



Chapter 6 Impacts of the Regional Water Plan

The development of viable strategies to meet the demand for water while supporting the long-term protection of resources of the state is an important goal of regional planning. The purpose of this chapter is to describe the overall potential impacts of the recommended 2016 Panhandle Water Plan and document how the Water Plan is consistent with the long-term protection of the state's water resources, agricultural resources, and natural resources.

In accordance with 31 TAC Chapter 357.40, each regional water plan shall identify key parameters of water quality and describe how implementing the Water Plan could affect these parameters. The plans also shall discuss the potential impacts of moving water from agricultural and rural areas to other purposes, socio-economic impacts of not meeting the water needs and impacts on navigation.

This chapter presents an assessment of the water quality parameters that could be affected by the implementation of water management strategies for Region A. Based on this assessment, the key water quality parameters for each type of strategies are identified. From this determination, the specific water management strategies selected for PWWA were evaluated with respect to potential impacts to the key water quality parameters. These discussions are presented in Section 6.1.

The impacts of moving water from agricultural and rural areas to other purposes, socio-economic impacts of not meeting the water demands and impacts on navigation are discussed in Sections 6.2 through 6.4.

The requirement to evaluate the consistency of the regional water plan with protection of resources is found in 31 TAC Chapter 357.41, which states:

“RWPGs shall describe how RWPs are consistent with the long-term protection of the state's water resources, agricultural resources, and natural resources as embodied in the guidance principles in §358.3(4) and (8) of this title (relating to Guidance Principles).”

Sections 6.5 through 6.7 address this issue by providing general descriptions of how the plan is consistent with protection of water resources, agricultural resources, and natural resources.

Additionally, the chapter will specifically address consistency of the 2016 Panhandle Water Plan with the state's water planning requirements. To demonstrate compliance with the state's requirements, a matrix has been developed and is included in Appendix F.

6.1 Potential Impacts of Water Management Strategies on Key Water Quality Parameters

Water quality plays an important role in determining the availability of water supplies to meet current and future water needs in the region. Evaluations of the potential impacts to water quality by each potential water management strategy is discussed in Chapter 5. This chapter describes the key water quality parameters for the surface water and groundwater sources in the region, identifies specific water quality concerns or issues, and discusses potential impacts on water quality associated with the recommended water management strategies.

The key water quality parameters to be evaluated are dependent on the water management strategy recommended. Strategies recommended for municipal use must meet drinking water standards, while water used for non-municipal purposes may not. Source water quality for strategies can have an impact on key water quality parameters of the region's water sources depending on potential use and/or discharge of the water.

Surface water sources in the PWPA include Greenbelt Reservoir and Lake Meredith. Water quality in these sources are generally good, but can contain elevated total dissolved solids (TDS) when lake levels are low (including chlorides and sulphates). CRMWA has supplemented water from Lake Meredith with groundwater from Roberts County to improve the water quality of the delivered water from the lake. Lake Meredith is also included on the State of Texas Clean Water Act Section 303(d) list for mercury in fish. Elevated salt contents, expressed in TDS, is also prevalent in many of the local rivers and streams in the PWPA.

Groundwater resources in the Panhandle region are generally potable, although region-wide up to approximately thirteen percent of the groundwater may be brackish. Groundwater quality issues in the region are generally related to elevated concentrations of nitrate, chloride, and TDS. Sources of elevated nitrate include cultivation of soils and domestic and animal sources. Higher concentrations of nitrate are typically found near agricultural areas and outcrop areas of the aquifer. Elevated concentrations of chloride are due to dissolution of evaporite minerals and upwelling from underlying, more brackish groundwater formations. Elevated concentrations of TDS are primarily the result of the lack of sufficient recharge and restricted circulation. Together, these limit the flushing action of fresh water moving through the aquifers.

Groundwater sources with known elevated concentrations of nitrates include the Seymour aquifer in the southeastern part of the region and parts of the Ogallala and Dockum aquifers, specifically in the heavily

irrigated counties. High TDS levels occur throughout the Blaine and Dockum aquifers. Also, much of the Whitehorse formation and Other aquifers have elevated TDS levels, which limits their use.

Table 6.1 summarizes the most pertinent water quality parameters in the PWPA for the types of strategies proposed in this plan.

Table 6-1: Key Water Quality Parameters by Water Management Strategy Type¹

Water Quality Parameter	Water Conservation	Reuse	Voluntary Transfer	New or Expanded Use of Groundwater	Brush Control	Conjunctive Use	Advanced Treatment	Precipitation Enhancement
Total dissolved solids (TDS)	+	+ / -	+ / -		+ / -	+	-	
Alkalinity	+					+		
Hardness	+					+		
Dissolved Oxygen (DO)	+	+ / -	+ / -		+ / -	+		
Nitrogen	+	+ / -	+ / -		+ / -	+	-	
Phosphorus	+	+ / -	+ / -		+ / -	+		
Radionuclides				-				
Metals ²		+	- ²	- ²			- ²	

¹ Water management strategies with no potential impacts to water quality are not shown in this table.

² Only for specific metals where there are significant discharges of the metal.

- + Positive Impact
- Negative Impact

The implementation of specific strategies can potentially impact both the physical and chemical characteristics of water resources in the region. The following is an assessment of the characteristics of each strategy type that may affect water quality and an identification of the specific water quality parameters that could be affected based on those characteristics. This assessment found that the implementation of water management strategies recommended in Chapter 5 of the Panhandle Water Plan is not expected to have negative impact on native water quality, and through conservation may improve water quality.

6.1.1 Water Conservation

Water conservation is a recommended strategy for irrigation and municipal water use in the PWPA. Recommended irrigation conservation measures include improvements in the efficiency of irrigation equipment, irrigation scheduling and advances in plant breeding. These recommended strategies are not

expected to affect water quality adversely. The results should be beneficial because the demand on surface and groundwater resources will be decreased. Municipal conservation should have similar beneficial effects, but at a smaller scale.

6.1.2 Reuse

In general, there are three possible water quality effects associated with the reuse of treated wastewaters:

- There can be a reduction in instream flow if treated wastewaters are not returned to the stream, which could affect TDS, nutrients, and DO concentrations of the receiving stream.
- Conversely, in some cases, reducing the volume of treated wastewater discharged to a stream could have a positive effect and improve levels of TDS, nutrients, DO, and possibly metals in the receiving stream.
- Reusing water multiple times and then discharging it can significantly increase the TDS concentration in the effluent and in the immediate vicinity of the discharge in the receiving stream. Total loading to the stream (i.e. the amount of dissolved material in the waste stream) should not change significantly.

These impacts will vary depending on the quality and quantity of treated wastewater that has historically been discharged to the stream and the existing quality and quantity of the receiving stream.

6.1.3 Voluntary Transfers

Voluntary transfers generally involve the sale of water from one provider to another. In the PWPA, these transfers are expected to be primarily groundwater sources. The surface water sources in the region are fully utilized. Additional use of surface water is discussed under Conjunctive Use in Section 6.1.6.

Voluntary transfers of groundwater sources will have minimal impacts on water quality parameters assuming there is no relative change in the amount of groundwater pumped. Impacts on key water quality parameters for large increases in groundwater pumpage to meet contractual sales are discussed in Section 6.1.4 (New and/or Expanded Use of Groundwater Resources).

Pending the location and use of the water under voluntary transfers, changes in locations of return flows (if applicable) could impact flows in receiving streams. Such impacts would be site specific and could be positive or negative, pending the changes.

Generally, these impacts are relative to the quantities of water that are diverted or redistributed. Small quantities are likely to have minimal to no impacts, while large quantities may have measured impacts.

6.1.4 New and/or Expanded Use of Groundwater Resources

Increased use of groundwater can decrease instream flows if the base flow is supported by spring flow. This is not expected to be a concern for the recommended water management strategies in the PWPA.

Most new groundwater development is from relatively deep portions of aquifers that most likely do not have significant impact on surface flows, such as Roberts County. A previous study conducted by the Bureau of Economic Geology concluded that no identifiable relationship can be found at this time relating increased pumping of the Ogallala to the deterioration of water quality (Freese and Nichols, Inc., 2006).

Increased use of groundwater has the potential to increase TDS concentrations in area streams if the groundwater sources have higher concentrations of TDS or hardness than local surface water and are discharged as treated effluent. This is not the case in most areas in PWPA since all, but one strategy proposes to use water from the Ogallala aquifer which has low to moderate levels of TDS. The City of Wellington is the only entity with additional groundwater development in the Seymour aquifer. Naturally occurring salt seeps and high TDS waters are common in Collingsworth County and discharges of slightly elevated TDS water will not impact these streams. In general, the discharges of wastewater from groundwater sources is not expected to impact streams in the PWPA.

6.1.5 Brush Control

Brush control is a recommended strategy for the Lake Meredith watershed. Impacts to the water quality of area streams will depend upon the methods employed to control the brush. It is assumed that chemical spraying will not be used near water sources. Mechanical removal, prescribed burns and use of the salt cedar beetle are the preferred methods near water sources. With these assumptions, chemical contamination of water source is very low. Increases in stream flow due to reduced evapotranspiration associated with the removed brush should improve water quality in the Lake Meredith watershed.

6.1.6 Conjunctive Use

Conjunctive use is a recommended strategy for CRMWA. This strategy would conjunctively use surface water from Lake Meredith and groundwater from the Ogallala aquifer. It would allow CRMWA the ability to operate Lake Meredith in a manner that minimizes impacts to key water quality parameters in the lake while still being able to provide sufficient supplies to its customers from groundwater.

6.1.7 Advanced Treatment

Advanced treatment is recommended for City of Wellington for nitrate removal. The waste stream from the advanced treatment would likely be discharged to a tributary of the Salt Fork of the Red River. The TCEQ would need to issue a discharge permit that would protect the water quality of the receiving stream. The small amount of proposed discharge is not expected to have significant impacts to key water quality parameters.

6.1.8 Precipitation Enhancement

Precipitation enhancement is considered as part of the irrigation conservation strategies. These operations are already in progress, so there are no expected changes in water quality associated with this strategy.

6.2 Impacts of Moving Water from Agricultural and Rural Areas

The implementation of water management strategies recommended in Chapter 5 of this regional plan is not expected to impact water supplies that are currently in use for agricultural purposes. The voluntary transfer of water from agricultural use to municipal use is predicated on a willing buyer, willing seller basis. Most of the recommended water management strategies for municipal water users rely on developing existing water rights. The methodology for assessing the available supply of water rights for this regional water plan protects the existing supplies of all current and future users.

6.3 Socio-Economic Impacts of Not Meeting Water Needs

The socio-economic impacts of not meeting the water needs will be prepared by the TWDB and included in the final Panhandle Water Plan.

6.4 Other Potential Impacts

In accordance with Section 10 of the Rivers and Harbors Act of 1899, navigable waters are those waters that are subject to the ebb and flow of the tide and/or are presently being used, or have been used in the past for use to transport interstate or foreign commerce. In the PWPA, the major rivers include the Canadian and Red Rivers. Neither of these rivers are considered navigable within the PWPA. Therefore, the Panhandle Water Plan does not have an impact on navigation.

The Panhandle Water Plan protects existing water contracts and option agreements by reserving the contracted amount for included in those agreements where those amounts were known. In some cases there were insufficient supplies to meet existing contracts. In those cases, water was reduced proportionately for each contract holder. For entities with needs, water management strategies were recommended to meet deficits in contractual obligations.

6.5 Consistency with the Protection of Water Resources

Water resources in the PWPA include surface water from the Canadian and Red River Basins and groundwater from two major and three minor aquifers. The primary water resource in the region is the Ogallala aquifer. Approximately 96 percent of the current water used in the region is from the Ogallala aquifer. Of the recommended strategies, 75 percent of the new water supply is associated with conservation in 2070 with irrigation conservation accounting for 74 percent. The remaining 25 percent is from additional development of the PWPA water resources.

The protections of water resources were considered through the supply allocation process and development of water management strategies. For surface water, the distribution of supplies do not exceed the safe yield of the reservoir. This provides some water in the lakes through the drought of record and provides some protections from future droughts. For groundwater, the desired future conditions, as adopted by the GMAs, were honored for both currently developed supplies and potential future strategies. For the Ogallala aquifer the DFCs were considered both geographically and in time for irrigation and municipal water users.

To be consistent with the long-term protection of water resources, the plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 5 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of the major strategies and the ways in which they minimize threats include the following:

6.5.1 Water Conservation

Strategies for water conservation have been recommended that will reduce the demand for water, thereby reducing the impact on the region's groundwater and surface water sources. Water conservation practices are expected to save approximately 123,011 acre-feet of water annually by 2020, reducing impacts on both groundwater and surface water resources. By 2070, the recommended conservation strategies savings total 488,140 acre-feet per year. These savings are in addition to the water savings assumed in the demands. The total projected water savings from conservation for the PWPA by 2070 is over 500,000 acre-feet per year when including the plumbing code savings.

6.5.2 Wastewater Reuse

This strategy will provide high quality treated wastewater effluent to meet water needs in the region. This strategy will decrease the future demands on surface and groundwater sources and will not have a major impact on water resources.

6.5.3 Voluntary Transfers

Under this strategy, surface and ground water rights holders with surplus water supplies will provide water to areas with current or projected needs. This strategy is proposed for customers of wholesale water providers and expanded sales to manufacturing water users that are already purchasing from a water provider. As proposed, this strategy will only use water that is available on a sustainable basis and will not significantly impact key water quality parameters.

6.5.4 New or Expanded Use of Groundwater

This strategy is recommended for entities with limited alternative sources and available groundwater supplies to meet needs. Groundwater supplies do not exceed the Modeled Available Groundwater (MAG) values that were determined to meet the desired future conditions of the groundwater source. These future conditions are considered protective of the water resource. Large transfers of groundwater may have the potential impacts to local surface water and springs. Such impacts were considered during the evaluation of the strategies. Where possible, strategies were selected that minimized impacts to surface water.

6.5.5 Brush Control

Brush control is recommended for the Lake Meredith watershed. This strategy will support the surface water supplies for Lake Meredith by reducing losses associated with evapotranspiration of invasive brush.

6.5.6 Conjunctive Use

Conjunctive use supports the management of surface water and groundwater sources to provide water necessary for beneficial use while protecting the individual water resource during periods of drought.

6.5.7 Advanced Treatment

The City of Wellington has a recommended long-term strategies for nitrate removal. Advanced treatment represents a potential additional source of water that could be used to augment existing freshwater sources.

6.5.8 Precipitation Enhancement

This strategy will support the water supplies in the Region by increasing stream flows and reducing irrigation demands due to increased rainfall.

6.6 Consistency with Protection of Agricultural Resources

Agricultural resources are an important component of the Panhandle economy and way of life. According to the 2012 Census of Agriculture, the PWPA has approximately 1,774,000 acres of land in 2,276 farms. Approximately 71 percent of the harvested cropland occurred in seven counties (Carson, Dallam, Hansford, Hartley, Moore, Ochiltree, and Sherman). The 2012 Census saw a reduction of acreage in production and number of farms. While the reductions are not significant, it may be a future trend and protection of these resources is critical to the PWPA.

The greatest needs identified in the PWPA are associated with irrigated agriculture. The plan assumes a level of demand reduction over time and the PWPG recommended water conservation to meet the

remaining needs. The PWPG also recognized the benefits of recommending conservation for all irrigation users to conserve and preserve limited water sources for future use.

Water management strategies for irrigated agriculture include a suite of strategies to conserve irrigation water. These strategies will reduce the projected deficit in the heavily irrigated counties and preserve water supplies for future use in the counties with no identified needs. The Water Plan also recommends the development of new groundwater, but most of these strategies are on lands with existing water rights. The transfer of agricultural water for other purposes would only occur on a willing buyer, willing seller basis.

6.7 Consistency with Protection of Natural Resources

The PWPA contains many natural resources and the water management strategies recommended in this plan are intended to protect those resources while still meeting the projected water needs of the region. The impacts of recommended strategies on specific resources are discussed below.

6.7.1 Threatened and Endangered Species

The abundance and diversity of wildlife in the PWPA is influenced by vegetation and topography, with areas of greater habitat diversity having the potential for more wildlife species.

The presence or potential occurrence of threatened or endangered species is an important consideration in planning and implementing any water resource project or water management strategy. Both the state and federal governments have identified species that need protection. Species listed by the U.S. Fish and Wildlife Service (USFWS) are afforded the most legal protection, but the Texas Parks and Wildlife Department (TPWD) also has regulations governing state-listed species. As detailed in Chapter 1, there are 15 state or federally protected species which have the potential to occur within the PWPA. This does not include species without official protection such as those proposed for listing or species that are considered rare or otherwise of special concern.

The proposed infrastructure strategies in the Panhandle Water Plan can be designed to avoid and/or minimize impacts to threatened and endangered species. Most of the recommended strategies include the development or expansion of groundwater, which has flexibility in the placement of wells and pipelines. The recommended conservation strategies in the Water Plan will continue to preserve water for wildlife. Brush control activities could potentially impact habitat for wildlife, including threatened and endangered species. However, the proposed methods can be implemented to minimize impacts. Also, the expected increase in stream flow from brush removal will provide water to these species.

6.7.2 Parks and Public Lands

The PWPA contains over 103,000 acres of protected parks and public lands. The PWPA is home to Palo Duro Canyon State Park, approximately 20,000 acres located in Armstrong and Randall Counties. Lake

Meredith National Recreation Area, which encompasses the area surrounding Lake Meredith, is part of the National Park Service and offers recreational and ecological benefits to the region. The Alibates Flint Quarries National Monument located adjacent to the Lake Meredith Recreation Area is the only national monument in the State of Texas. Buffalo Lake National Wildlife Refuge is also located in the Region and is a valuable wintering area for migratory waterfowl. In addition to these lands, the Region contains three National Grasslands. These include Black Kettle National Grassland in Hemphill County, McClellan Creek National Grassland in Gray County and Rita Blanca National Grassland in Dallam County. No recommended strategies require water supply projects located within these areas. Implementation of water management strategies should not directly impact these lands.

6.7.3 Energy Reserves

The oil and gas industry represent an important economic base for the region with significant activities in over 50 percent of the counties in the PWPA. In addition, there has been renewed interest in the Granite Wash shale formation (Anadarko Basin) in the northeastern Panhandle. The projected water demands reflect the increased water needs for production of local energy reserves. The Panhandle Water Plan identifies sufficient water to meet these needs. None of the recommended water management strategies is expected to impact oil or gas production in the region.

6.8 Consistency with Protection of Public Health and Safety

Consistent with the guiding principles for regional water planning, the Panhandle Water Plan protects the public health and safety of current and future residents in the PWPA through the identification of water management strategies. There are two counties in the PWPA that have limited supplies to serve future municipal water needs. In Moore County, water savings associated with irrigation conservation provides sufficient groundwater to meet the municipal water needs in the county. In Potter County, there is a considerable expected growth in County-Other that cannot be met through the development of local groundwater supplies. The City of Amarillo has limited means to serve unincorporated County-Other. It is expected that with the growth of this water user group, the municipal developments will incorporate into a city or town, at which time the City of Amarillo could serve them. With these assumptions, the municipal water users are expected to have sufficient water supplies for public health and safety.

6.9 Consistency with State Water Planning Guidelines

To be considered consistent with long-term protection of the State's water, agricultural, and natural resources, the PWPA water plan must also be in compliance with the following regulations:

- 31 TAC Chapter 357.35
- 31 TAC Chapter 357.40
- 31 TAC Chapter 357.41
- 31 TAC Chapter 358.3

The information, data, evaluation, and recommendations included in the 2016 Panhandle Water Plan collectively demonstrate compliance with these regulations. Appendix F presents a summary of the major components of the plan and references the regulations. The content of the 2016 Plan has been evaluated against this regulatory matrix.

6.10 Summary of Protections of State's Resources

The PWPG balanced meeting water needs with good stewardship of the water, agricultural, and natural resources within the region. During the strategy selection process, long-term protection of the State's resources were considered through the assessment of environmental impacts, impacts to agricultural and rural areas and impacts to natural resources.

In this plan, existing in-basin or region supplies were utilized as feasible before recommendations for new water supply projects. Wastewater reuse is an active water source to meet long-term power generation and industrial water needs in the PWPA. The plan assumes that this resource will be fully utilized to meet the growing demands of the power industry in the region.

The proposed conservation measures for the PWPA will continue to protect and conserve the State's resources for future water use.