4B.7 Augmentation of Millers Creek Reservoir

4B.7.1 Description of Canal Option

Millers Creek Reservoir is located in Baylor and Throckmorton Counties approximately 14 miles southwest of the City of Seymour. Lake Creek flows parallel to Millers Creek and the Millers Creek Reservoir. In an effort to increase the yield of the reservoir, this strategy includes diverting water from Lake Creek through a grass-lined canal into Brushy Creek, which flows into Millers Creek and eventually into Millers Creek Reservoir, as shown in Figure 4B.7-1.

The maximum monthly depletion from Lake Creek, assuming the Lake Creek diversion is the most senior in the basin, is approximately 700 cfs. Therefore, the grass-lined canal was sized to accommodate a 700 cfs flow rate at a 0.05 percent slope. The canal bottom width would be 90 feet and the maximum top width would be 287 feet; the water level would be 2.8 feet. The proposed canal location and Lake Creek channel dam are shown on Figure 4B.7-2. The proposed canal length is 1.8 miles from Lake Creek to Brushy Creek. The topography in the area is such that there is a topographic 'high' between Lake Creek and Brushy Creek and therefore, a massive volume of earth cut will be needed to construct the grass-lined canal. It is anticipated that about 40 percent of the excess fill will be disposed of on-site, adjacent to the canal creating 5-feet high, 120-feet wide berms along the top of the canal.

The approximately 8-feet high channel dam would be an earthfill embankment to impound runoff from the Lake Creek watershed. The dam embankment would extend approximately 5,000 feet across Lake Creek at an elevation of 1,477 ft-msl. When full, the lake formed by the dam would periodically inundate approximately 360 acres.

4B.7.1.1 Available Yield

Water potentially available for impoundment into the Millers Creek Reservoir was estimated using the Brazos G WAM. The model utilized a January 1940 through December 1997 hydrologic period of record. Estimates of water availability were derived subject to general assumptions for application of hydrologic models as adopted by the Brazos G Regional Water Planning Group and summarized previously. The model computed the streamflow available for diversion from Lake Creek into the Millers Creek Reservoir without causing increased shortages to existing downstream rights. Safe yield was computed subject to the reservoir having to pass

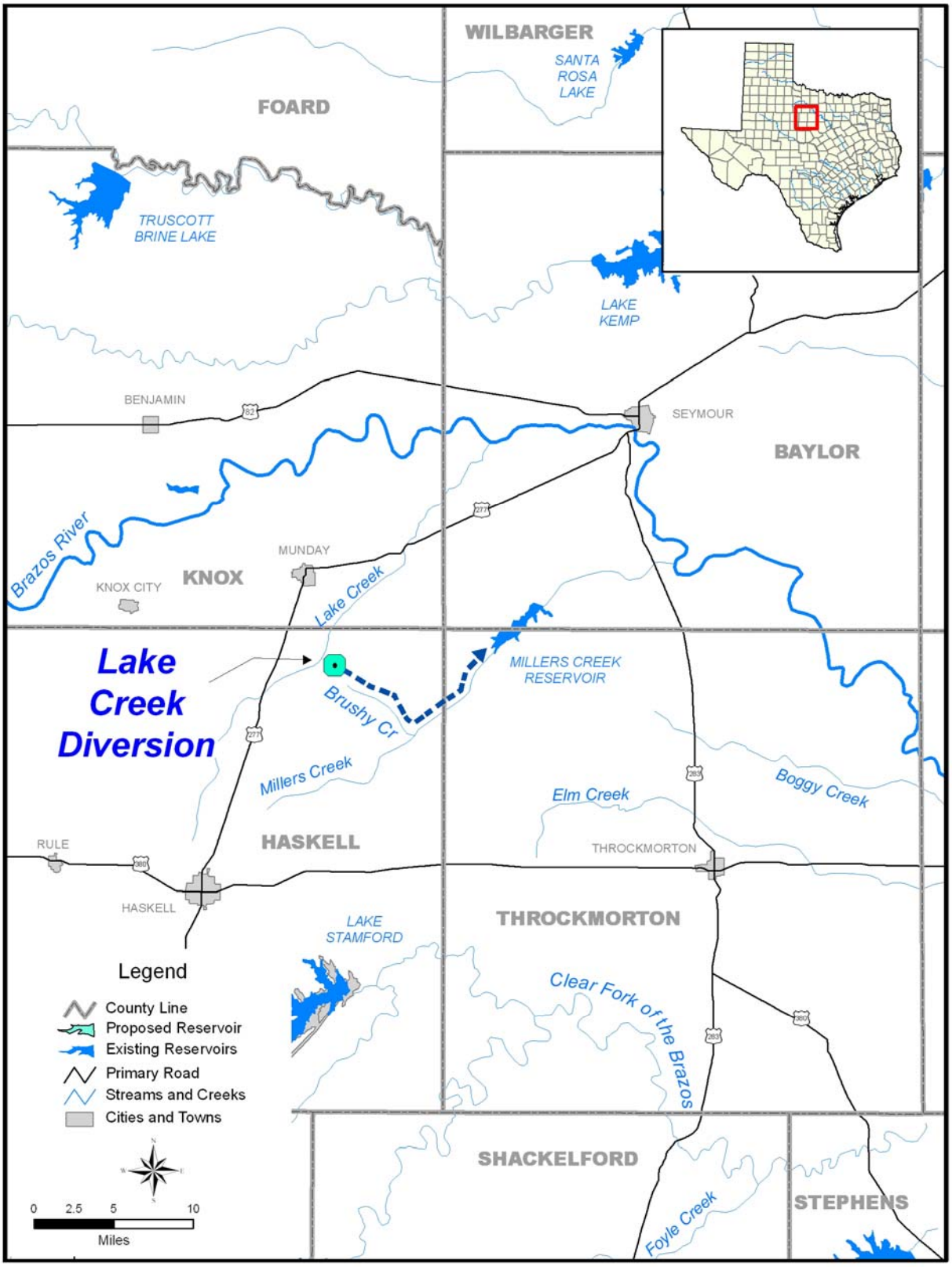

Figure 4B.7-1 Lake Creek Diversion to Millers Creek Reservoir

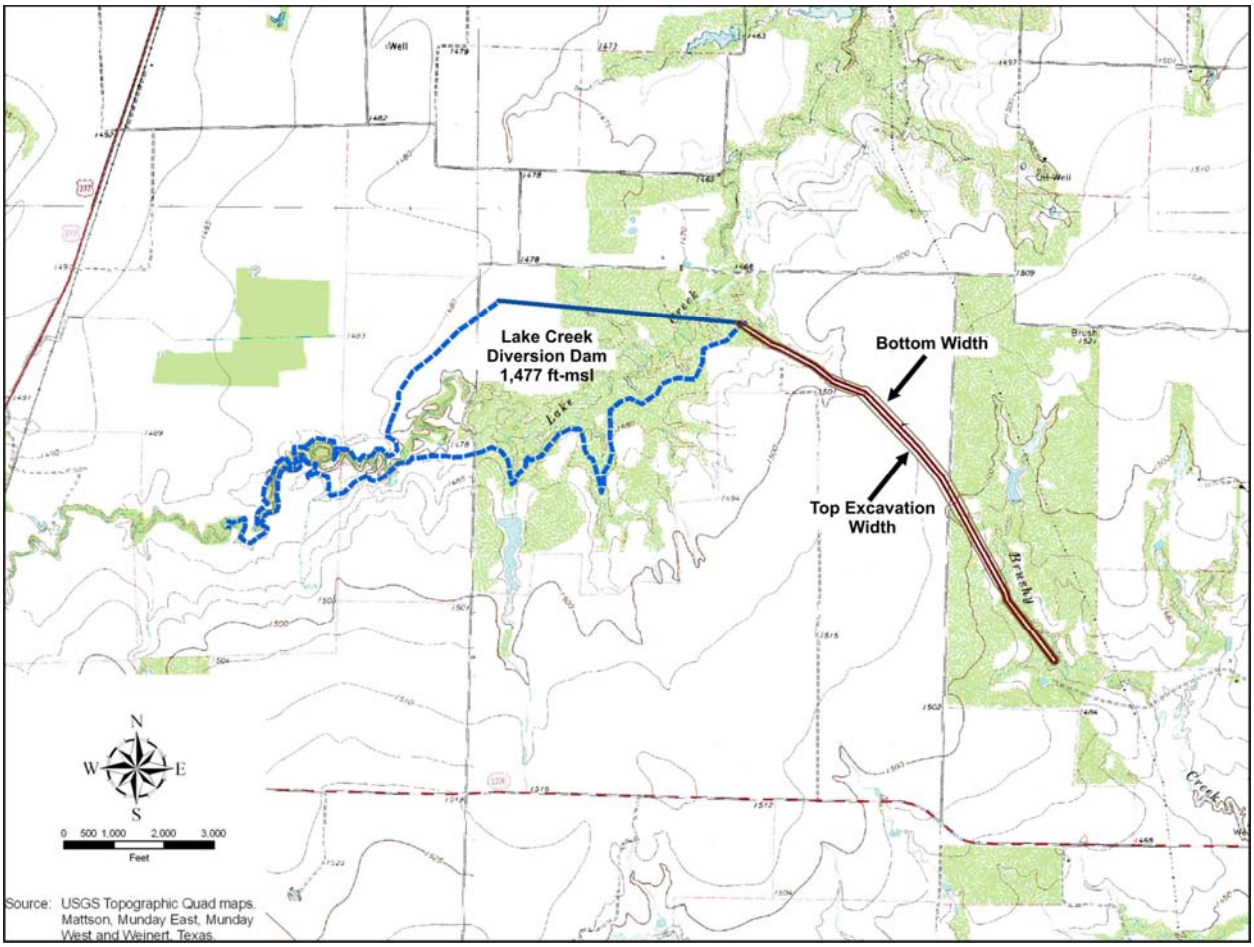

Figure 4B.7-2. Lake Creek Diversion Dam and Canal to Brushy Creek

inflows to meet Consensus Criteria for Environmental Flow Needs (CCEFN) instream flow requirements (Appendix H). The streamflow statistics used to determine the Consensus Criteria pass through requirements for the Lake Creek Diversion are shown in Table 4B.7-1.

The calculated safe yield of the Millers Creek Reservoir with the Lake Creek diversion is 5,350 acft/yr, assuming subordination of Possum Kingdom Reservoir to the Millers Creek Reservoir and the Lake Creek diversion. The Lake Creek diversion increases the yield of the Millers Creek Reservoir by 4,870 acft/yr. The yield impact on Possum Kingdom due to the reservoir and the diversion was assumed to be 2,500 acft/yr for costing purposes. Additional analysis is required to refine this estimate.

Figure 4B.7-3 illustrates the simulated Millers Creek Reservoir storage levels for the 1940 to 1997 historical period, subject to the safe yield of 5,350 acft/yr. Simulated reservoir contents remain above the Zone 2 trigger level (80 percent capacity) 91 percent of the time and

above the Zone 3 trigger level (50 percent capacity) nearly 100 percent of the time (all but 7 months of the simulation).

Table 4B.7-1.
Daily Natural Streamflow Statistics
for the Lake Creek Diversion

Month	*Median Flows - Zone 1 Pass Through Requirements (cfs)*	*25th Percentile Flows - Zone 2 Pass Through Requirements (cfs)*
January	0.0	0.0
February	0.5	0.0
March	0.3	0.0
April	0.0	0.0
May	0.3	0.0
June	1.3	0.0
July	0.1	0.0
August	0.0	0.0
September	0.0	0.0
October	0.0	0.0
November	0.0	0.0
December	0.0	0.0
Zone 3 (7Q2) Pass-Through Requirement (cfs):		0

Figure 4B.7-4 illustrates the changes in Lake Creek and Millers Creek streamflows caused by the project. The largest changes could be a decline in median streamflow in Lake Creek of 5.9 cfs during June and 3.9 cfs in May. During the months of January, February, August, and September there would be little change in Lake Creek streamflow. The largest change in Millers Creek streamflows due to the Lake Creek diversion could be an increase in median streamflow of 3.2 cfs during June and 1.6 cfs in May downstream from Millers Creek Reservoir. These increases are due to more frequent spills due to higher reservoir levels. During the months of January, July, September, and December there would be little change in the Millers Creek streamflow. Figure 4B.7-4 also illustrates the Lake Creek and Millers Creek streamflow frequency characteristics with the diversion in place. There is a very limited overall impact on flows due to the diversion.

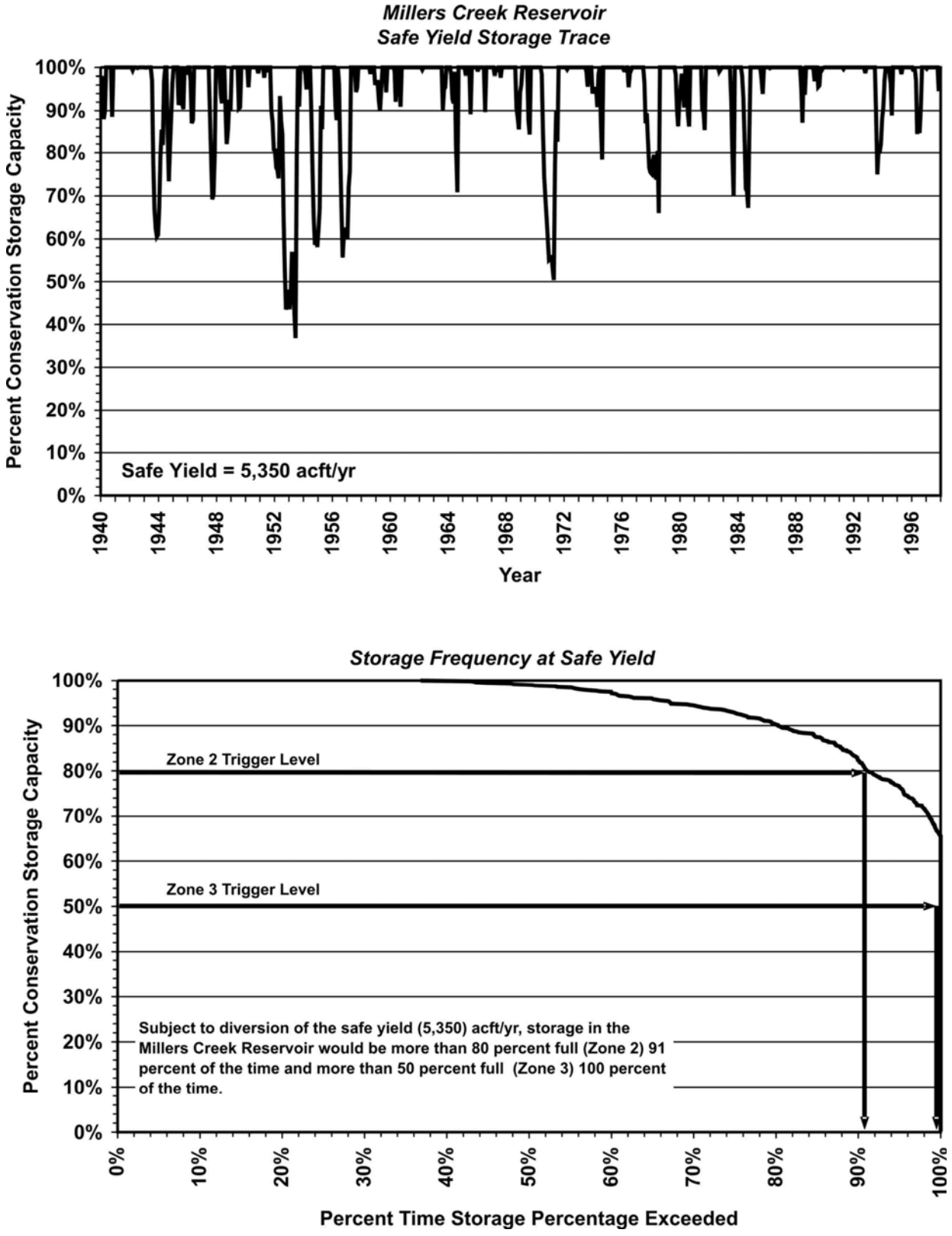

Figure 4B.7-3 Millers Creek Reservoir Storage Considerations

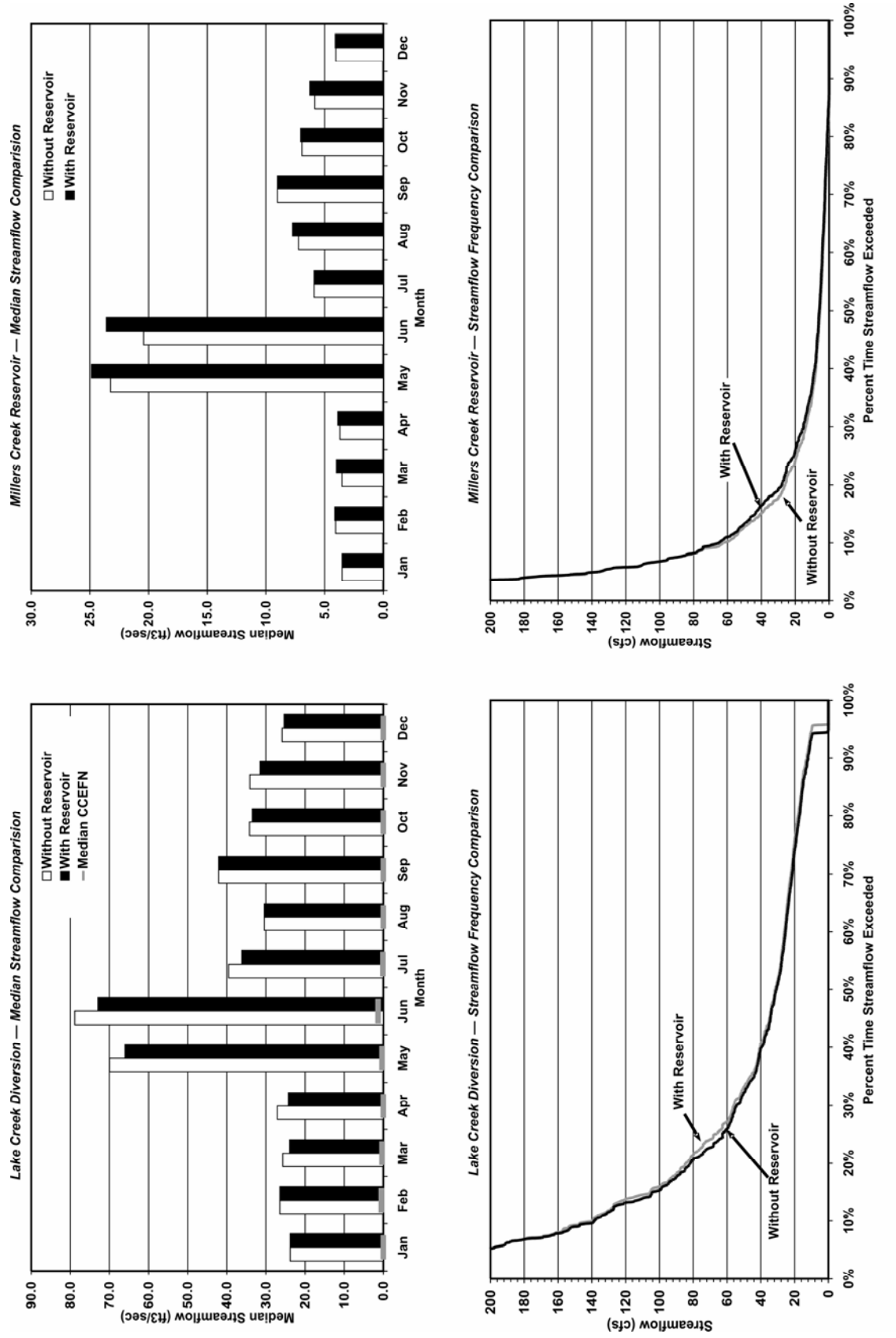

Figure 4B.7-4. Lake Creek Diversion and Millers Creek Reservoir Streamflow Comparisons

4B.7.1.2 Environmental Issues

The Millers Creek Reservoir Augmentation Site in Haskell County lies within the Rolling Plains Ecological Region (Gould et al. 1960). This region is located east of the High Plains, west of the West Cross Timbers and North Central Prairie, and north of the Edwards Plateau. It is characterized by nearly level to rolling topography, soft prairie sands and clays, juniper breaks, and midgrass prairie. The physiognomy of the region varies from open, short to tall, scattered to dense grasslands to savannahs with bunch grasses. Most of the plains are rangeland, but dryland and irrigated crops are increasingly important. Poor range management practices of the past have increased the density of invasive plant species and have decreased the value of the land for cattle production. Farming and grazing practices have also reduced the abundance and diversity of wildlife in the region (Telfair 1999). The climate is characterized as subtropical subhumid, with hot summers and dry winters. Average precipitation ranges between 24 and 26 inches (Larkin and Bomar 1983).

The Seymour Aquifer, an unconsolidated sand and gravel aquifer, is the only major aquifer in the project area. It is formed by alluvial deposits in 20 counties in north central Texas. The Seymour aquifer consists mainly of the scattered erosional remnants of the Seymour Formation of Pleistocene age, which consists of clay, silt, sand, and gravel, that were deposited by eastward-flowing streams. The aquifer generally has less than 100 feet of saturated thickness, but it is an important source of water for domestic, municipal, and irrigation needs (USGS 2004).

The physiography of the region includes recharge sand, undissected red beds, loose surficial sand, flood prone areas, and severely eroded land (Kier et al. 1977). Three major vegetation types occur within the general vicinity of the project area: Mesquite (*Prosopis glandulosa*) - Lotebush Shrub, Mesquite-Saltcedar (*Tamarix*) Brush/Woods, and Crops (McMahan et al. 1984). Variations of these primary types occur involving changes in the composition of woody and herbaceous species and physiognomy according to localized conditions and specific range sites. Mesquite-Lotebush Shrub could include the following commonly associated plants: yucca (*Yucca* spp.), skunkbush sumac (*Rhus trilobata*), agarito (*Berberis trifoliolata*), elbowbush (*Forestiera angustifolia*), juniper, tasajillo (*Opuntia leptocaulis*), cane bluestem (*Bothriochloa barbinodis*), silver bluestem (*Bothriochloa saccharoides*), little bluestem (*Schizachyrium scoparium*), sand dropseed (*Sporobolus cryptandrus*), Texas grama (*Bouteloua rigidiseta*), sideoats grama (*Bouteloua curtipendula*), hairy grama (*Bouteloua hirsuta*), red grama (*Bouteloua trifida*), tobosagrass (*Pleuraphis mutica*),

buffalograss (*Buchloe dactyloides*), Texas wintergrass (*Nasella leucotricha*), purple three-awn (*Aristida purpurea*), Engelmann daisy (*Engellmania peristena*), broom snakeweed (*Gutierrezia sarothrae*), and bitterweed (*Hymenoxys odorata*). Commonly associated plants of Mesquite-Saltcedar Brush/Woods are creosotebush (*Larrea tridentata*), cottonwood (*Populus deltoides*), desert willow (*Chilopsis linearis*), giant reed (*Arundo donax*), seepwillow (*Baccharis* sp.), common buttonbush (*Cephalanthus occidentalis*), whitethorn acacia (*Acacia constricta*), Australian saltbush (*Atriplex semibaccata*), fourwing saltbush (*Atriplex canescens*), lotebush, wolfberry (*Lycium berlandieri*), tasajillo, guayacan (*Guaiacum angustifolium*), alkali sacaton (*Sporobolus airoides*), Johnsongrass (*Sorghum halepense*), saltgrass (*Distichlis spicata*), cattail (*Typha* spp.), bushy bluestem (*Andropogon glomeratus*), and chino grama (*Bouteloua ramosa*). Crops include cultivated cover crops or row crops providing food and/or fiber for either man or domestic animals and may also include grassland associated with crop rotations and hay production.

4B.7.1.2.1 Potential Impacts

4B.7.1.2.1.1 Aquatic Environments including Bays & Estuaries

The potential impacts of this project were evaluated at the existing Millers Creek Reservoir, and at the Lake Creek diversion point. The diversion will occur at a small impoundment created by construction of a channel dam on Lake Creek. During periods of high flow, water will be diverted from the Lake Creek impoundment via a canal to Brushy Creek which feeds Millers Creek and Millers Creek Reservoir. There is a very limited anticipated impact associated with this project either in variability or quantity of monthly flow conditions. The difference in variability of median monthly flows at Millers Creek Reservoir would be negligible (measured by comparing sample variances of all monthly flows from 1940-1997 and predicted flows over that same time period with the project in place; sample variance without project $=3.07 \times 10^7$; sample variance with project $=3.10 \times 10^7$). The difference in variability of monthly flows at the Lake Creek diversion site would also be negligible (sample variance without project $=2.225 \times 10^7$; sample variance with project $=2.221 \times 10^7$). There would be a slight increase in median monthly flows at Millers Creek Reservoir (Table 4B.7-2); the highest increases (>10 percent) would occur in March and June. Flows would decrease slightly in the Lake Creek diversion site with a maximum of 10 percent reduction in April (Table 4B.7-3). Low-flows would be less common downstream of Millers Creek Reservoir. With the proposed

project, spills would occur 12 percent of the time compared to 15 percent without the project. Low flows would be slightly more common at the Lake Creek diversion site with an 85 percent exceedance value of 15.2 cfs with and 15.8 cfs without the proposed reservoir in place.

This project would have minimal influence on flow in the Brazos River or on freshwater inflows to the Brazos River estuary.

Table 4B.7-2.
Median Monthly Streamflow: Millers Creek Reservoir

Month	Without Project (cfs)	With Project (cfs)	Difference (cfs)	Percent Reduction
January	3.5	3.5	0.0	0%
February	4.1	4.1	-0.1*	-2%*
March	3.5	4.0	-0.5*	-13%*
April	3.7	3.9	-0.2*	-5%*
May	23.2	24.9	-1.6*	-7%*
June	20.4	23.6	-3.2*	-16%*
July	5.9	5.9	0.0	0%
August	7.2	7.7	-0.5*	-7%*
September	9.0	9.0	0.0	0%
October	6.9	7.0	-0.1*	-2%*
November	5.8	6.3	-0.4*	-7%*
December	4.0	4.1	0.0	-1%*

*Represents increase in flow under With Project conditions

Table 4B.7-3.
Median Monthly Streamflow: Diversion from Lake Creek to Brushy Creek

Month	Without Project (cfs)	With Project (cfs)	Difference (cfs)	Percent Reduction
January	23.8	23.8	0.0	0%
February	26.4	26.4	0.0	0%
March	25.7	23.9	1.8	7%
April	27.1	24.3	2.8	10%
May	69.9	66.0	3.9	6%
June	78.9	73.0	5.9	8%
July	39.5	36.2	3.4	8%
August	30.4	30.4	0.0	0%
September	42.1	42.1	0.0	0%
October	34.2	33.5	0.7	2%
November	34.1	31.5	2.6	8%
December	25.9	25.4	0.5	2%

4B.7.1.2.1.2 Threatened and Endangered Species

A total of 21 animal species could potentially occur within the vicinity of the site that are state- or federally-listed as threatened or endangered, candidates for listing, or exhibit sufficient rarity to be listed as a species of concern. This group includes three reptiles, 12 birds, four mammals, and two fish species (Table 4B.7-4). Four bird species and one mammal species federally-listed as threatened or endangered could occur (or historically occurred) in the project area. These include the bald eagle (*Haliaeetus leucocephalus*), interior least tern (*Sterna antillarum athalassos*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*). While the black-footed ferret (*Mustela nigripes*) historically occurred in the area, there have been no confirmed reports of this species in Texas since 1963 (Campbell 1995). The bald eagle, interior least tern, piping plover, and whooping crane are all seasonal migrants that could pass through the project area but would not likely be directly affected by the proposed reservoir.

A search of the Texas Wildlife Diversity Database (TPWD 2004c) revealed no documented occurrences of rare or listed species within the project vicinity (as noted on representative 7.5 minute quadrangle map(s) that include the project site). This is based on the best information available to TPWD. However, this does not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in the project area. On-site evaluations will be required by qualified biologists to confirm the occurrence of sensitive species or habitats.

4B.7.1.2.1.3 Wildlife Habitat

The ROW for the diversion canal connecting Lake Creek with Brushy Creek (that will transport diverted water to Millers Creek) is estimated to be approximately 1.8-miles long by with a minimum width of 131 feet and a maximum width of 289 feet.. This would result in approximately 48 acres of impact to wildlife habitat. Of this amount, approximately three acres would be comprised of Mesquite Brush, with the remaining acreage comprising Cropland.

Table 4B.7-4.
Potentially Occurring Species that are Rare or Federal- and State-Listed at the Diversion Site for Augmentation of Millers Creek Reservoir, Haskell County

Scientific Name	*Common Name*	*Federal/ State Status*	*Potential Occurrence*
Birds			
Falco peregrinus anatum	American Peregrine Falcon	DL/E	Migrant
Falco peregrinus tundrius	Arctic Peregrine Falcon	DL/T	Migrant
Ammodramus bairdii	Baird's Sparrow	SOC	Migrant
Haliaeetus leucocephalus	Bald Eagle	LT-PDL/T	Migrant
Buteo regalis	Ferruginous Hawk	SOC	Migrant*
Sterna antillarum athalassos	Interior Least Tern	LE/E	Migrant*
Tympanuchus pallidicinctus	Lesser Prairie Chicken	C/SOC	Resident
Charadrius montanus	Mountain Plover	SOC	Migrant*
Charadrius melodus	Piping plover	FT w/CH	Migrant
Charadrius alexandrinus	Snowy Plover	SOC	Migrant
Athene cunicularia hypugaea	Western Burrowing Owl	SOC	Migrant*
Grus americana	Whooping Crane	LE/E	Migrant
Fishes			
Notropis oxyrhynchus	Sharpnose Shiner	C/SOC	X
Notropis buccula	Smalleye Shiner	C/SOC	X
Mammals			
Mustela nigripes	Black-footed Ferret	LE/E	Extirpated
Cynomys ludovicianus	Black-tailed Prairie Dog	SOC	X
Myotis velifer	Cave Myotis Bat	SOC	X
Spilogale putorius interrupta	Plains Spotted Skunk	SOC	X
Vulpes velox	Swift Fox	SOC	X
Reptiles			
Nerodia harteri	Brazos Water Snake	SOC/T	X
Thamnophis sirtalis annectens	Texas Garter Snake	SOC	X
Phrynosoma cornutum	Texas Horned Lizard	SOC/T	X

(TPWD 2004a, b; USFWS 2003) * Nesting migrant; may nest in the county.

X = Occurs in county.

Federal Status: LE-Listed Endangered; LT-Listed Threatened; w/CH-with critical habitat in the state of Texas; PE-Proposed to Be Listed Endangered; PT-Proposed to Be Listed Threatened; PDL-Proposed to Be De-listed (Note: Listing status retained while proposed); E/SA T/SA-Listed Endangered on Basis of Similarity of Appearance, Listed Threatened on Basis of Similarity of Appearance; DL-De-listed Endangered/Threatened; C-Candidate (USFWS has substantial information on biological vulnerability and threats to support proposing to list as endangered or threatened. Data are being gathered on habitat needs and/or critical habitat designations); SOC-Species of Concern (some information exists showing evidence of vulnerability, but is not listed).

State Status: E-Listed as Endangered by the State of Texas; T-Listed as Threatened by the State of Texas;

SOC-Species of Concern (some information exists showing evidence of vulnerability, but is not listed).

A number of vertebrate species would be expected to occur within the general vicinity of the project site as indicated by county occurrence records (TAMU 1998). These include one species of salamander, five species of frogs and toads, three species of turtles, five species of lizards and skinks, and 17 species of snakes. Additionally, 78 species of mammals could occur within the site or surrounding region (TTU 1997) in addition to an undetermined number of bird species. A variety of fish species would be expected to inhabit streams and ponds within the site, but with distributions and population densities limited by the types and quality of habitats available.

4B.7.1.2.1.4 Cultural Resources

A search of the Texas Archeological Sites Atlas database indicates that three archeological sites have been documented within the general vicinity of the proposed diversion canal. These sites, which lie outside the current project alignment, were recorded as prehistoric habitation sites. Two of these sites (41KX95 and 41HK1) were recommended for further testing in 1973. Prior to construction of the diversion canal, the project must be coordinated with the Texas Historical Commission and a cultural resources survey must be conducted to determine if any cultural resources are present within the alignment. Any cultural resources identified during survey will need to be assessed for eligibility for inclusion in the National Register of Historic Places (NRHP) or as State Archeological Landmarks (SAL). Cultural resources that occur on public lands or within the Area of Potential Effect of publicly funded or permitted projects are governed by the Texas Antiquities Code (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (PL96-515), and the Archeological and Historic Preservation Act (PL93-291).

4B.7.1.2.1.5 Threats to Natural Resources

Threats to natural resources were identified in Section 1.7.3.2 and include lower stream flows, declining water quality, and reduced inflows to reservoirs. This project would have very limited impact associated with lower stream flows or declining water quality. Millers Creek Reservoir would have a slight increase in median monthly inflow that would enhance water quality and offset a decline in water levels.

4B.7.1.3 Engineering and Costing

The total project is estimated to cost $18.2 million for construction of a channel dam and grass-lined canal. The annual project costs are estimated to be $1.35 million; this includes annual debt service, operation and maintenance, and annual payment to the Brazos River Authority for lost yield in Possum Kingdom Reservoir. A summary of the project costs is presented in Table 4B.7-5. The cost for the estimated safe yield of 4,870 acft/yr translates to an annual unit cost for raw water of $0.85 per 1,000 gallons, or $277/acft.

Table 4B.7-5.
Cost Estimate Summary for
Augmentation of Millers Creek Reservoir (Canal Option)
(Second Quarter 2002 Prices)

Item	*Estimated Costs for Facilities*
Capital Costs	
Dam and Reservoir (1,477 ft. msl)	$11,213,000
Total Capital Cost	**$11,213,000**
Engineering, Legal Costs and Contingencies	$3,925,000
Environmental & Archaeology Studies and Mitigation	$273,000
Land Acquisition and Surveying (941 acres)	$297,000
Interest During Construction (2 years)	$2,514,000
Total Project Cost	**$18,222,000**
Annual Costs	
Reservoir Debt Service (6 percent, 40 years)	$1,211,000
Operation and Maintenance	
Dam and Reservoir	$25,000
Purchase of Water (2,500 acft/yr @ 45.75 $/acft)	$114,000
Total Annual Cost	**$1,350,000**
Available Project Yield (acft/yr)	4,870
Annual Cost of Water ($ per acft)	$277
Annual Cost of Water ($ per 1,000 gallons)	$0.85

4B.7.1.4 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 4B.7-6, and the option meets each criterion.

Table 4B.7-6.
Comparison of Augmentation of Millers Creek Reservoir (Canal Option) to Plan Development Criteria

Impact Category	*Comment(s)*
A. Water Supply	
1. Quantity	1. Sufficient to meet some needs
2. Reliability	2. High reliability
3. Cost	3. Reasonable
B. Environmental factors	
1. Environmental Water Needs	1. Low impact
2. Habitat	2. Low to moderate impact
3. Cultural Resources	3. Low to moderate impact
4. Bays and Estuaries	4. Low impact
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. Low impact
C. Impact on Other State Water Resources	• No apparent negative impacts on state water resources; no effect on navigation
D. Threats to Agriculture and Natural Resources	• Low to none
E. Equitable Comparison of Strategies Deemed Feasible	• Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	• Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	• None

Potential Regulatory Requirements:

- Texas Commission on Environmental Quality (TCEQ) Water Right and Storage permits;
- U.S. Army Corps of Engineers Permits will be required for discharges of dredge or fill into wetlands and waters of the U.S. for dam construction, and other activities (Section 404 of the Clean Water Act);

- TCEQ administered Texas Pollutant Discharge Elimination System (TPDES) Storm Water Pollution Prevention Plan;
- General Land Office (GLO) Easement if State-owned land or water is involved; and,
- Texas Parks and Wildlife Department (TPWD) Sand, Shell, Gravel and Marl permit if State-owned streambed is involved.

State and Federal Permits may Require the Following Studies and Plans:

- Environmental impact or assessment studies;
- Wildlife habitat mitigation plan that may require acquisition and management of additional land;
- Flow releases downstream to maintain aquatic ecosystems;
- Assessment of impacts on Federal- and State-listed endangered and threatened species; and,
- Cultural resources studies to determine resources impacts and appropriate mitigation plan that may include cultural resource recovery and cataloging; requires coordination with the Texas Historical Commission.

Land Acquisition Issues:

- Land acquired for reservoir and/or mitigation plans could include market transactions and/or eminent domain;
- Additional acquisition of rights-of-way and/or easements may be required; and
- Possible relocations or removal of residences, utilities, roads, or other structures.

4B.7.2 Description of Pipeline Option

Another option previously studied[1] to increase the yield of Millers Creek Reservoir is to divert water from Lake Creek through a 24-inch pipeline into Brushy Creek, which flows into Millers Creek and eventually into Millers Creek Reservoir, as shown in Figure 4B.7-1.

4B.7.2.1 Available Yield

Water potentially available for impoundment into the Millers Creek Reservoir was estimated by the previous study. The pipeline option was evaluated for flows that are above 5 cfs and below 15.5 cfs via a 24-inch pipeline. The increase in Millers Creek Reservoir firm yield due to the Lake Creek diversion would be 800 acft/yr.

[1] Freese & Nichols, Inc, "West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan," August 2004.

4B.7.2.2 Environmental Issues

The Lake Creek diversion pipeline option is located near the canal option; therefore, the existing environment is similar to that described in Section 4B.7.2. However, the potential environmental impacts of the pipeline option are likely to be less than the impacts associated with the canal option because the pipeline option encompasses a smaller area and therefore critical sites can be avoided more easily.

4B.7.2.3 Engineering and Costing

The total project is estimated to cost $7.47 million for construction of a diversion weir, intake canal, pipeline, and pump station. The annual project costs are estimated to be $708,000, including annual debt service, operation and maintenance, and annual payment to the Brazos River Authority for lost yield in Possum Kingdom. A summary of the project costs is presented in Table 4B.7-7. The cost for the estimated safe yield of 800 acft/yr translates to an annual unit cost for raw water of $2.72 per 1,000 gallons, or $885 per acft.

4B.7.2.4 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 4B.7-8, and the option meets each criterion.

Potential Regulatory Requirements:

- Texas Commission on Environmental Quality (TCEQ) Water Right and Storage permits;
- U.S. Army Corps of Engineers Permits will be required for discharges of dredge or fill into wetlands and waters of the U.S. for dam construction, and other activities (Section 404 of the Clean Water Act);
- TCEQ administered Texas Pollutant Discharge Elimination System (TPDES) Storm Water Pollution Prevention Plan;
- General Land Office (GLO) Easement if State-owned land or water is involved; and,
- Texas Parks and Wildlife Department (TPWD) Sand, Shell, Gravel and Marl permit if State-owned streambed is involved.

Table 4B.7-7.
Cost Estimate Summary for
Augmentation to the Millers Creek Reservoir (Pipeline Option)
(Second Quarter 2002 Prices)

Item	*Estimated Costs for Facilities*
Capital Costs	
Dam and Reservoir (Diversion Weir and Intake Canal)	$3,403,000
Intake and Pump Station	$1,312,000
Transmission Pipeline (24 in dia., 1.8 miles)	$584,000
Total Capital Cost	**$5,299,000**
Engineering, Legal Costs and Contingencies	$1,736,000
Environmental & Archaeology Studies and Mitigation	$265,000
Land Acquisition and Surveying	$10,000
Interest During Construction (2 years)	$158,000
Total Project Cost	**$7,468,000**
Annual Costs	
Debt Service (6 percent, 30 years)	$542,000
Operation and Maintenance	
Intake, Pipeline, Pump Station	$124,000
Pumping Energy Costs	$21,000
Purchase of Water (400 acft/yr @ $45.75/acft)	$18,300
Total Annual Cost	**$705,300**
Available Project Yield (acft/yr)	800
Annual Cost of Water ($ per acft)	$882
Annual Cost of Water ($ per 1,000 gallons)	$2.71

State and Federal Permitting Requirements:

- Environmental impact or assessment studies;
- Wildlife habitat mitigation plan that may require acquisition and management of additional land;
- Flow releases downstream to maintain aquatic ecosystems;

- Assessment of impacts on Federal- and State-listed endangered and threatened species; and,
- Cultural resources studies to determine resources impacts and appropriate mitigation plan that may include cultural resource recovery and cataloging; requires coordination with the Texas Historical Commission.

Land Acquisition Issues:

- Land acquired for reservoir and/or mitigation plans could include market transactions and/or eminent domain;
- Additional acquisition of rights-of-way and/or easements may be required; and
- Possible relocations or removal of residences, utilities, roads, or other structures.

Table 4B.7-8.
Comparison of Augmentation to the Millers Creek Reservoir (Pipeline Option) to Plan Development Criteria

Impact Category	*Comment(s)*
A. Water Supply	
1. Quantity	1. Sufficient to meet some needs
2. Reliability	2. High reliability
3. Cost	3. Reasonable
B. Environmental factors	
1. Environmental Water Needs	1. Low impact
2. Habitat	2. Low to moderate impact
3. Cultural Resources	3. Low to moderate impact
4. Bays and Estuaries	4. Low impact
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. Low impact
C. Impact on Other State Water Resources	• No apparent negative impacts on state water resources; no effect on navigation
D. Threats to Agriculture and Natural Resources	• Low to none
E. Equitable Comparison of Strategies Deemed Feasible	• Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	• Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	• None