

Chapter 4B

Types of Water Management Strategies

This section provides a review of the types of water management strategies considered for the ETRWPA. Included is a summary of the application of each strategy to meet the needs during the planning period. Chapter 4C provides a summary of the strategies considered for each WUG on a county basis and provides the costs for the strategies. WMSs considered include water conservation and drought management, wastewater reuse, expanded use of existing supplies, new supply development and interbasin transfers. WMSs to meet potential future demands, not presently approved by the TWDB, or those that require supply strategies within the ETRWPA to meet demands in other regions are not included. Details of these strategies are included under the discussion for wholesale water providers in Chapter 4C, specifically for the LNVA, UNRMWA, and SRA.

The ETRWPG evaluated WMSs available to meet the demands in the ETRWPA. The strategies considered include the following:

- Water conservation and drought management
- Wastewater reuse
- Expanded use of existing supplies
 - System operation,
 - Conjunctive use of groundwater and surface water,
 - Reallocation of reservoir storage
 - Voluntary redistribution of water resources
 - Voluntary subordination of water rights
 - Yield enhancement
 - Water quality improvements

- New supply development
 - Surface water resources
 - Groundwater resources
 - Brush control
 - Precipitation enhancement
 - Desalination
 - Water right cancellation
 - Aquifer storage and recovery
- Interbasin transfers

The screening criteria developed by the ETRWPG is provided in Appendix 4B-A.

4B.1 Water Conservation and Drought Management

Water conservation is defined as methods and practices that either reduce the demand for water supply or increase the efficiency of the supply or use so that available supply is conserved and made available for future use. Water conservation is typically a non-capital intensive alternative, although costs to individual customers can be significant (e.g., purchase costs for water-efficient appliances). All water supply entities and some major water right holders are required by regulations to have a Drought Contingency and Water Conservation Plan. These plans must detail the entity's procedures for reducing water demand at times when the demand threatens the total capacity of the water supply delivery system or when overall supplies are low.

If strong conservation measures are taken early in a drought and assumed in the planning stages, there is little or no flexibility remaining, should the drought exceed the conservation assumed during planning. The ability to adopt measures more stringent than planned could be limited in times of emergency.

4B.1.1 Regional Considerations. The water demand projections developed in Chapter 2 assume that approved conservation plans are in place and effective for all entities. The savings in water, associated with reduction in per capita usage attributed to the conservation measures, is estimated to be 20,600 ac-ft per year in 2060. Each entity

has varying amounts of additional demand reduction included in the future demand projections described in Chapter 2. The assumed reductions tended to increase for future projections. Conservation activities that were assumed to be in place for the projections included:

- Water-efficient plumbing fixtures consistent with the State Water Efficient Plumbing Act of 1991;
- More thorough use of leak detection processes;
- More widespread use of water efficient appliances;

Water conservation actions implemented as strategies would result in savings above that assumed for the TWDB projections. The Texas Water Development Board Report 362, published by the Water Conservation Implementation Task Force in November 2004, provides a review of best management practices for water conservation for municipal, industrial and agricultural water users. Water conservation strategies, using the guidelines in TWDB Report 362, were evaluated for water users that demonstrated needs in the planning period and met the following conditions:

- Municipal users with current per capita water use greater than 140 gpcd,
- Municipal users that have industrial, commercial and institutional customers that account for more than 20% of the city's total water use,
- Manufacturing users located in counties where manufacturing use is greater than 1,000 ac-ft per year or with an identifiable industry with water use greater than 500 ac-ft per year.

Water conservation strategies for other users (irrigation, steam-electric, livestock and mining) were not developed. These users comprise between 25% to 33% of the total water demand in the ETRWPA during the planning period. Water conservation has recently begun to be utilized in irrigation of rice in one area of the ETRWPA. The water conservation efforts were driven by economic reasons (i.e., billing of water used from

metered flow as opposed to acreage farmed). The financial incentive has led to four conservation measures being implemented; irrigation scheduling, field maintenance, land leveling and tailwater recovery. Metering began in 2004, however, it was not until 2005 that billing on the amount metered was implemented. Comparison of the two years indicated average water consumption to be reduced from 3.79 acre-feet per acre farmed to 2.84 acre-feet per acre farmed. The demand for steam-electric use is projected to grow from 4% to 12% of the demand during the 50-year period. The projections for steam-electric use were provided by the TWDB. Most of the demand will be consumed by new projects, which include conservation in the projected water use. Livestock and mining comprise a total of 4% to 5% of the demand. The cost of water in these industries comprises a small percentage of the overall business cost and it is not expected these industries will see an economic benefit to water conservation

4B.1.2 Selected Water Conservation Strategies. The following are selected water conservation strategies for municipal and manufacturing users.

Municipal Water Conservation Strategies. Water conservation strategies were evaluated for those municipal users showing a need during the planning period and have a per capita water use greater than 140 gpcd. Entities with this type of use customarily have larger commercial and industrial users in relation to the general population. Water conservation practices evaluated included public and school education, water conservation pricing, and passive implementation of new water conserving clothes washing machines. Public and school education would involve providing formal and indirect means of information on how to conserve water. Water conservation pricing requires an increasing rate structure with increasing use. The effectiveness of this measure is in part affected by whether water conservation pricing is currently implemented. The passive implementation of new water conserving clothes washing machines is the natural replacement of clothes washers with time.

Education costs were applied to all of the entities meeting the above criteria. Assumptions made in evaluating the efficiency of this measure included restrictions that the annual budget spent on education would be limited to approximately \$1.00 per capita

or per 1,000 gallons water conserved, whichever was most restrictive. The total budget available will be an indication as to the effectiveness of the program. Table 4B.1 indicated efficiencies assigned to various ranges of available budget.

Table 4B.1 Water Conservation Efficiencies

Budget		Efficiency of Conservation
Low	High	
\$1,500 (minimum)	\$9,999	1.5%
\$10,000	\$19,999	2.0%
\$20,000	\$29,999	2.5%
\$30,000	\$40,000 (maximum)	3.0%

Water conservation pricing will be most effective in areas where groundwater resources are becoming less available and requires high expenditures in capital projects to supply water. Only those entities meeting the above criteria and located in counties that are reaching the limits of groundwater were considered for this strategy. Where the recommended strategies were less than \$1.00 per 1,000 gallons the efficiency achieved is assumed to be 1.0%. A 2.0% efficiency is assumed where the recommended strategy exceeds \$1.00 per 1,000 gallons.

Implementation of the passive clothes washer strategy was limited to areas where the recommended strategy exceeds \$1.00 per 1,000 gallons. The assumptions made in this strategy include a replacement rate of 7.7% per year with a total saving of 5.6 gpcd where installed. Details of municipal conservation strategies are provided in Appendix B. The total savings in water during the planning period for the selected entities is provided in Table 4B.2.

Table 4B.2 Water Conservation Savings for Selected Entities

Entity (County)	Amount Conserved					
	2010	2020	2030	2040	2050	2060
Frankston (Anderson)			6	7	8	9
Diboll (Angelina)	11	20	26	34	53	72
Lufkin (Angelina)	50	117	189	249	319	408
New Summerfield (Cherokee)		10	18	21	23	26
Rusk (Cherokee)				51	66	76
Lumberton/Lumberton MUD (Hardin)	76	116	146	167	190	215
Athens(Henderson)	1	6	12	17	22	30
County-Other (Henderson)	31	57	74	92	108	129
Kirbyville (Jasper)	3	4	5	6	7	7
Appleby WSC (Nacogdoches)				22	39	62
Nacogdoches (Nacogdoches)		229	425	514	654	787
Center (Shelby)	15	34	47	60	67	75
Bullard (Smith)		3	4	5	6	8
Lindale Rural WSC (Smith)			5	7	9	12
Tyler (Smith)	301	526	772	1,036	1,234	1,344
TOTAL	488	1,122	1,729	2,288	2,805	3,260

Water conservation strategies for municipal users that have industrial, commercial and institutional customers that account for more than 20% of the city’s total water use were not considered individually. The water conservation strategies for this group are evaluated under conservation strategies considered for the manufacturing user group

Manufacturing Water Conservation Strategies. The criteria for evaluating water conservation measures in manufacturing uses was limited to counties showing a need in this sector during the planning period with use greater than 1,000 ac-ft per year or with an identifiable industry with water use greater than 500 ac-ft per year. The counties meeting these criteria include Angelina, Nacogdoches, Newton, Orange and Polk. The

distribution, by the general category of manufacturing use, on a county basis is provided in Table 4B.3.

Table 4B.3 Manufacturing Water Conservation

County	Manufacturing Type			
	Timber/Paper	Food	Manufacturing	Petrochemical
Angelina	90%	7%	3%	
Nacogdoches	7%	81%	12%	
Newton	100%			
Orange	40%		2%	58%
Polk	100%			

There are readily available supplies of water to meet manufacturing needs in Newton, Orange and Polk counties. Development of water management strategies for Angelina and Nacogdoches will require more intense planning. The timber and paper industries in Angelina County, for the most part, provide their own ground or surface water. Any conservation measures will more than likely be based on economic justification to expand plant capacity and will not affect water availability to the region as a whole. The remaining industries, food and manufacturing facilities in Angelina and Nacogdoches Counties, should be considered for water conservation. The majority of the water in these sectors is supplied by municipal suppliers that face the needs for major WMSs.

TWDB Report 362 lists fourteen best management practices for industrial users. Application of each of the practices to the food and manufacturing industries in Angelina and Nacogdoches Counties is not practical at this time. However, the industrial water audit practice is a feasible alternative to consider for implementation. The TWDB Report 362 determined that an audit should result in savings of 10 to 35 percent if an audit has not been performed. Table 4B.4 indicates the expected savings of implementation of this water conservation strategy is based on a savings of 10 percent.

Table 4B.4 Manufacturing Water Conservation Savings (ac-ft per year)

County	Demand or Savings					
	2010	2020	2030	2040	2050	2060
Angelina						
Total Demand	30,266	34,359	37,982	41,642	44,887	48,356
Food & Manufacturing Demand	3,066	7,159	10,782	14,442	17,687	21,156
Water Conservation Savings	307	716	1,088	1,444	1,769	2,116
Nacogdoches						
Total Demand	2,288	2,553	2,786	3,016	3,214	3,468
Food & Manufacturing Demand	2,118	2,383	2,616	2,846	3,044	3,298
Water Conservation Savings	212	239	262	285	304	330

Water Conservation Environmental Issues. No substantial environmental impacts are anticipated, as water conservation is typically a non-capital intensive alternative that is not associated with direct physical impacts to the natural environment. A summary of the few environmental issues that might arise for this alternative are presented in Table 4B.5.

Table 4B.5 Potential Environmental Issues Associated with Water Conservation

Environmental Issue	Evaluation Result
Implementation Measures	Voluntary reduction, water pricing, city drought contingency plans
Environmental Water Needs/Instream Flows	No substantial impact identified, assuming relatively low reduction in diversions and return flows: substantial reductions in municipal and industrial diversions from water conservation would result in possibly low to moderate positive impacts as more stream flow would be available for environmental water needs and instream flows.
Bays and Estuaries	No substantial impact identified, assuming relatively low reduction in diversions and return flows.
Fish and Wildlife Habitat	No substantial impact identified, assuming relatively low reductions in diversions and return flows; possible low to moderate positive impact to aquatic and riparian habitats with substantial reductions as more stream flow would be available to these habitats.

**Table 4B.5 Potential Environmental Issues Associated
With Water Conservation (Cont.)**

Environmental Issue	Evaluation Result
Cultural Resources	No substantial impact anticipated
Threatened and Endangered Species	No substantial impact identified, assuming relatively low reduction in diversions and return flows; possible low to moderate positive impact to aquatic and riparian threatened and endangered species (where they occur) with substantial diversion reductions.
Comments	Assumes no substantial change in infrastructure

Water Conservation Cost Considerations. Since water conservation plans are required for each community, regular costs for implementing and enforcing a general conservation program were not estimated. Only the efforts needed to enforce a more stringent conservation plan over and above that assumed in the projections were studied. The only strategy that created a direct cost on the entity is school and public education.

Water Conservation Implementation Issues. Water conservation as a water supply option has been compared to the plan development criteria, as shown in Table 4B.6. Based on the table, it is evident that water conservation meets the evaluation criteria.

Table 4B.6 Water Conservation Evaluation

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Limited. 2. Variable, dependent on public acceptance. 3. Reasonable.
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. None or low impact. 2. No apparent negative impact. 3. None. 4. None or 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	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	Not applicable

4B.2 Wastewater Reuse

Wastewater reuse utilizes treated wastewater effluent as either a replacement for a potable water supply or involves the treatment of wastewater to parameters that allows it to be returned to the water supply resource.

There are no wastewater reuse strategies defined for the ETRWPA. While Athens MWA has received a reuse permit that allows the City of Athens to discharge its wastewater effluent to Lake Athens, the City and MWA have decided not to pursue this strategy at this time due to costs. Athens MWA is pursuing entering into a contract with the Athens Fish Hatchery to return water that is passed through its facility back to Lake Athens. Currently, the hatchery does return this water as part of its operations, but it is under no contractual obligations to do so.

4B.3 Expanded Use of Existing Supplies

Expanded use of existing supplies includes additional use from existing groundwater and local sources and voluntary redistribution of water resources.

4B.3.1 Expanded Use of Groundwater. Groundwater is still a viable and cost-effective supply of water for the ETRWPA. Approximately 60 percent of WUGs with a need during the planning period are expected to continue using groundwater as a source of new supplies. The supplies established in Chapter 3, Section 3.1 were used to evaluate the ability to meet demands for the ETRWPA. Where needs are shown for unspecified users such as irrigation and livestock, the expansion of groundwater use was evaluated on the same percentage usage of existing supplies. Counties that are near capacity in utilizing the groundwater resources are Angelina, Cherokee, Hardin, Nacogdoches, Orange, Shelby and Smith. Evaluation of the expanded use of groundwater is presented by aquifer and county in Tables 4B.7-11.

Table 4B.7 Water Management Strategies Utilizing Gulf Coast Aquifer

Entity	Projected Additional Groundwater Demand (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Hardin County						
County-Other	153	306	306	306	459	459
Manufacturing	114	114	114	114	114	114
Jasper County						
County-Other	632	632	632	632	632	632
Jefferson County						
Mining	0	0	0	0	4	9
Newton County						
Manufacturing	400	400	400	800	800	800
Orange County						
County-Other	140	140	140	140	140	140
Mauriceville WSC	0	203	203	203	203	203
Polk County						
County-Other	208	417	624	832	832	832
Tyler County						
County-Other	0	251	251	251	251	251

Table 4B.8 Water Management Strategies Utilizing Carrizo-Wilcox Aquifer

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Anderson County						
County-Other	0	0	0	0	0	100
Frankston	0	0	120	120	120	120
Mining	0	120	120	120	120	120
Angelina County						
Hudson WSC	0	0	600	600	2000	2000
Lufkin	4650	4650	4650	4650	4650	4650
Steam Electric	1000	1000	1000	1000	1000	1000
Cherokee County						
New Summerfield	0	0	121	242	242	242
Rusk	0	0	0	0	212	212
Henderson County						
County-Other	50	50	50	50	50	50
Houston County						
Irrigation	383	766	1149	1532	1915	2298
Livestock	211	211	422	633	844	1080
Nacogdoches County						
D&M WSC	0	0	310	310	310	310
Livestock	0	0	322	644	966	1350
Swift WSC	350	350	350	350	350	350
Rusk County						
Mining	0	0	0	158	158	158
Sabine County						
County-Other	32	32	32	64	64	64
Livestock	50	50	50	100	100	100
San Augustine County						
Irrigation	90	90	90	90	90	90
Livestock	150	150	250	300	400	400
Shelby County						
County-Other	100	200	300	300	350	350
Livestock	1500	2500	3000	3000	3500	3500
Smith County						
Bullard	0	100	100	100	200	200
Lindale Rural WSC	0	0	0	0	0	80

Table 4B.9 Water Management Strategies Utilizing Queen City Aquifer

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Anderson County						
County-Other	0	0	0	0	0	100
Henderson County						
County-Other	50	50	50	100	200	500
Smith County						
Irrigation	40	40	80	120	168	168
Mining	47	141	188	235	282	329

**Table 4B.10 Water Management Strategies Utilizing
Yegua-Jackson Aquifer**

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Angelina County						
County-Other	0	0	150	150	300	300
Diboll	600	600	600	600	600	600
Trinity County						
County-Other	0	0	0	60	60	60

Expanded Use of Groundwater Environmental Issues. Consideration was given to limiting supply availability to the amount of groundwater that could be withdrawn from the aquifers over the planning period that will not cause more than 50 feet of water level declines, or 10% reduction in saturated thickness whichever is less.

**Table 4B.11 Potential Environmental Issues Associated With
Increased Use of Groundwater**

Environmental Issue	Evaluation Result
Implementation Measures	Local impact resulting from development of well fields, storage facilities, pump stations and pipelines.
Environmental Water Needs/Instream Flows	Potential increase in return flows to streams.
Bays and Estuaries	No substantial impact identified
Fish and Wildlife Habitat	No substantial impact identified
Cultural Resources	No substantial impact anticipated
Threatened and Endangered Species	No substantial impact identified.

Expanded Use of Groundwater Cost Considerations. Cost considerations are affected by the distance from development of wells to the need for the water. Facilities requiring capital investment include wells, pipelines, pump stations and storage. Some wells may require minor treatment.

Expanded Use of Groundwater Implementation Issues. This water supply option has been compared to the plan development criteria, and how the option meets each criterion as shown in Table 4B.12.

Table 4B. 12 Comparison of Wastewater Reuse Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Sufficient to meet needs 2. High reliability 3. Moderate
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. Low impact 2. Low impact 3. Low impact 4. Negligible impact
C. Impact on Other State Water Resources	No apparent negative impacts; no effect on navigation.
D. Threats to Agriculture and Natural Resources	None
E. Equitable Comparison of Strategies Deemed Feasible	Option considered to meet demands of all user groups except Steam-Electric
F. Requirements for Interbasin Transfers	None
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None

4B.3.2 Voluntary Redistribution For the purpose of the 2011 Plan, “voluntary redistribution” is defined as an entity in possession of water rights or water purchase contracts freely selling, leasing, giving, or otherwise providing water to another entity. Typically, the entity providing the water has determined that it does not need the water for the duration of the transfer. The transfer of water could be for a set period of years or a permanent transfer. Voluntary redistribution is essentially a water purchase.

Voluntary redistribution has many benefits over other supply options because it can be much easier than implementing a new reservoir project, it typically costs less than large capital projects, and it avoids implementation issues of new reservoir projects such as environmental and local impacts. Most importantly, redistribution of water makes use of existing resources and provides a more immediate source of water.

Entities that have the potential to meet demands through voluntary redistribution, either by having available supplies or currently providing needs through voluntary redistribution and having the ability to obtain new supplies were identified. It is important to remember that redistribution of water is voluntary. No group or individual is required to participate. Therefore, other strategies should be identified for groups relying on redistribution where the supply would place a burden on the distributor. A discussion of entities considered as potential suppliers of voluntary redistribution is provided below.

Voluntary Redistribution Strategies. Table 4B.13 includes a list of needs met by voluntary redistribution.

Table 4B.13 Needs Met by Voluntary Redistribution

Water Provider	Entity with Need	Water Supply (ac-ft per year)					
		2010	2020	2030	2040	2050	2060
City of Palestine (Lake Palestine)	Steam-Electric (Anderson County)		21,853	21,853	21,853	21,853	21,853
City of Lufkin (Lake Kurth, Sam Rayburn)	County-Other (Angelina County)	0	0	1,100	1,100	1,100	1,100
	Four Way WSC	0	0	0	0	0	225
	Diboll	800	800	800	800	1,600	1,600
	Manufacturing (Angelina County)	6,800	15,800	15,800	15,800	15,800	15,800
LNVA	Mining (San Augustine)	1,000	6,500	0	0	0	0
	Steam-Electric (Jefferson)	0	25,951	25,951	25,951	25,951	25,951
Athens MWA	City of Athens	20	30	44	60	85	117
	Irrigation (Henderson)	152	158	164	169	175	181
UNRMWA	County-Other (Henderson County)	0	150	200	300	400	500
SRA	Steam-Electric (Newton)	0	0	15,000	15,000	15,000	15,000
	Manufacturing (Orange)	5,000	15,000	20,000	25,000	30,000	30,000
	Steam-Electric (Rusk)	0	0	0	0	1,500	1,500
	County-Other (Shelby)	150	150	150	150	150	150
	Livestock (Shelby)	0	0	0	4,000	4,000	4,000
	Mining (Shelby)	250	1,250	0	0	0	0
City of Carthage	Manufacturing (Panola)	96	116	132	147	160	187
City of Tyler	Community Water Company	121	121	121	227	227	227
	Manufacturing (Smith)	0	0	294	294	294	294
	Whitehouse	27	0	0	0	0	0
City of Center	County-Other (Shelby County)	50	50	50	50	50	50
Houston County WCID	Manufacturing (Houston)	0	2	5	8	11	15
	Steam-Electric Power (Nacogdoches)	0	340	340	340	340	340
Hudson WSC	Hudson	0	0	125	400	800	1,200

*Alternative strategy

Voluntary Redistribution Environmental Issues. No significant environmental impacts are anticipated, as available water resources identified for this option are supplied through existing reservoirs or groundwater sources. A summary of the few environmental issues that might arise for this alternative are presented in Table 4B.14.

**Table 4B.14 Potential Environmental Impacts Associated
With Voluntary Redistribution**

Environmental Issues	Evaluation Result
Implementation Measures	Terms of contract addressed on a case by case basis. Potential construction of treatment and distribution infrastructure.
Environmental Water Needs/Instream Flows	No substantial impact identified.
Bays and Estuaries	No substantial impact identified
Fish and Wildlife Habitat	Impact dependent on location and size of project.
Cultural Resources	Impact dependent on location and size of project.
Threatened and Endangered Species	Impact dependent on location and size of project.

Voluntary Redistribution Cost Considerations. Potential costs of purchasing and using water available from voluntary redistribution are listed below:

- Cost of raw water;
- Treatment costs;
- Conveyance costs;
- Additional costs required by water supplier.

Voluntary Redistribution Implementation Issues. This water supply option has been compared to the plan development criteria, as shown in Table 4B.15.

An issue facing redistribution is proper compensation for the entity or individual that owns the water right or contract for water. If an entity has arranged through contracts to have more water than they currently need or may need in the study period, they should be compensated for the expense and upkeep of any facilities already in place.

Table 4B.15 Comparison of Voluntary Redistribution Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Significant quantity available in parts of the Region 2. High Reliability 3. Low to moderate
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. No impact identified. 2. Low impact in areas of construction. 3. Possible low impact. 4. No substantial impact
C. Impact on Other State Water Resources	No apparent negative impacts, no effect on navigation.
D. Threats to Agriculture and Natural Resources	No impact identified.
E. Equitable Comparison of Strategies Deemed Feasible	Considered to meet the needs of all user groups.
F. Requirements for Interbasin Transfers	Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	

The following issues should be considered when negotiating a voluntary redistribution agreement:

- Quantity of water to be redistributed;
- Location of excess water supply;
- Location of buyer with water need;
- Necessary water treatment and distribution facilities;

- Determination of fair market value;
- Consideration of how existing contracts will affect the sale or lease;
- Length of agreement;
- Expiration dates of agreement;
- Drought contingencies;
- Protections needed by entity providing water;
- Protections needed by entity needing water;
- Enforcement of protections, and
- Other conditions specific to buyer and seller.

4B.3.3 Expanded Local Supplies. Expansion of existing supplies involves the development of supplies currently being used near the source of demand, usually groundwater or local supplies (supply ponds). The WUGs that would implement this strategy are limited to irrigation, livestock and mining. The implementation of this strategy involves the assumption that the future needs will be filled by the same percentage usage of current supplies. Where groundwater is being used as a current supply, the additional usage has been included with the increase in use of groundwater. The analysis contained in this section is limited to sources other than groundwater. The WUGs that would implement this strategy are included in Table 4B.16.

Table 4B.16 Water User Groups Utilizing Expanded Local Supplies

Entity	Project Supply Demand (acre-feet)					
	2010	2020	2030	2040	2050	2060
Livestock – Sabine County	0	50	50	100	200	300
Livestock – San Augustine County	0	0	0	0	0	300
Livestock – Shelby County (Sabine Basin)	0	0	500	500	500	500

Expanded Local Supplies Environmental Issues. The expansion of local supplies is very limited in volume and geographic area. Impacts of this WMS on the environment are expected to be negligible.

Expanded Local Supplies Cost Consideration. Costs will vary with each project. This strategy involves development of additional stock ponds for livestock and costs are generally low.

Expanded Local Supplies Implementation Issues. Implementation issues associated with expansion of local supplies are not anticipated.

4B.4 New Reservoirs

Major water providers in the ETRWPA have performed numerous studies on locations of reservoir sites. The ETRWPA possesses many features attractive to reservoir construction. The process of implementing a new reservoir is a multi-decade task of identifying, evaluating, and resolving environmental impacts associated with the reservoir, and evaluating the economic feasibility of the project. These studies are beyond the scope of regional water planning. The process of implementation can go beyond the 50-year planning cycle in the current water planning process. The consideration of reservoir projects in the ETRWPA is based on major water providers located in the ETRWPA presenting information to the ETRWPG that demonstrates their ability and willingness to serve needs in the 50-year planning cycle. For proposed reservoirs, justification and environmental impacts analyses are the responsibility of the sponsoring major water provider.

Two reservoirs are recommended as potential strategies for the needs in the current planning cycle: Lake Columbia and Lake Fastrill. Lake Columbia is located predominately in Cherokee County but extends into the southern portion of Smith County. The reservoir would be formed by construction of a dam on Mud Creek approximately 2.5 miles downstream of U.S. Highway 79 crossing. The dam is expected to impound water approximately 14 miles upstream with an estimated surface of 10,000

acres. The firm yield for the reservoir site is 75,700 acre-feet with a total storage volume at normal pool elevation of 315 feet, msl or 187,839 acre-feet. Lake Fastrill would be located on the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and upstream of the Weches Dam Site. At the normal pool elevation of 274 ft msl, the firm yield of the reservoir is estimated at 148,780 ac-ft per year.

Needs that would potentially be met by the development of Lake Columbia are provided in Table 4B.17. In addition, Lake Columbia is a recommended strategy for all participants in the project. Some participants intend to replace existing groundwater supplies with water from Lake Columbia. These users may or may not show a need in the 2011 Plan.

Table 4B.17 Demands Supplied by Lake Columbia

Entity	Projected Supply Demand (acre-feet)					
	2010	2020	2030	2040	2050	2060
Manufacturing (Angelina)	0	8,551	8,551	8,551	8,551	8,551
Mining (Angelina)	2,000	4,000	0	0	0	0
New Summerfield	0	1,000	1,000	1,000	1,000	1,000
Rusk	0	3,000	3,000	3,000	3,000	3,000
Mining (Cherokee)	500	1,500	0	0	0	0
Mining (Nacogdoches)	2,500	7,000	0	0	0	0
Steam Electric (Nacogdoches)	0	5,000	5,000	5,000	13,400	13,400
Steam Electric (Rusk)	0	0	0	0	0	8,500
Jackson WSC	0	600	600	600	600	600
Whitehouse	0	1,200	1,200	1,200	1,200	1,200

Water demands that would be satisfied by the development of Lake Fastrill are indicated in Table 4B.18.

Table 4B.18 Demands Supplied by Lake Fastrill

Entity	Projected Supply Demand (acre-feet)					
	2010	2020	2030	2040	2050	2060
UNRMWA	0	0	0	148,780	148,780	148,780
City of Dallas						
Steam-Electric Power (Anderson County)*						
TOTAL				148,780	148,780	148,780

* Alternative Strategy

New Reservoirs Environmental Issues. Environmental impacts associated with the development of a new reservoir can be significant. Evaluation of such impacts is generally beyond the scope of water planning. Table 4B.19 provides a basic evaluation of issues.

Table 4B.19 Environmental Issues Associated with Development of New Reservoirs

Environmental Issues	Evaluation Result
Implementation Measures	Dam and reservoir covering 10,000 acres.
Environmental Water Needs/Instream Flows	Probable moderate impact
Bays and Estuaries	Possible cumulative impact to limited areas of coastal marsh
Fish and Wildlife Habitat	Possible high impact to species in general. Possible moderate impact on State-listed species.
Cultural Resources	Probable moderate impact.
Threatened and Endangered Species	Probable moderate impact.

New Reservoirs Cost Consideration. As with any major reservoir project, the project costs are large. Based on comparison with other projects of similar size, it is estimated the proposed Lake Columbia project has an annualized cost of \$16,280,500. This figure is an annualized estimate of cost that includes the construction of the dam, land acquisition, resolution of conflicts, environmental permitting and mitigation, and technical services.

Costs for Fastrill Reservoir will be included once Region C completes cost updates.

New Reservoirs Implementation Issues. This water supply option has been compared to the plan development criteria, as shown in Table 4B.20. The option meets each criterion.

Table 4B.20 Comparison of Development of New Reservoirs to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Sufficient to meet needs 2. High reliability 3. Reasonable to High
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. Moderate impact 2. High impact 3. High impact 4. Negligible impact
C. Impact on Other State Water Resources	Moderate impacts on state water resources (available water); moderate effect on navigation
D. Threats to Agriculture and Natural Resources	Moderate to high impact on bottomland farms and habitat in reservoir area
E. Equitable Comparison of Strategies Deemed Feasible	Option is considered to meet shortages
F. Requirements for Interbasin Transfers	Potential interbasin transfer to Trinity Basin
G. Third Party Social and Economic Impacts from New Reservoirs	Varies: Potential for positive economic impacts