ATTACHMENT 4
CHANGES TO WATER MANAGEMENT STRATEGIES & PROJECTS
WEST TEXAS WATER PARTNERSHIP STRATEGIES

WUGs:	**Midland, San Angelo, Abilene**	**Capital Cost:**	$ 549,093,000
WMS Name:	**West Texas Water Partnership**	**Annual Cost** (During Amortization):	$ 1,783 per acre-foot $ 5.47 per 1,000 gal
WMS Type:	Regional		
WMS Yield:	28,400 acre-feet	**Annual Cost** (After Amortization):	$ 403 per acre-foot $ 1.24 per 1,000 gal
WMS Status:	Recommended	**Implementation:**	2030

Strategy Description

In December 2010, the cities of Abilene, Midland and San Angelo met to discuss cooperative strategies in response to a developing drought. As the drought intensified a cooperative response could not be timely implemented, and the cities constructed and brought on-line individual strategies to provide adequate water supplies for their customers. Recognizing the benefits of working together to address future water supplies, the three cities continued to meet and evaluate long-term water supplies for the West Texas region. Through an Interlocal Agreement, the cities formed the West Texas Water Partnership (Partnership or WTWP) to pursue water management strategies that could be jointly developed by the Partnership.

The WTWP recently contracted for groundwater from the Edwards-Trinity Plateau Aquifer in Pecos County (GMA 7). The total contracted supply is 28,400 acre-feet per year (acft/yr), allocated as follows: Abilene – 8,400 acft/yr; Midland – 15,000 acft/yr; and San Angelo – 5,000 acft/yr.

To provide 28,400 acft/yr, twelve (12) groundwater supply wells are anticipated to be constructed. Produced groundwater will be transported through a network of well field collector pipes to a single standpipe. Water will then be transported generally north via gravity in a 42-inch transmission pipeline to an intermediate pump station near Monahans. From this intermediate pump station, water will be transported in a 42-inch transmission pipeline to the T-Bar Ranch, owned by the City of Midland.

Advanced treatment will be required for a portion of the groundwater flow to meet regulatory standards. Preliminary evaluations indicate about 60% of the flow will undergo treatment using ultrafiltration followed by reverse osmosis. Final treatment requirements will be determined during preliminary design. To maximize use of this groundwater source, a recovery stage is proposed for both the ultrafiltration and reverse osmosis processes. Waste from the treatment process is expected to be approximately 5 percent, which is comparable to conventional treatment. Waste will be disposed using evaporation ponds. The treatment plant will be located on Midland's T-Bar Ranch.

From the treatment plant, the Edwards-Trinity Plateau groundwater will be transported to Midland and San Angelo using the City of Midland's T-Bar transmission system and a direct 27-inch pipeline from Midland to San Angelo. No groundwater will be delivered directly to Abilene. Abilene will receive its share of the WTWP through an exchange of contracted supplies in Lake Ivie from Midland and San Angelo. This water will be transported to Abilene through existing infrastructure.

Quantity, Reliability and Cost

To minimize the size and cost of the transmission pipeline between Midland and San Angelo, the Partnership anticipates developing a cooperative use strategy for its collective supplies in O.H. Ivie Reservoir (Ivie). Each of the three of the WTWP cities contract with the Colorado River Municipal Water District (CRMWD) for 16.54% of the safe yield from Ivie. Under the anticipated cooperative use strategy,

Abilene would utilize Midland's Ivie allocation in exchange for a portion of Abilene's Edwards-Trinity Plateau groundwater allocation. Abilene would also use a portion of San Angelo's Ivie allocation in exchange for a portion of Abilene's Edwards Plateau groundwater to reach their total of 8,400 acre-feet per year of supply from the WTWP. This approach reduces the quantity of groundwater to be transported beyond Midland and infrastructure requirements. Abilene's share of the Edwards-Trinity groundwater is then used by Midland and San Angelo to offset the Ivie supplies sent to Abilene. The Partnership will follow up on initial conversations with the CRMWD to explore necessary methodologies and agreements to implement a cooperative use strategy of the Partnership's collective Ivie supplies. Meetings between the parties are anticipated in the late fall/early winter of 2020/2021. The cost sharing agreement does not change, and the total project costs would be shared by the three participants. Table C-16 shows the quantity of supply to each user from this arrangement.

Table C- 16
Supply to Each User from the West Texas Water Partnership (acre-feet per year)

	Supply 2020	Supply 2030	Supply 2040	Supply 2050	Supply 2060	Supply 2070
Midland Ivie Water to Abilene		5,209	5,070	4,930	4,791	4,651
San Angelo Ivie Water to Abilene		3,191	3,330	3,470	3,609	3,749
Total WTWP Supply to Abilene		*8,400*	*8,400*	*8,400*	*8,400*	*8,400*
San Angelo Original Groundwater Share		5,000	5,000	5,000	5,000	5,000
Groundwater to San Angelo to Replace Ivie Water Sent to Abilene		3,191	3,330	3,470	3,609	3,749
Total Groundwater to San Angelo		*8,191*	*8,330*	*8,470*	*8,609*	*8,749*
Midland Original Groundwater Share		15,000	15,000	15,000	15,000	15,000
Groundwater to Midland to Replace Ivie Water Sent to Abilene		5,209	5,070	4,930	4,791	4,651
Total Groundwater to Midland		*20,209*	*20,070*	*19,930*	*19,791*	*19,651*
Groundwater Total		*28,400*	*28,400*	*28,400*	*28,400*	*28,400*

The total quantity of supply from this strategy is 28,400 acre-feet. Elevated levels of total dissolved solids, notably chloride, will require a portion of the supply to undergo advanced treatment. The reliability for this source is high.

The capital cost to fully implement this strategy is $549,093,000.

Environmental Factors

The environmental issues associated with this strategy are expected to be low. It is assumed that the new pipelines would be routed around sensitive environmental areas to limit potential impacts. The conceptual design for this project includes evaporation ponds for the disposal of treatment waste stream. A properly designed and maintained facility should have minimal environmental impact.

Agricultural and Rural Impacts

Construction of the pipelines may have temporary impacts on agricultural or rural users whose land is temporarily disrupted but no permanent impacts are anticipated. The treatment facility and evaporation

ponds are anticipated to be built on the Midland T-Bar Ranch which is property already owned by the City so it will not cause further impacts to agricultural land.

Impacts to Natural Resources and Key Parameters of Water Quality

The current conceptual design for this project uses evaporation ponds to dispose of the brine waste stream. If this were to change and the brine was released to a stream, impacts to the receiving water body would need to be evaluated.

Impacts on Other Water Resources and Management Strategies

There are two versions of the WTWP strategy included in the Region F and Region G water plans. For planning purposes, this version is recommended and the other is alternative. It is anticipated that only one of these versions would be implemented, not both.

This strategy may also impact the need for and timing of other strategies of the participants.

Other Issues Affecting Feasibility

The strategy is conceptual in nature and will continue to develop. As with all strategies, prior to implementation, the partners will need to obtain all necessary permits.

WUG NAME:	Midland, San Angelo, Abilene
STRATEGY:	West Texas Water Partnership
AMOUNT (ac-ft/yr):	28,000

CONSTRUCTION COSTS

Well Field	**Quantity**	**Unit**	**Unit Price**	**Cost**
Water Wells	12	EA	$650,000	$7,800,000
Well Field Piping	1	LS	$3,750,000	$3,750,000
Access Roadways	1	LS	$2,500,000	$2,500,000
Electrical Distribution	1	LS	$3,500,000	$3,500,000
Storage Tank	1	LS	$2,000,000	$2,000,000
Contractor Mob/Demob (3%)				$590,000
Engineering and Contingencies (35%)				$7,050,000
Subtotal Well Field				**$27,190,000**

Pipeline	**Quantity**	**Unit**	**Unit Price**	**Cost**
Transmission Pipeline - 42"	419,000	LF	$300	$125,700,000
Transmission Pipeline - 27"	610,000	LF	$235	$143,350,000
Right-of-Way Easements	61,600	ROD	$200	$12,320,000
Contractor Mob/Demob (3%)				$8,070,000
Engineering and Contingencies (30%)				$86,830,000
Subtotal Pipeline				**$376,270,000**

Pump Station & Ground Storage	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pump Station	2	LS	$3,500,000	$7,000,000
Electrical/SCADA	2	LS	$800,000	$1,600,000
Storage Tank	3	LS	$1,300,000	$3,900,000
Contractor Mob/Demob (3%)				$380,000
Engineering and Contingencies (35%)				$4,510,000
Subtotal Pump Station/Ground Storage				**$17,390,000**

Treatment	**Quantity**	**Unit**	**Unit Price**	**Cost**
Ultrafiltration (Primary/Recovery)	1	LS	$14,800,000	$14,800,000
Reverse Osmosis (Primary/Recovery)	1	LS	$16,830,000	$16,830,000
Chemical Systems	1	LS	$1,940,000	$1,940,000
Evaporation Pond	1	LS	$9,400,000	$9,400,000
Buildings/Yard Piping	1	LS	$12,930,000	$12,930,000
Electrical/SCADA	1	LS	$10,500,000	$10,500,000
Storage Tanks (Pretreatment/Clearwells)	1	LS	$8,170,000	$8,170,000
Contractor Mob/Demob (3%)				$2,240,000
Engineering and Contingencies (35%)				$26,880,000
Subtotal Treatment				**$103,690,000**

CONSTRUCTION TOTAL	**$524,540,000**

Permitting and Mitigation		$2,800,000
Interest During Construction (3%)	18 months	$21,753,000
TOTAL COST		**$549,093,000**
ANNUAL COSTS		
Debt Service (3.5%)		$38,635,000
Operation and Maintenance		$6,320,000
Electrictiy ($0.08/kwh)		$4,960,000
Total Annual Costs		$49,915,000
UNIT COSTS (Until Amortized)		
Per Acre-Foot of treated water		$1,783
Per 1,000 Gallons		$5.47
UNIT COSTS (After Amortization)		
Per Acre-Foot		$403
Per 1,000 Gallons		$1.24

WUGs:	**Midland, San Angelo, Abilene**	**Capital Cost:**	$ 327,504,000
WMS Name:	**West Texas Water Partnership Alternative**	**Annual Cost** (During Amortization):	$ 1,165 per acre-foot $ 3.58 per 1,000 gal
WMS Type:	Regional	**Annual Cost** (After Amortization):	$ 342 per acre-foot $ 1.05 per 1,000 gal
WMS Yield:	28,400 acre-feet	**Implementation:**	2030
WMS Status:	Alternative		

Strategy Description

In December 2010, the cities of Abilene, Midland and San Angelo met to discuss cooperative strategies in response to a developing drought. As the drought intensified a cooperative response could not be timely implemented, and the cities constructed and brought on-line individual strategies to provide adequate water supplies for their customers. Recognizing the benefits of working together to address future water supplies, the three cities continued to meet and evaluate long-term water supplies for the West Texas region. Through an Interlocal Agreement, the cities formed the West Texas Water Partnership (Partnership or WTWP) to pursue water management strategies that could be jointly developed by the Partnership.

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Advanced treatment will be required for a portion of the groundwater flow to meet regulatory standards. Preliminary evaluations indicate about 60% of the flow will undergo treatment using ultrafiltration followed by reverse osmosis. Final treatment requirements will be determined during preliminary design. To maximize use of this groundwater source, a recovery stage is proposed for both the ultrafiltration and reverse osmosis processes. Waste from the treatment process is expected to be approximately 5 percent, which is comparable to conventional treatment . Waste will be disposed using evaporation ponds. The treatment plant will be located on Midland's T-Bar Ranch.

From the treatment plant, water will be transported to Midland using the City of Midland's existing T-Bar transmission system. It is anticipated that no groundwater would be delivered directly to Abilene or San Angelo, and both Abilene and San Angelo would receive its share of the WTWP through an exchange of supplies in Lake Ivie. This water would be transported to these partners through existing infrastructure.

Quantity, Reliability and Cost

Each of the three of the WTWP cities contract with the Colorado River Municipal Water District (CRMWD) for 16.54% of the safe yield from O.H. Ivie Reservoir (Ivie). The remaining safe yield from Ivie is allocated to the CRMWD system. Under this alternative strategy, the Partnership will meet with the CRMWD to explore cooperative strategies to serve the needs of the West Texas region. If a mutually

beneficial cooperative strategy can be developed, the need for a pipeline between Midland and San Angelo described in the recommended strategy could be eliminated. Meetings between the parties are anticipated in the late fall/early winter of 2020/2021.

The total quantity of supply from this strategy is 28,400 acre-feet. Elevated levels of total dissolved solids, notably chloride in the groundwater, will require a portion of the supply to undergo advanced treatment. The reliability for this source is high.

The capital cost to fully implement this strategy is $327,504,000. The total project costs would be shared by the three participants.

Environmental Factors

The environmental issues associated with this strategy are expected to be low. It is assumed that the pipeline from the well field to the T-Bar Ranch would be routed around sensitive environmental areas to limit potential impacts. The conceptual design for this project includes evaporation ponds for the disposal of treatment waste stream. A properly designed and maintained facility should have minimal environmental impact.

Agricultural and Rural Impacts

Construction of the pipeline may have temporary impacts on agricultural or rural users whose land is temporarily disrupted but no permanent impacts are anticipated. The treatment facility and evaporation ponds are anticipated to be built on the Midland T-Bar Ranch which is property already owned by the City so it will not cause further impacts to agricultural land.

Impacts to Natural Resources and Key Parameters of Water Quality

The current conceptual design for this project uses evaporation ponds to dispose of the brine waste stream. If this were to change and the brine was released to a stream, impacts to the receiving water body would need to be evaluated.

Impacts on Other Water Resources and Management Strategies

There are two versions of the West Texas Water Partnership strategy included in the Region F and Region G water plans. For planning purposes, this version is an alternative strategy. It is anticipated that only one of these versions would be implemented, not both.

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Well Field Piping	1	LS	$3,750,000	$3,750,000
Access Roadways	1	LS	$2,500,000	$2,500,000
Electrical Distribution	1	LS	$3,500,000	$3,500,000
Storage Tank	1	LS	$2,000,000	$2,000,000
Contractor Mob/Demob (3%)				$590,000
Engineering and Contingencies (35%)				$7,050,000
Subtotal Well Field				**$27,190,000**

Pipeline	**Quantity**	**Unit**	**Unit Price**	**Cost**
Transmission Pipeline - 42"	419,000	LF	$300	$125,700,000
Right-of-Way Easements	24,600	ROD	$200	$4,920,000
Contractor Mob/Demob (3%)				$3,770,000
Engineering and Contingencies (30%)				$40,320,000
Subtotal Pipeline				**$174,710,000**

Pump Station & Ground Storage	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pump Station	1	LS	$3,500,000	$3,500,000
Electrical/SCADA	1	LS	$800,000	$800,000
Storage Tank	1	LS	$1,300,000	$1,300,000
Contractor Mob/Demob (3%)				$170,000
Engineering and Contingencies (35%)				$2,020,000
Subtotal Pump Station/Ground Storage				**$7,790,000**

Treatment	**Quantity**	**Unit**	**Unit Price**	**Cost**
Ultrafiltration (Primary/Recovery)	1	LS	$14,800,000	$14,800,000
Reverse Osmosis (Primary/Recovery)	1	LS	$16,830,000	$16,830,000
Chemical Systems	1	LS	$1,940,000	$1,940,000
Evaporation Pond	1	LS	$9,400,000	$9,400,000
Buildings/Yard Piping	1	LS	$12,930,000	$12,930,000
Electrical/SCADA	1	LS	$10,500,000	$10,500,000
Storage Tanks (Pretreatment/Clearwells)	1	LS	$8,170,000	$8,170,000
Contractor Mob/Demob (3%)				$2,240,000
Engineering and Contingencies (35%)				$26,880,000
Subtotal Treatment				**$103,690,000**

CONSTRUCTION TOTAL	**$313,380,000**
Permitting and Mitigation	$1,150,000

Interest During Construction (3%)	18 months	$12,974,000
TOTAL COST		**$327,504,000**
ANNUAL COSTS		
Debt Service (3.5%)		$23,044,000
Operation and Maintenance		$4,820,000
Electrictiy ($0.08/kwh)		$4,760,000
Total Annual Costs		$32,624,000
UNIT COSTS (Until Amortized)		
Per Acre-Foot of treated water		$1,165
Per 1,000 Gallons		$3.58
UNIT COSTS (After Amortization)		
Per Acre-Foot		$342
Per 1,000 Gallons		$1.05