traffic Control	1	LS	$125,000.00	$125,000.00
27	Easement Acquisistion	1	LS	$450,000.00	$450,000.00
28	Surveying and Easement Preparation	1	LS	$85,000.00	$85,000.00
	SUBTOTAL OF TRANSMISSION LINE CONSTRUCTION COST				**$34,353,635**
CONSTRUCTION OF GROUND STORAGE TANK AND PUMP STATION AT CANTON WTP					
29	Mobilization and Bonds	1	LS	$45,000.00	$45,000.00
30	Sitework & Access	1	LS	35,000.00	$35,000.00
31	Pump Building (30' x 40')	1,200	SF	85.00	$102,000.00
32	Pumps and Controls	4	EA	35,000.00	$140,000.00
33	Yard Piping	1	LS	75,000.00	$75,000.00
34	1 Million Gallon GST	2	EA	600,000.00	$1,200,000.00
35	Chemical Feed System	1	LS	100,000.00	$100,000.00
36	Electrical & Instrumentation	1	EA	25,000.00	$25,000.00
37	Surveying and Easement Preparation	1	LS	5,000.00	$5,000.00
	SUBTOTAL OF GST AND PUMP STATION CONSTRUCTION COST				**$1,727,000**
CONSTRUCTION SUBTOTAL					**$37,245,635**
ENGINEERING AND CONTINGENCIES (20%)					$7,449,127
ENGINEERING, CONSTRUCTION PHASE ADDITIONAL (1.5%)					$558,685
TOTAL PROBABLE COST OF CONSTRUCTION					**$45,253,447**

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option A - Purchase Treated Water from the City of Tyler
Opinion of Probable Costs
as of 1/16/2009

AMORTIZATION OF CONSTRUCTION COST (20 YRS, 6% INTEREST)

Calculating the payment amount per period

$$A = P\frac{r(1+r)^n}{(1+r)^n - 1}$$

where

A = payment amount per period
P = intital principal (loan amount)
r = interest rate per period
n = total number of payments

$$A = \$45{,}253{,}447\ \frac{0.005(1+0.005)^{240}}{(1+0.005)^{240}-1}$$

A = $324,210 per month

A = $3,890,520 per year

Calculating the interest rate per period

$$r = \left(1+\frac{i}{n}\right)^{n/p} - 1$$

where

r = rate per payment period
i = nominal annual interest rate (6%)
n = number of compounding periods per year (4)
p = number of payment periods per year (12)

$$r = \left(1+\frac{0.06}{4}\right)^{4/12} - 1$$

r = 0.0050 or 0.50 %

OPERATION AND MAINTENANCE COST

PUMP STATION NEAR LAKE PALESTINE WTP
Four (4) Pumps, including one (1) standby
Each Pump: 2213 US GPM @ 240 Ft, 200 Hp.

1 Operation Time
a. High Flow Times
6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times
24 - 8 (2) = 8 hrs

2 Power Consumption
Total Power = (600(8) + 200 (8)) 0.7457/0.84 = 5,682 Kwh/day

Yearly Power Cost = 5,682 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $248,872

Service and Maintenance Cost
Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option A - Purchase Treated Water from the City of Tyler
Opinion of Probable Costs
as of 1/16/2009

OPERATION AND MAINTENANCE COST

DISTRIBUTION PUMP STATION

Four (4) Pumps, including one (1) standby
Each Pump: 5667 US GPM @ 200 Ft, 300 Hp.

1 Operation Time

a. High Flow Times

6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times

24 - 8 (2) = 8 hrs

2 Power Consumption

Total Power = (900(8) + 300 (8)) 0.7457/0.84 = 8,522 Kwh/day

Yearly Power Cost = 8,522 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $373,264

Service and Maintenance Cost

Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

TOTAL OPERATION AND MAINTENANCE COST

= $116,639 + $7,200 + $373,264 + $7,200 = **$636,536 per year**

COST TO PURCHASE TREATED WATER FROM TYLER

Average Month Demand (Ultimate) 5.78 MGD

Two-Part Rate

Demand Rate	$15,000.00	per MGD per month
Volume Rate	$1.25	per 1000 gallons
Demand Charge (per month)	86,700	
Volume Charge (per month)	219,761	
Total Charge (per month)	306,461	
Effective Volumetric Rate	$1.74	per 1000 gallons

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option A - Purchase Treated Water from the City of Tyler
Opinion of Probable Costs
as of 1/16/2009

SUMMARY OF COST TO PURCHASE TREATED WATER FROM THE CITY OF TYLER	
Total Cost of Construction	$45,253,447
Amortized Construction Cost (20 Yrs, 6% Interest)	$3,890,520
Pump Stations Operation and Maintenance Cost	$636,536
Total Annual Cost (Debt Service plus O & M)	$4,527,056
Cost for treated water purchase from City of Tyler = $1.74 per 1000 gallons	
Total Annual Cost for treated water purchase from City of Tyler	$3,670,878
Total Annual Cost for Option A (purchase treated water from Tyler)	$8,197,934

Note: Unit cost based on 5.78 MGD usage in order to compare unit cost for Option C.

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option B - Purchase Raw Water From Upper Neches River MWA
Opinion of Probable Costs
as of 1/16/2009

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
CONSTRUCTION OF METERING STATION NEAR THE CITY OF ATHENS					
1	Mobilization & Bonds	1	LS	$15,000.00	$15,000.00
2	Metering Station	1	LS	$385,000.00	$385,000.00
3	Surveying and Easement Preparation	1	LS	$5,000.00	$5,000.00
	SUBTOTAL OF METERING STATION CONSTRUCTION COST				**$405,000**
CONSTRUCTION OF PUMP STATION NEAR THE CITY OF ATHENS					
4	Mobilization & Bonds	1	LS	$15,000.00	$15,000.00
5	Access Drive	100	SY	$50.00	$5,000.00
6	Earthwork	1000	CY	$15.00	$15,000.00
7	Pump Station Structure	1	LS	$350,000.00	$350,000.00
8	Pumps, Starters, & Controls Package (incl SCADA)	4	EA	$45,000.00	$180,000.00
9	Piping & Valves	1	LS	$100,000.00	$100,000.00
10	Gates & Fencing	1	LS	$30,000.00	$30,000.00
11	3 Phase Power	1	LS	$10,000.00	$10,000.00
12	Sitework / Landscaping	1	LS	$10,000.00	$10,000.00
13	Surveying and Easement Preparation	1	LS	$5,000.00	$5,000.00
	SUBTOTAL OF PUMP STATION CONSTRUCTION COST				**$720,000**
CONSTRUCTION OF TRANSMISSION LINE FROM THE CITY OF ATHENS TO CANTON WTP					
14	Mobilization & Bonds	1	LS	$400,000.00	$400,000.00
15	Trench Safety	105,818	LF	$1.00	$105,818.00
16	24" C905 PVC-Water Main	105,818	LF	$100.00	$10,581,800.00
17	Fittings and Valves (3%)	1	LS	$317,454.00	$317,454.00
18	Creek Crossings	25	EA	$5,000.00	$125,000.00
19	Road Crossings	26	EA	$7,500.00	$195,000.00
20	Seeding, Sodding, and Fertilizer	105,818	LF	$1.75	$185,181.50
21	Temporary Sediment Control (Silt Fence / Hay Bales)	105,818	LF	$1.00	$105,818.00
22	SWPPP, NOI Storm Water Permitting Compliance	1	LS	$50,000.00	$50,000.00
23	Traffic Control	1	LS	$62,500.00	$62,500.00
24	Easement Acquisistion	1	LS	$232,000.00	$232,000.00
25	Surveying and Easement Preparation	1	LS	$40,000.00	$40,000.00
	SUBTOTAL OF TRANSMISSION LINE CONSTRUCTION COST				**$12,400,572**
CONSTRUCTION OF 8.13 MGD EXPANSION TO CANTON WTP					
25	Plant Expansion	8.13	MGD	$3,000,000	$24,390,000
	SUBTOTAL OF PLANT EXPANSION CONSTRUCTION COST				**$24,390,000**
CONSTRUCTION SUBTOTAL					**$37,915,572**
ENGINEERING AND CONTINGENCIES (20%)					$7,583,114
ENGINEERING, CONSTRUCTION PHASE ADDITIONAL (1.5%)					$568,734

TOTAL PROBABLE COST OF PROJECT	**$46,067,420**

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option B - Purchase Raw Water From Upper Neches River MWA
Opinion of Probable Costs
as of 1/16/2009

AMORTIZATION OF CONSTRUCTION COST (20 YRS, 6% INTEREST)

Calculating the payment amount per period

$$A = P\frac{r(1+r)^n}{(1+r)^n - 1}$$

where

A = payment amount per period
P = intital principal (loan amount)
r = interest rate per period
n = total number of payments

Calculating the interest rate per period

$$r = \left(1 + \frac{i}{n}\right)^{n/p} - 1$$

where

r = rate per payment period
i = nominal annual interest rate (6%)
n = number of compounding periods per year (4)
p = number of payment periods per year (12)

$$A = \$46{,}067{,}420\ \frac{0.005(1+0.005)^{240}}{(1+0.005)^{240} - 1}$$

$$r = \left(1 + \frac{0.06}{4}\right)^{4/12} - 1$$

A = $330,041 per month

r = 0.0050 or 0.50 %

A = $3,960,492 per year

OPERATION AND MAINTENANCE COST FOR PUMP STATIONS

RAW WATER PUMP STATION NEAR ATHENS
Four (4) Pumps, including one (1) standby
Each Pump: 2213 US GPM @ 180 Ft, 125 Hp.

1 Operation Time
a. High Flow Times
6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times
24 - 8 (2) = 8 hrs

2 Power Consumption
Total Power = (375(8) + 125 (8)) 0.7457/0.84 = 3,551 Kwh/day

Yearly Power Cost = 3,551 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $155,534

Service and Maintenance Cost
Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option B - Purchase Raw Water From Upper Neches River MWA
Opinion of Probable Costs
as of 1/16/2009

OPERATION AND MAINTENANCE COST FOR PUMP STATIONS

DISTRIBUTION PUMP STATION

Four (4) Pumps, including one (1) standby

Each Pump: 5667 US GPM @ 200 Ft, 300 Hp.

1 Operation Time

a. High Flow Times

6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times

24 - 8 (2) = 8 hrs

2 Power Consumption

Total Power = (900(8) + 300 (8)) 0.7457/0.84 = 8,522 Kwh/day

Yearly Power Cost = 8,522 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $373,264

Service and Maintenance Cost

Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

TOTAL OPERATION AND MAINTENANCE COST

= $116,639 + $7,200 + $373,264 + $7,200 = **$543,198 per year**

OPERATION AND MAINTENANCE COST FOR WATER TREATMENT PLANT

1. Chemical cost for alum and chlorine $500,000

2. Employees Salaries

a. Base Salaries

3 Operators at $25.00/hr x 2,080 hrs/yr = $156,000
2 Maintenance and Service Workers at $10.00/hr x 8 x 5 days x 52 weeks/yr = $41,600
1 Chief Operator at $32.00/hr x 8 x 5 days x 52 weeks/yr = $66,560

Total Employee Base Salary = $264,160 per year

b. Additional Salary Costs for Overtime, etc. = $50,000 per year
Total Salary Cost = $264,160 + $50,000 = $314,160 per year

3. Equipment services and replacement cost = $35,000 per year

4. Other Annual Operating Costs = $350,000

Total Annual O & M Cost = $500,000 + $314,160 + $ 35,000 + $350,000 = $1,199,160

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option B - Purchase Raw Water From Upper Neches River MWA
Opinion of Probable Costs
as of 1/16/2009

COST TO PURCHASE RAW WATER FROM UPPER NECHES RIVER MUNICIPAL WATER AUTHORITY		
Average Month Demand (Ultimate)	5.78 MGD	
Two-Part Rate		
Demand Rate	$7,500.00	per MGD per month
Volume Rate	$0.75	per 1000 gallons
Demand Charge (per month)	43,350	
Volume Charge (per month)	131,856	
Total Charge (per month)	175,206	
Effective Volumetric Rate	$1.00	per 1000 gallons

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option B - Purchase Raw Water From Upper Neches River MWA
Opinion of Probable Costs
as of 1/16/2009

SUMMARY OF COST TO PURCHASE RAW WATER FROM UPPER NECHES RIVER MWA & TREATMENT	
Total Cost of Construction	$46,067,420
Amortized Construction Cost (20 Yrs, 6% Interest)	$3,960,492
Pump Stations Operation and Maintenance Cost	$543,198
Water Treatment Plant Operation and Maintenance Cost	$1,199,160
Total Annual Cost (Debt Service plus O & M)	$5,702,850
Cost for raw water purchase from UNRMWA = $1.00 per 1000 gallons	
Total Annual Cost for raw water purchase from UNRMWA	$2,109,700
Total Annual Cost for Option B (purchase raw water from UNRMWA)	$7,812,550

Note: Unit cost based on 5.78 MGD usage in order to compare unit cost for Option C.

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option C - Proposed Mill Creek Reservoir
Opinion of Probable Costs
as of 1/16/2009

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
PROPOSED MILL CREEK RESERVOIR					
1	Land Purchase	2,000	AC	$2,500.00	$5,000,000.00
2	Relocations	1	LS	$500,000.00	$500,000.00
3	Dam and Spillway Structures				
3.1	Clearing and Grubbing	8.5	AC	$8,000.00	$68,000.00
3.2	Topsoil Strip, Stockpile & Replace	27,300	CY	$5.00	$136,500.00
3.3	Core Trench Excavation	10,300	CY	$6.00	$61,800.00
3.4	Embankment Clay Fill	264,400	CY	$6.00	$1,586,400.00
3.5	Embankment Random Fill	289,400	CY	$4.00	$1,157,600.00
3.6	Embankment Riprap	5,000	CY	$100.00	$500,000.00
3.7	Revegetation	17.2	AC	$5,000.00	$86,000.00
3.8	Emergency Spillway				
3.8.1	Clearing	5	AC	$5,000.00	$25,000.00
3.8.2	Topsoil Strip, Stockpile & Replace	11500	CY	$5.00	$57,500.00
3.8.3	Excavation	130000	CY	$3.00	$390,000.00
3.8.4	Revegetation	20	AC	$5,000.00	$100,000.00
3.9	Service Spillway				
3.9.1	Clearing & Grubbing	5	AC	$5,000.00	$25,000.00
3.9.2	Excavation	5000	CY	$5.00	$25,000.00
3.9.3	Concrete Wall Footings	250	CY	$500.00	$125,000.00
3.9.4	Concrete Walls	600	CY	$800.00	$480,000.00
3.9.5	Concrete Slabs	1000	CY	$500.00	$500,000.00
3.9.6	Concrete Toe Walls	50	CY	$500.00	$25,000.00
3.9.7	Drainage System	1	LS	$100,000.00	$100,000.00
3.9.8	Rock Riprap	600	CY	$100.00	$60,000.00
3.9.9	Fencing	600	LF	$15.00	$9,000.00
3.10	Outlet Works				
3.10.1	Concrete Riser	40	CY	$1,000.00	$40,000.00
3.10.2	Riser Access Walkway	1	LS	$20,000.00	$20,000.00
3.10.3	30" RCCP	400	LF	$100.00	$40,000.00
3.10.4	Gates	3	EA	$10,000.00	$30,000.00
3.10.5	Rock Riprap	250	CY	$100.00	$25,000.00
3.11	Care of Water	1	LS	$50,000.00	$50,000.00
4	Environmental & Mitigation	1	LS	$1,000,000.00	$1,000,000.00
5	Surveying and Geotech Services	1	LS	$1,000,000.00	$1,000,000.00
	SUBTOTAL OF RESERVOIR CONSTRUCTION COST				**$13,222,800**
PROPOSED INTAKE STRUCTURE					
6	Buoys & Signs	1	LS	$500.00	$500.00
7	Intake Structure	1	LS	$350,000.00	$350,000.00
8	Chemical Feed System	1	LS	$90,000.00	$90,000.00
9	Bridge	1	LS	$760,000.00	$760,000.00
10	Access drive and parking	50	SY	$50.00	$2,500.00
11	Crane & hoist	1	LS	$2,500.00	$2,500.00
12	Earthwork	200	CY	$10.00	$2,000.00
13	Pumps, Starters, & Controls Package (incl SCADA)	4	EA	$45,000.00	$180,000.00
14	Piping & valves	1	LS	$10,000.00	$10,000.00
15	Fencing	300	LF	$25.00	$7,500.00
16	Hatches	1	LS	$2,000.00	$2,000.00
17	Sitework / landscaping	1	LS	$2,000.00	$2,000.00

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option C - Proposed Mill Creek Reservoir
Opinion of Probable Costs
as of 1/16/2009

	SUBTOTAL OF INTAKE STRUCTURE CONSTRUCTION COST				**$1,409,000**
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL COST**
PROPOSED TRANSMISSION LINE					
18	Mobilization & Bonds	1	LS	$400,000.00	$400,000.00
19	Trench Safety	48,653	LF	$1.00	$48,653.00
20	24" C905 PVC-Water Main	48,653	LF	$100.00	$4,865,300.00
21	Fittings and Valves (3%)	1	LS	$145,959.00	$145,959.00
22	Creek Crossings	6	EA	$5,000.00	$30,000.00
23	Road Crossings	2	EA	$7,500.00	$15,000.00
24	Highway Crossings	2	EA	$15,000.00	$30,000.00
25	Interstate Crossing	1	EA	$25,000.00	$25,000.00
26	Seeding, Sodding, and Fertilizer	48,653	LF	$1.75	$85,142.75
27	Temporary Sediment Control (Silt Fence / Hay Bales)	48,653	LF	$1.00	$48,653.00
28	SWPPP, NOI Storm Water Permitting Compliance	1	LS	$50,000.00	$50,000.00
29	Traffic Control	1	LS	$50,000.00	$50,000.00
30	Easement Acquisition	1	LS	$134,000.00	$134,000.00
	SUBTOTAL OF TRANSMISSION LINE CONSTRUCTION COST				**$5,927,708**
CONSTRUCTION OF 8.13 MGD EXPANSION TO CANTON WTP					
31	Plant Expansion	8.13	MGD	$3,000,000	$24,390,000
	SUBTOTAL OF PLANT EXPANSION CONSTRUCTION COST				**$24,390,000**
CONSTRUCTION SUBTOTAL					**$44,949,508**
ENGINEERING AND CONTINGENCIES (20%)					$8,989,902
ENGINEERING, CONSTRUCTION PHASE ADDITIONAL (1.5%)					$674,243

TOTAL PROBABLE COST OF PROJECT	**$54,613,653**

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option C - Proposed Mill Creek Reservoir
Opinion of Probable Costs
as of 1/16/2009

AMORTIZATION OF CONSTRUCTION COST (20 YRS, 6% INTEREST)

Calculating the payment amount per period

$$A = P\frac{r(1+r)^n}{(1+r)^n - 1}$$

where

A = payment amount per period
P = intital principal (loan amount)
r = interest rate per period
n = total number of payments

$$A = \$54{,}613{,}653\ \frac{0.005(1+0.005)^{240}}{(1+0.005)^{240}-1}$$

A = $391,269 per month

A = $4,695,228 per year

Calculating the interest rate per period

$$r = \left(1+\frac{i}{n}\right)^{n/p} - 1$$

where

r = rate per payment period
i = nominal annual interest rate (6%)
n = number of compounding periods per year (4)
p = number of payment periods per year (12)

$$r = \left(1+\frac{0.06}{4}\right)^{4/12} - 1$$

r = 0.0050 or 0.50 %

OPERATION AND MAINTENANCE COST FOR PUMP STATIONS

INTAKE PUMP STATION AT PROPOSED RESERVOIR
Four (4) Pumps, including one (1) standby
Each Pump: 2213 US GPM @ 260 Ft, 200 Hp.

1 Operation Time
a. High Flow Times
6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times
24 - 8 (2) = 8 hrs

2 Power Consumption
Total Power = (600(8) + 200 (8)) 0.7457/0.84 = 5,682 Kwh/day

Yearly Power Cost = 5,682 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $248,872

Service and Maintenance Cost
Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option C - Proposed Mill Creek Reservoir
Opinion of Probable Costs
as of 1/16/2009

OPERATION AND MAINTENANCE COST FOR PUMP STATIONS

DISTRIBUTION PUMP STATION
Four (4) Pumps, including one (1) standby
Each Pump: 5667 US GPM @ 200 Ft, 300 Hp.

1 Operation Time
a. High Flow Times
6 - 9 am = 3 hrs
11 - 2 pm = 3 hrs
5 - 7 pm = 2 hrs
Total High Flow Time = 8 hrs

b. Low Flow Times
24 - 8 (2) = 8 hrs

2 Power Consumption
Total Power = (900(8) + 300 (8)) 0.7457/0.84 = 8,522 Kwh/day

Yearly Power Cost = 8,522 Kwh/day x 365 days/yr x $ 0.12 kw/hr = $373,264

Service and Maintenance Cost
Use $25.00/ hr x 12 hrs /month x 2 people x 12 months = $7,200

TOTAL OPERATION AND MAINTENANCE COST

= $248,872 + $7,200 + $373,264 + $7,200 = **$636,536 per year**

OPERATION AND MAINTENANCE COST FOR WATER TREATMENT PLANT

1. Chemical cost for alum and chlorine $500,000

2. Employees Salaries
a. Base Salaries
3 Operators at $25.00/hr x 2,080 hrs/yr = $156,000
2 Maintenance and Service Workers at $10.00/hr x 8 x 5 days x 52 weeks/yr = $41,600
1 Chief Operator at $32.00/hr x 8 x 5 days x 52 weeks/yr = $66,560

Total Employee Base Salary = $264,160 per year

b. Additional Salary Costs for Overtime, etc. = $50,000 per year
Total Salary Cost = $264,160 + $50,000 = $314,160 per year

3. Equipment services and replacement cost = $35,000 per year

4. Other Annual Operating Costs = $350,000

Total Annual O & M Cost = $500,000 + $314,160 + $ 35,000 + $350,000 = $1,199,160

City of Canton
Long-Term Surface Water Supply Options
Exhibit 17
Option C - Proposed Mill Creek Reservoir
Opinion of Probable Costs
as of 1/16/2009

SUMMARY OF COST TO CONSTRUCT PROPOSED MILL CREEK RESERVOIR AND TREATMENT	
Total Cost of Construction	$54,613,653
Amortized Construction Cost (20 Yrs, 6% Interest)	$4,695,228
Pump Stations Operation and Maintenance Cost	$636,536
Water Treatment Plant Operation and Maintenance Cost	$1,199,160
Total Annual Cost (Debt Service plus O & M)	$6,530,924
Total Annual Cost for Option C (Construct Mill Creek Reservoir)	$6,530,924

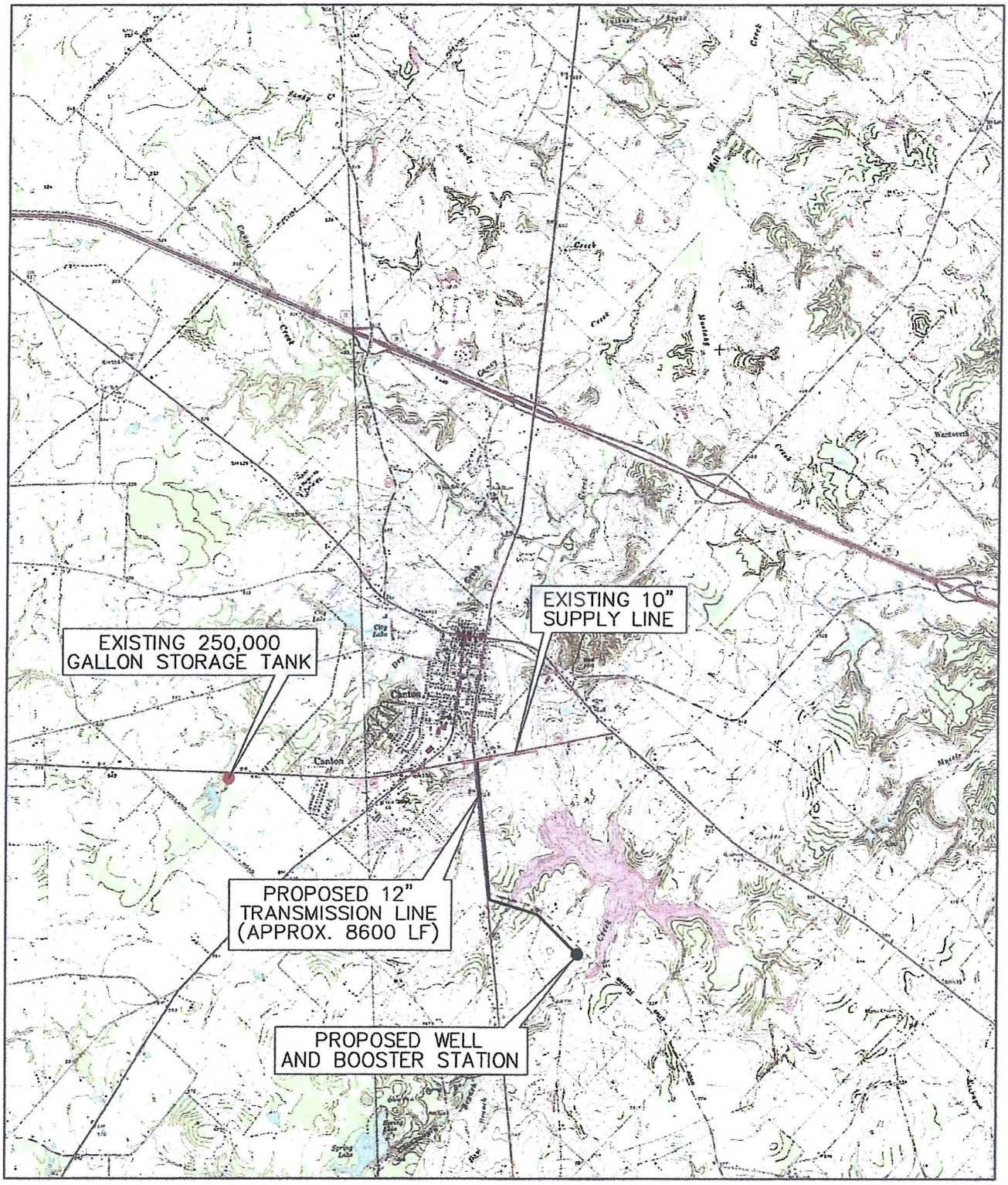
NOTE: Unit Cost based on 5.78 MGD usage

Exhibit 18
Cost Comparison of Options

City of Canton
Long-Term Surface Water Supply Options
Exhibit 18 - Cost Comparison of Alternatives

	Annual Cost ($ Million)			
Option	Debt Service	Operation and Maintenance	Water Purchase	Totals
A - Purchase Treated Water from Tyler	3.89	0.64	3.67	8.20
B - Purchase Raw Water from UNRMWA	3.96	1.74	2.11	7.81
C - Construct Mill Creek Reservoir	4.70	1.84	0	6.54

Exhibit 19
Proposed New Well Location Map and Opinion of Probable Cost



PROPOSED WATER WELL NO. 3

SCALE: 1" = 5,000'

BAR IS ONE INCH IN LENGTH
ON ORIGINAL DRAWING. CHECK
SCALE AND ADJUST ACCORDINGLY.

ONE INCH

Proj No. 014080101 Sht. No. EX 19	THIS DOCUMENT IS FOR INTERIM REVIEW AND IS NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES GARY L. BURTON, III TEXAS P.E. NO. 86643 DATE: 01/03/08	VAN ZANDT COUNTY LONG-TERM WATER SUPPLY STUDY	GARY BURTON ENGINEERING, INC. CONSULTING - PLANNING - PERMITTING - DESIGN - MANAGEMENT 14531 HWY. 155 S TYLER, TX 75703 PHONE (903) 561-6984 FAX (903) 561-6757

Gary Burton Engineering, Inc.

as of 12/04/2008

Consulting • Planning • Permitting • Design • Management

Project: **City of Canton**
FM 2909 Well & Booster Station
Opinion of Probable Cost

Water Well Only

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
1	Mobilization and Bonds	1	LS	$11.000.00	11.000.00
2	Test Hole & Water Sample	1	LS	80.000.00	80.000.00
3	Water Well & Pump	1	LS	350.000.00	350.000.00
PROBABLE COST OF CONSTRUCTION-WELL & PUMP					***$441,000.00***
Construction Contingency (10%)					***$44,100.00***
TOTAL PROBABLE COST OF CONSTRUCTION					***$485,100.00***
Environmental, NEPA Clearance, FONSI					**$5,000.00**
Surveying & Preliminary Engineering					**$10,000.00**
Easements, Acquisition & Legal (Est $10,000/AC)					**$15,000.00**
Engineering Basic Services (Design, Bid, & Contract Administration)					**$41,000.00**
Construction Observation					**$6,000.00**
TOTAL PROBABLE COST OF WATER WELL PROJECT					***$562,100.00***

Booster Station

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
1	Mobilization and Bonds	1	LS	$12.000.00	12.000.00
2	Sitework & Access	1	LS	50.000.00	50.000.00
3	Pump Building (20' x 30')	600	SF	90.00	54.000.00
4	High Service Pumps & Piping	2	EA	30.000.00	60.000.00
5	Yard Piping	1	LS	40.000.00	40.000.00
6	50.000 Gallon GST	1	EA	100.000.00	100.000.00
7	5.000 Gallon Hydropneumatic Tank	1	EA	30.000.00	30.000.00
8	Emergency Generator	1	EA	40.000.00	40.000.00
9	Chlorine/Ammonia Building & Equipment	1	LS	30.000.00	30.000.00
10	Electrical & Instrumentation	1	EA	50.000.00	50.000.00
PROBABLE COST OF CONSTRUCTION-PLANT					***$466,000.00***
Construction Contingency (10%)					***$46,600.00***
TOTAL PROBABLE COST OF CONSTRUCTION					***$512,600.00***
Environmental, NEPA Clearance, FONSI					**$5,000.00**
Surveying & Preliminary Engineering					**$2,500.00**
Easements, Acquisition & Legal (Est $10,000/AC)					
Engineering Basic Services (Design, Bid, & Contract Administration)					**$43,000.00**
Construction Observation					**$8,000.00**
TOTAL PROBABLE COST OF BOOSTER STATION PROJECT					***$571,100.00***

Gary Burton Engineering, Inc.

as of 12/04/2008

Consulting • Planning • Permitting • Design • Management

Project: **City of Canton**
From Proposed Booster Station to Exist. 10" Supply Line
12" Water Main

Opinion of Probable Cost

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL COST
Water Improvements					
1	Mobilization & Bonds	1	LS	$15,000.00	$15,000.00
2	Clear & Grub	4,000	LF	$5.00	$20,000.00
3	12" Water Main, C-900 (CL 150)	8,600	LF	$30.00	$258,000.00
4	18" Dry Bore, w/ Steel Encasement	300	LF	$160.00	$48,000.00
5	12" to 10" Connection	1	EA	$3,500.00	$3,500.00
6	12" Gate Valve	4	EA	$3,000.00	$12,000.00
7	Air Release Valve	2	EA	$4,000.00	$8,000.00
8	Fire Hydrant Assembly	4	EA	$3,000.00	$12,000.00
9	D.I. Fittings	1.5	TONS	$8,000.00	$12,000.00
10	Trench Safety	8,600	LF	1.00	8,600.00
11	Slick Bore Driveways	200	LF	100.00	20,000.00
12	Open Cut and Repair Dirt/Gravel Drive	40	LF	15.00	600.00
13	Asphalt Pavement Repair	150	LF	40.00	6,000.00
14	Crushed Stone Embedment	400	CY	30.00	12,000.00
15	Seeding, Sodding, and Fertilizer	8,600	LF	$2.00	$17,200.00
16	Temporary Sediment Control (Silt Fence / Hay Bales)	8,600	LF	$2.50	$21,500.00
17	SWPPP, NOI Storm Water Permitting Compliance	1	LS	$2,500.00	$2,500.00
18	Traffic Control	1	LS	$2,500.00	$2,500.00
SUBTOTAL PROBABLE COST OF CONSTRUCTION					***$479,400.00***
Construction Contingency (10%)					***$47,940.00***
TOTAL PROBABLE COST OF CONSTRUCTION					***$527,340.00***
Environmental, NEPA Clearance, FONSI					**$10,000.00**
Surveying & Preliminary Engineering					**$17,000.00**
Easements, Acquisition & Legal (Est $10.00/LF)					**$86,000.00**
Engineering Basic Services (Design, Bid, & Contract Administration)					**$45,000.00**
Construction Observation					**$8,500.00**
TOTAL PROBABLE COST OF PROJECT					***$693,840.00***

overlies the Wilcox aquifer. Exhibit 4 shows the location and technical data for all public wells in the area with capacities over 100 gpm. The public water supply wells in the study area produce from 60 to 400 gpm, with an average capacity per well of 186 gpm.

2. SURFACE WATER

a. CITY OF CANTON

The City of Canton owns a water supply reservoir known as Mill Creek Lake. Its location relative to the City limits is presented in Exhibit 5. The water rights certificate of adjudication for the reservoir is included as Exhibit 6. The technical data for the reservoir are as follows:

Year Constructed:	1975
Watershed Area:	6208 acres (9.7 sq. miles)
Surface Area at normal pool:	256 acres
Volume at normal pool:	2260 acre-feet
Yield:	1500 ac-ft/year

In addition to Mill Creek Reservoir, the City has 50 acre-feet per year available from the Old City Lake. However, the use of this small amount for water supply needs is not practical due to recreational uses and cost of access.

Note that the water rights certificate of adjudication shows a yield for the Mill Creek Reservoir of 1,500 acre-feet per year, but the Region D plan reduced the available yield to 706 acre-feet per year. The reason for this reduction is apparently based on recent water availability modeling results by the TCEQ.

b. UPPER NECHES RIVER MUNICIPAL WATER AUTHORITY

The UNRMWA maintains a total water right of 238,110 acre-feet/year for diversions from Lake Palestine and a downstream location at Rocky Point Dam. The UNRMWA operates these rights as a system. Available supply using the modified Neches WAM Run 3 is estimated at 222,200 acre-feet per year in year 2000, decreasing to 214,600 acre-feet per year by 2060. The Authority has existing water supply contracts with the cities of Dallas, Tyler and Palestine, and a small amount to other local water users.

Presently, the City of Dallas does not have transmission facilities to transport water from Lake Palestine. The city of Tyler recently completed a 30 mgd treatment and transmission facility from the lake, and is now using water from this source.

The City of Dallas is currently in the early planning stages of exploring alternatives to access its portion of the water in Lake Palestine. In a cooperative effort with the

IX. LIST OF EXHIBITS

Exhibit No.	Exhibit Description
1	Average Monthly Precipitation vs. Average Monthly Gross Lake Surface Evaporation Rate
2	Major and Minor Aquifers of Texas
3	Existing Regional Reservoirs
4	Existing Public Water Wells
5	Canton Reservoirs
6	Canton Certificate of Adjudication
7	Requests for Water in the Upper Sabine Basin
8	Canton Water Distribution System
9	Projected Water Demand
10	Potential Van Zandt County Dam Sites
11	TCEQ Water Availability Modeling Maps
12	Option A Map - Purchase Treated Water From Tyler
13	Option B Map - Purchase Raw Water
14	Option C Map - Potential Reservoir Locations
15	Proposed Reservoir and Pipeline Map
16	Proposed Dam Plan and Profile
17	Opinions of Probable Cost
18	Cost Comparison of Options
19	Proposed New Well Location Map and Opinion of Probable Cost
20	PowerPoint Slides Comparing Mill Creek to Grand Saline Creek

Exhibit 20
PowerPoint Slides
Comparing Mill Creek to
Grand Saline Creek

City of Canton Site Comparison

Parameter	Mill Creek	Grand Saline Creek
Drainage Area (Square Miles)	32.7	29.7
Surface Area (Acres)	1460	1644
Depth (Feet)	32	30
Yield in Drought (MGD)	5.7	5.2

City of Canton Site Comparison (Cont'd.)

Parameter	Mill Creek	Grand Saline Creek
Miles of Road Affected	0.6	1.4
Oil / Gas Wells in Footprint	4	3
Pipelines (Feet)	8742	3264
Water Systems	1	2
Transmission Lines (Feet)	0	11,747

City of Canton Site Comparison (Cont'd.)

Parameter	Mill Creek	Grand Saline Creek
Number of Parcels Affected	75	104
Number of Property Owners	50	75
Total Acreage Affected	5414	4081
Total Appraised Value (Million Dollars)	14.6	14.0
Appraised Value (Per Acre)	$2,704	$3,426