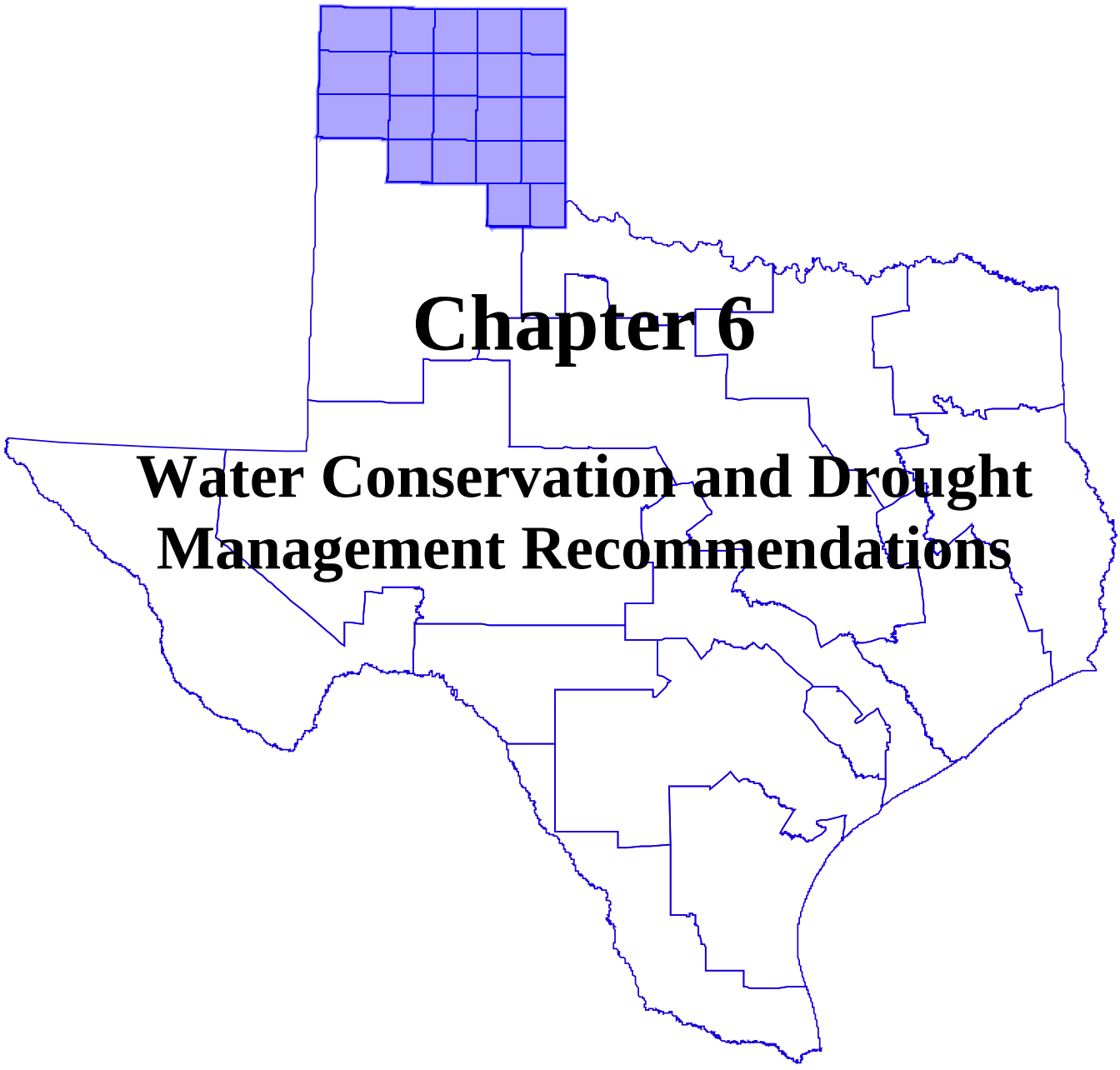

Chapter 6

Water Conservation and Drought Management Recommendations

6.1 Introduction

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of all existing water resources and must be considered for all water user groups with needs, or shortages. For municipalities and manufacturers, advanced drought planning and conservation can be used to protect their water supplies and increase reliability during drought conditions. Some of the demand projections developed for regional water planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act. Additional municipal water savings can be expected from the Federal mandate for energy efficient clothes washing machines, which went into effect in 2007.

The Panhandle Regional Water Planning Group (PWPG) encourages all water user groups to practice advanced conservation efforts to reduce water demand, not only during drought conditions, but as a goal in maintaining future supplies. The term "advanced" conservation means conservation techniques that go beyond implementation of the state's plumbing fixture requirements and beyond the adoption and implementation of water conservation education programs. Advanced conservation efforts for municipal users should include a 1 percent annual demand reduction until the region reaches an average of 140 gpcd use. This demand management strategy will achieve this target sometime in the 2040 decade. All retail public water suppliers that are required to prepare and submit water conservation plans should establish targets for water conservation including specific goals for per-capita water user and for water loss programs using appropriate water conservation best-management practices (BMPs) or other water conservation techniques to achieve their targets and goals in an effort to increase efficiency in water use and achieve conservation as defined in Chapter 11 of the Texas Water Code.

Reductions in demands due to conservation were not specifically quantified by the TWDB for manufacturing, mining, irrigation and livestock needs. Conservation savings are incorporated into the implementation of new methods and technologies in livestock operations. For Livestock uses, any future reduction in demands due to the use of such technologies is already reflected in the projected demands as developed by regional agricultural experts and users. Agricultural conservation savings can be achieved through the implementation of demand reduction strategies as outlined in Chapter 4 and summarized in this chapter. Steam electric power generation will achieve future conservation savings through the implementation and construction of more efficient generating facilities. In addition, steam electric power generation will practice conservation by utilizing reuse supplies for future demands. Conservation was considered during the development of power demands.

Regional water guidelines require each region's water plan to address drought management and conservation for each supply source within the region. This includes both groundwater and surface water. The PWPG believes that utilizing advanced water conservation measures (i.e. savings associated with active conservation measures for municipal and industrial uses) will be implemented by local governing entities or water

users as conditions arise. The PWPG encourages water conservation as a means of meeting future water demands.

Currently, one of the 56 municipal water users in the Panhandle have per capita water use less than 100 gallons per person per day and 13 entities are less than the Water Conservation Task Force recommended state average of 140 gallons per person per day. As shown in Table 6-1, the Panhandle regional gpcd numbers vary from a high of 334 to a low of 99 gpcd, both for County-Other water users, while the regional median is 191 and an average of 195 gpcd. Based on average gpcd use, a 1 percent annual decrease in municipal consumption would take over 30 years to reach the Conservation Task Force recommended target of 140 gpcd. While municipal use represents approximately 5 percent of the total regional water demands in 2010, the potential savings from advanced municipal conservation compared to agricultural conservation are relatively small. However, conservation savings in the irrigated agriculture sector would provide significant amounts of savings and sustainability for other users as groundwater supplies in the region continue to decline.

Table 6-1 shows the 1980-2002 average, the 2003-2007 average (5 years) and the 1980-2007 average gallons per capita per day (gpcd) for the recognized municipal user groups located in the PWPA. The 2003-2007 averages represent the most recent 5-year increment for which data were available. It also represents the time period following implementation of the State Water-Efficiency Plumbing Act. The statistical evaluation on Table 6-2 includes the uses for County-Other category which attempts to capture water use among communities with less than 500 in population. These demand numbers are compiled by the TWDB through water use surveys conducted annually of all retail and wholesale providers.

Table 6-1: Municipal Water Users Gallons Per Capita Per Day

Municipal Water User	1980-2002 Average GPCD	2003-2007 Average GPCD	27 year Average GPCD
Amarillo	202	223	205
Booker	243	235	242
Borger	144	134	142
Cactus	181	249	194
Canadian	206	202	206
Canyon	162	175	164
Childress	188	201	191
Clarendon	197	144	188
Claude	177	216	184
Dalhart	237	252	239
Dumas	168	224	178
Fritch	163	181	166
Groom	216	212	215
Gruver	247	233	245
High Texas Water Co.	99	99	99
Lake Tanglewood	145	182	156
Lefors	148	182	155
McLean	251	260	253
Memphis	169	193	174
Miami	222	246	226
Pampa	164	152	163
Panhandle	196	157	191
Perryton	208	217	209
Shamrock	143	146	144
Skellytown	95	134	107
Spearman	203	248	211
Stinnett	167	177	169
Stratford	267	221	259
Sunray	212	203	210
TCW Supply Co.	255	255	255
Texline*	334	334	334
Vega	225	252	230
Wellington	182	180	182
Wheeler	190	213	193
White Deer	156	197	161
REGIONAL STATISTICS (including County-Other)			
Average GPCD	193	204	195
Median GPCD	190	203	191
Highest GPCD	334	334	334
Lowest GPCD	95	99	99

* Texline supplies commercial water to a local fertilizer plant that was not historically metered separately.
* Source: TWDB Water Use Survey (http://www.twdb.state.tx.us/wushistorical/)

Table 6-2: County-Other Water Users Gallons per Capita per Day

County	GPCD
Armstrong	115
Carson	194
Childress	188
Collingsworth	233
Dallam	138
Donley	109
Gray	135
Hall	249
Hansford	171
Hartley	154
Hemphill	121
Hutchinson	163
Lipscomb	199
Moore	189
Ochiltree	132
Oldham	117
Potter	75
Randall	113
Roberts	125
Sherman	150
Wheeler	138

* Source: TWDB Water Use Survey (http://www.twdb.state.tx.us/wushistorical/)

6.2 Agricultural Conservation

Agricultural conservation savings can provide for a significant amount of the water demand in the PWPA. According to TWDB and other agricultural conservation experts, the potential benefit of water conservation is most dramatically demonstrated in on-farm irrigation. While on-farm irrigation improvements are still an important component to the overall conservation savings associated with irrigated agriculture, the one strategy that yields the largest water savings in the PWPA is the adoption of drought resistant varieties of corn, cotton and soybeans which are being developed with the aid of biotechnology. This strategy is estimated to have the potential to save 10.6 million acre-feet (cumulative savings), which equates to 14.7 percent of the total irrigation water pumped over the 50-year planning horizon. The next significant water saving strategy includes the application of five major on-farm irrigation water conservation practices. These five practices include: (1) Low Elevation Precision Application (LEPA) sprinklers, (2) surge flow furrow irrigation valves, (3) drip irrigation, (4) soil moisture measurement and irrigation scheduling, and (5) the use of on-farm underground water distribution pipelines. Working in conjunction with the USDA-NRCS, State Soil and Water Conservation Board, local soil and water conservation districts, and local groundwater conservation districts, many local experts assists farmers in maximizing irrigation efficiency. Other strategies considered and recommended include Change in Crop Type, Conversion to Dryland, Change in Crop Variety and Conservation Tillage. Precipitation

Enhancement shows great potential in increased water savings for irrigated agriculture, but it is currently practiced in counties within the Panhandle GCD.

Based on the evaluation of agricultural conservation strategies discussed in Chapter 4, it was concluded that the following conservation strategies can be implemented in the area: (1) Use of North Plains Evapotranspiration Network (NPET), (2) Change in Crop Variety, (3) Irrigation Equipment Efficiency Improvements, (4) Change in Crop Type, (5) Implementation of Conservation Tillage Methods, (6) Precipitation Enhancement, (7) Conversion from Irrigated to Dryland and (8) Biotechnology. Using these strategies and the assumptions discussed in Chapter 4, Table 6.3 shows the maximum potential conservation savings that could be achieved within the PWPA during the planning cycle.

Table 6.3 Potential Agricultural Conservation Savings

Agricultural Conservation Savings (acre-feet/year)						
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Armstrong	0	2,955	3,036	3,182	3,263	3,343
Carson	0	23,537	24,179	25,333	25,975	26,616
Childress	0	2,260	2,324	2,439	2,503	2,566
Collingsworth	0	4,276	4,418	4,673	4,815	4,957
Dallam	0	77,900	127,101	140,186	141,582	141,582
Donley	0	4,089	4,210	4,428	4,549	4,669
Gray	0	7,166	7,361	7,711	7,905	8,100
Hall	0	4,524	4,658	4,899	5,032	5,166
Hansford	0	34,246	55,074	61,026	61,762	61,762
Hartley	0	70,010	115,042	126,809	128,028	128,028
Hemphill	0	310	318	334	342	350
Hutchinson	0	10,478	17,009	18,870	19,092	19,092
Lipscomb	0	3,063	3,144	3,290	3,371	3,452
Moore	0	42,950	70,343	78,343	79,194	79,194
Ochiltree	0	23,477	24,119	25,273	25,914	26,555
Oldham	0	1,110	1,140	1,195	1,225	1,256
Potter	0	1,298	1,335	1,402	1,439	1,476
Randall	0	24,279	24,924	26,086	26,732	27,377
Roberts	0	3,965	4,087	4,307	4,429	4,551
Sherman	0	55,693	91,668	101,369	102,462	102,462
Wheeler	0	2,291	2,355	2,469	2,532	2,595
TOTAL	**0**	**399,879**	**587,845**	**643,622**	**652,146**	**655,152**

Based on the relative potential for water savings and the potential impact on the regional economy, the irrigation conservation strategies are recommended in two different tiers. The first tier represents the strategies that result in the highest level of conservation and have a positive impact to the regional economy. These include biotechnology adoption of

drought resistant crops, the use of the NPET to schedule irrigation, irrigation equipment efficiency improvements and implementation of conservation tillage methods. The second tier while recommended is considered less desirable because of their anticipated negative impact on the regional economy. The second tier includes: changes in crop variety, changes in crop type and converting irrigated acreage to dryland farming. Since there are no current sponsors for precipitation enhancement in 14 of the 21 counties in the PWPA, precipitation enhancement is considered an alternative strategy in these 14 counties. This is because it cannot be implemented by an individual producer and little participation has been shown in implementing this strategy by water districts in the region with exception of the Panhandle GCD.

The associated water savings with these strategies are "potential" water savings. In the absence of water use constraints, most if not all the strategies considered will simply increase gross receipts. The improved water use efficiencies generated from some of these strategies may actually increase the depletion rate of the Ogallala aquifer. Also, potential water savings may be overestimated when combinations of strategies are implemented. In some cases, some of the recommended strategies are mutually exclusive on the same irrigated land (for example, irrigation efficiencies and conversion to dryland farming).

6.3 Water Conservation Plans

The TCEQ defines water conservation as "a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water."

The TCEQ requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more. Water conservation plans are also required for all water users applying for a State water right, and may also be required for entities seeking State funding for water supply projects. Legislation passed in 2003 requires all conservation plans to specify quantifiable 5-year and 10-year conservation goals and targets. While these goals are not enforceable, they must be identified. All updated water conservation plans were to be submitted to the Executive Director of the TCEQ by May 1, 2005. In 2007 legislation was passed that requires all public water suppliers with greater than 3,300 connections to submit a conservation plan to the TWDB by May 1, 2009.

In the PWPA, eight water suppliers hold municipal or industrial surface water rights in excess of 1,000 acre-feet per year or have more than 3,300 connections. There are no entities with surface irrigation water rights greater than 10,000 acre-feet per year. Each of these entities is required to develop and submit to the TCEQ a water conservation plan. Several water users have contracts with regional water providers for water of 1,000 acre-feet per year or more. Presently, these water users are not required to develop water conservation plans unless the user is seeking State funding; however, a wholesale water

provider may request that its customers prepare a conservation plan to assist in meeting the goals and targets of the wholesale water provider's plan. A list of the users in the PWPG required to submit water conservation plans is shown in Table 6-4.

There are numerous irrigation users pumping groundwater in excess of 10,000 acre-feet per year and these users are usually regulated through the local GCD which will issue well permits to these users. The GCD is required to submit a groundwater management plan to the TWDB for approval.

To assist entities in the PWPA with developing water conservation plans, model plans for municipal water users (wholesale or retail public water suppliers), industrial users and irrigation districts are included in Appendix J. Each of these model plans address the latest TCEQ requirements and is intended to be modified by each user to best reflect the activities appropriate to the entity.

The focus of the conservation activities for municipal water users in the PWPA are:

- Education and public awareness programs,
- Reduction of unaccounted for water through water audits and maintenance of water systems, and
- Water rate structures that discourage water waste.

Industrial water users include manufacturing and processing industries as well as smaller local manufacturers. Conservation activities associated with industries are very site and industry-specific. Some industries can utilize brackish water supplies or wastewater effluent while others require only potable water. It is important in evaluating conservation strategies for industries to balance the water savings from conservation to economic benefits to the industry and the region.

Table 6-4: Water Users in the PWPA that are Required to Prepare Water Conservation Plans

Municipal and Industrial Water Users	Irrigation Water Users
City of Amarillo	None in Region A
Canadian River Municipal Water Authority	
Greenbelt Municipal Water Authority	
Palo Duro River Authority	
Borger	
Canyon	
Dumas	
Pampa	

The focus of the conservation activities for industrial users is:

- Evaluation of water saving equipment and processes, and
- Water rate structures that discourage water waste.

6.4 Groundwater Conservation Districts

The Texas Legislature has established a process for local management of groundwater resources through Groundwater Conservation Districts (GCD). The districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. An elected board governs these districts and establishes rules, programs and activities specifically designed to address local problems and opportunities. Texas Water Code §36.0015 states, in part, "Groundwater Conservation Districts created as provided by this chapter are the state's preferred method of groundwater management."

All GCDs are required to develop a groundwater management plan and submit it to the TWDB for certification. A newly created district is required to submit its management plan no later than two years after its creation. If a district requires a confirmation election after its creation, a management plan should be submitted no later than two years after the confirmation election (§356.3, Texas Administrative Code, relating to Required Management Plan). A groundwater management plan is a 10-year plan that describes a district's groundwater management goals. These goals include providing the most efficient use of groundwater, controlling and preventing waste of groundwater, controlling and preventing subsidence, addressing conjunctive surface water management issues, addressing natural resource issues, addressing drought conditions, and addressing conservation (§§356.5 and 356.6, Texas Administrative Code, relating to Management Plan and Plan Submittal, respectively).

There are currently six GCDs in operation in the PWPA. Their management plan goals and objectives are summarized as follows:

6.4.1 Mesquite Groundwater Conservation District (Mesquite GCD)

The District was created in November 1986 and expanded in October 2007. The district covers the whole of Collingsworth County, Hall County and portions of Childress County. The District is dominated by agricultural production. About 65 percent of the District is rangeland, 30 percent is cropland and the rest is urban, transportation or water areas. According to District records, there are slightly more than 600 active irrigation wells within the District. There are several municipal or public supply wells within the District. The remaining wells are non-permitted water supplies for household and livestock consumption. The District's overall management goal is to have 50 percent of the underground water supplies (saturated thickness) that was available in 2008 still available by 2058. The District's specific goals as outlined in their water management plan are listed below.

- Implement measures to provide for the conservation of the groundwater resources of the District
- Provide for the most efficient use of groundwater
- Implement management strategies that will control and prevent waste and contamination of groundwater

- Implement strategies to address drought conditions
- Implement Strategies to enhance water supplies.

The District has specified the following management objectives in order to meet the goals stated above:

- Monitor static water levels in selected wells
- Conduct water quality analysis of selected wells
- Publicize groundwater conservation issues through local newspapers, group presentations, schools and other media opportunities.
- Monitor selected flowmeters on wells to facilitate water usage efficiency standards
- Publicize the need for efficient use of groundwater through local newspapers, group presentations, schools, and other media opportunities
- Identify and address local irrigation practices which are wasteful of groundwater resources
- Maintain a program to identify, locate and obtain closures of abandoned wells
- Maintain the District drought contingency plan
- Recharge Enhancement
- Rainwater Harvesting

6.4.2 Hemphill County Underground Water Conservation District

The Hemphill County Underground Water Conservation District (Hemphill County UWCD) was created in 1995 and an updated management plan was adopted in July 2007. The purpose of the District is to provide for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater, and of groundwater reservoirs or their subdivisions. This will be achieved through rules, education programs, District-provided services, and through mutual cooperation of local, state, and federal agencies. The District issues water well permits, collects groundwater information, performs water quality analyses, and provides well system tests and other services.

The primary goals of the District are to ensure that its activities are consistent with sound business practices, that the public interest will always be considered in District business, that impropriety shall be avoided to ensure and maintain public confidence in the District, and that the Board shall control and manage the affairs of the District lawfully, fairly, impartially, and in accordance with the stated purposes of the District.

The District has outlined the following management goals.

- Providing the most efficient use of groundwater
- Controlling and preventing waste of groundwater
- Natural resource issues which impact the use and availability of groundwater and which are impacted by the use of groundwater
- Addressing conjunctive surface water management issues

- Addressing drought conditions
- Addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, and brush control.
- Addressing, in a quantitative manner, the desired future conditions of the groundwater resources selected pursuant to the Water Code

The District has outlined the following management objectives in order to meet the above goals.

- All new or permitted wells are to be registered or permitted with the District
- Maintain a system of permitted the use and production of groundwater
- Establish a monitor well network
- Evaluate district rules on an annual basis
- Provide information to the public on reducing wasteful practices
- Reduce the waste of water as far as is reasonably and economically viable. Work with the Texas Railroad Commission (TRC) to monitor for waste of water and develop economical methods to prevent contamination.
- Publish notice for the drilling and operation of salt water disposal wells
- Review potential groundwater contamination from oil and gas activities on an annual basis
- Review potential groundwater contamination from agricultural activated on an annual basis
- Participate in the regional planning process by attend regional planning group meetings
- Monthly review of Palmer drought index
- Quarterly assessment of the status of drought in the District
- Sponsor public education at board meeting
- Submit an article regarding water conservation to local newspaper
- Educate students on the importance of water as a natural resource, water conservation or the prevention of contamination.

6.4.3 North Plains Groundwater Conservation District No. 2

The North Plains Groundwater Conservation District No. 2 (North Plains GCD) was created in 1955. The district encompasses all of Sherman, Hansford, Ochiltree, Lipscomb and parts of Dallam, Hartley, Moore, and Hutchinson counties. The District adopted a water management plan on August 18, 1998 and a revised water management plan dated May 2008. The overall goal of the District is to ensure that its activities are consistent with sound business practices; that the interest of the public shall always be considered in conducting District business; that impropriety or the appearance of impropriety shall be avoided to ensure and maintain public confidence in the District; and that the Board shall control and manage the affairs of the District lawfully, fairly, impartially, and in accordance with the stated purposes of the District. The water management plan lists the following specific goals:

- Providing the most efficient use of groundwater
- Controlling and preventing the waste of groundwater
- Conjunctive surface water management issues
- Natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater
- Addressing drought conditions
- Promote water conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control
- Determine desired future conditions of the groundwater resources

The District has outlined the following management objectives in order to achieve the above goals:

- Evaluate the requirement that all new wells be properly spaced and comply with well density standards
- Limit groundwater withdrawal amounts based on an allowable production limitation and contiguous water right acres limitation
- Analyze the current and future socio-economic impacts to water rights owners from schedule reduction of the allowable production limit to promote conservation
- Installation of water well flow meters on each non-exempt and non-domestic well
- Calculate total annual groundwater withdrawals by all water rights owners that have wells capable of producing more than 25,000 gallons of water a day
- Track the location of all domestic, livestock and rig supply water wells within the district
- Track the location and dispositions of all non-exempt water wells capable of producing more than 25,000 gallons of groundwater a day
- Conduct groundwater level monitoring
- Provide pump tests and pump plant efficiency tests for water users
- Update, publish and distribute hydrologic maps
- Control and prevent waste of groundwater through education and mitigation
- Promote beneficial use of groundwater through research and education
- Assist well owners with water quality testing
- Protect the quality of the aquifer through Check Valve Program and requirements
- Provide public information regarding Xeriscape and drip irrigation to address drought conditions
- Continue supporting water conservation research addressing drought conditions with Texas Agrilife Research
- Maintain current partnership with Texas Agrilife Research to promote in agricultural water conservation
- Implement the eight water management strategies recommended by the 2007 State Water Plan
- Participate in the Ogallala Aquifer Project as part of the industry review committee for modeling the economic impacts of water conservation policy

- Provide the public information regarding rainwater harvesting
- Provide the public information regarding brush control

6.4.4 The High Plains Underground Water Conservation District No. 1

The High Plains Underground Water Conservation District No. 1 (High Plains UWCD) created its water management plan on August 11, 1998 and amended the plan in January, 2004. This plan will remain in effect, unless a revised is approved. The High Plains UWCD has jurisdiction in the PWPA in Potter and Randall Counties. The District has outlined the following goals under the water management plan:

- Providing the most efficient use of Ground Water
- Controlling and preventing the waste of Ground Water
- Controlling and preventing subsidence
- Addressing conjunctive and surface water management issues.
- Natural resources issues that impact the use and availability of Ground Water
- Addressing drought conditions
- Addressing conservation
- Other management goals

The District states the following objectives as the means to achieve the above goals:

- Continue water level monitoring program
- Continue to update, publish and distribute county hydrologic atlases
- Continue to issue well permits according to District's spacing rules
- Continue to administer the low interest agricultural water conservation equipment loan program
- Continue pre-plant soil moisture monitoring program
- Continue potential evaportranspiration irrigation scheduling program
- Maintain irrigation tailwater abatement program
- Promote efficient Ag irrigation technologies
- Address urban water waste
- Assist residents with water quality testing
- Continue to assure proper closing, destruction, or re-equipping of abandoned or replaces wells under District rules
- Continue to enforce the District's rule on the closing of open or uncovered wells
- Monthly newsletter
- Continue to provide news releases to print and electronic media
- Continue to produce radio and TV public service announcements and distribute them to stations within the district
- Continue to make public presentations
- Continue to maintain public information boards at the District office
- Continue to design public information displays for use at fairs/meetings
- Continue to provide information via internet website

- Continue to sponsor classroom education programs
- Continue to make classroom presentations
- Continue to make audio-visual materials available to teachers

6.4.5 Panhandle Groundwater Conservation District

The Panhandle Groundwater Conservation District (Panhandle GCD) was created by legislature in 1955. It covers Carson, Donley, Gray, Roberts, and Wheeler counties and also parts of Armstrong, Hutchinson, Hemphill, and Potter counties. The Panhandle GCD adopted a water management plan on August 20, 2008. The plan will remain in effect for a period of ten years, unless it is revised before that period. The District's overall management standard is to have 50 percent of current supplies, or saturated thickness, still available 50 years after the first certification of this plan. The Panhandle GCD has listed the following goals within its water management plan:

- Retain 50 percent of current supplies in 50 years (overall goal)
- Implement strategies that will provide the most efficient groundwater use
- Implement strategies that will control and prevent groundwater waste or contamination
- Implement strategies to address drought conditions
- Implement strategies to address conjunctive surface water management strategies
- Implement strategies that address natural resources issues which impact the use and availability of groundwater
- Improve operating efficiency and customer service
- Operate a rainfall enhancement program
- Conservation

In order for the above goals to be achieved, the following objectives need to be fulfilled, per the District's water management plan:

- Develop a system for measurement and evaluation of groundwater supplies
- Develop a groundwater modeling capability
- Encourage efficient groundwater use by implementing various programs
- Take positive and prompt action to identify all reported wasteful practices
- Prevent waste by implementing PGCD rule 15 – "depletion"
- Control and prevent contamination of groundwater
- Continue and possibly expand groundwater conservation programs
- Conduct emergency response/drought contingency planning
- Evaluate the impact of surface water use on groundwater
- Monitor and report on impacts of endangered species on local groundwater resources
- Monitor the possible effects of pumping on White Deer Creek
- Strive to stabilize water measurement and sampling costs per well
- Continue to provide timely response to customer assistance requests
- Operate a rainfall enhancement program and plan future activities

6.4.6 Gateway Groundwater Conservation District (Gateway GCD)

The Gateway Groundwater Conservation District (Gateway GCD) was created in May 2002. It covers a portion of Childress County in the PWPA. The District is currently developing its Groundwater Management Plan. It has been submitted to the TWDB, but it has not been approved to date.

6.5 Water Conservation Management and Drought Contingency Plans

In 1997, the Texas Legislature directed the TCEQ to adopt rules establishing common drought plan requirements for water suppliers in response to drought conditions throughout the state. Since 1997, the TCEQ has required all wholesale public water suppliers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit drought contingency plans. TCEQ now also requires all retail public water suppliers serving less than 3,300 connections to prepare and adopt drought contingency plans by no later than May 1, 2009. All drought contingency plans shall be available for inspection upon request.

6.5.1 Drought Contingency Plans

Drought management is a temporary strategy to conserve available water supplies during times of drought or emergencies. This strategy is not recommended to meet long-term growth in demands, but rather acts as means to minimize the adverse impacts of water supply shortages during drought. The TCEQ requires drought contingency plans for wholesale and retail public water suppliers and irrigation districts. A drought contingency plan may also be required for entities seeking State funding for water projects.

Drought contingency plans typically identify different stages of drought and specific triggers and response for each stage. In addition, the plan must specify quantifiable targets for water use reductions for each stage, and a means and method for enforcement. As with the water conservation plans, drought contingency plans are to be updated and submitted to the TCEQ by May 1, 2009.

Model drought contingency plans were developed for the PWPG and are included in Appendix J. Each plan identifies four drought stages: mild, moderate, severe and emergency. Some plans also include a critical drought stage. The recommended responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Each entity will select the trigger conditions for the different stages and the appropriate response.

6.5.2 Regional Drought Triggers

Thirteen drought contingency plans were submitted to the PWPG. The majority of the submitted plans use trigger conditions based on the demands placed on the water distribution system. Of the plans reviewed one user based trigger actions on well levels,

five based actions on storage reservoir levels and seven based actions on demands/consumption. A brief description of each plan is provided below, followed by a summary of the submitted plans in Table 6-5.

6.5.2.1 City of Amarillo

The City of Amarillo updated their Drought Contingency Plan on July 29, 2009. The triggering criteria of this plan are based on prolonged conditions of no rain usually associated with hot summer like conditions, high water demands and the vulnerability of the water sources under drought conditions including unforeseen natural disasters, equipment failure and contamination problems. The trigger criteria are listed below.

- **Mild:** Total consumption has reached 80 percent of production capacity for five consecutive days **and/or** CRMWA has requested initiation of their stage I (mild water shortage) requirement based on projected 3 year future supply at Lake Meredith **and/or** equipment failure causes reduction of capacity by 5 percent for 3 days when total consumption is at 80 percent production capacity.
- **Moderate:** Total consumption has reached 85 percent of production capacity for five consecutive days **and/or** CRMWA has requested initiation of their stage II (moderate water shortage) requirement based on projected 2 year future supply at Lake Meredith **and/or** equipment failure causes reduction of capacity by 10 percent for 3 days when total consumption is at 80 percent production capacity.
- **Severe**: Total consumption has reached 90 percent of production capacity for five consecutive days **and/or** CRMWA has requested initiation of their stage III (mild water shortage) requirement based on projected 1.5 year future supply at Lake Meredith **and/or** equipment failure causes reduction of capacity by 15 percent for 3 days when total consumption is at 80 percent production capacity.
- **Critical:** Total consumption has reached 95 percent of production capacity for five consecutive days **and/or** equipment failure causes reduction of capacity by 25 percent for 3 days when total consumption is at 70 percent production capacity.

6.5.2.2 City of Borger

The City of Borger updated their Drought Contingency Plan by passing Ordinance No. O-07-05 on September 6, 2005, which amended Chapter 51, Texas Water Code. The goal of the plan is to regulate and/or prohibit non-essential water uses during times of water shortage or other water supply conditions. Trigger conditions are based on water use patterns, weather conditions and water production and delivering capabilities and are defined as follows:

- **Mild:** (i) When water supply allocations from CRMWA to the municipal water system are equal to or less than 3,300 acre-feet per year, and the projected use from the municipal water system's owned water wells exceeds 2,700 acre-feet per year.

(ii) When pursuant to the requirements specified in the municipal water system's wholesale water purchase contract with CRMWA, notification is received from the authority requesting initiation of Stage 1 of the drought contingency plan
(iii) When due to declining water level, mechanical failure, or any other unforeseen event in the municipal water system's owned wells, an amount of water less than or equal to 2,760 acre-feet of water cannot reasonably be expected to be produced, and there are not adequate allocations from CRMWA to bring the total available water to 6,000 acre-feet per calendar year.
(iv) Any mechanical, accidental regulatory or unforeseen event that might negatively affect the daily safe operating capacity of the municipal water system to continually provide a safe and reliable supply of drinking water that meets all state and federal standards. This condition or triggering even must also be expected to persist for several days or weeks.

- **Moderate:**
(i)When water supply allocations from CRMWA to the municipal water system are equal to or less than 2,825 acre-feet per year, and the projected use from the municipal water system's owned water wells exceeds 2,700 acre-feet per year.
(ii) When pursuant to the requirements specified in the municipal water system's wholesale water purchase contract with CRMWA, notification is received from the authority requesting initiation of Stage 2 of the drought contingency plan
(iii) When due to declining water level, mechanical failure, or any other unforeseen event in the municipal water system's owned wells, an amount of water less than or equal to 2,300 acre-feet of water cannot reasonably be expected to be produced, and there are not adequate allocations from CRMWA to bring the total available water to 5,525 acre-feet per calendar year.
(iv) Any mechanical, accidental regulatory or unforeseen event that might negatively affect the daily safe operating capacity of the municipal water system to continually provide a safe and reliable supply of drinking water that meets all state and federal standards. This condition or triggering even must also be expected to persist for several days or weeks.

- **Severe:**
- (i)When water supply allocations from CRMWA to the municipal water system are equal to or less than 2,314 acre-feet per year, and the projected use from the municipal water system's owned water wells exceeds 2,750 acre-feet per year.
(ii) When pursuant to the requirements specified in the municipal water system's wholesale water purchase contract with CRMWA, notification is received from the authority requesting initiation of Stage 3 of the drought contingency plan
(iii) When due to declining water level, mechanical failure, or any other unforeseen event in the municipal water system's owned wells, an amount of water less than or equal to 2,150 acre-feet of water cannot reasonably be expected to be produced, and there are not adequate allocations from CRMWA to bring the total available water to 5,064 acre-feet per calendar year.
(iv) Any mechanical, accidental regulatory or unforeseen event that might negatively affect the daily safe operating capacity of the municipal water system

to continually provide a safe and reliable supply of drinking water that meets all state and federal standards. This condition or triggering even must also be expected to persist for several days or weeks.

- **Critical:**
- (i)When water supply allocations from CRMWA to the municipal water system are equal to or less than 1,803 acre-feet per year, and the projected use from the municipal water system's owned water wells exceeds 2,800 acre-feet per year.
  (ii) When pursuant to the requirements specified in the municipal water system's wholesale water purchase contract with CRMWA, notification is received from the authority requesting initiation of Stage 4 of the drought contingency plan
  (iii) When due to declining water level, mechanical failure, or any other unforeseen event in the municipal water system's owned wells, an amount of water less than or equal to 2,000 acre-feet of water cannot reasonably be expected to be produced, and there are not adequate allocations from CRMWA to bring the total available water to 4,603 acre-feet per calendar year.
  (iv) Any mechanical, accidental regulatory or unforeseen event that might negatively affect the daily safe operating capacity of the municipal water system to continually provide a safe and reliable supply of drinking water that meets all state and federal standards. This condition or triggering even must also be expected to persist for several days or weeks.

- **Emergency:**
  (i) Major water line breaks, pump, or other system failures that occur, which cause unprecedented loss of capacity to provide safe and adequate supply of water to all or portions of the system
  (ii) Extended electrical power failures, natural or manmade contamination of the water supply sources(s) that might cause unprecedented outages.

6.5.2.3 City of Canyon

Ordinance No. 730 passed January 1, 2000, resulted in the adoption of a Drought Contingency Plan by The City of Canyon. The Ordinance is aimed at establishing criteria for the initiation and termination of drought response stages; establishing restrictions on certain water uses; establishing penalties for the violation of and provisions for enforcement of these restrictions; establishing procedures for granting variances and providing severability and an effective date. The City of Canyon's triggering criteria are based on vulnerability of their water supply to shortages during drought conditions, periods of high water demand, and the potential for natural disasters, equipment failure, or contamination of the supply and are defined as follows:

- **Mild:** Total consumption has reached 65% of total production capacity for five consecutive days, **or** any combination of mechanical failures in production, transmission or distribution that reduces the total production capacity, or contamination of water supply.

- **Moderate:** Total consumption has reached 75% of total production capacity for five consecutive days, **or** any combination of mechanical failures in production, transmission or distribution that reduces the total production capacity, or contamination of water supply.
- **Severe:** Total consumption has reached 80% of total production capacity for five consecutive days, **or** any combination of mechanical failures in production, transmission or distribution that reduces the total production capacity, or contamination of water supply.
- **Critical:** Total consumption has reached 90% of total production capacity for five consecutive days, **or** any combination of mechanical failures in production, transmission or distribution that reduces the total production capacity, or contamination of water supply.
- **Emergency:** As conditions warrant, per the decision of City Manager

6.5.2.4 City of Dalhart

The City of Dalhart created a Drought Contingency Plan on August 24, 1999. Triggering criteria of this plan, as outlined below, are based on an analysis of the City's Water System consisting of 8 underground water wells and existing main pumping station.

- **Mild:** Dry weather conditions occur before and during the normal landscape growing season, annually from May 1 through September 30.
- **Moderate:** Total daily water demand equals or exceeds 90 percent of system capacity (5.7 million gallons) for three consecutive days, or equals or exceeds 95 percent of system capacity (6 million gallons) on a single day.
- **Severe:** Total daily water demand equals or exceeds 6 million gallons for three consecutive days, or equals or exceeds 100 percent of system capacity (6.3 million gallons) on a single day.
- **Emergency:** City Manager, Director of Public Works, Water Superintendent, or designee determines that an emergency exists due to equipment failure, causing loss of capacity to provide water service, or natural or man-made contamination of the water supply source or system.

6.5.2.5 City of Dumas

The Drought Contingency Plan for City of Dumas was created on June 28, 1999, but has not been adopted yet in the form of an Ordinance. The triggering conditions are based on the City's water demand exceeding the water supply, as outlined below.

- **Mild:** City's water demand exceeds 90 percent of the water production capacity, for three consecutive days.
- **Moderate:** City's water demand exceeds 95 percent of the water production capacity, for three consecutive days.
- **Severe:** City's water demand meets or exceeds the water production capacity for three consecutive days.

- **Critical:** City's water demand exceeds water production capacity by 5 percent for three consecutive days
- **Emergency:** The Mayor or designee determines that a water supply emergency exists due to an equipment failure, causing loss of capability to provide water service, or natural or man-made contamination of water supply source.

6.5.2.6 City of Higgins

The City of Higgins passed an Ordinance to adopt a Drought Contingency Plan on September 11, 2000. The triggering criteria are based on an imbalance of water supply and demand, as described briefly below.

- **Mild:** Specific capacity of City of Higgins well(s) is equal to or less than 90 percent of the well's original capacity or total daily water demand equals or exceeds 300 thousand gallons for three consecutive days.
- **Moderate:** Specific capacity of City of Higgins well(s) exceeds 90 percent of the well's original capacity for three days.
- **Severe:** Specific capacity of City of Higgins well(s) exceeds 95 percent of the well's original capacity for three days.
- **Critical:** System outage
- **Emergency:** Mayor or designee determines that a water supply emergency exists due to equipment failure, causing a loss of capability to provide water service or a natural or man-made contamination of the water supply source (s).

6.5.2.7 City of Pampa

The City of Pampa adopted the Drought Contingency Plan on April 27, 2009. Triggering conditions are based on water supply, and are detailed as follows:

- **Mild:** CRMWA informs Pampa that Lake Meredith has dropped to a projected three year future water supply level. Continuously falling water storage levels do not refill above 70 percent overnight.
- **Moderate:** CRMWA informs Pampa that Lake Meredith has dropped to a projected two year future water supply level. Continuously falling water storage levels do not refill above 50 percent overnight.
- **Severe:** CRMWA informs Pampa that Lake Meredith has dropped to a projected 1.5 year future water supply level. Continuously falling water storage levels do not refill above 40 percent overnight.
- **Emergency:** CRMWA informs Pampa of equipment failure, causing loss of capability to provide water services, or a natural or man-made contamination of the water supply source. When city wells, supply lines, pumps or storage system failures occur causing unprecedented loss of capability to provide water service or contamination of source has occurred.

6.5.2.8 City of Shamrock

Ordinance 02-01 resulted in the adoption of a Drought Contingency Plan for the City of Shamrock on June 6, 2002. The triggering criteria are based on the vulnerability of the City of Shamrock's water supply to shortages during drought conditions, periods of high demand, and the potential for natural disasters, equipment failures, or contamination of the water supply. These criteria are described briefly below.

- **Mild:** Total consumption has reached 65 percent of the total production capacity for five consecutive days, or the Mayor determines that there is a mechanical failure that causes loss of capacity by a significant amount, or contamination of water supply.
- **Moderate:** Total consumption has reached 75 percent of the total production capacity for five consecutive days, or the Mayor determines that there is a mechanical failure that causes loss of capacity by a significant amount, or contamination of water supply.
- **Severe:** Total consumption has reached 80 percent of the total production capacity for five consecutive days, or the Mayor determines that there is a mechanical failure that causes loss of capacity by a significant amount, or contamination of water supply.
- **Critical:** Total consumption has reached 90 percent of the total production capacity for five consecutive days, or the Mayor determines that there is a mechanical failure that causes loss of capacity by a significant amount, or contamination of water supply.
- **Emergency:** Mayor determines that the water supply is in a state of emergency.

6.5.2.9 City of Turkey

The City of Turkey adopted a Drought Contingency Plan by the passage of Ordinance No. 0110 on October 11, 2001. The triggering criteria are based on water well location in a heavy use farming community, and are described briefly as follows:

- **Mild:** Combined storage in the reservoir equal to or less than 75 percent storage capacity.
- **Moderate:** Combined storage in the reservoir equal to or less than 50 percent storage capacity.
- **Severe:** Combined storage in the reservoir equal to or less than 25 percent storage capacity.
- **Emergency:** The City of Turkey determines that an equipment failure has caused loss of capability to provide water service.

6.5.2.10 City of Wellington

The City of Wellington adopted a Drought Contingency Plan on October 2, 2000. The triggering criteria are based on total system capacity and /or total gallons per day produced, as described below.

- **Mild:** Total daily water demand equals or exceeds 90 percent of system capacity for five consecutive days.
- **Moderate:** Total daily water demand equals or exceeds 95 percent of system capacity for three consecutive days.
- **Severe:** Total daily water demand equals or exceeds 100 percent of system capacity for three consecutive days.
- **Emergency:** Mayor or designee determines that an equipment failure caused a loss of capability to provide water service, or natural or man-made contamination of water supply source.

6.5.2.11 City of White Deer

The City of White Deer has adopted a Drought Contingency Plan. The triggering criteria are based on an analysis of the City's water system consisting of four underground water wells and one pump station with two 1,000 gallon pumps. These criteria are outlined as follows:

- **Mild:** Period of dry weather conditions during normal landscape growing season from May 1 through September 30.
- **Moderate:** Total daily water demand equals or exceeds 550 thousand gallons for three consecutive days, or equals or exceeds 625 thousand gallons on a single day.
- **Severe:** Total daily water demand equals or exceeds 575 thousand gallons for three consecutive days, or equals or exceeds 650 thousand gallons on a single day.
- **Critical:** Mayor or designee determines that an equipment failure has caused a loss of capacity to provide water service.

Drought Trigger Conditions for Surface Water Supply

Drought trigger conditions for surface water supply are customarily related to reservoir levels. The PWPG will be working with the regional operators of reservoirs to coordinate the trigger conditions. Trigger conditions which have been ascertained for the region's reservoirs as follows:

6.5.2.12 Canadian River Municipal Water Authority (Lake Meredith)

CRMWA adopted a Drought Contingency Plan on July 14, 1999 and the same was revised on January 14, 2009. CRMWA will recognize that a water shortage condition exists when the total supply is expected to be available to the member cities from CRMWA in the coming year has been determined to be less than the amounts given in the following table, at the time of any review of the supply by the CRMWA Board of Directors

- **Mild:** 65,000 AF – 74,499 AF.
- **Moderate:** 55,000 AF – 64,999 AF.
- **Severe:** 0 AF - 54,999 AF.

Table 6-5: Type of Trigger Condition for Entities with Drought Contingency Plans in PWPA

Entity	Type Trigger Condition	
	Demand	Supply
Carson County		
White Deer	X	
Collingsworth County		
Wellington	X	
Dallam County		
Dalhart	X	
Gray County		
Pampa		X
CRMWA		X
Hall County		
Turkey		X
Hartley County		
Dalhart	X	
Hutchinson County		
Borger	X	X
CRMWA		X
Lipscomb County		
Higgins		X
Moore County		
Dumas	X	
Potter County		
Amarillo	X	X
CRMWA		X
Randall County		
Amarillo	X	X
CRMWA		X
Randall County		
Canyon	X	
Roberts County		
CRMWA		X
Wheeler County		
Shamrock	X	

6.5.2.13 Greenbelt Municipal and Industrial Water Authority/Greenbelt Reservoir

The Board of Directors for Greenbelt Municipal and Industrial Water Authority passed a resolution adopting a Drought Contingency Plan on August 19, 1999. Triggering criteria are based on water storage levels in the Greenbelt Reservoir and are described as follows:

- **Mild:** Water storage level reaches an elevation of 2,637.
- **Moderate:** Water storage level reaches an elevation of 2,634 and daily flow or daily demand for water equals or exceeds 7.5 million gallons.
- **Severe:** Water storage level reaches an elevation of 2,631 and daily flow or daily demand for water equals or exceeds 7.5 million gallons.
- **Emergency:** Water storage level reaches an elevation of 2,628 and daily flow or daily demand for water equals or exceeds 7.5 million gallons, or there is an equipment failure, causing a failure to provide water service, or a natural or man-made contamination of water supply.

6.5.2.14 Palo Duro Reservoir

Palo Duro River Authority adopted a conservation plan for Palo Duro Creek Reservoir in May of 1987. Triggering criteria are based on water storage levels in Palo Duro Reservoir and are described as follows:

- **Mild:** Water storage level reaches an elevation of 2,876 feet.
- **Moderate:** Water storage level varies between 2,876 and 2,864 feet.
- **Severe:** Water storage level drops below 2,864 feet.
- **Emergency:** One or more of the major pumps or transmission line in the raw or treated water supply systems should fail, impairing the capability of the delivery system.

Table 6-6: Reservoirs in the Panhandle Region Planning Area

Condition	**Reservoir Capacity**		
	Greenbelt Reservoir	Lake Meredith	Palo Duro Reservoir
Mild	75%	75%	75%
Moderate	66%	66%	66%
Severe	50%	50%	50%

6.6 Water Conservation Recommendations

6.6.1 Water-Saving Plumbing Fixture Program

The Texas Legislature created the Water-Savings Plumbing Fixture Program on January 1, 1992 to promote water conservation. Manufacturers of plumbing fixtures sold in Texas must comply with the Environmental Performance Standards for Plumbing Fixtures, which requires all plumbing fixtures such as showerheads, toilets and faucets sold in Texas to conform with specific water use efficiency standards.

Because more water is used in the bathroom than any other place in the home, water-efficient plumbing fixtures play an integral role in reducing water consumption, wastewater production, and consumers' water bills. It is estimated that switching to water-efficient fixtures can save the average household between $50 and $100 per year on water and sewer bills. Many hotels and office buildings find that water-efficient fixtures can save 20 percent on water and wastewater costs.

6.6.2 Water Conservation Best Management Practices

The 78th Texas Legislature under Senate Bill 1094 created the Texas Water Conservation Implementation Task Force and charged the group with reviewing, evaluating, and recommending optimum levels of water use efficiency and conservation for the state. TWDB Report 362, Water Conservation Best Management Practices Guide was prepared in partial fulfillment of this charge. The Guide is organized into three sections, for municipal, industrial, and agricultural water user groups with a total of 55 Best Management Practices (BMPs). Each BMP has several elements that describe the efficiency measures, implementation techniques, schedule of implementation, scope, water savings estimating procedures, cost effectiveness considerations, and references to assist end-users in implementation. This document can be accessed at the following TWDB web site:

http://www.twdb.state.tx.us/assistance/conservation/TaskForceDocs/WCITFBMPGuide.pdf

6.6.3 Water Conservation Tips

The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at:

http://www.twdb.state.tx.us/assistance/conservation/consindex.asp .

6.7 Model Water Conservation Plan

Model Water Conservation Plans for municipal, industrial and irrigation water users were developed for the PWPA and are found in Appendix J. These can be obtained through the Texas Water Development Board planning website. General model water conservation plan forms are also available from TCEQ in WordPerfect and PDF formats. A printed copy of the form from TCEQ can be obtained by calling TCEQ at 512/239-4691 or by email to wras@tceq.state.tx.us.