Regional Raw Water Supply Study

for Central Oklahoma

COWRA

Central Oklahoma Water Resource Authority

PO Box 851331
Yukon, OK 73085-1331

The City of Chickasha

Del City 1948 Oklahoma

Edmond 1889

GOLDSBY

City of Midwest City State of Oklahoma

City of Moore Oklahoma Incorporated 1893

Norman

Seal of the City of Oklahoma City

City of Seminole

Shawnee

Oklahoma City Water Utilities Trust

Regional Raw Water Supply Study

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Oklahoma City Water Utilities Trust

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OKLAHOMA

Final Report

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Section 1
Introduction

1.1 Project Overview

The Regional Water Supply Study for Central Oklahoma (the study) was conducted to characterize the financial, technical, and regulatory feasibility of bringing additional water supplies from southeast Oklahoma to meet the projected needs of participating central Oklahoma communities (participants) through 2060. The study was initiated and facilitated through a collaboration of central Oklahoma communities who together are contemplating the potential formation of the Oklahoma Regional Water Utilities Trust (ORWUT). Participants in the study included the following: Central Oklahoma Water Resource Authority (Mustang, Yukon, El Reno, Piedmont, Okarche, and Calumet), City of Chickasha, City of Edmond, City of Norman, City of Midwest City, City of Seminole, City of Oklahoma City, City of Moore, City of Del City, City of Shawnee, and Town of Goldsby.

The water supply project contemplated in the study, referred to as the "project" in this report, would include acquisition of Sardis Lake, a new surface water diversion, pumping and pipeline conveyance infrastructure, metro-area terminal storage, water treatment, and transmission facilities to deliver either raw or treated water to the participating water providers.

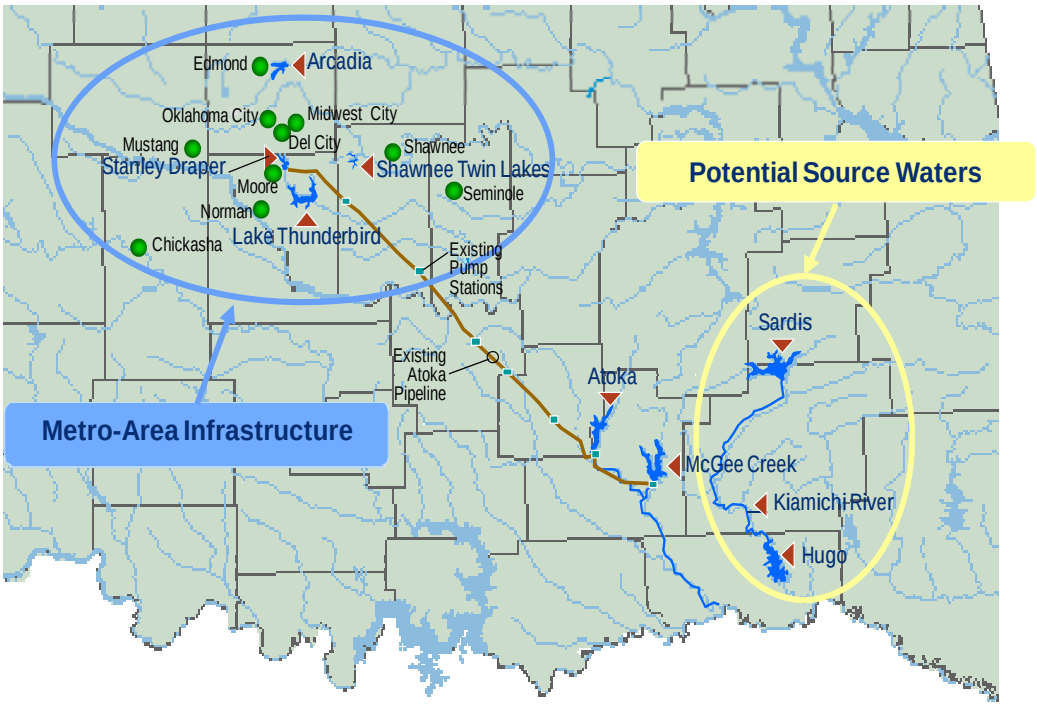


Figure 1-1
Alternatives for Each Major Project Component

Alternatives for each major project component were identified and assessed as part of the study, as shown in **Figure 1-1**. It is anticipated that the majority of the pipeline alignment would parallel the existing Oklahoma City Atoka Pipeline using the existing easement from Atoka Lake to Lake Stanley Draper. Alternate diversion sites in the Kiamichi River Basin in southeast Oklahoma, and alternative approaches to metro-area terminal storage, treatment, and transmission were evaluated as described in subsequent sections of this report.

The project's construction and operation could be administered through ORWUT. The primary goal of the study was to provide sufficient information for the participants to determine whether each will continue with the next step toward implementation of the project. An overview of the study approach is provided in **Figure 1-2**. Each of these steps is described in more detail in subsequent sections of this report.

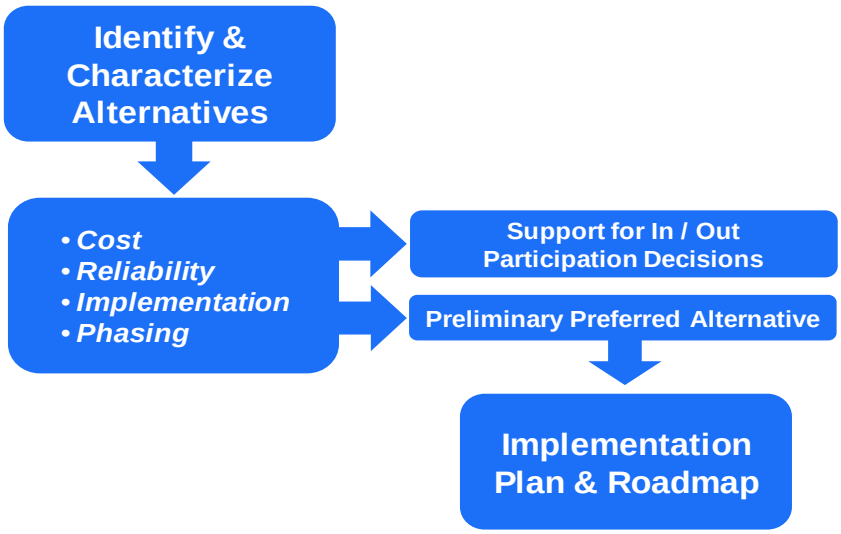


Figure 1-2
Study Process Overview

Participants and CDM met during five separate Workshops to continually communicate the progress and gather input from each with regards the needs of each individual. During Workshop #1 the participants, through a facilitated process, defined the following mission statement for the project.

To engage in a facilitated process which recognizes the broad differences in group members and allows us to make informed decisions on participation (opt in/opt out) in a regional water supply project with particular consideration to cost and timing.

To implement the Mission Statement, communication of project progress and milestones were critical for participants to make informed decisions with regards to this project. To facilitate the communication between CDM and participants weekly progress reports were distributed to all participants to provide continual updates of progress. These reports provided up to date information related to progress, data collection, initial findings, and project milestones. **Figure 1-3** is an example of the work progress schedule followed throughout the project.

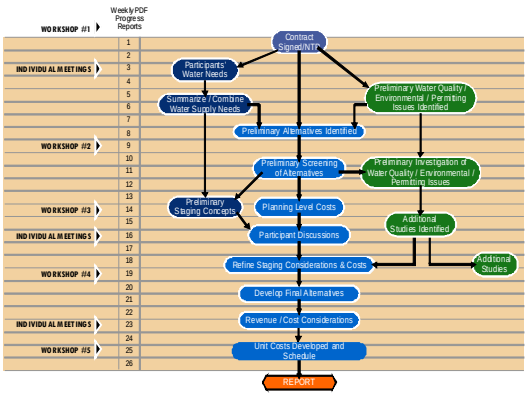


Figure 1-3
Work Progress Schedule

1.2 Demand Projections and Water Rights Needs

Section 2 of this report reviews total water demand projections for Oklahoma City and the incremental water supply needs for each of the nine other participants in this study were assembled for analysis. Incremental water supply needs, for purposes of this study, are the water supplies the participants are requiring from the project while maintaining their existing resources. This approach allows for the establishment of both the infrastructure required and the additional water rights needed to meet participant demands.

Figure 1-4 shows the project demands along with the need for resources and infrastructure through 2060 required to receive water from southeast Oklahoma.

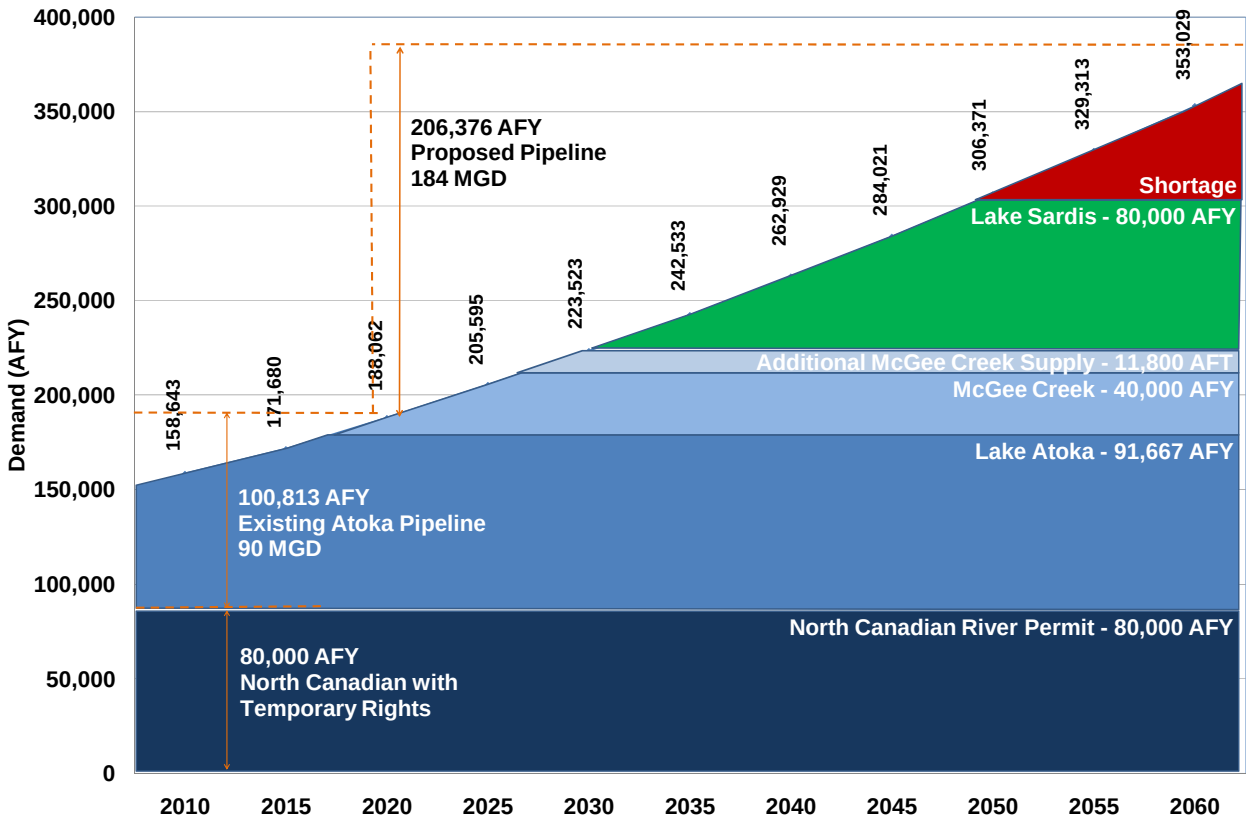


Figure 1-4
Project Demands and the Need for Resources and Infrastructure through 2060

1.3 Source and System Alternatives

Section 3 of this report reviews water needs of participants and where they currently acquire water existing supplies. This review includes projection of individual demands from three primary source categories: local surface water bodies (Lake Thunderbird, Arcadia Lake, Shawnee Twin Lakes, Tecumseh Lake and Lake Stanley

Draper), local groundwater pumping (Garber-Wellington Aquifer), and purchases of water from the Oklahoma City Water Utility Trust (OCWUT). OCWUT has an additional type of supply, as it already acquires water from surface water bodies in southeast Oklahoma (Atoka Lake and McGee Creek Reservoir) via the Atoka Pipeline system. The Source and System Alternatives section of this report provides a summary of existing supplies and projected demands through 2060 and is reported in 5-year increments for use in other sections of this report.

1.4 Supply and Transmission Alternatives

Section 4 of this report reviews the four source alternatives that were considered in the development of this report. **Figure 1-5** reflects these alternatives and their general location within the Kiamichi River Basin. The four source alternatives consist of: Sardis Lake, Hugo Lake, the Kiamichi River at Moyer's Crossing, and the Kiamichi River at Highway 3. These four sites were selected based on previous evaluations and anticipated availability of water supplies and for consistency with Oklahoma City's pending permit application for water from Sardis Lake. Water from one of these withdrawal locations will be pumped to the McGee Creek Reservoir, Atoka Lake, or a constructed receiving tank prior to introduction into the existing and new Atoka Pipelines (see Sections 4.2 and 4.3).

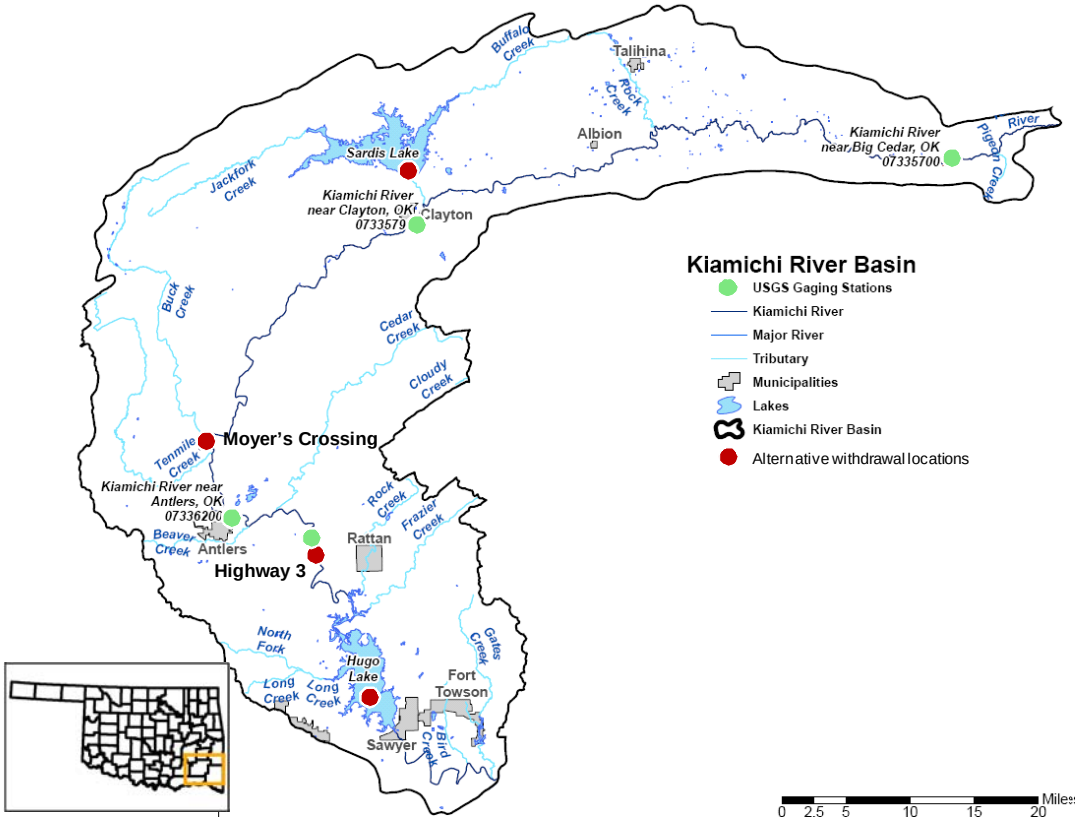


Figure 1-5
Source Alternatives Map

Intermediate storage between the sources (diversions) in the Kiamichi River Basin and the Atoka Pipeline(s) will offer operational flexibility, especially for the riverine source alternatives, since the timing of withdrawals need not necessarily match the timing of actual water demands. Water would be pumped from one of the four Kiamichi River Basin source alternatives into one of the three intermediate storage alternatives before entering the existing and new parallel Atoka Pipelines. Three alternatives for intermediate water storage prior to entering the Atoka Pipeline(s) were considered; Atoka Lake, McGee Creek Reservoir, and a constructed holding tank. Both Atoka Lake and McGee Creek Reservoir are existing supply sources for Oklahoma City. The McGee Creek Reservoir system delivers water to Atoka Lake and both sources deliver water to Oklahoma City through the existing Atoka Pipeline (See Section 4.3).

Once the water is brought from the southeast Oklahoma region via the parallel Atoka Pipelines, it will need to be delivered to the participants in central Oklahoma. In order to clearly define the analysis, three alternative delivery themes were developed. These themes represent, as a starting point, the extremes between a centralized and decentralized system. Ultimately, a hybrid configuration of the delivery themes will probably be the most practical solution, but starting with the themes described below allows a general comparison between a centralized and decentralized system.

The three delivery themes evaluated were as follows:

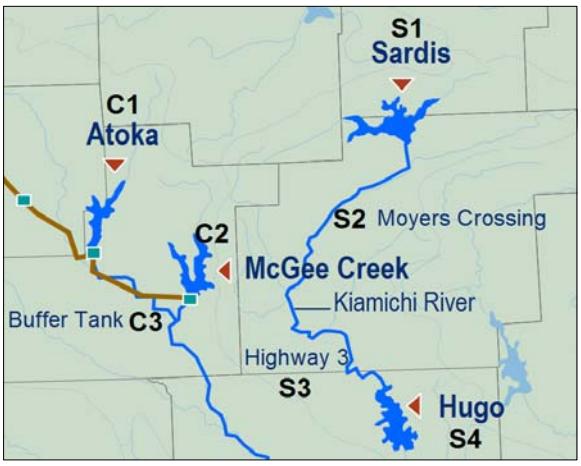
- Theme D1 - Centralized: Regional Treatment at (expanded) Stanley Draper Water Treatment Plant
- Theme D2 – Semi-Centralized: New Regional Water Treatment Plant at Lake Thunderbird
- Theme D3 - Decentralized: Local Treatment at individual plants

1.5 Summary of Water Availability Analysis

Section 5 of this report reviews the water availability review results. The amount of water available to participants once a pipeline project from the Kiamichi River Basin is completed was estimated with a computer model of the hydrology and operations of the contributing basins and reservoirs. The analysis estimated the yield that would be sustainable from each site even during the most severe drought of record. The analysis also considers the potential impacts of pending allocations that may someday become permitted withdrawals by other parties. This analysis was a precursor to a more detailed combined modeling analysis of the entire regional raw water system, which is also included in this report (Section 11).

Results of the water availability analysis are presented in Section 5 of this report. Several key findings are listed below:

- Oklahoma City's pending request for 80,000 AFY from Sardis Lake would have to be increased to meet the full demand over the 50-year planning period for this project.



- Diversions from Sardis Lake would be a marginal alternative, and would barely provide sufficient water to meet projected demands in 2060. Any of the other source alternatives would be marginal without augmenting supply with Sardis releases. However, if Sardis Lake releases supplemental flow when needed, the withdrawal alternatives at Moyer's Crossing, Highway 3, and Hugo Lake could provide ample supply through 2060 *under existing permitted water rights allocations only, and recognizing that Oklahoma City's pending request for 80,000 AFY from Sardis would have to increase in volume*. Concerted releases of water from Sardis Lake may provide opportunities for basin-wide water management to support current and future withdrawals as well as promote stability, even improvement, in local ecosystems.

- There are significant increases in average 10-year yield when comparing normal hydrologic conditions to the drought of record. Under normal conditions (and existing water allocations), the yield to ORWUT could increase by as much as 150 – 300 mgd above the sustainable yield during drought conditions, depending on the source.

- When pending future allocations are considered (senior to Oklahoma City's pending allocation from Sardis Lake of 80,000 AFY; additional 120,000 AFY from Sardis Lake and additional 310,000 AFY from Hugo Lake assumed), the system would be over-allocated during severe drought conditions (by 10 – 20 percent in most cases, with more extreme deficits expected if Sardis were the sole source for participants), but could reliably supply all users during average hydrologic conditions. The projected deficits could potentially be managed through drought-year demand management measures, negotiated use agreements, additional system storage, or supplemental local sources. Additional study would be required.

- The decision of whether to route water through Atoka Lake or McGee Creek Reservoir does not noticeably affect system yield.

1.6 Environmental Regulatory Requirements

Section 6 describes the various alternatives under consideration for the transfer of water from southeastern Oklahoma to central Oklahoma. Regardless of the alternatives selected, significant environmental regulatory requirements must be addressed prior to receiving approval from regulatory agencies for implementation of an alternative. This section provides an overview of the key environmental issues associated with water transfers and water delivery pipeline construction, as they are known at this time. This information will be presented mostly within the context of applicable federal and state laws and regulations. Compliance with these regulatory requirements does not typically occur independently of one another. For example, compliance with federal Clean Water Act requirements may require a demonstration of compliance with federal Endangered Species Act requirements.

1.7 Estimated Conveyance Infrastructure Cost

Section 7 of this report reviews infrastructure needs to receive water from the source water alternatives. Conveyance infrastructure is a significant component required to utilize additional water supplies acquired from southeast Oklahoma. Section 4 of this report reviewed alternatives and were formulated for three primary system components:

1. Raw water transmission from a source water alternative in southeast Oklahoma

2. Increased raw water transmission capacity along the existing McGee Creek and Atoka Pipeline corridors

3. Regional distribution of treated or raw water to each participant

Section 7 of the Report provides feasibility level opinions of probable costs developed to quantify capital and project implementation costs for infrastructure identified water delivery themes. Section 7 also reviews the methodology used to estimate required conveyance infrastructure components and develop opinions of probable costs.

1.8 Estimated Operations and Maintenance

Following the estimation of infrastructure cost in the previous section, Section 8 provides for an analysis of operational and maintenance (O&M) costs associated with this project. O&M costs include power costs for pumping, water treatment costs, and annual maintenance on the conveyance infrastructure. These costs were determined using the water supply simulation tool developed for this project. The scenario tool includes a conceptual-level network representation of the regional water system that allows for water supply-and-demand mass balance calculations to be performed on each pipeline in the system in order to determine the flow of water required to meet the projected demands. Pumping and treatment costs are then derived from the determined flow rates. Additional information about the simulation tool can be found in **Appendix E** to this report.

1.9 Project Cost Distribution to Participants

Distribution costs components were established in Section 7 and 8 of this report then divided between participants in Section 9 based on projected demands reported in Section 3. The distribution of project capital costs will be compared with operational costs in Section 10 in order to establish an estimated unit cost for each participant. Four (4) supply alternatives were analyzed in detail reflecting the four source alternatives considered in this report.

1.10 Unit Cost Distribution for Participants

The previous section developed the distribution of costs to participants. Section 10 provides an analysis of the impact of the costs on the individual participants. The costs from Section 7, 8, and 9 will be analyzed and overall costs per 1,000 gallons developed per participant. The costs per participant will also be expressed as a cost per water connection, based on capital and operation and maintenance costs (existing and new).

1.11 Decision Modeling

Section 11 summarizes the process and method to compare the system-wide alternatives or system alternatives. System alternatives are composed of alternatives for the southeast Oklahoma part of the system (source alternatives and intermediate delivery alternatives) and the central Oklahoma part of the system (delivery alternatives). The source, intermediate delivery and delivery alternatives (the "building blocks" of the system alternatives) were described in Section 3.

The objective of the system alternative comparison and ranking was to define, in a defensible and transparent way, a viable system alternative as a starting point for subsequent phases of the project. Subsequent phases include environmental documentation, a selection of a definitive source selection, route and alignment verification and preliminary design. In order to identify a consented system

alternative, a multi criteria ranking approach was selected. The process to implement that approach and the results of the process are presented in this section.

1.12 Schedule of Future Activities

Section 12 of this report provides a listing of activities needed in the execution of this project. Section 2 reported that the parallel Atoka Pipeline will need to be operational by 2020 in order to meet the participants' water supply needs. Storage rights from Sardis Lake should be acquired prior to the construction of any improvements. In addition, the infrastructure and additional water rights to deliver water from one of the four source water alternatives needs to be in place by 2030 to meet the participants' projected water demands.

In order to accomplish the 2020 and 2030 targets, a series of actions and projects will have to occur. These can be categorized as follows:

- Organizational
- Environmental & Permitting
- Water Rights
- Public Outreach
- Engineering & Construction
- Funding/Financing

Section 12 reviews the major steps necessary to be able to operate the new Atoka Pipeline by 2020 and receive water from the selected diversion location by 2030.

1.13 Summary of Economic and Non-Economic Findings

Section 13 of this report reviews the findings, economic and non-economic, resulting from the investigations completed in this study. Consideration of the various aspects of this project results in the consideration of the following:

- Economic Review of Alternatives – Capital Costs

- Economic Review of Alternatives – Operation and Maintenance

- Economic Review of Alternatives – Unit Cost Distribution to Participants

- Comparison of Alternatives – Non-Economic Considerations

Section 13 concludes with a Summary of Alternatives Comparison wherein the twelve separate source alternatives are represented as to their ranking score established by project participants. This figure identifies the Moyers Crossing as the most favorable means of collecting waters and then delivered using Theme D1 as discussed within the report.

Section 2
Demand Projections and Water Right Needs

2.1 Introduction

This section summarizes total water demand projections for Oklahoma City and the incremental water supply needs for each of the nine other participants in this study. Incremental water supply needs, for purposes of this study, are the water supplies the participants are seeking from the project. They do not include projected water demands that would be met by other sources. This approach allows for the establishment of both the infrastructure required and the additional water rights needed to meet study participants' project needs through the year 2060.

To initiate discussions, preliminary project needs were developed for each participant at the beginning of this study. In accordance with the scope of work for the study, the participants supplied their final project water delivery expectations based on their individual demand projections and their other available or anticipated sources of supply. The annual project need projections, reported in five year time increments, provided the basis for all analyses required for this project.

2.2 Oklahoma City Demand Projections

Demand projections for Oklahoma City included the needs of seven (7) Base Load Customers who chose not to participate in this study but will ultimately receive water from the project. The following communities represent the Base Load Cities for this project: Blanchard, Cashion, Newcastle, Purcell, The Village, Tuttle, and Warr Acres. **Table 2-1** represents the projected demands for Oklahoma City and the seven Base Load Customers in acre-feet per year (AFY). The information contained in **Tables 2-1** and **2-1A** was derived from data contained in the latest Master Plan Report completed for Oklahoma City in 2003.

Year	Oklahoma City	Base Load Cities							Total
		Blanchard	Cashion	Newcastle	Purcell	The Village	Tuttle	Warr Acres	
2010	116,127	837	26	644	0	2,009	11	2,057	**121,711**
2015	123,886	1,014	44	803	0	1,990	44	2,106	**129,888**
2020	132,164	1,230	68	913	0	1,971	95	2,156	**138,596**
2025	140,994	1,491	99	1,036	72	1,953	168	2,208	**148,020**
2030	150,414	1,807	141	1,176	96	1,934	244	2,260	**158,073**
2035	160,464	2,191	196	1,335	105	1,916	372	2,314	**168,894**
2040	171,186	2,657	270	1,517	115	1,897	555	2,369	**180,565**
2045	182,623	3,221	365	1,722	126	1,879	804	2,426	**193,167**
2050	194,826	3,905	451	1,956	138	1,862	1,079	2,483	**206,700**
2055	207,028	4,589	538	2,190	149	1,844	1,354	2,541	**220,234**
2060	219,230	5,274	624	2,424	161	1,826	1,629	2,599	**233,767**

Table 2-1
Oklahoma City and Base Load Cities' Demands (AFY)

Year	Oklahoma City	Base Load Cities							Total
		Blanchard	Cashion	Newcastle	Purcell	The Village	Tuttle	Warr Acres	
2010	103.67	0.75	0.02	0.57	0.00	1.79	0.01	1.84	**108.66**
2015	110.60	0.91	0.04	0.72	0.00	1.78	0.04	1.88	**115.96**
2020	117.99	1.10	0.06	0.82	0.00	1.76	0.08	1.92	**123.73**
2025	125.87	1.33	0.09	0.92	0.06	1.74	0.15	1.97	**132.14**
2030	134.28	1.61	0.13	1.05	0.09	1.73	0.22	2.02	**141.12**
2035	143.25	1.96	0.17	1.19	0.09	1.71	0.33	2.07	**150.78**
2040	152.83	2.37	0.24	1.35	0.10	1.69	0.50	2.11	**161.20**
2045	163.04	2.88	0.33	1.54	0.11	1.68	0.72	2.17	**172.45**
2050	173.93	3.49	0.40	1.75	0.12	1.66	0.96	2.22	**184.53**
2055	184.82	4.10	0.48	1.96	0.13	1.65	1.21	2.27	**196.61**
2060	195.72	4.71	0.56	2.16	0.14	1.63	1.45	2.32	**208.69**

Table 2-1A
Oklahoma City and Base Load Cities' Demands (mgd)

At the beginning of this study, Central Oklahoma Water Resources Authority (COWRA) projected their project needs increasing from 9,745 AFY (8.7 million gallons per day or "mgd") in 2010 to 40,325 AFY (36 mgd) in 2060. After the completion of initial assessments COWRA requested the reduction of their maximum project deliveries to 22,403 AFY (20 mgd). The difference between initial and final COWRA project needs was then assigned to Oklahoma City. The study assumes that in the future, COWRA project needs beyond the revised total will be provided by Oklahoma City through treated water wholesale purchase agreements. Therefore Oklahoma City's total demand was increased, for the purpose of this study, to reflect this requested change. **Tables 2-2** and **2-2A** provide the additional demand projected for Oklahoma City based on the revised COWRA demands.

Year	Oklahoma City + Base Load	Additional COWRA	Total
2010	121,711	0	**121,711**
2015	129,888	0	**129,888**
2020	138,596	0	**138,596**
2025	148,020	0	**148,020**
2030	158,073	0	**158,073**
2035	168,894	2,576	**171,471**
2040	180,565	5,713	**186,277**
2045	193,167	8,737	**201,904**
2050	206,700	11,762	**218,462**
2055	220,234	14,898	**235,132**
2060	233,767	17,922	**251,690**

Table 2-2
Oklahoma City + Base Load Cities + COWRA Extra Demands (AFY)

Year	Oklahoma City + Base Load	Additional COWRA	Total
2010	108.66	0.00	**108.66**
2015	115.96	0.00	**115.96**
2020	123.73	0.00	**123.73**
2025	132.14	0.00	**132.14**
2030	141.12	0.00	**141.12**
2035	150.78	2.30	**153.08**
2040	161.20	5.10	**166.30**
2045	172.45	7.80	**180.25**
2050	184.53	10.50	**195.03**
2055	196.61	13.30	**209.91**
2060	208.69	16.00	**224.69**

Table 2-2A
Oklahoma City + Base Load Cities + COWRA Extra Demands (mgd)

2.3 Incremental Water Supply Needs for Each Participant

All study participants need additional water supplies to meet projected 2060 demands. **Tables 2-3** and **2-3A** represent the reported incremental needs of each participant to be provided by the project, other than Oklahoma City and Base Load Cities. The following participants provided the information contained in **Tables 2-3** and **2-3A**: COWRA, Moore, Chickasha, Norman, Shawnee, Seminole, Del City, Edmond, and Midwest City.

Year	COWRA	Moore	Chickasha	Norman	Shawnee	Seminole	Del City	Edmond	Midwest City	Total
2010	9,745	8,849	6,049	3,999	3,472	2,016	1,680	1,120	0	**36,931**
2015	12,770	9,073	6,161	3,372	3,584	2,240	1,680	2,912	0	**41,793**
2020	15,794	9,409	6,273	5,556	3,584	2,464	1,680	4,705	0	**49,466**
2025	18,930	9,745	6,385	7,841	3,696	2,800	1,680	6,497	0	**57,575**
2030	21,955	9,969	6,497	10,227	3,808	3,024	1,680	8,289	0	**65,450**
2035	22,403	10,305	6,609	12,702	3,921	3,248	1,680	10,081	112	**71,062**
2040	22,403	10,641	6,721	15,268	4,033	3,472	1,680	11,986	448	**76,651**
2045	22,403	10,865	6,833	17,934	4,145	3,696	1,680	13,778	784	**82,118**
2050	22,403	11,201	6,945	20,700	4,257	4,033	1,680	15,570	1,120	**87,909**
2055	22,403	11,537	7,057	24,061	4,369	4,257	1,680	17,362	1,456	**94,182**
2060	22,403	11,762	7,169	26,514	4,481	4,481	1,680	20,947	1,904	**101,339**

Table 2-3
Incremental Supply Needs Identified by Participants (AFY)

Year	COWRA	Moore	Chickasha	Norman	Shawnee	Seminole	Del City	Edmond	Midwest City	Total
2010	8.70	7.90	5.40	3.57	3.10	1.80	1.50	1.00	0.00	**32.97**
2015	11.40	8.10	5.50	3.01	3.20	2.00	1.50	2.60	0.00	**37.31**
2020	14.10	8.40	5.60	4.96	3.20	2.20	1.50	4.20	0.00	**44.16**
2025	16.90	8.70	5.70	7.00	3.30	2.50	1.50	5.80	0.00	**51.40**
2030	19.60	8.90	5.80	9.13	3.40	2.70	1.50	7.40	0.00	**58.43**
2035	20.00	9.20	5.90	11.34	3.50	2.90	1.50	9.00	0.10	**63.44**
2040	20.00	9.50	6.00	13.63	3.60	3.10	1.50	10.70	0.40	**68.43**
2045	20.00	9.70	6.10	16.01	3.70	3.30	1.50	12.30	0.70	**73.31**
2050	20.00	10.00	6.20	18.48	3.80	3.60	1.50	13.90	1.00	**78.48**
2055	20.00	10.30	6.30	21.48	3.90	3.80	1.50	15.50	1.30	**84.08**
2060	20.00	10.50	6.40	23.67	4.00	4.00	1.50	18.70	1.70	**90.47**

Table 2-3A
Incremental Supply Needs Identified by Participants (mgd)

2.4 Summary of Supply Needs

The combination of the total Oklahoma City demands reported in **Tables 2-2** and **2-2A** and the incremental supply needs of the remaining participants reported in **Tables 2-3** and **2-3A** provide the total supply needs for this study. In addition, this information provides the basis for evaluation of water rights requirements and infrastructure staging opportunities. **Tables 2-4** and **2-4A** provide the Oklahoma City total and the participants' incremental supply needs for delivery via the project. The combined total is the amount of water that would need to be delivered through a combination of the existing Atoka Pipeline and the new parallel pipeline from southeast Oklahoma contemplated in this study. The new diversion, conveyance, and treatment facilities were sized to meet the incremental difference between total demands and existing infrastructure capacities.

Year	Oklahoma City Total	Participants Total	Project Total
2010	121,711	36,931	**158,643**
2015	129,888	41,793	**171,680**
2020	138,596	49,466	**188,062**
2025	148,020	57,575	**205,595**
2030	158,073	65,450	**223,523**
2035	171,471	71,062	**242,533**
2040	186,277	76,651	**262,929**
2045	201,904	82,118	**284,021**
2050	218,462	87,909	**306,371**
2055	235,132	94,182	**329,313**
2060	251,690	101,339	**353,029**

Table 2-4
Total Project Supply Needs Identified by Participants (AFY)

Year	Oklahoma City Total	Participants Total	Project Total
2010	108.66	32.97	**141.63**
2015	115.96	37.31	**153.27**
2020	123.73	44.16	**167.89**
2025	132.14	51.40	**183.54**
2030	141.12	58.43	**199.55**
2035	153.08	63.44	**216.52**
2040	166.30	68.43	**234.73**
2045	180.25	73.31	**253.56**
2050	195.03	78.48	**273.51**
2055	209.91	84.08	**293.99**
2060	224.69	90.47	**315.16**

Table 2-4A
Total Project Supply Needs Identified by Participants (mgd)

Figure 2-1 shows the demands, in acre-feet per year, graphically for each participant in direct relation to each other.

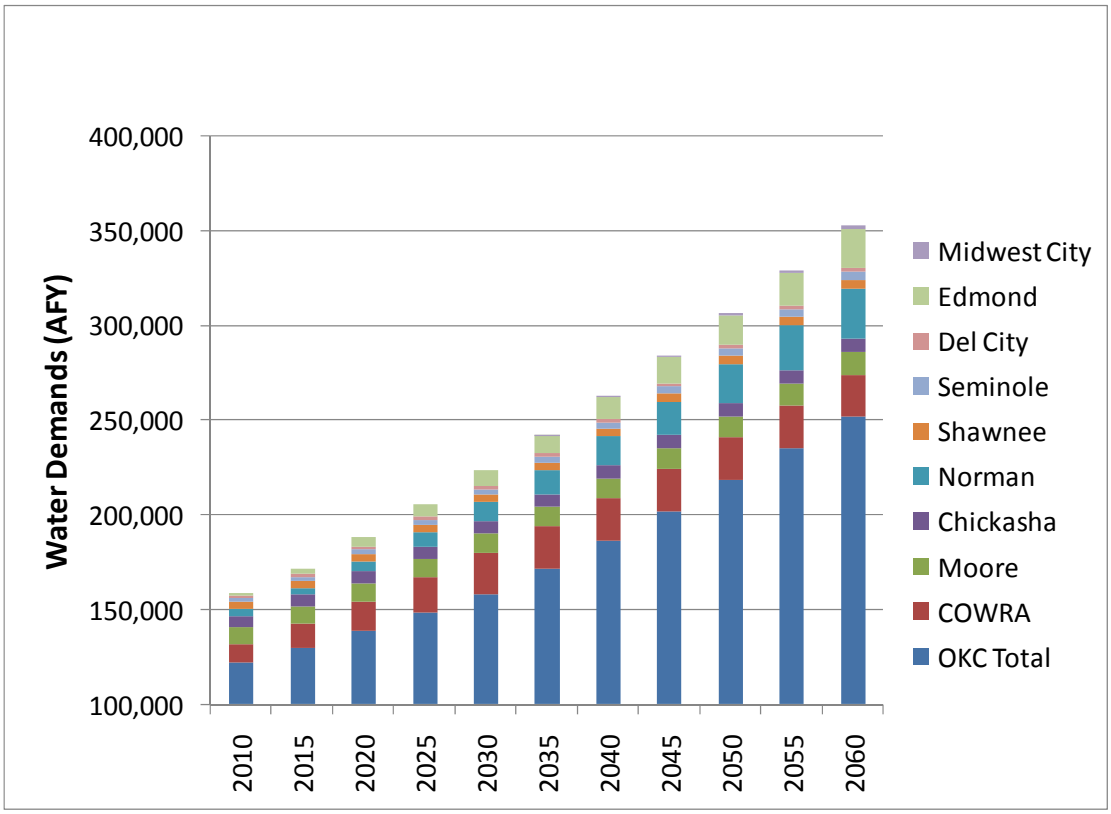


Figure 2-1
Projected Water Demands

2.5 Additional Water Rights Required

The City of Oklahoma City possesses surface water permits totaling 223,467 AFY at a combination of multiple diversion sites. This total does not sufficiently meet project demands projected for 2060. **Tables 2-5** and **2-5A** provide a summary of surface water permits currently possessed by Oklahoma City and the amount of additional water rights required to meet project demands. For simplicity in preliminary planning the study assumes that water rights held in Southeast Oklahoma by the City of Oklahoma City may be made available to the participants on a contractual basis and that new water rights in Southeast Oklahoma supplies would be shared in some manner.. If water rights are to instead be held individually, the amount of additional water rights needed to meet the 2060 demand on the project would be higher than shown in **Tables 2-5** and **2-5A**.

North Canadian River Permit	80,000
Atoka Lake Permit	91,667
McGee Creek Reservoir Permit	40,000
Additional McGee Creek Reservoir Permit	11,800
Permitted Total	**223,467**
Projected 2060 Needs	353,029
Sardis Lake Pending	80,000
Additional Water Rights Required	**49,562**

Table 2-5
Estimate of Additional Water Rights Needed for 2060
Project Deliveries (AFY)

North Canadian River Permit	71.42
Atoka Lake Permit	81.84
McGee Creek Reservoir Permit	35.71
Additional McGee Creek Reservoir Permit	10.53
Permitted Total	**199.50**
Projected 2060 Needs	315.16
Sardis Lake Pending	71.42
Additional Water Rights Required	**44.25**

Table 2-5A
Estimate of Additional Water Rights Needed for 2060
Project Deliveries (mgd)

Figure 2-2 visually presents the current water permits and the timeframe for projected demands. The projected demands reflect those presented in **Tables 2-5** and **2-5A**. Additional water rights would be needed to meet demands beyond about 2050.

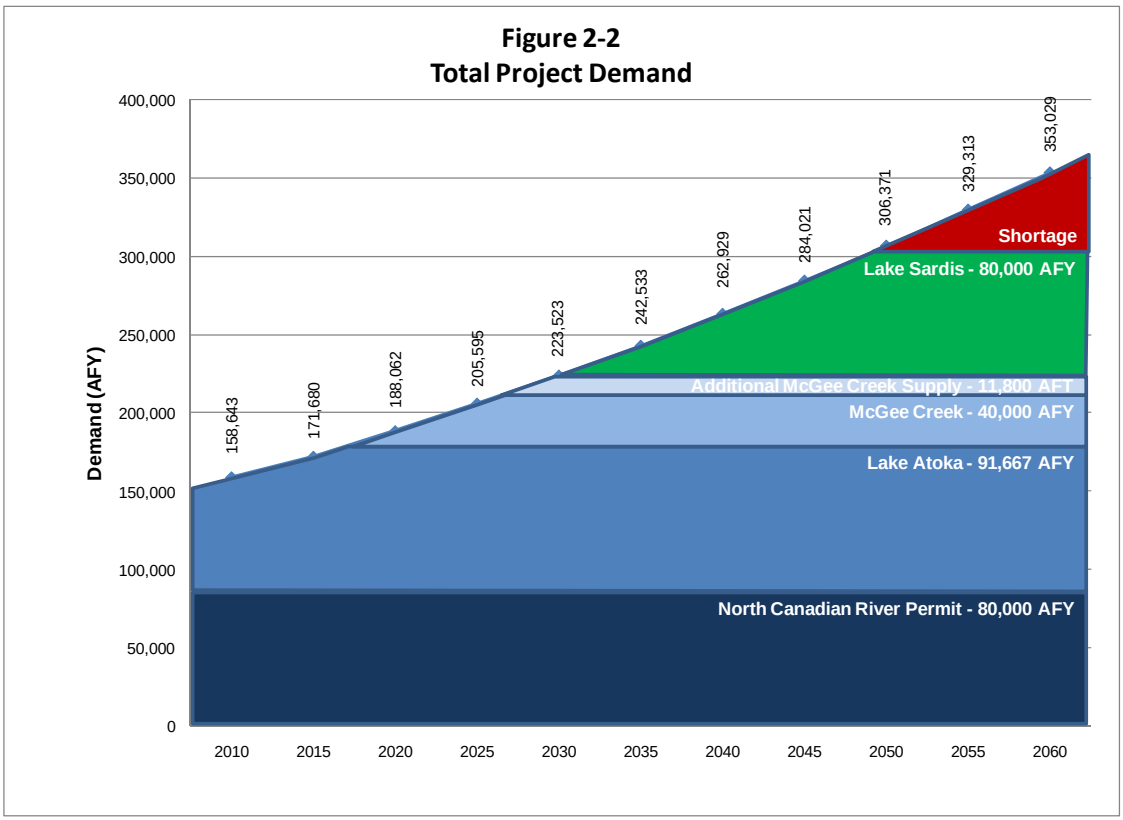


Figure 2-2
Total Project Demand

2.6 Additional Pipeline Capacity Needs

Water from southeast Oklahoma will be delivered through either the existing Atoka Pipeline or the new pipeline associated with the project. Currently, Oklahoma City has the ability to provide 80,000 AFY from their North Canadian Water System and 100,813 AFY through the existing Atoka Pipeline. The remaining project water will be delivered through the proposed pipeline. For the purpose of this study, the new pipeline will have the capacity to provide water through 2060. The capacity of the new pipeline will need to be 184 mgd (206,376 AFY). It is projected that the new line will reach full hydraulic capacity 10-years after the end of the planning period of the project.

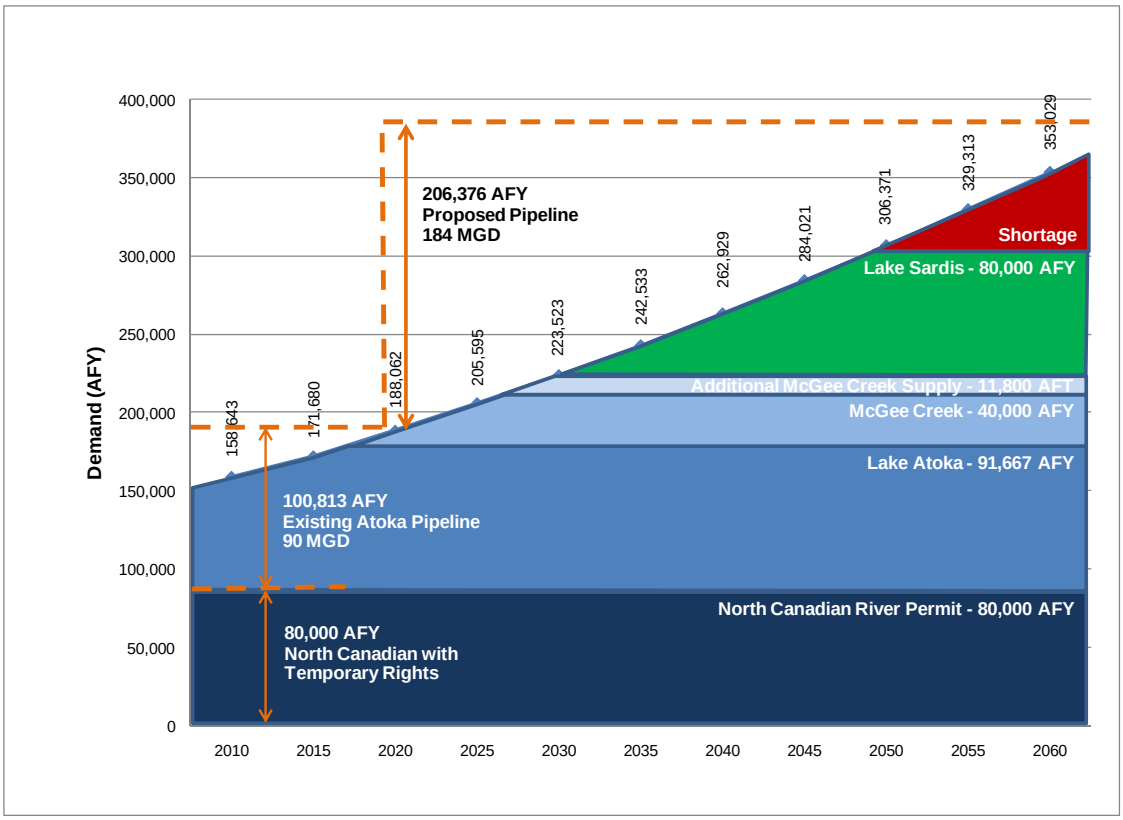


Figure 2-3
Timeframe for Additional Pipeline Capacity Needs

2.7 Summary

The demands for the participants increase from 158,643 AFY in 2010 to 353,029 AFY in 2060. To meet these demands will require additional water rights in the future. A line constructed in parallel to the Atoka Pipeline will help meet the delivery of supplies by 2020. This line will have the capacity to deliver approximately 206,376 AFY (184 mgd) when fully utilized in the future. Water supplied by Sardis Lake will be required by 2030. The current water permit application for Sardis Lake would, if executed at existing levels, provide water supplies until approximately 2050. To ensure water supplies beyond 2050 will require either an amendment to the Sardis Lake permit application or acquisition of additional water supply sources in southeast Oklahoma.

Section 3
Existing Source and System Description

3.1 Existing Supply Sources

The project participants currently acquire their water supplies from three primary source types: local surface water bodies, local groundwater pumping, and purchases of water from OCWUT. OCWUT has an additional, existing source of supply, as it already acquires water from surface water bodies in southeast Oklahoma via the Atoka Pipeline system (i.e. McGee Creek Reservoir and Atoka Lake).

For this study, current water supplies by source type were provided by the participants. **Table 3-1** shows the supply breakdown by participant for each of the three general source types (in annual average mgd and AFY).

Participant	Surface Water WTP Production		Groundwater Production		OCWUT Purchases	
	[mgd]	[AFY]	[mgd]	[AFY]	[mgd]	[AFY]
Chickasha	3.3	3,675	0.0	0	0.0	0
COWRA	0.0	0	3.8	4,238	0.8	872
Del City	1.7	1,896	0.7	817	0.0	0
Edmond	5.3	5,916	5.5	6,120	0.0	17
Midwest City	5.2	5,788	0.6	651	0.0	0
Moore	0.0	0	4.9	5,435	1.4	1,583
Norman	10.4	11,618	2.4	2,663	0.2	191
OKC	96.0	107,550	0.0	0	0.0	0
Seminole**	0.0	0	0.0	0	0.0	0
Shawnee	4.1	4,622	0.0	0	0.0	0

**** Seminole did not provide existing production capabilities**

Table 3-1
Average Annual Water Supplies [in mgd and AFY], by source type (2000-2007)

Additionally, projected annual supply volumes for local surface water and groundwater sources are shown by participant in **Tables 3-2** and **3-3** below. The projections for the most part were assumed to be constant through the year 2060 and were provided by the participants. These projections were used in determining the facility needs and the capital and operations costs for the regional supply project.

Projections for incremental water supply needs are provided in Section 2 of this report.

Projected Local Surface Supplies - through 2060	
Participant	**[AFY]**
Chickasha	3,585
Del City	1,849
Edmond*	12,880
Midwest City	5,647
Moore	0
Norman	11,327
OKC	0
Seminole	0
Shawnee	4,504
COWRA	0
TOTAL	**41,852**

***** The City of Edmond local surface projections are 7,435 AFY in 2010 and ramping up to 12,880 by 2025, then remaining flat through 2060

Table 3-2
Projected Local Surface Source Supplies

Projected Local Groundwater Supplies – Through 2060	
Participant	**[AFY]**
Chickasha	0
Del City	795
Edmond	5,972
Midwest City	639
Moore	5,299
Norman	2,599
OKC	0
Seminole	0
Shawnee	0
COWRA	1,378
TOTAL	**16,682**

Table 3-3
Projected Local Groundwater Source Supplies

3.2 Existing Source Transmission Pipelines

3.2.1 Background and Previous Investigations

CDM reviewed information pertaining to the existing raw water transmission system consisting of the McGee Creek and Atoka Pipelines which deliver raw water from southeast Oklahoma sources into Lake Stanley Draper.

The McGee Creek Pipeline delivers water from McGee Creek Reservoir to Atoka Lake through a 13-mile long transmission pipeline. The first 11 miles of the pipeline, 72-inches in diameter, is a pumped delivery system. This line discharges into a 1.5-million gallon (MG) storage tank and the remaining 2 miles of 66-inch diameter pipeline flows by gravity from the storage tank to Atoka Lake. The firm capacity of this existing delivery system is approximately 56 mgd.

The Atoka Pipeline consists of approximately 100 miles of 60-inch concrete pipeline and a series of pump stations to lift water from Atoka Lake to Lake Stanley Draper (approximately 565 feet of vertical lift). All 6 pump stations operate in series and, from southeast to northwest, are named as follows: Atoka, Coalgate, Stonewall, Ada, Konowa, and Macomb Pumping Stations. Except for the Atoka pump station, all the stations are of similar design and include 5-MG storage tanks on the suction supply of each station. Peak capacity of the Atoka Pipeline is currently limited by pumping capacity and pressure limitations of the pipeline. There are existing operational issues which further limit capacity, but these are considered rectifiable with improvements at the pump stations. Current peak capacity is approximately 76 mgd based on the capacity of the limiting pump station (Atoka). If improvements are made to the pump stations (pumps, variable speed drives, etc.) and a comprehensive pipe cleaning and improvement program is implemented, capacity increases are anticipated to be in the range of 80 to 90 mgd. Previous studies differ on the exact capacity improvements that are possible without a parallel pipe installation.

Recent evaluations of the Atoka and McGee systems have been conducted by MWH (2003) and Boyle Engineering (2007). The most recent evaluation (Boyle) included detailed hydraulic capacity evaluation and pipeline condition assessment. Field testing conducted during the mid 1990s indicates the Hazen-Williams roughness coefficient 'C' for the pipeline varies between 110 and 130. Lower head losses (higher 'C' coefficient) are not achievable without extensive cleaning and lining operations. Using higher head pumps to achieve greater flow capacity also has limitations due to the peak operating pressure of various segments of the existing pipeline. Therefore, the Boyle study recommends a combination of cleaning, selected pipeline upgrades, and revised pumping to improve future design capacity of the existing Atoka Pipeline. Oklahoma City is currently rehabilitating pump stations under project number WC-0499, scheduled for construction completion in 2011.

3.2.2 Hydraulic Criteria for Parallel Transmission Pipeline

At the planning level, it is prudent to use a reasonable but conservative approach to preliminarily select new facility needs. With comparison of facility alternatives using the same criteria, the most cost effective and efficient improvements can be identified at the planning level and refined at a later time using conceptual and preliminary engineering with revised criteria as appropriate. Using the previous evaluations documented MWH, and Boyle studies, CDM selected hydraulic criteria to be used at the planning level for the proposed pipelines contemplated in this study. Those include transmission from the point of diversion to the parallel Atoka transmission pipeline, the parallel transmission pipeline itself, and local transmission/distribution pipelines in the central Oklahoma metro area. While conservative, the recommended criteria are anticipated to be reflective of and consistent with previous evaluations and also reflect achievable results with current industry technology and practices for water transmission.

Table 3-4 summarizes major hydraulic criteria used for sizing of future facilities whether parallel or new stand alone alternatives. The criteria were first applied to the Atoka Pipeline parallel and evaluated by comparing conceptual hydraulic grade line performance with existing conditions. In this case, hydraulic grade elevations at any point along the pipe alignment were established as the same or lower than that for existing peak operating conditions. Based on this, the same criteria were used for sizing of new facilities (source and distribution).

Hydraulic Criterion	Value	Comment
Flow rate (Source)	Average Day - Annual	Assumes Terminal Storage addresses higher peaking requirements throughout the year.
Flow rate (Distribution)	Maximum Day - Annual	Assumes capacity must match treatment needs (whether raw or finished) typical of treatment plant sizing.
Maximum pipe velocity	6 feet per second	To maintain reasonable head losses; some variation allowed, but not greater than 7 feet per second.
Maximum operating pressure	150 psi	Reflects pressure on pump station discharge and can vary with selected pipe material. Believed to be conservative and consistent with current operational limitations on Atoka and McGee systems.
Minimum residual pressure	15 psi	Consistent with direct booster delivery or the equivalent hydraulic grade line (HGL) for a suction tank feeding a booster pump station.
Hazen-Williams 'C' factor	120	Reflects future conditions and includes line minor losses averaged over distance.
Maximum – average day peaking factor	Specific to community	Evaluated for each Distribution delivery alternative for specific communities served.

Table 3-4
Hydraulic Criteria Used for Transmission Facility Sizing in this Study

Section 4
Supply and Transmission Alternatives

4.1 Source Alternatives

Four source alternatives were considered in the development of this report. **Figure 4-1** reflects these alternatives and their general location within the Kiamichi River Basin. The four source alternatives consist of: Sardis Lake, Hugo Lake, the Kiamichi River at Moyer's Crossing, and the Kiamichi River at Highway 3. These four sites were selected based on previous evaluations and anticipated availability of water supplies, and for consistency with Oklahoma City's pending permit application for water from Sardis Lake. Water from one of these withdrawal locations will be pumped to the McGee Creek Reservoir, Atoka Lake, or a constructed receiving tank prior to introduction into the existing and new Atoka Pipelines (see Sections 4.2 and 4.3). Relevant factual information for each source alternative is summarized briefly in **Figure 4-1** and **Table 4-1**. Analysis of water availability from each source is presented in Section 5. Detailed discussions of costs and other factors influencing the decision process (environmental issues, water rights, etc.) are also included in subsequent sections of this report.

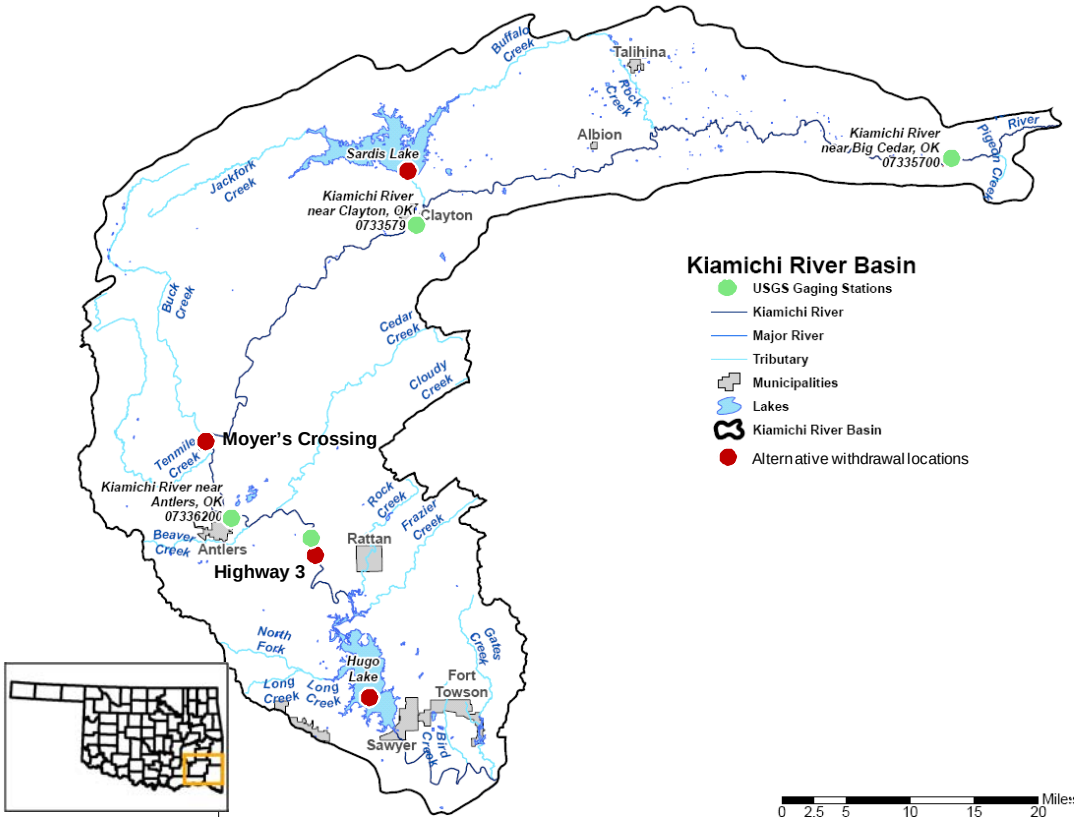


Figure 4-1
Source Alternatives Map

Source ID	Source	Type / Operator	Drainage Area (mi^2)	Conservation Storage (AF)	Existing Local Water Rights (AFY)[4]	Pending Water Rights: Non-OKC (AFY)[4]	Pending Water Rights: OKC (AFY)[4]
S1	Sardis Lake	Reservoir/ USACE	275	274,209[1]	8,269	~120,000 +[3]	80,000
S2	Kiamichi River at Moyer's Crossing	River withdrawal	~1,100	---	7,192[2]	---	---
S3	Kiamichi River at Highway 3	River withdrawal	~1,400	---	2,508[2]	---	---
S4	Hugo Lake	Reservoir/ USACE	1,709	135,474[1]	31,360	310,000 +[3]	---

[1] *Per United States Army Corps of Engineers (USACE) Website*
[2] *Water rights for the riverine alternatives refer to the reach of river between the alternative and the next upstream alternative.*
[3] *Additional allocations are pending, but some may have expired or may not be granted. The numbers shown above represent assumptions used in the analysis presented in Section 5.*
[4] *See Table 4-3 at the end of Section 4.2 for a list of individual water rights allocations*

Table 4-1
Summary Features of Source Alternatives

4.1.1 Sardis Lake

Sardis Lake drains a 275-square mile sub-watershed of the Kiamichi River Basin, and is located off of the mainstem of the Kiamichi River. It is operated by the United States Army Corps of Engineers (USACE), primarily for flood control purposes, local supply, and recreation. It has 274,209 acre-foot (AF) of conservation storage, of which only 8,269 acre-foot per year (AFY) is currently allocated, and 122,564 AF of flood control storage. The conservation pool ranges from elevation 542 feet to 599 feet (only 124 AF are inaccessible below 542 feet), and the flood control pool extends to an elevation of 607 feet. Controlled releases of water from the reservoir downstream to the Kiamichi River are currently limited primarily to flood control purposes. A lake level management plan has been recommended, but not enacted, and currently does not guide water level management decisions.

4.1.2 Kiamichi River at Moyer's Crossing

The Moyer's Crossing location is approximately 7 miles upstream of the United States Geological Survey (USGS) gauging station at Antlers (USGS station # 07336200). It drains approximately 1,100 square miles of the Kiamichi River Basin, and is located on the mainstem of the river. There is no existing impoundment at Moyer's Crossing, and as such, this alternative is the only alternative involving withdrawal from the free-flowing stream. To facilitate a withdrawal from this location, a small impoundment will likely be necessary to provide continuous depth for the streambank intake structure and pumps. Preliminary estimates suggest that the influence of a low-head impoundment (a low weir with a height of approximately 2 feet) may be required to extract water from the river. The impact of a low-head impoundment would only extend upstream approximately one mile. The analysis

presented in Section 5 considers this alternative either as a sole source (the Kiamichi River itself alone) or as a source augmented by coordinated releases from Sardis Lake.

4.1.3 Kiamichi River at Highway 3

The Highway 3 Crossing is located very near the USGS gauging station at Belzoni (USGS station # 07336500, obsolete since 1972), and drains approximately 1,400 square miles of the Kiamichi River Basin. While maps of the watershed (including **Figure4-1**) illustrate this location on the free-flowing Kiamichi River, it is actually impacted by Hugo Lake backwater effects. Field measurements suggest that the elevation of the river channel bottom at the Highway 3 crossing is approximately 390 feet. This depth is near the defined bottom, also at 390 feet, of the conservation pool in Hugo Lake. On the day that this measurement was obtained, the measured water surface at the Highway 3 crossing was also within one foot of the reported water surface elevation of Hugo Lake, as reported by the USACE. Consequently, it is conceivable that the site effectively has access to the majority of the conservation pool storage in Hugo Lake if an intake would be constructed mid-channel (discussed further in Section 5).

4.1.4 Hugo Lake

Hugo Lake drains approximately 1,709 square miles of the Kiamichi River Basin and impounds water on the mainstem of the river. It is operated by the USACE, primarily for flood control purposes, water supply, and downstream water quality requirements in the Red River. It has 135,474 AF of conservation storage, and 793,369 AF of flood control storage. 31,360 AFY is currently allocated for water supply purposes to local users. The conservation pool ranges from elevation 390 feet to 406 feet (31,480 AF are inaccessible below 390 feet), and the flood control pool extends to an elevation of 437.5 feet. Controlled releases of water from the reservoir downstream to the Kiamichi River are limited to flood control purposes and a daily release of 90 mgd to help support water quality objectives in the Red River.

4.2 Intermediate Delivery Alternatives

Intermediate storage between the sources (diversions) in the Kiamichi River Basin and the Atoka Pipeline(s) will offer operational flexibility, especially for the riverine source alternatives, since the timing of withdrawals need not necessarily match the timing of actual water demands. Water would be pumped from one of the four Kiamichi River Basin source alternatives (discussed in Section 4.1) into one of the three intermediate storage alternatives before entering the existing and new parallel Atoka Pipelines.

Three alternatives for intermediate water storage were considered prior to entering the Atoka Pipeline(s); Atoka Lake, McGee Creek Reservoir, and a constructed holding tank. Both Atoka Lake and McGee Creek Reservoir are existing supply sources for Oklahoma City. The McGee Creek Reservoir system delivers water to Atoka Lake and both sources deliver water to Oklahoma City through the existing Atoka Pipeline

(See Section 4.3). The intermediate delivery/storage alternatives are shown in **Figure 4-2**, and key features are listed in **Table 4-2.** Section 7.3 discusses the specific routes that were identified as most appropriate for the subsequent analysis.

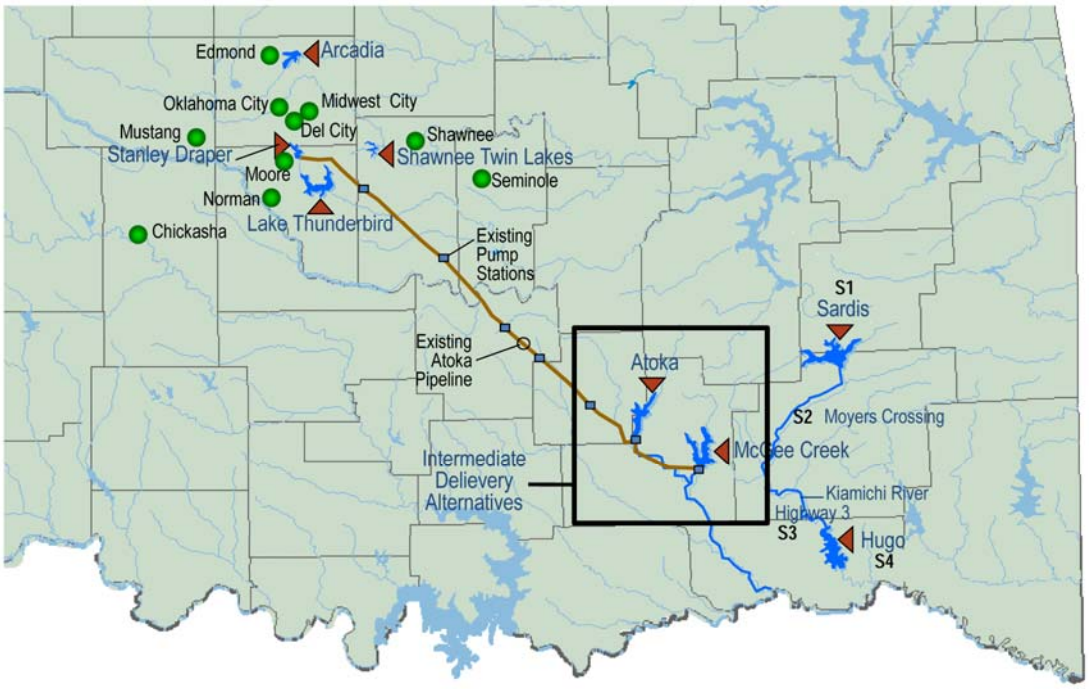


Figure 4-2
Intermediate Delivery/Storage Alternatives Map

ID	Source	Operator	Drainage Area (mi^2)	Firm Yield (AFY)	Conservation Storage (AF)	Existing Local Water Rights (AFY)[3]	Existing OKC Water Rights (AFY)[3]
C1	Atoka Lake	OKC	154	92,067	123,475	2,315	91,667
C2	McGee Creek Reservoir	USACE	171	71,800	108,004[1]	24,608	40,000
C3	Buffer Tank	---	---	---	1,000 - 5,000[2]	---	---

[1] *Per USACE Website*
[2] *Sizing of the buffer tank was evaluated only at a conceptual level at this stage*
[3] *See table at the end of Section 4.2 for a list of individual water rights allocations.*

Table 4-2
Summary Features of Delivery/Storage Alternatives

4.2.1 Atoka Lake

Atoka Lake is located approximately 100 miles southeast of Oklahoma City, and serves as an existing source of water for the city. It impounds water from North

Boggy Creek, a tributary of Muddy Boggy Creek, which eventually joins the Clear Boggy Creek to flow into the Red River. It can deliver up to 84,000 AFY to the city via the Atoka Pipeline using existing pump configurations. Past studies have calculated 100,813 AFY to be the delivery rate if operated at 100% capacity. Oklahoma City has water rights totaling 91,667 AFY associated with Atoka Lake. The current hydraulic capacity of the pipeline limits the actual deliveries available from Atoka Lake and McGee Creek Reservoir.

4.2.2 McGee Creek Reservoir

Like Atoka Lake, McGee Creek Reservoir is located approximately 115 miles southeast of Oklahoma City, and serves as an existing source of water for the city. It drains 171 square miles of the McGee Creek watershed, a tributary of Muddy Boggy Creek, which eventually joins the Clear Boggy Creek to flow into the Red River. It can deliver up to 40,000 AFY to Oklahoma City via the Atoka Pipeline, though the combined yield of McGee Creek Reservoir and Atoka Lake is limited by the hydraulic capacity of the existing pipeline, which can currently deliver approximately 84,000 AFY. The reservoir is operated by the USACE, primarily for water supply and flood control. It has 108,004 AF of conservation storage and 85,288 AF of flood storage. 64,608 AFY is currently allocated for water supply for the region and Oklahoma City. The conservation pool ranges from elevation 515 feet to 577 feet (5,944 AF are inaccessible below 515 feet), and the flood control pool extends to an elevation of 595.5 feet.

4.2.3 Buffer Tank

This alternative was considered only at a very conceptual level in this evaluation. It was considered primarily as a reserve alternative in case the blending of water from the Kiamichi River with water in Atoka Lake or McGee Creek Reservoir could be shown to create a risk of unacceptable water quality degradation. No firm sizes were developed, and the constructed tank was generally evaluated in sizes at or below 5,000 AF, to provide buffering storage for the average necessary daily yield from the Kiamichi River Basin of approximately 150 mgd by 2060 (difference between existing water rights from Atoka Lake and McGee Creek Reservoir and total projected Participant demand in 2060). The tank itself would not provide any additional yield. Like the two existing reservoirs, it would be located at the upstream end of the Atoka Pipelines. Further specifications were deemed unnecessary at this time unless Atoka Lake or McGee Creek Reservoir proved to be problematic with respect to receiving and blending water from the Kiamichi River Basin. To summarize the status of existing and pending water allocations that will or may affect availability of water from the Kiamichi Basin, **Table 4-3** provides a summary of individual water users and their current allocations, as well as pending allocations that are senior to Oklahoma City's request for 80,000 AFY.

Water Source	Existing Allocations			Pending Allocations Senior to OKC (inclusive)		
	User	Permit #	Volume (AFY)	Applicant	Application #	Volume (AFY)
Sardis Lake	Latimer Co Rural Water District #2	19880022	1,000	Standefer	19920030	45
	Addington	19910037	30	Clayton COC	19930001	75,000
	Sardis Lake Water Authority	19910054	6,000	Sardis WRB	19930013	221,000
	Wilson	19980004	300	Sardis Lake Water Auth.	19930014	44,750
	Lockhart	19980031	295	Oklahoma City	20070017	80,000
Hugo Lake	Hugo Municipal Authority	19540795	1,700	Hugo Municipal Auth.	20020029	200,000
	Wildlife Conservation, Dept of	19660677	90	Tarrant Regional Water District	20070005	310,000
	Hugo Municipal Authority	19720048	28,800	Howard	20070014	237.5
Kiamichi River: Sardis to Moyers	Clayton Public Works Authority	19620087	50			
	Clayton Public Works Authority	19800075	400			
	Emery	19830049	636			
	Decker Revocable Trust	19930039	428			
	Jackson	19980005	310			
	King - Dennis	20000025	320			
Kiamichi River: Moyers to Hwy 3	Antlers Public Works Authority	19540874	235			
	Antlers Public Works Authority	19720060	523			
	Redman	19820134	262			
	Redman	19860023	82			
	Pushmataha Co Rural Water Dist #3	19920022	400			
	Pushmataha Co Rural Water Dist #3	19930017	300			
McGee Creek Reservoir	Atoka, City of	19730282A	8,000			
	County Commissioners of Atoka Co	19730282B	8,000			
	Southern Oklahoma Development Trust	19730282C	4,000			
	Oklahoma City, City of	19730282D	40,000			
	Stream Natural Resources L C	19990035	396			
	Coalgate, City of	20040009	4,608			
Atoka Lake	Oklahoma City, City of	19540613	31,367			
	Corrections, Dept of	19560390	30			
	Oklahoma Gas & Electric Company	19690369	285			
	Oklahoma City, City of	19800048	60,300			
	Mack Alford Correctional Center	19860011	180			
	Atoka, City of	19910049	2,000			

Table 4-3
Individual Water Rights Summary

Slight discrepancies exist between the sum totals of existing rights from each source and the assumed rights assigned in the models (due to data availability at the time of model development). The differences are either negligible or result in modestly conservative supply estimates for the Participants. They do not affect the conclusions of the study.

4.3 Delivery Alternatives

Once the water is brought from the southeast Oklahoma region via the parallel Atoka Pipelines, it will need to be delivered to the Participants in central Oklahoma. There are a number of factors to consider in the water delivery configuration. These include: the amount of infrastructure required (and the resulting cost), the efficiency of the distribution system, the structure of the system (centralized or decentralized), and the ownership and operations of the facilities.

In order to clearly define the analysis, three delivery *themes* were developed. These themes represent, as a starting point, the extremes between a centralized and decentralized system. Ultimately, a hybrid configuration of the delivery themes will probably make the most sense, but starting with the themes described below allows a general comparison between a centralized and decentralized system.

The three delivery themes evaluated were as follows:

- Theme D1: Regional Treatment at (expanded) Stanley Draper Water Treatment Plant (WTP) (centralized)
- Theme D2: New Regional WTP at Lake Thunderbird (semi-centralized)
- Theme D3: Local Treatment (decentralized)

For each of these themes and for each city, there are differences in the terminal storage body for regional water, the configuration (and cost) of conveyance infrastructure to the cities, and the location of water treatment. **Tables 4-4** through **4-6** show the terminal storage, location of treatment, and delivery point for each of the cities. **Figures 4-4** through **4-6** show schematics of the distribution themes.

City/Agency	Terminal Storage	Treatment Location
Chickasha	Lake Stanley Draper	Stanley Draper WTP (existing)
Shawnee	Shawnee Twin Lakes	Shawnee WTP (existing)
Seminole	Tecumseh Lake	Tecumseh WTP (existing)
Norman	Lake Stanley Draper	Stanley Draper WTP (existing)
Moore	Lake Stanley Draper	Stanley Draper WTP (existing)
OKC	Lake Stanley Draper	Stanley Draper WTP (existing)
Edmond	Lake Stanley Draper	Stanley Draper WTP (existing)
Midwest City	Lake Stanley Draper	Stanley Draper WTP (existing)
Del City	Lake Stanley Draper	Stanley Draper WTP (existing)
COWRA	Lake Stanley Draper	Stanley Draper WTP (existing)

Table 4-4
Delivery Theme D1 Attributes

City/Agency	Terminal Storage	Treatment Location
Chickasha	Lake Thunderbird	Thunderbird Regional WTP
Shawnee	Shawnee Twin Lakes	Shawnee WTP (existing)
Seminole	Tecumseh Lake	Tecumseh WTP (existing)
Norman	Lake Thunderbird	Thunderbird Regional WTP
Moore	Lake Thunderbird	Thunderbird Regional WTP
OKC	Lake Stanley Draper	Stanley Draper WTP (existing)
Edmond	Lake Stanley Draper	Stanley Draper WTP (existing)
Midwest City	Lake Thunderbird	Thunderbird Regional WTP
Del City	Lake Thunderbird	Thunderbird Regional WTP
COWRA	Lake Stanley Draper	New COWRA WTP

Table 4-5
Delivery Theme D2 Attributes

City/Agency	Terminal Storage	Treatment Location
Chickasha	Lake Stanley Draper	Chickasha WTP (expanded)
Shawnee	Shawnee Twin Lakes	Shawnee WTP (existing)
Seminole	None	New Seminole WTP
Norman	Lake Thunderbird	Norman WTP (expanded)
Moore	Lake Stanley Draper	Stanley Draper WTP (existing)
OKC	Lake Stanley Draper	Stanley Draper WTP (existing)
Edmond	Arcadia Lake	Edmond WTP (expanded)
Midwest City	Lake Thunderbird	Midwest City WTP (expanded)
Del City	Lake Thunderbird	Del City WTP (expanded)
COWRA	Lake Stanley Draper	New COWRA WTP

Table 4-6
Delivery Theme D3 Attributes

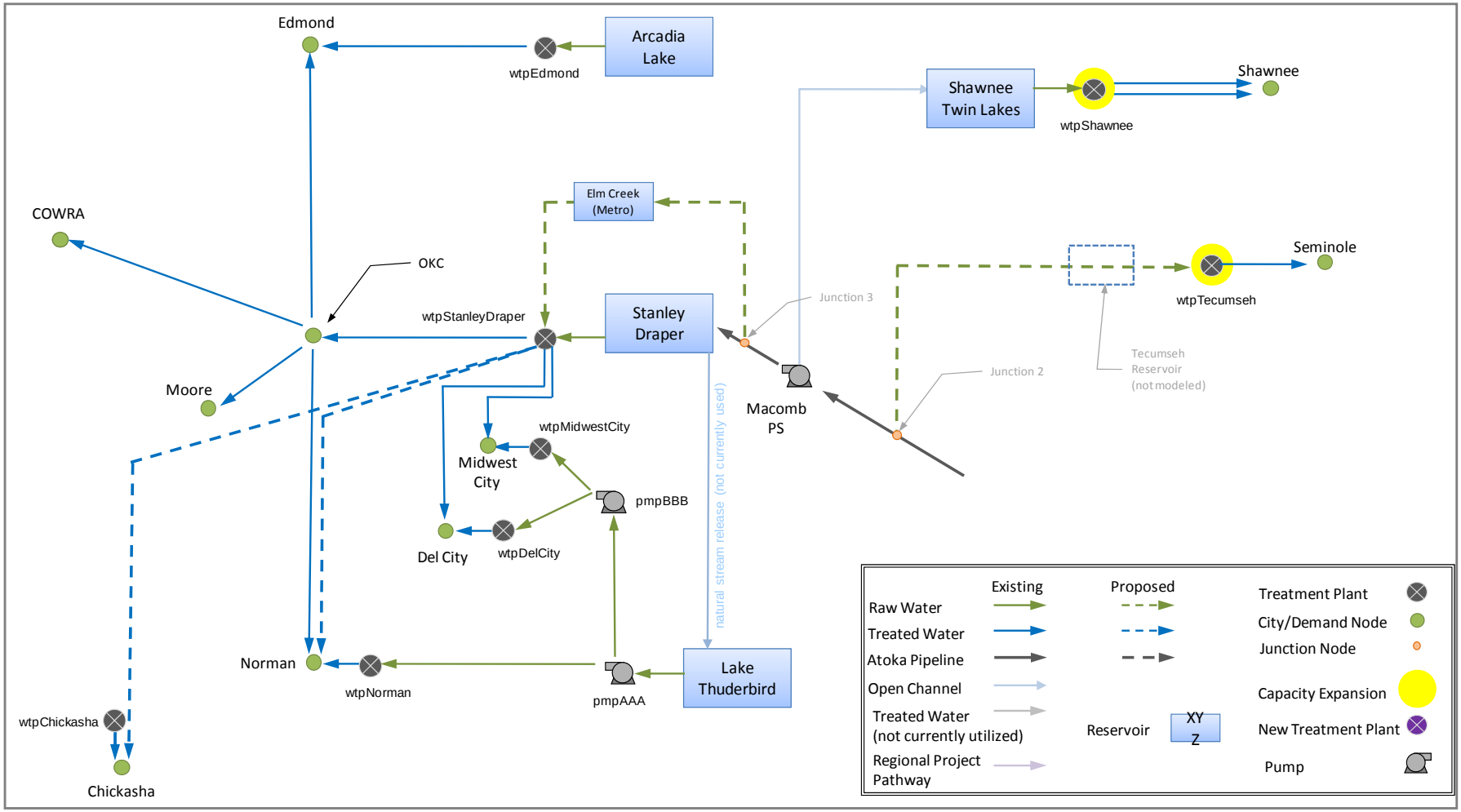


Figure 4-3
Delivery Theme D1 Schematic

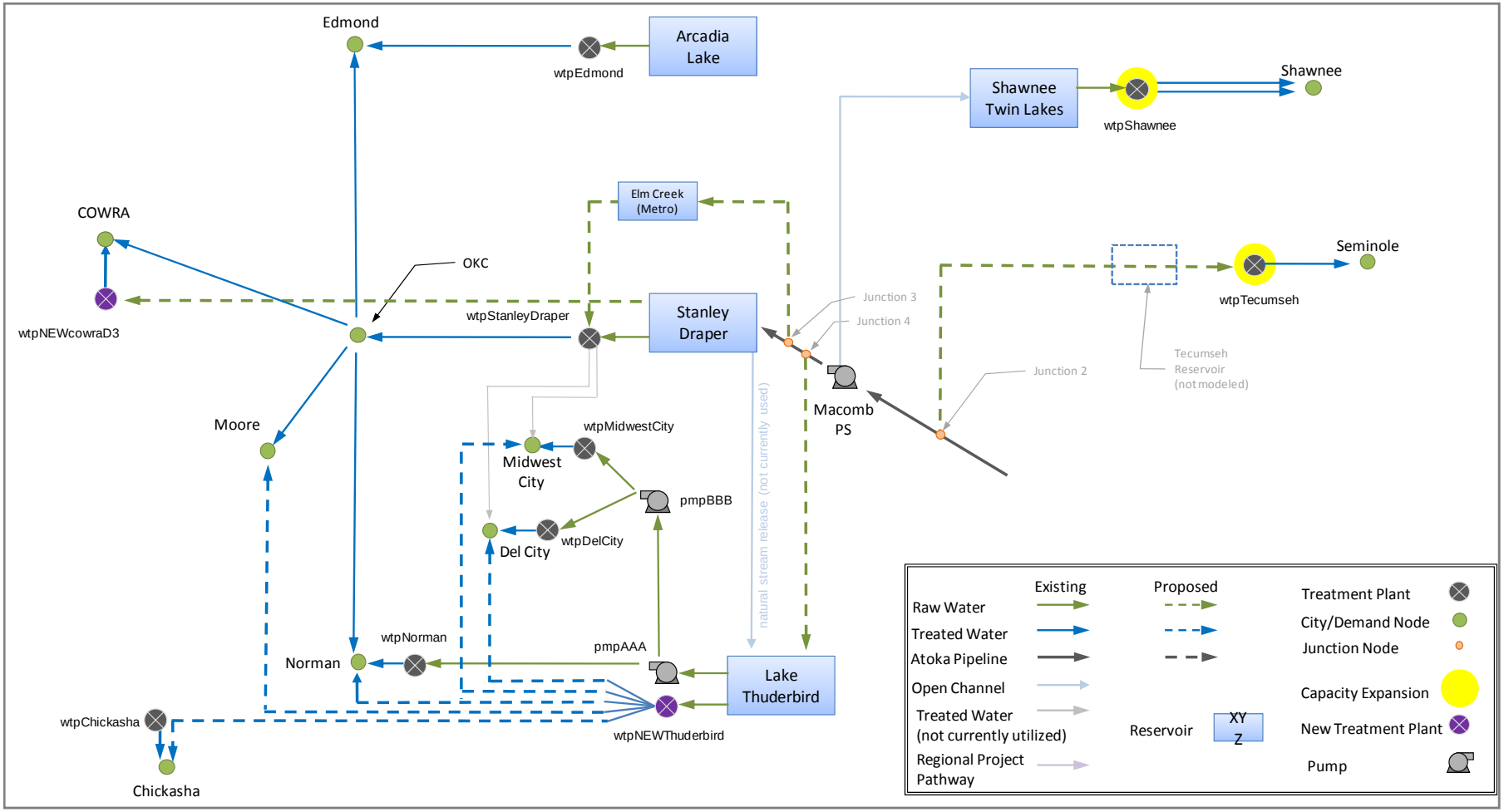


Figure 4-4
Delivery Theme D2 Schematic

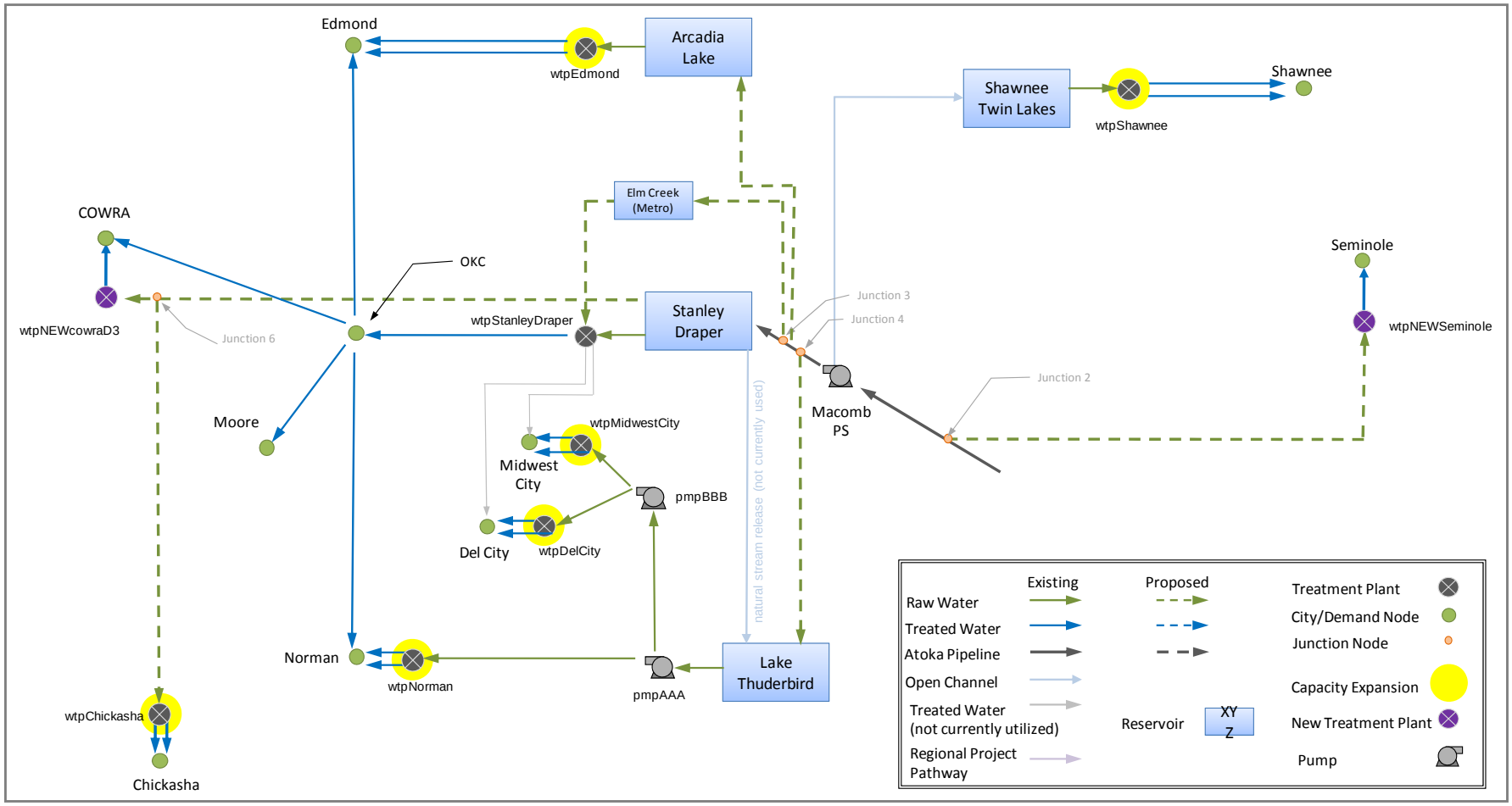


Figure 4-5
Delivery Theme D3 Schematic

Section 5
Water Availability Analysis

5.1 Introduction

The primary goal of this analysis was to estimate the amount of water that would be available to the participants (assumed to be ORWUT, if formed) once a pipeline project is completed to bring water from the Kiamichi River Basin to central Oklahoma. Four alternative locations in the Kiamichi River Basin were identified as potential withdrawal locations (Section 4). This analysis examines the supply that would be sustainable from each site even during the most severe drought of record. The analysis also considers the potential impacts of pending allocations that may someday become permitted withdrawals by other parties.

This supply availability analysis was a precursor to the more detailed combined modeling analysis of the entire regional raw water system, which is discussed in Section 11 and included existing and new pipelines, terminal reservoirs, local sources, treatment facilities, and branch lines to individual communities. This initial analysis is aimed only at understanding the bounds of the supply side of the system; that is, the source waters in the Kiamichi River Basin linked with Oklahoma City's existing supply reservoirs at the southern end of the Atoka Pipeline (Atoka Lake and McGee Creek Reservoir).

Specifically, this analysis sought to answer the following questions:

- What would be the sustainable supply from the four source alternatives to participants? That is, how much water would be continuously available through the drought of record?
- How much water would be available under average hydrologic conditions?
- Is available supply affected by the decision to pass water through McGee Creek Reservoir or Atoka Lake?
- What are the potential impacts of pending water rights applications that were filed prior to Oklahoma City's pending request from Sardis Lake?

5.2 Hydrologic Summary

Several USGS gages are located in the Kiamichi River Basin, but few have long-term records of natural hydrology that are unaffected by the storage dynamics of Sardis Lake (See **Table 5-1** and **Figure 5-1**). Actual records of reservoir inflows and operations were only available for recent years, and were not necessarily representative of the most hydrologically stressed conditions that can be expected in this region.

USGS Gage ID	Gage Location	Drainage Area (square miles)	Period of Record	Notes
07335700	Kiamichi River near Big Cedar, OK	40.1	1965-2007	Too brief to be representative
07335790	Kiamichi River near Clayton, OK	708	1981-2007	Does not include drought of record, flow records are influenced by Sardis Lake operations
07336200	Kiamichi River near Antlers, OK	1,138	1983-2007	Does not include drought of record, flow records are influenced by Sardis Lake operations
07336500	Kiamichi River near Belzoni, OK	1,423	1925-1972	Includes drought of record, located near 3 of 4 potential withdrawal sites, records not influenced by Sardis Lake operations (pre-1972)

Table 5-1
USGS Streamflow Gages in the Kiamichi River Basin

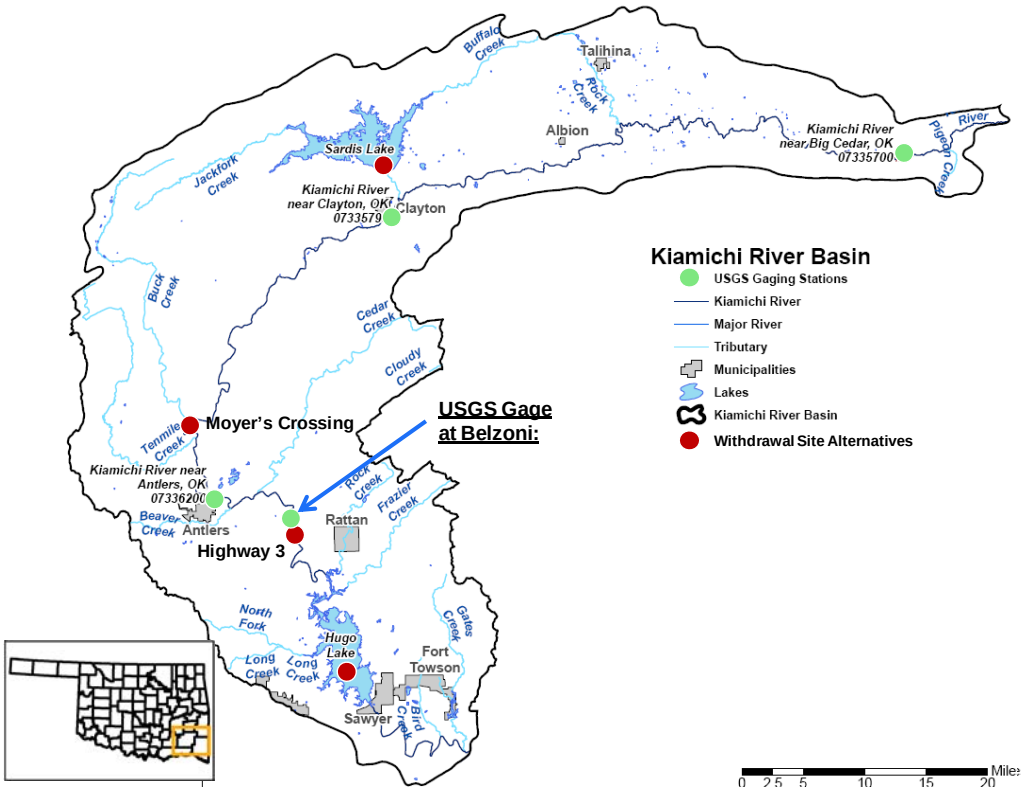
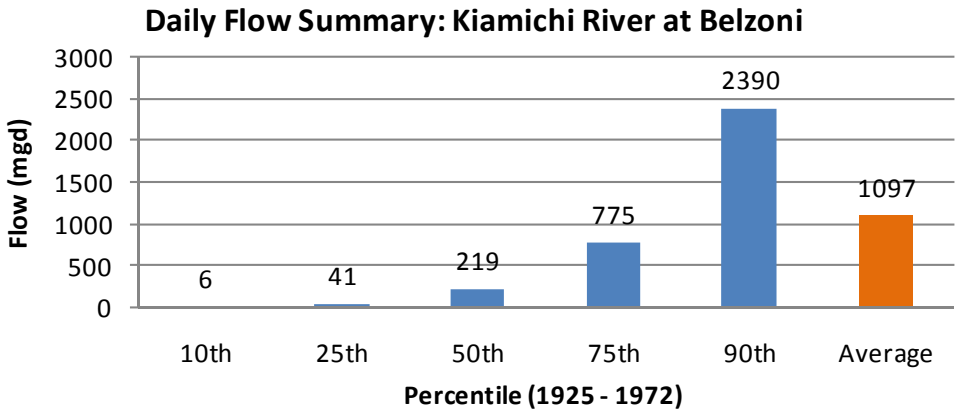


Figure 5-1
Kiamichi River Basin and Representative Hydrologic Gage

To simulate water availability throughout the Kiamichi River Basin, a representative USGS gaging station was identified. The flow record at USGS gage # 07336500 (Kiamichi River at Belzoni) was selected as the representative data set for the basin for the following reasons:

- The record spans the period from 1925 – 1972, which provides a wide range of hydrologic conditions, including the driest ten-year period of historical hydrology prior to construction of Sardis Lake (1958 through 1967). This ten-year period also includes the single driest year on record (1963). The record of streamflow is not influenced by the presence of Sardis Lake and its impoundment of water that would have otherwise flowed to the Kiamichi River – Sardis Lake was constructed after the period of record at the Belzoni gage ended, so the recorded values represent natural streamflow.

- The location of the gage is roughly coincident with the Highway 3 withdrawal location (see **Figure 5-2**). It is also very close to Hugo Lake and to Moyer's Crossing, which suggests that it is a very good representation of the local hydrology for three of the four withdrawal alternatives.



Numbers for each bar represent its value

Figure 5-2
Flow Statistics for Kiamichi River at Belzoni

The flow statistics over the period of record for the Belzoni gage are presented in **Figure 5-2**[1]. They suggest that sustainable supply from a free-flowing river would be relatively low compared with anticipated project demands, and this suggests the need for storage. However, storage could assume two forms in the alternatives to be addressed in this analysis; either as the direct source (withdrawing directly from a

[1] The full timeseries record of flow at the Belzoni gage (USGS gage # 07336500) is available at the USGS website:
http://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&search_site_no=07336500&referred_module=sw

reservoir) or as a supplemental source (augmenting streamflow to offset or boost instream withdrawals).

To estimate natural flows at the prospective withdrawal locations throughout the basin, the flow record from the Belzoni gage was transposed using drainage area ratios. This is a simplified approach, but one that is often appropriate when transposing flows within subwatersheds in a single river basin, and especially when the subwatersheds are constituents of each other, as they are in this case:

- The subwatershed draining into Sardis Lake is 20 percent of the drainage area measured at the Belzoni gage (prior to Sardis Lake construction).
- The subwatershed upstream of the Moyer's Crossing withdrawal site constitutes 80 percent of the watershed represented by the Belzoni gage data.
- The locations of the Belzoni gage and the prospective withdrawal site at the Highway 3 crossing are practically coincident.
- The subwatershed represented by the Belzoni gage constitutes 83 percent of the drainage area into Hugo Lake.

The flow record for the Belzoni Gage was also transposed to generate estimates of inflows to Atoka Lake and McGee Creek Reservoir, since available records for those reservoirs were not as extensive as the USGS data in the Kiamichi River Basin, nor did they include the effects of the drought of record. However, a verification test was conducted to test the efficacy of the transposition of Kiamichi River flow data outside its basin. The assumption of hydrologic similarity between the Kiamichi River Basin and the watersheds draining to McGee Creek Reservoir and Atoka Lake was tested by using the transposed flows and the modeling approach described below to estimate the firm supply of just Atoka Lake and McGee Creek Reservoir. The published firm yield of McGee Creek Reservoir is 71,800 AFY, and that of Atoka Lake is 92,067 AFY. (MWH Report, 2003, Table 9-1). Combined, these two reservoirs can yield approximately 163,867 AFY, or 146 mgd. Correspondingly, the model with transposed hydrologic inflows estimated a firm yield of 122 mgd to the Atoka Pipelines, plus an additional 24 mgd to satisfy local water rights, for a total of 146 mgd. The equality of the published and simulated values suggests that the transposed hydrology is sufficiently representative of hydrologic conditions in these nearby watersheds, and can be used to extend their period of record.

5.3 Supply Estimation Model

5.3.1 Model Formulation

A river and reservoir computer model was developed to help quantify the potential supply available from the four withdrawal locations. The model employed an optimization technique in which the withdrawals were maximized subject to a series of constraints, which included existing storage capacities, water rights, conveyance capacities, and river flows. **Note that the intent of this work was NOT to formulate**

plans for maximizing withdrawals from the watershed, but to quantitatively define upper bounds on the physical availability of water to help distinguish the alternative withdrawal sites. While maximizing the available supply, the model also minimized unnecessary spills from storage reservoirs in order to maintain water levels in the conservation pools as high as possible.

The model was developed in Microsoft Excel with the Premium Solver Platform extension, distributed by Frontline Systems, Inc. The Solver is a powerful optimization algorithm that identifies maximum or minimum values of an objective, which can be cost, firm supply, or other mathematical functions. An optimization program for interconnected reservoirs is comprised of four principal components:

- A mathematical **objective**, which is to be either minimized or maximized (examples include minimization of operating or capital costs, maximization of available supply or supply reliability, minimization of pollutant loads, or combinations of various objectives),
- A set of "**decision variables**" (withdrawals, water transfers, spills, etc.), which are allowed to vary until the mathematical objective reaches a maximum or minimum value,
- A set of **constraints** that bound the values of the decision variables and create a multi-dimensional "decision space" (based on hydraulics, system limitations, regulations, economics, and social or environmental concerns).
- **Network** of flow pathways and storage elements, through which water is routed in response to the decision variables.

The goal of an optimization program is to find the combination of decision variables that either maximizes or minimizes an objective within the confines of the constraints on the problem. The formulation of the central Oklahoma Supply model is described in **Table 5-2**, and the network configuration is illustrated in **Figure 5-3**.

Network Configuration *(see also Figure 5-3)*	Natural hydrologic timeseries (as discussed in Section 5.2) are routed through the system, either directly into reservoirs or into segmented reaches of the Kiamichi River, using drainage area ratios to transpose the USGS gage date from Belzoni. The user defines which storage basins, withdrawal alternative, and operational interconnections are active for a given scenario (each scenario is characterized by only one withdrawal site and one intermediate storage option, and therefore only one interconnection pathway). *This model only represents the Kiamichi River Basin and Atoka Lake and McGee Creek Reservoir – it does not simulate the conveyance and distribution systems downstream of these primary sources.*
Objective *(shown from highest priority to lowest)*	1. Satisfy local water rights in the Kiamichi River Basin as much as possible (these have priority over central Oklahoma withdrawals) 2. Maximize continuous annual average withdrawal from the system to central Oklahoma after satisfying local water rights in the Kiamichi River Basin *(to establish upper bounds on availability – not to formulate an actual plan to extract as much water as possible).* 3. Minimize spills from Sardis Lake and Hugo Lake.

Constraints	▪ Reservoir volumes ≥ Minimum Conservation Pool ▪ Reservoir volumes ≤ Maximum Conservation Pool ▪ Operational flows ≤ Hydraulic Capacity ▪ Downstream water needs satisfied (90 mgd water quality release from Hugo Lake)
Decision Variables	▪ Monthly releases from Sardis Lake to Kiamichi River (it is assumed that Sardis Lake is available to provide supplemental flow to the river in concert with downstream withdrawal locations). ▪ Monthly transfer from Kiamichi River Basin (storage or river) to intermediate storage (Atoka, McGee) ▪ Monthly withdrawal into the pipeline(s) – [To be maximized] ▪ Monthly spills from all reservoirs
Scenario Duration and Timestep	The model simulates any 10-year period of historical hydrology between 1926 and 1972 at a monthly timestep.

Table 5-2
Supply Model Formulation

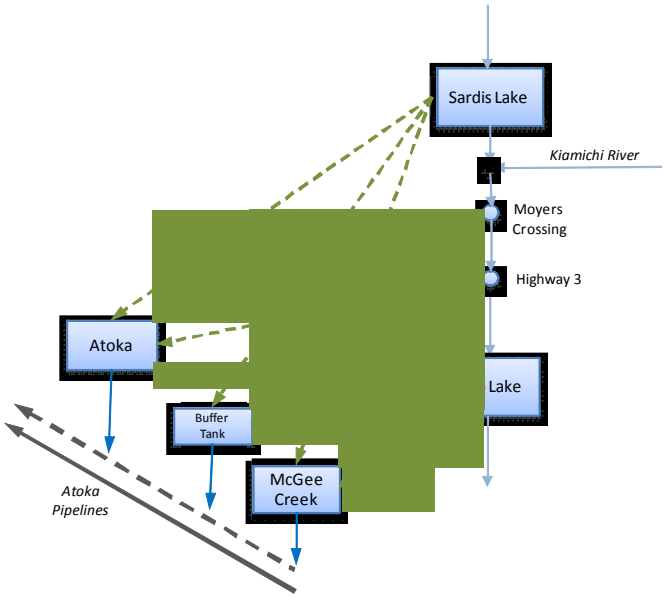


Figure 5-3
Network Configuration of Central Oklahoma Yield Model

5.3.2 Model Assumptions

The following fundamental assumptions guided the analysis:

- For this study, "*sustainable supply*" is defined as the continuous withdrawal of water from the system (into the existing and new Atoka Pipelines) that can be maintained without excursions in the reservoirs below the conservation pool limits, and while satisfying existing local water rights in the source watersheds to the greatest extent possible.

- Supply into the Atoka Pipelines as presented in this report represents the combined contributions of existing sources (McGee Creek Reservoir and Atoka Lake) and one of four potential new sources in the Kiamichi River Basin: Sardis Lake, Kiamichi River at Moyer's Crossing, Kiamichi River at Highway 3, and Hugo Lake.

- Monthly withdrawals are allowed to vary by ±10 percent to account for seasonality of supply or demand, as well as conservation measures that would likely be triggered by a severe drought.

- The driest ten-year period of historical hydrology prior to construction of Sardis Lake was used to estimate the sustainable supply. In this case, these historical years spanned the period from 1958 through 1967, and included the driest year on record (1963). More normal hydrologic patterns were also examined using the period of 1926-1935, which exhibited the averaged 10-year runoff volume for the period of record. **Figure 5-4** illustrates the annual average runoff at the USGS gage at Belzoni for the period of record. Daily flows are averaged into monthly average flows (AF/month) for use in the model.

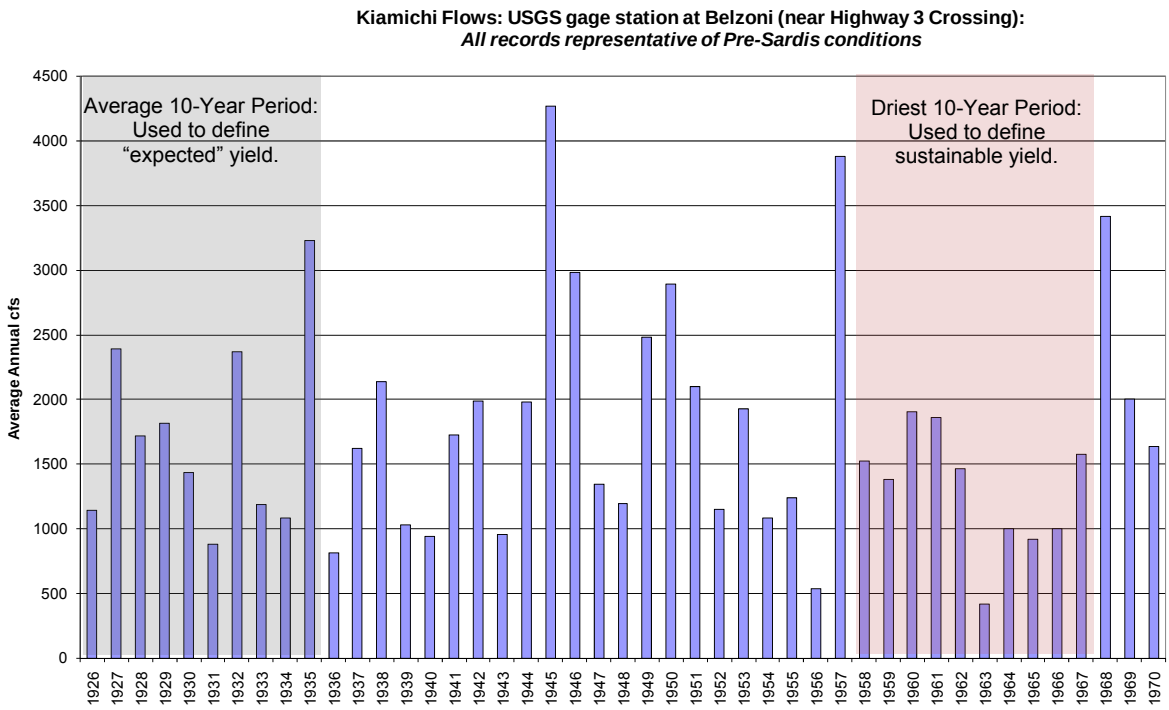


Figure 5-4
Annual Hydrology of Kiamichi River at Belzoni (near Highway 3)

- Water is only available for withdrawal from the conservation pools in each reservoir. Flood flows are assumed to be passed downstream during the month in which they occur, and water is not accessible in the model below the conservation pool thresholds. The following volumes represent the conservation pool volumes in the model (some are approximate, as different sources report slight variations in these volumes - in these cases, the lowest reported volume was used to obtain conservative estimates):

  <u>Conservation Storage Volumes:</u>

Sardis Lake:	274,209 AF
Hugo Lake:	109, 560 AF
McGee Creek Reservoir:	97,273 AF
Atoka Lake:	123,475 AF

  As an alternative, the model can specify monthly lake level targets if lake level management plans include numerical targets or guidelines.

- All existing permitted local water rights (non-Oklahoma City) in the Kiamichi River Basin and in McGee Creek Reservoir and Atoka Lake (are accounted for in this analysis, and held in reserve even if they have not been historically exercised.

These permitted water rights to entities other than Oklahoma City (local users in southeast Oklahoma) are prioritized above the supply to the participants, since they have already been permitted. Existing non-Oklahoma City local water rights accounted for in this analysis include (summarized from the statewide database in AFY):

Sardis Lake:	8,269 AFY
Hugo Lake:	31,360 AFY
Kiamichi River between Sardis Lake and Moyer's Crossing:	7,192 AFY
Kiamichi River between Moyer's Crossing and Hwy. 3:	2,508 AFY
McGee Creek Reservoir:	24,608 AFY
Atoka Lake:	2,315 AFY

Pending allocations (withdrawal rights for which entities have applied but which have not yet been permitted) are also examined (See Section 5.5). Refer to Table 4.3 for a detailed list of existing and pending water allocations.

- The model allows releases from Sardis Lake to the Kiamichi River to supplement river flows for scenarios with downstream withdrawal points. This feature can be deactivated to test the available supply of downstream withdrawal points independent of augmentation from Sardis Lake releases.

- The model allows analysis with or without the hydraulic capacity constraints associated with conveying water between reservoirs. Supply availability is reported herein without hydraulic (infrastructure) constraints applied.

- A year-round requirement to maintain a 90-million gallon per day (mgd) downstream release from Hugo Lake for water quality purposes is enforced in the model.

- The withdrawal point from the Kiamichi River at Highway 3 is within the backwater of Hugo Lake. CDM estimated that the channel invert roughly coincides with the bottom of the conservation pool of the reservoir. For this analysis, it was assumed that approximately 80 percent of the available water supply storage capacity in Hugo Lake would be accessible at the Highway 3 location. This is an approximation that attempts to account for uncertainty in field measurements and the need to retain some water depth at the intake location.

5.3.3 Model Testing

It is not possible to confirm the predicted supply values from this exercise because the reservoirs in the Kiamichi River Basin have not been historically operated near their firm yield levels. However, Section 9 of the Oklahoma City Water Master Plan Report (MWH, 2003) cites the calculated firm yield of Sardis Lake as 156,800 AFY, or approximately 139.5 mgd. The model discussed in this section and used to estimate the water availability for this study computed the firm yield (available supply) of

Sardis Lake (the difference between the first two columns in **Figure 5-5** in Section 5.4) as approximately 139 mgd, or within 0.3% of the published value.

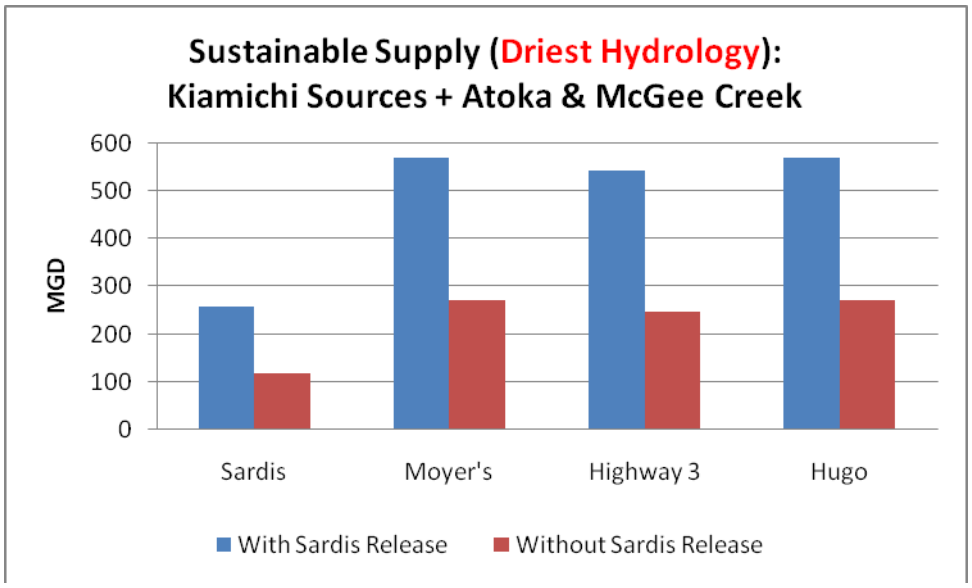
Also, as was done to test the efficacy of the hydrologic transposition of data outside the Kiamichi River Basin, we can rely on the test of Atoka Lake and McGee Creek Reservoir to determine if the model represents reasonable reservoir dynamics. As stated above, the published firm yield of McGee Creek Reservoir is 71,800 AFY, and that of Atoka Lake is 92,067 AFY (Montgomery Watson Harza Report, 2003, Table 9-1). Combined, these two reservoirs can yield approximately 163,867 AFY, or 146 mgd. Correspondingly, the model with transposed hydrologic inflows estimated a firm supply of 122 mgd to the Atoka Pipelines, plus an additional 24 mgd to satisfy local water rights, for a total of 146 mgd. The similarity of the published and simulated values suggests that the model is an effective means of estimating the sustainable supply of the combined southeast Oklahoma sources under investigation.

5.4 Baseline Supply Results with Existing Southeast Oklahoma Permits

The model was run for eight baseline scenarios; each of the four alternative sources was analyzed with and without supplemental releases from Sardis Lake. The sustainable supply results are presented in **Figure 5-5**, and represent the **combined supply of the alternative source in the Kiamichi River Basin PLUS the available (and allocated) supply from Atoka Lake and McGee Creek Reservoir to Oklahoma City**. Again, available supply is defined as water that is physically available after non-Oklahoma permits are satisfied, regardless of whether or not Oklahoma City has permitted rights to the water. Results represent only the water that would be available to central Oklahoma *after* existing permitted local rights (non-Oklahoma City rights) in southeastern Oklahoma are satisfied. For an analysis of pending allocations in addition to currently permitted allocations, see Section 5.5.

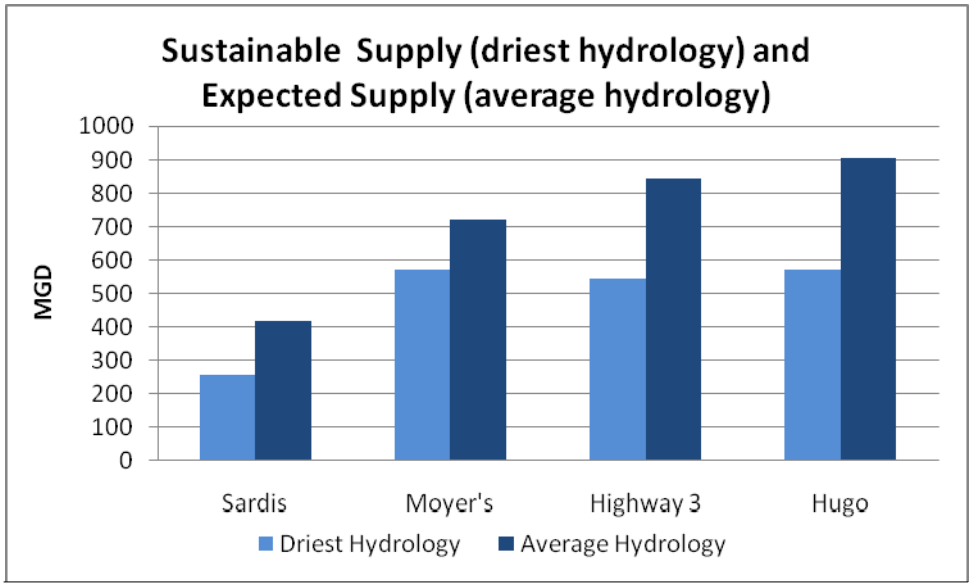
Figure 5-6 presents the sensitivity of the supply results to historical hydrology by comparing the sustainable supply through the driest 10-year period (1958-1967) with the sustainable supply through an average 10-year period (1926-1935). Results for the driest period can be interpreted as the "sustainable supply" and used for planning purposes, while the results of the average period can be interpreted as "expected supply" and used for costing.

The evaluation concluded that supply estimates are independent of which existing source reservoir (Atoka or McGee Creek) is selected as the point of intermediate delivery for the Kiamichi River Basin water. Tests were conducted with each intermediate alternative and no differences were observed in the results.



Note: "Sardis without Sardis Release" is simply the combined yield of Atoka and McGee Creek Reservoirs to the Atoka Pipeline(s).

Figure 5-5
Baseline Supply Results to Central Oklahoma with Existing Water Rights Allocations



Note: These values include supplemental releases from Sardis Lake.

Figure 5-6
Comparison of Sustainable Supply to Average Supply

Several important conclusions can be drawn from the results in **Figure 5-5,** recalling that only existing permits in southeast Oklahoma are prioritized in these scenarios above water that would be physically available for participant withdrawals:

- Sardis Lake would be a marginal alternative, and would barely provide sufficient water to meet projected demands for the project in 2060 (see Section 2).

- Any of the other source alternatives would be marginal without augmenting supply with Sardis Lake releases. However, if Sardis Lake releases supplemental flow when needed, the withdrawal alternatives at Moyer's Crossing, Highway 3, and Hugo Lake could provide ample supply through 2060 *under existing permitted water rights allocations*. That is, the water would be physically available, even though the pending Oklahoma City allocation from Sardis Lake (or elsewhere) of 80,000 AFY would need to increase.

- For the source alternatives downstream of Sardis Lake, the benefit that can be gained from intermittent supplemental releases from Sardis Lake is more than the fully sustainable supply from Sardis Lake itself. Sardis Lake itself (without McGee Creek Reservoir and Atoka Lake) can provide approximately 150 mgd on a fully sustainable basis, yet it augments the sustainable supply of the other downstream alternatives by approximately 300 mgd. This is because the need for supplemental flow is not continuous – there are extended periods during which the downstream sources can provide the full supply without augmentation. Therefore, Sardis Lake storage would not be constantly depleted, and instead of providing ~150 mgd all of the time, it can provide ~300 mgd some of the time.

- **Figure 5-6** illustrates that under normal conditions (average hydrology), the available supply over the 10-year experimental periods increases significantly over the sustainable supply defined by the driest periods. Increases in "expected" supply range from approximately 150 mgd to over 300 mgd above the sustainable supply. For planning purposes, however, it is recommended that the driest hydrology be used to define long-term sustainable supply.

- These results consider only the existing water allocations in the Kiamichi River Basin, and from Atoka Lake and McGee Creek Reservoir. Existing permitted water rights in southeast Oklahoma (non-Oklahoma City) are satisfied first, and the remaining water is presented in this section as the sustainable supply to central Oklahoma. Section 5.5 examines the sensitivity of the reported values to pending future allocations of water in the Kiamichi River Basin.

5.5 Potential Impacts of Pending Water Rights Allocations

The results presented above are based solely on existing (permitted) water allocations in the Kiamichi River Basin and Atoka Lake and McGee Creek Reservoir. Several large-scale water permit applications are pending in the Kiamichi River Basin. Pending applications include Oklahoma City's permit application on March 13, 2007

for 80,000 AFY (which would need to be amended and expanded to satisfy the collective needs contemplated in this study). Some of the pending permit applications filed before Oklahoma City's (senior to the 80,000 AFY requested by Oklahoma City) may have expired or may be denied by OWRB, for various reasons, but for the purpose of this analysis, it was assumed that a permit request for rights to 310,000 AFY from Hugo Lake could be granted, and cumulative permit requests totaling allocations of approximately 120,000 AFY could be granted from Sardis Lake. Both of these volumes were requested prior to Oklahoma City's request for 80,000 AFY, and are therefore considered to be senior rights in this hypothetical analysis. Should these rights be granted ahead of (senior to) allocations to ORWUT/Oklahoma City, the remaining sustainable supply could theoretically be reduced substantially, and the system may not be able to reliably supply all users during conditions that replicate the drought of record.

The water availability model was used to examine the potential impact of pending water allocations (senior to Oklahoma City) on sustainable supply to ORWUT, and on the expected supply during normal hydrologic conditions. The model was formulated such that all existing local (non-Oklahoma City) rights *and* pending future rights senior to Oklahoma City would be satisfied to the greatest extent possible before providing water to ORWUT. For this analysis, then, the total water rights (existing and pending non-Oklahoma City rights) that would be senior to withdrawals by the participants were as follows:

Sardis Lake:	128,269 AFY
Hugo Lake:	341,360 AFY
Kiamichi River between Sardis Lake and Moyer's Crossing:	7,192 AFY
Kiamichi River between Moyer's Crossing and Hwy. 3:	2,508 AFY
McGee Creek Reservoir:	24,608 AFY
Atoka Lake:	2,315 AFY

The model assigns priorities as follows:

- Priority 1a: Existing permitted water rights
- Priority 1b: Pending future rights senior to Oklahoma City
- Priority 2: Supply to central Oklahoma (including Oklahoma City's request for 80,000 AFY from Sardis Lake).

In other words, existing permitted rights and pending future rights that are senior to Oklahoma City's request for 80,000 AFY from Sardis Lake are given priority over withdrawals to the participants for the purpose of this analysis. However, the model is formatted to re-prioritize these rights for experimental purposes.

In addition to prioritizing the senior water rights (existing and pending), the model reports the deliveries of water to non-Oklahoma City users as the average monthly

values over the 10-year simulation period, while capping any monthly non-Oklahoma City withdrawal at one-twelfth of its annual maximum value. This means that there may be months in which water is simply unavailable, while in other months the maximum amount is available. The constraints on ORWUT withdrawals are more stringent for this exercise in the interest of defining sustainable ORWUT supply, and as mentioned, allow monthly deviations of only 10 percent around the average 10-year withdrawal. This is not an attempt to formulate policy or prioritization practices, but represents a conservative estimate of potential future water availability throughout the basin. Results for conditions representing the drought of record are presented in **Figure 5-7**, and those for average hydrologic conditions are presented in **Figure 5-8**. The figures should be viewed with the following points of understanding:

- The pending rights in the figures (added to existing permitted rights) are only those that are senior to Oklahoma City's request for 80,000 AFY.
- Oklahoma City's pending request for 80,000 AFY would need to be increased to satisfy the entire ORWUT demand as it is represented in this study.
- It was assumed that for withdrawal locations downstream of Sardis Lake, supplemental water releases from Sardis Lake would be available.

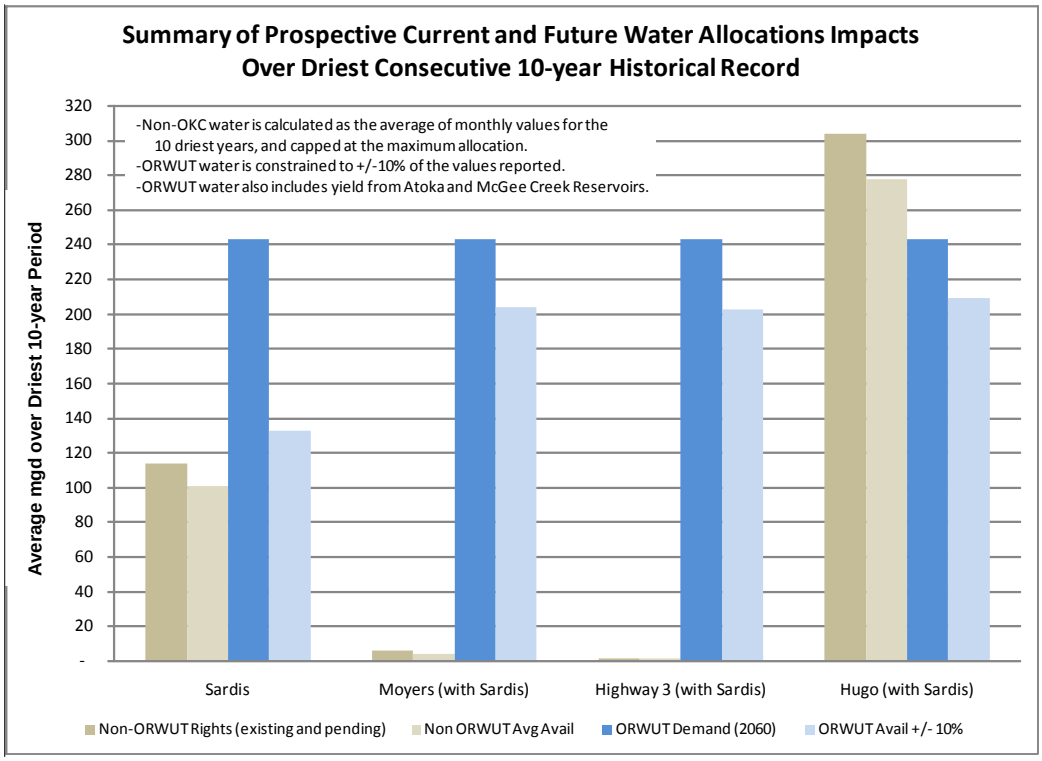


Figure 5-7
Impact of Pending Future Allocations on Sustainable Yield

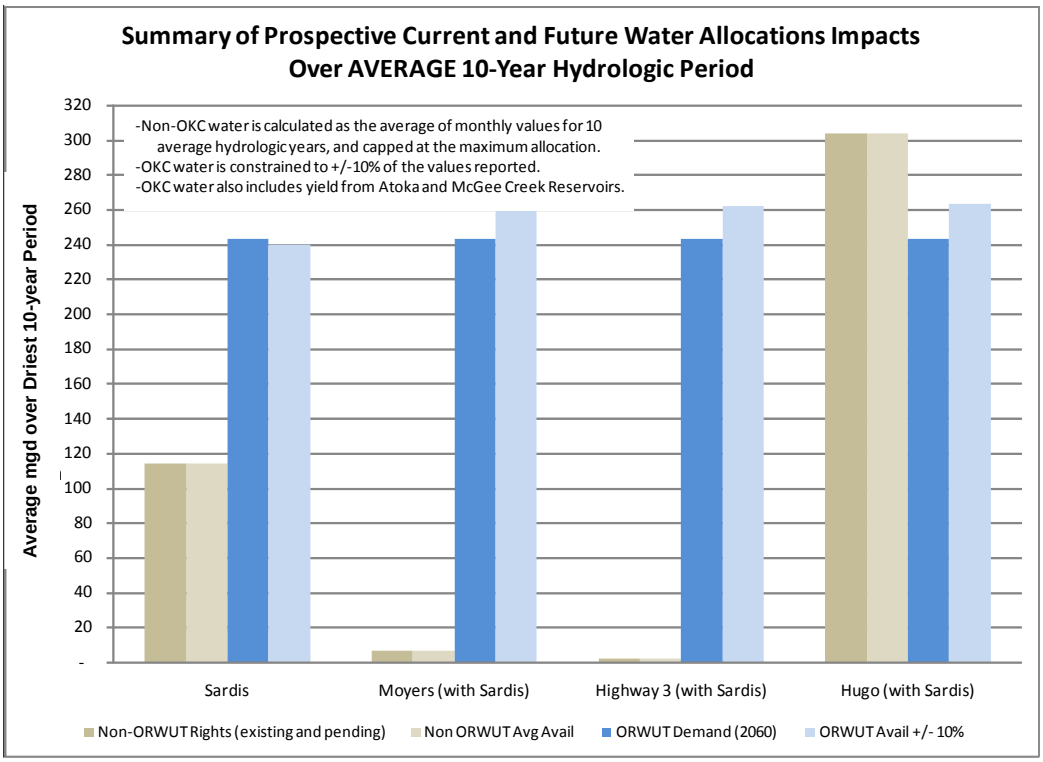


Figure 5-8
Impact of Pending Future Allocations on Average Yield

The results clearly indicate two important findings:

- Under extreme drought conditions, the system could not reliably support the pending future allocations that are senior to Oklahoma City's 80,000 AFY and the 2060 ORWUT demand simultaneously. However, the simulated deficits are not necessarily beyond management, as they typically range from 10 – 20 percent (with the exception of Sardis Lake as the sole source for ORWUT), and these may potentially be overcome with concerted drought-year demand management measures, negotiated use agreements, additional system storage, or supplemental local sources.

- Under normal hydrologic conditions, the system can be expected to satisfy existing and pending non-Oklahoma City allocations as well as the full 2060 ORWUT demand, though the supply from Sardis Lake as a sole source remains marginal.

5.6 Water Availability Conclusions

More detailed conclusions of the water availability analysis are presented in Sections 5.4 and 5.5. Listed here are the fundamental observations from this analysis:

- Water availability is a physical measure of water in the system that could be used by the participants after senior rights (existing permits and pending senior allocations, depending on the scenarios) are extracted to the greatest extent possible. The availability of water, however, does not necessarily mean that a permitted right exists for the participants – Oklahoma's pending request for 80,000 AFY from Sardis Lake would have to be increased to meet the full demand over the 50-year planning period for this project.

- Diversions directly from Sardis Lake would meet projected demands in 2060. However, this supply source would be marginal, as would any of the other source alternatives without augmenting supply with Sardis Lake releases. However, if Sardis Lake releases supplemental flow when needed, the withdrawal alternatives at Moyer's Crossing, Highway 3, and Hugo Lake could provide ample supply through 2060 *under existing permitted water rights allocations only, and recognizing that Oklahoma City's pending request for 80,000 AFY from Sardis Lake would have to increase in volume*. Concerted releases of water from Sardis Lake may provide opportunities for basin-wide water management to support current and future withdrawals as well as promote stability, even improvement, in local ecosystems.

- The decision of whether to route water through Atoka Lake or McGee Creek Reservoir does not noticeably affect system supply.

- There are significant increases in average 10-year supply when comparing normal hydrologic conditions to the drought of record. Under normal conditions (and existing water allocations), the supply to ORWUT could increase by as much as 150 – 300 mgd above the sustainable supply during drought conditions, depending on the source.

- When pending future allocations are considered (senior to Oklahoma City's pending allocation from Sardis Lake of 80,000 AFY; additional 120,000 AFY from Sardis Lake and additional 310,000 AFY from Hugo Lake assumed), the system would be overallocated during severe drought conditions (by 10 – 20 percent in most cases, with more extreme deficits expected if Sardis Lake were the sole source for ORWUT), but could reliably supply all users during average hydrologic conditions. The projected deficits could potentially be managed through drought-year demand management measures, negotiated use agreements, additional system storage, or supplemental local sources.

Section 6
Environmental Regulatory Requirements

6.1 Introduction

Section 6 describes the various alternatives under consideration for the transfer of water from southeastern Oklahoma to central Oklahoma. Regardless of the alternatives selected, significant environmental regulatory requirements must be addressed prior to receiving approval from regulatory agencies for implementation of an alternative. This section provides an overview of the key environmental issues associated with water transfers and water delivery pipeline construction, as they are known at this time. This information will be presented mostly within the context of applicable federal and state laws and regulations. Compliance with these regulatory requirements does not typically occur independently of one another. For example, compliance with federal Clean Water Act requirements may require a demonstration of compliance with federal Endangered Species Act requirements.

6.2 Regulatory Overview

Numerous federal, state, and local laws and regulations can affect the design and implementation of water supply projects. For this review, the focus is on federal and state regulatory requirements. Where appropriate, local regulatory requirements are also identified. However, these local requirements will need to be further evaluated once final alternatives are selected and the specific locations for construction of water transfer infrastructure have been identified.

6.2.1 Clean Water Act

The Federal Water Pollution Control Act and its amendments of 1972, 1977, 1981, and 1987 comprise what is commonly known as the Clean Water Act (CWA). The CWA provides the basis for the protection of all inland surface waters, estuaries, and coastal waters. The federal Environmental Protection Agency (EPA) is responsible for ensuring the implementation of the CWA and its governing regulations (primarily Title 40 of the Code of Federal Regulations), but may delegate its authority to the states. Key sections of the CWA relevant to project implementation include:

Section 303 – Water Quality Standards and Implementation Plans

- Sections 303(a), (b), and (c) establish the foundation for the protection of water quality through the development and implementation of water quality standards. These standards consist of both the beneficial uses of each waterbody under CWA jurisdiction and the water quality criteria required for protecting those uses. The Oklahoma Water Resources Board (OWRB) establishes water quality standards for Oklahoma.

- Section 303(d) requires states to "regularly" identify waterbodies not meeting water quality standards even after all required effluent limitations have been implemented (e.g., through a wastewater discharge permit). These waters are often

referred to as "303(d) listed" or "impaired" waters. All waterbodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) developed, which assigns pollutant discharge allocations to all potential pollutant sources. The Oklahoma Department of Environmental Quality (ODEQ) develops the 303(d) list for the state every two years (as required by the CWA) and submits the list to the EPA for approval. The most recently approved list is the 2008 303(d) list.

- Section 303(e) requires each state to implement a "continuing planning process" to guide implementation of water quality standards, e.g., through the issuance of discharge permits or implementation of TMDLs. The ODEQ implements these provisions in Oklahoma.

Section 402 – National Pollutant Discharge Elimination System (NPDES)

- NPDES permits are required for point source discharges (both wastewater and stormwater) to surface waters under the jurisdiction of the CWA. NPDES permits contain discharge requirements that include: (a) technology-based limits (based on the ability of dischargers within specific industrial categories to treat the discharge); and (b) water quality-based limits, which are applied if technology-based limits are believed insufficient to provide protection of the receiving water's water quality standards. The EPA has delegated issuance of NPDES permits to the ODEQ, where they are referred to as Oklahoma Pollutant Discharge Elimination System (OPDES) permits.

Section 404 – Permits for Dredged or Fill Material

- Section 404 addresses the discharge of dredged and fill material into waterbodies under CWA jurisdiction. The types of activities affected by this section include fills for land development projects, water projects involving dams and diversions (e.g., water transfer facility construction), and infrastructure development (e.g., pipeline construction across stream channels or bridge crossings). The United States Army Corps of Engineers (USACE) administers the Section 404 program through the issuance of individual and general permits. Individual permits are required where a project has the potential to have a significant impact on a waterbody and the expected mitigation to minimize impacts is generally site-specific. General permits may be issued on a nationwide, regional or state-specific basis to address various categorical activities, e.g., utility line or pipeline construction, where impacts to waterbodies are expected to be small and the mitigation of impacts is similar regardless of the project type or location.

Section 401 – Certification

- States have the authority to authorize, condition, or deny any federal permit or license in order to achieve compliance with state water quality standards. An example of a federal permit or license where this review occurs is the USACE-issued Section 404 dredge and fill permit. The decision to grant or deny certification is based on a state's evaluation of whether the proposed activity and implementation of federal permit conditions will comply with state water quality

6.2.2 Endangered Species Act

The purposes of the Endangered Species Act (ESA) are to provide (1) a means whereby the ecosystems upon which threatened and endangered species depend may be conserved; and (2) a program for the conservation of such threatened and endangered species. The United States Fish and Wildlife Service (USFWS) is the federal agency charged with ESA implementation. Section 7 of the ESA (Interagency Cooperation) requires that federal agencies conduct a biological consultation with the USFWS on federal actions that could impact a protected species. For example, prior to issuance of a CWA Section 404 permit, a federal action, the USACE is required to consult with the USFWS regarding any ESA issues associated with the project site. Although the USFWS is the lead agency for conducting biological consultations to comply with ESA requirements, the USFWS coordinates this activity with the state agency charged with protection of state wildlife resources, i.e., the Oklahoma Department of Wildlife Conservation.

The biological consultation process may be informal or formal. In some cases the consultation may be begin as an informal process, but it reverts to a formal process if significant biological concerns are identified. The USFWS decides whether a biological consultation will be formal or informal. This decision is based on the potential impact of the proposed activity on protected species and their habitats:

- If the proposed activity *is not likely to adversely affect* listed species then the consultation is informal. As needed, the applicant works with the USFWS to address any design concerns that could lead to an adverse affect. This effort may require providing additional data, e.g., biological surveys, to support USFWS decisions.

- If the proposed activity *is likely to adversely affect* listed species, then the USFWS initiates a formal consultation and prepares a biological opinion. As needed, the USFWS identifies reasonable and prudent alternatives to mitigate impacts to listed species. Mitigation may require modification to the original project proposal. During this process, the USFWS may require biological surveys or environmental studies to support decisions.

The difference between an informal and formal biological consultation process is significant. If informal, the time frame for completion of the consultation process is typically less than six months. In contrast, a formal biological process may last one to two years (or longer if lengthy biological studies are required) and the outcome is uncertain. While it is extremely rare for a project to be denied, it is common for the formal consultation process to result in a modified project plan so that concerns regarding the protection of species and their habitat are addressed.

6.2.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to undertake an assessment of the environmental effects of their proposed actions prior to making a decision on whether to proceed with implementation. A NEPA evaluation is required where there is a clear federal nexus to the proposed project, e.g., federal funding is involved, or a federal agency is a proponent of the project. A NEPA evaluation may be required where the federal nexus is not as direct, e.g., issuance of a federal permit such as a CWA Section 404 permit or where there is substantial local/regional interest in the project and federal agencies are involved, e.g., USACE through issuance of a permit.

Implementation of a NEPA process results in the development of an Environmental Assessment (EA), Environmental Impact Statement (EIS), or both. If the significance of project impacts is uncertain at the beginning of the process, then an EA is typically prepared. The EA evaluates the significance of environmental effects and, as appropriate, identifies the means to achieve project objectives with minimal environmental impact. Two potential outcomes of an EA process are:

- A finding of no significant impact (FONSI) and the project proceeds; or
- A finding of potentially significant environmental impacts, which results in a requirement to develop an EIS.

An EIS, rather than an EA, may be prepared at the beginning of the NEPA process because the project is expected from the outset to have a potentially significant environmental impact. The final EIS document is a Record of Decision (ROD), which describes the alternatives evaluated, records the final decision, and identifies the mitigation requirements if the project is implemented. A supplemental EIS may need to be prepared if the ROD creates new, unevaluated environmental concerns.

The length of the NEPA process can vary substantially. For example, for simple projects an EA may be completed in a matter of months. However, for complex projects, such as an inter-basin water transfer, an EA may take more than a year and often an EIS will ultimately be required. An EIS for inter-basin water transfers may take a number of years to complete.

6.2.4 Other Requirements

Identification of the regulatory requirements for implementation of a project tends to focus on the major federal and state environmental laws and regulations. However, local/regional governments and agencies (e.g., transportation departments, railroads, utilities, etc.) also have numerous regulatory requirements to be complied with before a project moves forward. The nature of these requirements depends on knowledge of the specific location of project elements, e.g., location of where pump stations will be constructed. These requirements will be described below to the extent they are known at this time.

6.3 Water Quality

All potential project alternatives will result in the transfer of water from southeastern Oklahoma waterbodies to central Oklahoma reservoirs. Accordingly, it is important to evaluate the water quality of all waters to identify any potential concerns in the source waters themselves or as a result of commingling waters of varying water quality. Following this evaluation, the project team met with OWRB staff to discuss the findings and identify any OWRB staff water quality concerns. The following sections summarize water quality characteristics of each waterbody and the findings of discussions with OWRB staff.

6.3.1 Water Quality Data

The project team requested from OWRB staff water quality data from 2003 to present from potential source waters (Atoka Lake, McGee Creek Reservoir, Sardis Lake, Hugo Lake, and the Kiamichi River) and potential receiving waters (Arcadia Lake, Shawnee Reservoirs #1 and #2, Lake Stanley Draper, and Lake Thunderbird). OWRB staff provided water quality data from the state water quality database and annual Beneficial Use Monitoring Program (BUMP) reports, which provide annual water quality summaries for the state's waterbodies.

Available water quality data were analyzed seasonally and annually to provide the mean, median, maximum, and minimum values for sampled water quality parameters. Information on the trophic classification of each reservoir was obtained from the BUMP reports. This classification is reported in two ways: (1) trophic classification (**Table 6-1**); and (2) Carlson Trophic State Index (TSI), which is calculated from the following water quality parameters: chlorophyll a concentration, total phosphorus concentration, and Secchi depth values (measure of water clarity) (see **Table 6-1**, "Characteristics" column).

The state CWA Section 303(d) list was consulted to identify water quality impairments established for each waterbody. This evaluation was based on the 2008 303(d) list which was recently approved by the EPA on October 22, 2008.

Water Quality	Trophic Classification	Characteristics[1]
Best	Oligotrophic	Low primary productivity and nutrient levels; TSI typically < 30.
	Oligotrophic to Mesotrophic	Low to moderate primary productivity and nutrient levels.
	Mesotrophic	Moderate primary productivity and nutrient levels; TSI typically ranges from 40 to 50.
	Mesotrophic to Eutrophic	Moderate to high primary productivity and nutrient levels;
	Eutrophic	High primary productivity and nutrient levels; TSI typically ranges from 50 to 60.
Poorest	Hypereutrophic	High to excessive levels of primary productivity and nutrient conditions; TSI typically ranges from 70 to 80.

1 *see Carlson, R.E. and J. Simpson. 1996. A Coordinator's Guide to Volunteer Lake Monitoring Methods. North American Lake Management Society.*

Table 6-1
Water Quality Based on Trophic Characteristics

6.3.2 Existing Water Quality – Potential Source Waters

Table 6-2 summarizes the current trophic status, TSI value, and impairment status of each source waterbody. **Table 6-3** summarizes the median values of key water quality parameters: (1) nutrients – total nitrogen, total phosphorus, chlorophyll a; (2) water clarity – Secchi depth; and (3) salts – total dissolved solids. **Tables A-1, A-2**, and **A-3** (**Appendix A**) provide a complete summary (annual and seasonal) of the mean, median, and maximum/minimum values (2003-present), respectively, for each sampled water quality parameter in potential source waters.

The source waters with the best water quality are those with the best trophic classification, lowest TSI value, lowest nutrient levels, highest clarity, and lowest total dissolved solids. Based on these criteria, McGee Creek Reservoir has the best water quality. In contrast, Hugo Lake has the poorest water quality.

According to the 2008 303(d) or impaired waters list, all five potential source waters have water quality impairments (**Table 6-2**). For the reservoirs, the most common impairments are low dissolved oxygen and high turbidity. The Kiamichi River at Antlers is listed as impaired for elevated copper and lead concentrations. The impaired waters listing of these waterbodies was discussed with OWRB staff to determine whether these impairments were a concern with regards to potential water transfers. OWRB staff stated that these impairments were not a concern.

Waterbody	Trophic Class[1]	Carlson's Trophic State Index[1]	Waterbody Impairments[2]
Atoka Lake	Mesotrophic to Eutrophic	51	Turbidity, color, dissolved oxygen
Hugo Lake	Eutrophic	53	Turbidity, color
McGee Creek Reservoir	Mesotrophic	43	Dissolved oxygen, pH
Sardis Lake	Mesotrophic	50	Turbidity, dissolved oxygen
Kiamichi River @ Antlers	Not applicable to rivers		Copper, lead

[1] Based on the most recent water quality assessment in OWRB BUMP reports
[2] Based on 2008 303(d) list approved by EPA Region 6, October 22, 2008

Table 6-2
Trophic Classification and Impairment Status of Potential Source Waters

Waterbody	Total Nitrogen (mg/L)[1]	Total Phosphorus (mg/L)[1]	Chlorophyll-a (mg/m^3)	Secchi Depth (cm)	Total Dissolved Solids (g/L)
Atoka Lake	0.70	0.06	6.90	25.00	0.05
Hugo Lake	0.61	0.06	9.66	40.00	0.04
McGee Creek Reservoir	0.48	0.01	2.43	150.00	0.02
Sardis Lake	0.48	0.03	5.70	72.00	0.03
Kiamichi River @ Antlers	0.54	0.04	N/A	N/A	0.03

[1] If data results were reported as less than detection, then the detection level was used in calculating median values.

Table 6-3
Median Annual Water Quality Values for Selected Water Quality Constituents Analyzed at each Potential Source Water
(2003 – present; N/A – not applicable to waterbody)

6.3.3 Existing Water Quality – Receiving Waters

Table 6-4 summarizes the current trophic status, TSI value, and impairment status of each waterbody. **Table 6-5** summarizes the median values of key water quality parameters: (1) nutrients – total nitrogen, total phosphorus, chlorophyll a; (2) water clarity – Secchi depth; and (3) salts – total dissolved solids. **Tables A-1, A-2**, and **A-3** (**Appendix A**) provide a complete summary (annual and seasonal) of the mean, median, and maximum/minimum values (2003-present), respectively, for each sampled water quality parameter in potential receiving waters.

The receiving waters with the best water quality are those with the best trophic classification, lowest TSI, lowest nutrient levels, highest clarity and lowest dissolved

solids. Based on these criteria, Lake Stanley Draper has the best water quality. In contrast, Arcadia Lake and Lake Thunderbird have the poorest water quality.

According to the 2008 303(d) or impaired waters list, all five potential receiving waters have water quality impairments (**Table 6-4**). The most common impairments are low dissolved oxygen and high turbidity. The impaired waters listing of these waterbodies was discussed with OWRB staff to determine whether these impairments were a concern with regards to potential water transfers. OWRB staff stated that these impairments were not a concern.

Waterbody	Trophic Class[1]	Carlson's Trophic State Index[1]	Waterbody Impairments[2]
Arcadia Lake	Eutrophic	58	Chlorophyll-a; turbidity
Shawnee #1 Reservoir	Oligotrophic to Mesotrophic	41	Dissolved oxygen
Shawnee #2 Reservoir	Mesotrophic	42	Turbidity, dissolved oxygen
Lake Stanley Draper	Oligotrophic to Mesotrophic	40	Turbidity
Lake Thunderbird	Eutrophic	57	Chlorophyll-a; dissolved oxygen, turbidity

[1] Based on the most recent water quality assessment in OWRB BUMP reports
[2] Based on 2008 303(d) list approved by EPA Region 6, October 22, 2008

Table 6-4
Trophic Classification and Impairment Status of Potential Receiving Waters

Waterbody	Total Nitrogen (mg/L)[1]	Total Phosphorus (mg/L)	Chlorophyll-a (mg/m^3)	Secchi Depth (cm)	Total Dissolved Solids (g/L)
Arcadia Lake	0.93	0.05	20.95	62.50	0.27
Shawnee #1 Reservoir	0.37	0.02	2.55	65.00	0.15
Shawnee #2 Reservoir	0.58	0.02	3.10	81.00	0.14
Lake Stanley Draper	0.30	0.01	2.27	102.00	0.06
Lake Thunderbird	0.81	0.04	13.20	58.00	0.26

[1] if data results were reported as less than detection, then the detection level was used in calculating median values.

Table 6-5
Median Annual Water Quality Values for Selected Water Quality Constituents Analyzed at each Potential Receiving Water (2003 – present)

6.4 Water Transfers

Implementation of a water transfer alternative will require a number of federal and state permits and approvals. As will be noted below, uncertainty remains in some

regulatory areas regarding the process for obtaining final project approval. Where uncertainties are noted, recommendations are provided at the end of Section 6 for reducing these uncertainties in the near term.

6.4.1 Clean Water Act

The following CWA permits are expected to be required to implement any of the water transfer alternatives:

- *Individual Section 404 Dredge and Fill Permit* – Construction of infrastructure to withdraw water from a waterbody, e.g., pump stations, diversions, or piping, is expected to require application for an individual Section 404 permit from the USACE. As a cooperating federal agency with the USFWS, prior to issuance of any Section 404 permit, the USACE is responsible for consulting with the USFWS to address any ESA concerns. In addition, before the permit may be issued, concurrence must be obtained from Oklahoma's State Historic Preservation Office (SHPO) and the Oklahoma Archeological Society. Obtaining concurrence with these state offices may require completion of cultural surveys in the project area.

- *Section 401 Water Quality Certification* – The USACE issues the Section 404 permit; however, the State of Oklahoma certifies the permit under CWA Section 401. The certification process can result in additional mitigation requirements not included in the USACE-issued permit.

- *OPDES Stormwater Construction Permit* – All construction activities that affect more than one acre of land and are not located on Indian land require coverage under, "General Permit OKR10 for Storm Water Discharges from Construction Activities within the State of Oklahoma". Application for the permit occurs by filing a Notice of Intent and preparing a Stormwater Pollution Prevention Plan. If the construction activity occurs on Indian land, then the project requires coverage under the federal construction general stormwater permit. Application for this permit is made to EPA Region 6.

- *OPDES Wastewater Discharge Permit* – If operation of the water transfer infrastructure requires a regular or occasional discharge, then an OPDES wastewater permit will be required. Depending on the nature of the discharge, this permit may be either a general or individual permit.

- *Permit to Construct Water Supply Infrastructure* – Prior to construction of water supply facilities, ODEQ requires submittal and approval of an "Application for Permit to Construct Water Pollution Control or Public Water Supply Facilities and/or Supply Potable Water".

6.4.2 Endangered Species Act

Section 7 of the ESA requires that federal agencies coordinate with the USFWS on federal actions that could impact a protected species, e.g., issuance of a discharge

permit. Because construction of water transfer infrastructure facilities will require a federal Section 404 dredge and fill permit, consultation between the USACE and USFWS will be required. The following protected species are currently potentially located in the project area and would be included in the consultation process:

- Ouachita rock pocketbook mussel
- Scaleshell mussel
- Winged mapleleaf mussel
- Leopard darter
- Indian bat
- Eastern prairie fringed orchid
- Piping plover
- American burying beetle
- Interior least tern
- Red-cockaded woodpecker

The project team met with Mr. David Martinez at the USFWS Tulsa, Oklahoma office to discuss potential ESA issues associated with water transfer alternatives. Mr. Martinez indicated that the primary species of concern in the list above are the three currently protected mussel species. The USFWS also noted that there are other mussel species in the Kiamichi River Basin that may require protection in the next 10-20 years.

Of the three mussel species currently protected under the ESA, recovery activities have focused on the Ouachita rock pocketbook mussel. A species Recovery Plan[1], adopted in 2004, established a number of implementation activities to support efforts to protect and recover this species. Since 2004 the USFWS has been actively engaged in research with other regional partners to better understand the life history and habitat needs of this mussel. However, the USFWS indicated that more data will be needed to understand the environmental flow requirements that best support the species.

Based on a conceptual presentation of the project elements, the USFWS provided a preliminary opinion regarding its expectations for biological consultation as the project moves forward. The type and extent of the biological consultation process will depend on the project alternative chosen (**Table 6-6**).

[1] USFWS 2004. Ouachita Rock Pocketbook (*Arkansia wheeleri*): Recovery Plan. U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM. March 2004.

No.	Water Transfer Alternative	Consultation Type	Basis for Opinion
1	Sardis Lake to Atoka Lake	Formal	Reduces water availability in the watershed
2	Sardis Lake release; withdrawal at Moyers Crossing	Formal	Potential habitat impacts from water release and construction of water transfer facilities
3	Sardis Lake release; withdrawal downstream of Highway 3	Informal to Formal	Downstream of planned mussel recovery area, but potential impacts from water release
4	Sardis Lake release; withdrawal from Hugo Lake	Informal to Formal	Downstream of planned mussel recovery area, but potential impacts from water release

Table 6-6
Summary of USFWS Preliminary Opinion Regarding Biological Consultation Process

Alternatives 1 and 2 are the two alternatives where formal biological consultation is likely. The other two alternatives may be able to be completed as an informal process, primarily because the construction of water transfer facilities would occur downstream of areas covered by the Recovery Plan. However, the USFWS reserves the right to move to a formal process if issues such as the impact of Sardis Lake releases to augment downstream flows are expected to impact the species unless the project is modified in some manner.

6.4.3 NEPA Consultation

It is unclear at this time whether it will be necessary to implement a NEPA process for the proposed water transfer. No direct federal nexus is expected, i.e., no plans exist for the project to use federal funding and no federal agency will be a project proponent. However, project implementation will require significant involvement from two federal agencies – the USACE and USFWS. The USACE's involvement is particularly significant since it not only includes issuance of a CWA Section 404 permit but their involvement may also include authorization to modify operation of Sardis Lake to release water for withdrawal at a point downstream in the watershed.

Given this significant federal agency participation and the likely substantial local/regional interest in the project, it is expected that the USACE will invoke NEPA and require preparation of an EA or EIS. If this occurs, then it is likely that the USFWS biological consultation will occur in coordination with the preparation of the NEPA documents rather than the Section 404 permit application.

6.4.4 OWRB Water Use Permit

Transfer of water from southeastern to central Oklahoma requires a water use permit from the OWRB. Water use permit applications are evaluated according to the following criteria:

- Unappropriated water is available in the amount the applicant has applied for;
- The applicant has a present or future need for the water;
- The applicant intends to put the water to a beneficial use, e.g., municipal water supply or irrigation;
- The proposed use does not interfere with domestic, existing appropriative uses; and
- If the water will be used outside its original watershed, its use will not interfere with existing or proposed beneficial uses within the watershed of origin.

6.4.5 Other Requirements

There may be additional approvals or permits necessary in the local areas where water transfer infrastructure facilities are sited, e.g., local county requirements. These local requirements will need to be evaluated once an alternative is selected and the locations for facility construction are identified.

6.5 Water Delivery Pipeline Construction

Construction of the water delivery pipeline will require a number of federal, state, and local permits and approvals. The following sections summarize the expected regulatory requirements, as known at this time.

6.5.1 Clean Water Act

The following CWA permits are expected to be required to implement construction of the water delivery pipeline:

- *Section 404 Nationwide Dredge and Fill Permit* – Pipeline construction will likely be permitted under a Nationwide Section 404 Permit #12, Utility Line Activities. This permit authorizes the construction, maintenance, or repair of pipelines, including outfall and intake structures, and the associated excavation, backfill, or bedding for the utility lines, in all waters under CWA jurisdiction, as long as no change in pre-construction contours occurs. Application occurs by submitting a Pre-Construction Notification form to the USACE. As a cooperating federal agency with the USFWS, prior to authorizing pipeline construction under a nationwide permit, the USACE is responsible for consulting with the USFWS to address any ESA concerns. In addition, the USACE will also require concurrence with the Oklahoma SHPO office and the Oklahoma Archeological Society. Obtaining concurrence from these agencies will likely require completion of cultural surveys

since the original Atoka Pipeline was constructed in the 1960s, before historical and archeological surveys were required as part of the permitting process. Given the length of the pipeline, completion of these cultural surveys may be a significant undertaking.

- *Section 401 Water Quality Certification* – The USACE issues the Section 404 nationwide permit; however, the State of Oklahoma certifies the permit under Section 401. The certification process can result in additional mitigation requirements not included in the USACE-issued permit.

- *OPDES Stormwater Construction Permit* – All construction activities that affect more than one acre of land and are not located on Indian land require coverage under, "General Permit OKR10 for Storm Water Discharges from Construction Activities within the State of Oklahoma". Application for the permit occurs by filing a Notice of Intent and preparing a Stormwater Pollution Prevention Plan. If the construction activity occurs on Indian land, then the project requires coverage under a federal construction general stormwater permit. Application for this permit is made to EPA Region 6.

- *OPDES Wastewater Discharge Permit* – If operation of a pipeline pump station requires a regular or occasional discharge, then an OPDES wastewater permit will be required. Depending on the nature of the discharge, this permit may be either a general or individual permit.

- *Permit to Construct Water Supply Infrastructure* – Prior to construction of water supply facilities, including pipelines, ODEQ requires submittal and approval of an "Application for Permit to Construct Water Pollution Control or Public Water Supply Facilities and/or Supply Potable Water".

6.5.2 Endangered Species Act

As described in Section 6.5.1, pipeline construction will likely be permitted under a Section 404 Nationwide Permit #12, Utility Line Activities. Prior to receiving authorization for pipeline construction under this permit, the USACE is required to ensure compliance with ESA requirements. Accordingly, the USACE will initiate consultation with the USFWS prior to granting authorization. The following protected species are currently potentially located in the project area and would be included in the consultation process:

- American burying beetle
- Whooping crane
- Piping plover
- Arkansas river shiner
- Interior least tern
- Black-capped vireo

The project team met with Mr. David Martinez at the USFWS Tulsa, Oklahoma office to discuss potential ESA issues associated with the construction of the water delivery pipeline. Mr. Martinez indicated that the primary species of concern for pipeline construction is the American burying beetle. However, because pipeline construction projects are common in the area because of ongoing oil and gas exploration activity, the USFWS has developed mitigation procedures to address concerns regarding potential impacts to the species and its habitat resulting from pipeline construction. Accordingly, the biological consultation can likely be completed informally. While the USFWS will require mitigation activities to protect the American burying beetle (which will likely include biological surveys), expected mitigation activities have already been defined and can be incorporated as special conditions in the 404 permit.

6.5.3 NEPA Consultation

Requirements for compliance with NEPA for water delivery pipeline construction are unclear at this time. Similar to the proposed water transfer alternatives, no direct federal nexus exists for this project, i.e., no plans exist to federal funding for the project and no federal agency is a project proponent. However, implementation of the project does require participation by federal agencies (issuance of permits and approvals) and because the purpose of the pipeline is to transfer water, the potential for substantial public interest is high. Moreover, it is possible that a NEPA compliance process, if implemented, could result in the linkage of both projects (water transfer and pipeline construction) since the projects are related. As will be discussed below, resolution of NEPA compliance uncertainty is an important early step in project implementation.

6.5.4 Other Requirements

In addition to the major federal and state requirements described above, the following additional permits, approvals, and consultations will be required during implementation of the pipeline construction project:

Federal and State

- United States Bureau of Reclamation (USBOR) – the federal USBOR owns Lake Thunderbird and McGee Creek Reservoir. Any activities involving these reservoirs such as construction of a pipeline between McGee Creek Reservoir and Atoka Lake will require consultation with the USBOR.

- Environmental Protection Agency – if any Indian lands are crossed by the pipeline, then the EPA may become involved in the permit/approvals process, e.g., Section 404 dredge and fill permit or Section 402 stormwater discharge permit.

- Oklahoma Transportation Department - utility permits are required for crossings of state owned/maintained highways. The Transportation Department has one permit for freeways (interstate) crossings and another permit for all other state owned/maintained roadways.

Regional Utilities

- Oil and Gas Pipeline Crossings – permits/approvals are required where the water delivery pipeline crosses oil and gas lands or facilities.
- Railroad and Crossings – permits/approvals required from specific railroad companies.
- Transmission Line Crossings – permits/approvals required from the owners of transmission line crossings.

Local Requirements

- Cities & Counties – various local permits or approvals are required in association with right of way crossings and construction of infrastructure, e.g., pump stations.
- Indian Lands – coordination with Indian tribes will be needed where Indian lands are crossed by the pipeline. If federal permits/approvals are involved, then the EPA will be included in this consultation. Additional evaluation of Indian consultation requirements is needed once a final pipeline alignment is selected.
- Atoka Lake Association and McGee Creek Reservoir Authority – coordination is needed with these organizations which administer resources associated with these reservoirs.
- Others – once the final alignment is determined, detailed analysis of additional land owners and facilities in the path of the pipeline will identify any other local requirements.

6.6 Environmental Permits and Approvals – Next Steps

Many of the regulatory requirements for initiating the water transfer and water delivery pipeline constructions are known at this time and can be factored into an implementation schedule. However, uncertainty remains in some areas, e.g., NEPA compliance requirements, the role of the sovereign Indian nations, and specific local permit/approval requirements. Resolution of these uncertainties will not change the numerous regulatory requirements already identified, but it may change the approach and schedule for implementation. The following sections provide recommended next steps for implementing the environmental permits and approvals process.

6.6.1 Resolve NEPA Compliance Uncertainty

The decision for implementing a NEPA process rests with the three key federal agencies that will participate in the permit issuance process: USACE, USFWS and EPA. Of these three agencies, the USACE will have the most significant role in issuing permits. Accordingly, it is recommended that the USACE be consulted with soon to determine the need to implement a NEPA process. Resolution of this uncertainty will also clarify requirements for USFWS biological consultation (i.e., whether this

consultation will occur during the NEPA process or during the Section 404 permit review process), and the participation of sovereign Indian nations.

6.6.2 Initiate Consultation with Sovereign Indian Nations

From a regulatory standpoint, the interests of the Indian sovereign nations will be addressed by regulatory agencies charged with issuing permits, e.g., if a Section 404 permit affects Indian lands, the USACE will work with the EPA to ensure Indian interests, if any, are addressed during the Section 404 permit process. In addition, if a NEPA process is implemented, then tribal interests would be considered during that process. While these regulatory processes include requirements to protect Indian lands, additional coordination with the sovereign nations is recommended as it is expected that Indian tribes will take an active interest in any proposals to transfer water out of the region. Accordingly, it is recommended that outreach to the appropriate tribal governments begin early in the project so that they become partners rather than adversaries.

6.6.3 Consult with USFWS to Identify Environmental Studies

Regardless of how the biological consultation process is initiated (i.e., Section 404 permit or NEPA process) the USFWS recommends that the project proponents consult with USFWS staff early in the project planning process by participating in a "pre-application consultation". Such a meeting provides opportunity for obtaining an early understanding of what kinds of information/data the USFWS will need to facilitate its biological consultation process. For example, for the proposed water transfer the USFWS has already indicated that the applicant should expect to have to conduct environmental flow studies to develop a reservoir operational approach that does not impact protected species or their habitat in the Kiamichi River Basin. If such studies are expected, the project proponent can work with the USFWS to complete these studies early in the approval process rather than wait until the studies are formally requested, which could result in delays in project approvals.

6.6.4 Finalize Identification of Local Environmental and Permitting Requirements

Many of the specific local permit/approval requirements cannot be determined until a final water transfer alternative and water delivery pipeline alignment is selected. Once these decisions are made and it is known where all constructed facilities will be sited, then additional analysis of local permit/approval requirements can be completed.

6.6.5 Monitor Environmental Permit Requirements

The analysis completed for this section is based on current information. However, regulatory requirements often change. These changes are often minor and easily addressed, but given the long implementation period expected for this project, the potential for significant regulatory changes to occur increases. Accordingly, it is recommended that periodic environmental and permit reviews be conducted to monitor changes in regulatory requirements.

Section 7
Estimated Conveyance Costs

7.1 Introduction

Conveyance infrastructure to utilize additional water supplies acquired from southeast Oklahoma will require significant investment. As discussed in Section 4, alternatives were formulated for three primary conveyance system components:

1. Raw water transmission from a source water alternative in southeast Oklahoma

2. Increased raw water transmission capacity along the existing McGee Creek and Atoka Pipeline corridors

3. Regional distribution of treated or raw water to each participant

Feasibility level opinions of probable costs were developed to quantify capital and project implementation costs for infrastructure identified water delivery theme.. Section 7 of this report reviews the methodology used to estimate required conveyance infrastructure components and develop associated opinion of probable project costs.

7.2 Approach for Estimating Costs for Conveyance

This study includes a significant number of alternatives covered within the broad categories of distribution, source, and transmission. For this project the most efficient way to develop costs was on a unit basis. Unit costs were developed for broad categories that include pipeline (unit length), pumping (horsepower), raw and finished storage (volume), and treatment (flow). Within some of these categories, unit pricing included additional subcategories to better define costs (i.e., piping by rural construction vs. tunneling as an example). Some special categories of cost for specific elements were also developed for occurrences that were unique to a single configuration or alternative. An example is a specific river diversion or reservoir intake which received a defined lump cost assignment.

Each unit cost category included appropriate breakdowns for labor and materials (equipment) at a base estimating level. The base level unit cost categories included specific construction components (not to be confused with contingency since these costs would be included in a typical construction bid) that generally break down as follows:

- 1 percent Building Permit
- 9 percent sales tax
- 1 percent Insurance
- 2 percent GC Bonds
- 9 percent GC Field General Conditions
- 10 percent GC Margin

The basis of some of these factors was determined to reflect regionally specific conditions. Finally, a 25 percent contingency (1.25 x unit cost adjusted with construction) was included to develop total capital cost.

CDM uses a computerized estimating system (Timberline). The system consists of a custom database (over 100,000 items) that groups items into definable cost systems and a spreadsheet to display results grouped according to user defined Work Breakdown Structures. The database is continuously updated based on hundreds of years of combined CDM construction personnel experience and vendor surveys. Specific estimate items are assigned crews with standard labor productivities. Local wage rates are incorporated into a Labor Rate Table unique to each estimate. Labor and equipment productivities along with material pricing are adjusted to reflect local practice. Estimates are displayed in a universally understood spreadsheet format.

Opinions of probable cost for this project were prepared to reflect an overall planning stage typical of a feasibility level of study. Please note that CDM has no control over the cost of labor, materials, equipment, or services furnished, schedule, contractor's methods of determining pricing, competitive bidding, market conditions or negotiation terms. CDM does not guarantee that these opinions will not vary from actual cost or contractor's bids. The unit costs and 25 percent contingency do not include change orders, design, construction oversight, client costs, finance or funding, legal fees, land acquisition, or temporary/ permanent easements or any other costs associated with this project. These additional "Project Implementation" costs were included separately, and derived as 20 percent of the capital cost (1.2 x opinion of probable capital cost).

7.3 Source Alternatives

Raw water transmission for the identified options generally consists of raw water pipelines and associated pump stations. To meet the projected 2060 demands discussed in Section 2, new pipelines will be needed to convey supply from one of the new sources located at Sardis Lake, the Kiamichi River, or Hugo Lake to either Atoka Lake or the McGee Creek Reservoir. To provide buffer capacity for future conveyance improvements, demands were extrapolated to 2070.

In order to meet the 2070 projected demands the parallel Atoka Pipeline will need a conveyance capacity of 195 mgd. The capacity required for the parallel Atoka Pipeline was determined using the following basis:

- Projected average day demand information provided in Section 2 extrapolated to 2070 in order to provide a buffer to allow for implementation of future conveyance improvements
- An assumed capacity of 90 mgd from the existing Atoka Pipeline, which is dependent upon completion of pump station and pipeline improvements

Conveyance capacity of 155 mgd for the pipeline from a new supply source in southeast Oklahoma to Atoka Lake was determined using the following basis:

- Assumed that no excess conveyance capacity is available in the existing McGee Creek Pipeline
- Review of available existing and future supplies from Atoka Lake, McGee Creek Reservoir and the Canadian River that were presented in Section 2
- The difference, on an average day basis, between projected 2060 demands and the identified existing and future supplies.

Figure 7-1 summarizes the 2070 basis for supply and capacity requirements for facilities. All source related conveyance facilities were sized using the flows listed in the column on the right hand side of the figure.

The analysis to quantify required conveyance infrastructure was initiated by developing concept level pipeline routes for each source alternatives identified in Section 4. Each route was defined using available base mapping including aerial photography, roads and USGS topography. The viability of each route was reviewed with field reconnaissance to confirm existing topography, roads and visible infrastructure. The focus of the field reconnaissance was to identify existing obstacles that could substantially affect the feasibility for construction of a new raw water transmission pipeline. **Figure 7-2** provides an overview of the routes from each of the four source alternatives to Atoka Lake for which infrastructure costs were developed. Detailed maps of the source routes are included on CD at the end of **Appendix B**.

As discussed in Section 3, estimated pipe sizes were determined based on an average flow velocity of 6 to 7 feet per second. Preliminary pump station locations along the four source routes were identified based on existing topography and maintaining maximum and minimum operating pressure of 150 psi and 15 psi, respectively. The required horsepower of each pump station was estimated based on the total dynamic head at each location using the length and profile of each pipeline and the Hazen-Williams equation with a conservative long term 'C' factor of 120. The horsepower required for each station was computed assuming a 65 percent combined motor and pump efficiency.

Please note that this study is intended to identify the infrastructure requirements, sizes and costs at a planning level of detail. Review and refinement of the pipeline sizes should be completed during preliminary and final engineering design to confirm anticipated performance and evaluate the cost versus benefit of alternate design and route options. Alternative design options would include more detailed evaluation of elements such as pipe size, operating velocities, operating pressure, head loss, pipe wall thickness, surge control, and pump size.

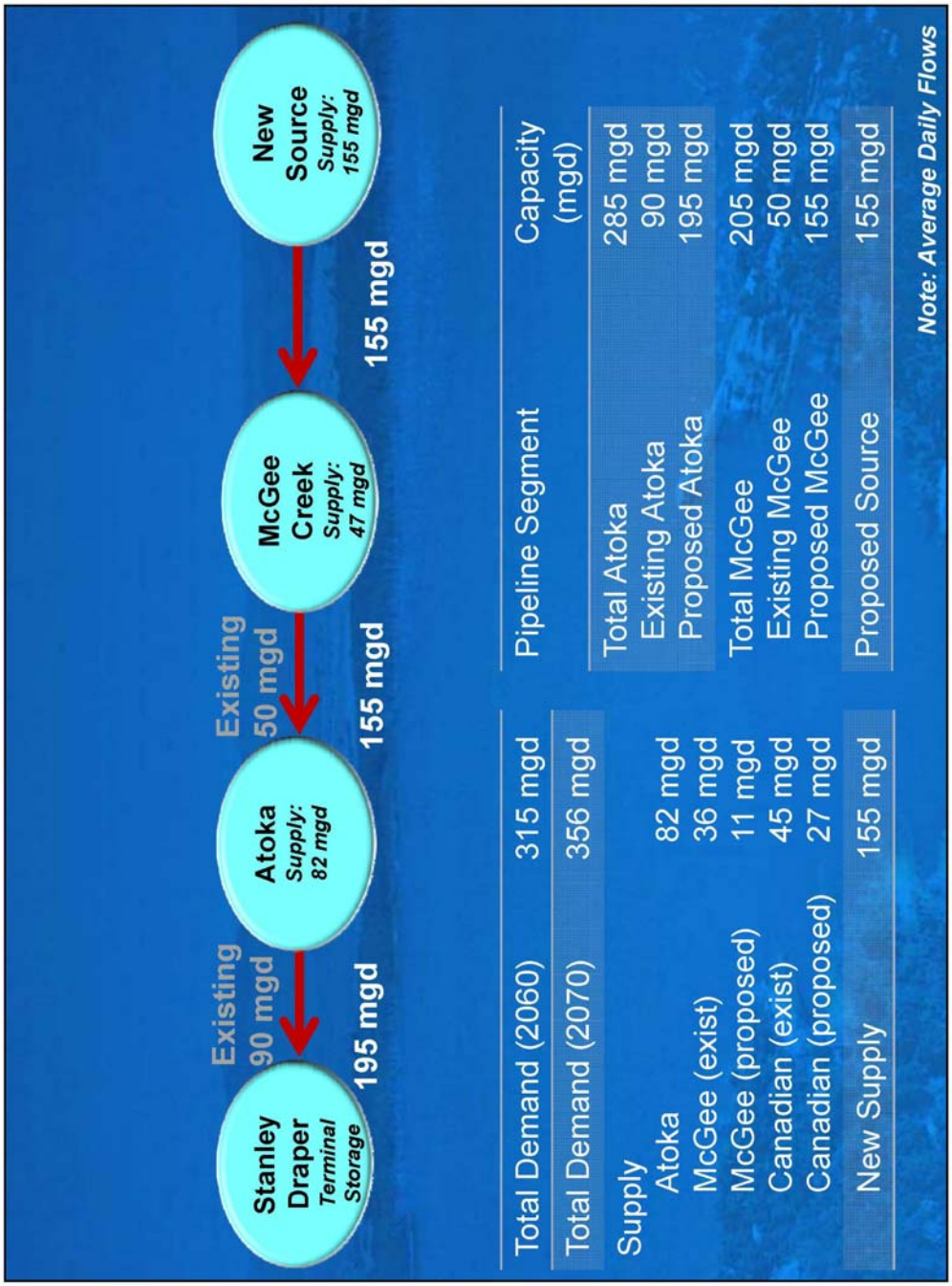


Figure 7-1
Source Demand and Flow Summary

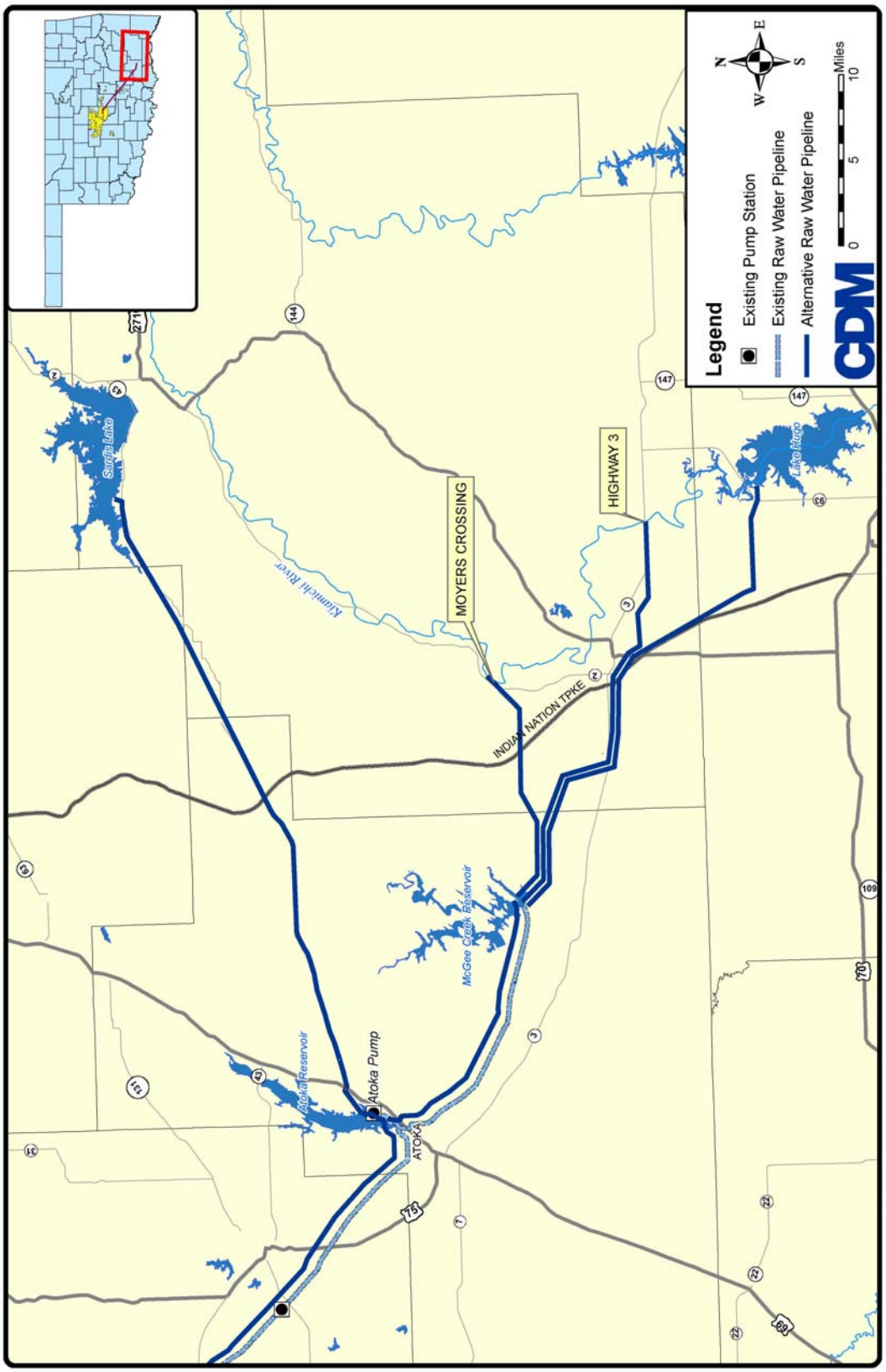


Figure 7-2
Route Alternatives from Southeast Oklahoma Sources

7.3.1 Sardis Lake

At a concept level, two options were identified to convey new supply from Sardis Lake to Atoka Lake:

- Sardis Lake directly to Atoka Lake
- Sardis Lake to McGee Creek Reservoir, and then to Atoka Lake

Routes for both options were developed and reviewed. Since the existing McGee Creek Pipeline has minimal excess conveyance capacity, the second option of conveying new supply from Sardis Lake to McGee Creek Reservoir, and then to Atoka Lake will require a much longer pipeline than the alternative of conveying flows directly from Sardis Lake to Atoka Lake. Therefore, infrastructure needs and costs were only developed for the first option.

The most direct route for the pipeline alignment from Sardis Lake to Atoka Lake was to generally follow Oklahoma State Highway 43. A plan view of the conceptual route is presented in **Figure 7-3**.

Based on the design flow of 155 mgd (see Figure 7-1) and the hydraulic criteria discussed previously, the primary infrastructure components required to convey flows from Sardis Lake to Atoka Lake include:

- 39.6 miles of 90-inch diameter pipe
- 11,200 horsepower pump station
- 4,000 horsepower pump station
- Intake structure at Sardis Lake

Presented in 2009 dollars, the opinion of probable capital cost for raw water transmission from Sardis Lake to Atoka Lake is $294 million and the probable total cost for project implementation is $353 million. Additional supporting detail is provided in **Appendix B**.

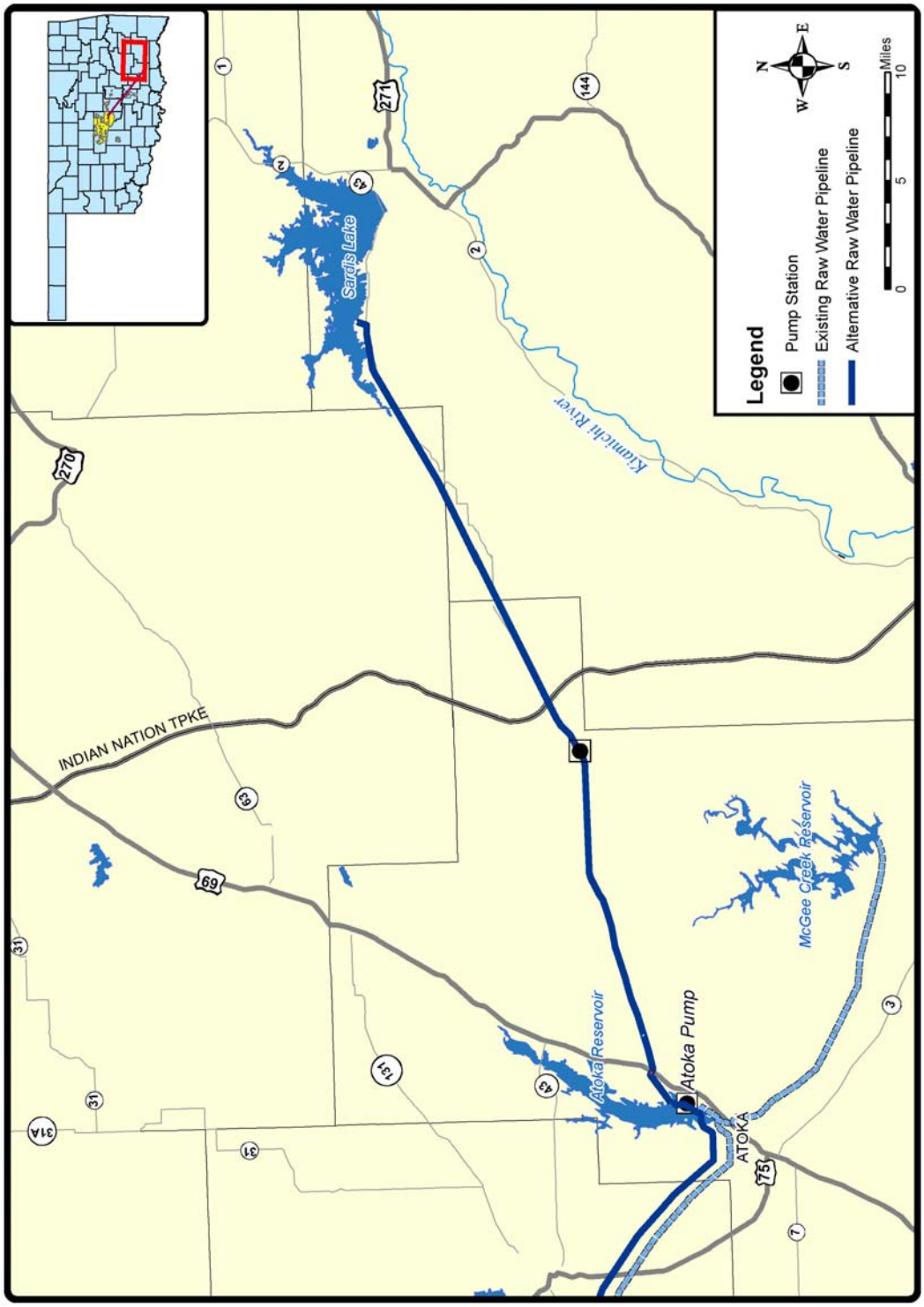


Figure 7-3
Raw Water Transmission from Sardis Lake to Atoka Lake

7.3.2 Kiamichi River (Moyer's Crossing)

The Kiamichi River at Moyer's Crossing is due east from McGee Creek Reservoir. No existing roads exist between Moyer's Crossing and the McGee Creek Reservoir, so the concept level pipeline alignment was located to minimize elevation gain over the length of the route. A plan view of the conceptual route is presented in **Figure 7-4**.

The primary infrastructure components required to convey flows from the Kiamichi River at Moyer's Crossing to McGee Creek Reservoir include:

- 14.7 miles of 90-inch diameter pipe
- 12,000 horsepower pump station
- Low head intake structure at the Kiamichi River

Presented in 2009 dollars, the opinion of probable capital cost for raw water transmission from the Kiamichi River at Moyers to a storage tank at McGee Creek Reservoir is $136 million and the probable total cost for project implementation is $163 million. Additional supporting detail is provided in **Appendix B**.

7.3.3 Kiamichi River (Highway 3)

The Kiamichi River at Highway 3 is located further south and east from the McGee Creek Reservoir than Moyer's Crossing. Approximately one third of the pipeline alignment to convey new supply northwest to McGee Creek Reservoir follows Highway 3, and the remainder was located to based on topography to minimize elevation gain. A plan view of the conceptual route is presented in **Figure 7-5**.

The primary infrastructure components required to convey flows from the Kiamichi River at Highway 3 to McGee Creek Reservoir include:

- 25.8 miles of 90-inch diameter pipe
- 12,600 horsepower pump station
- 4,400 horsepower pump station
- Intake structure at the Kiamichi River

Presented in 2009 dollars, the opinion of probable capital cost for raw water transmission from the Kiamichi River at Highway 3 to a storage tank at McGee Creek Reservoir is $217 million and the probable total cost for project implementation is $260 million. Additional supporting detail is provided in **Appendix B**.

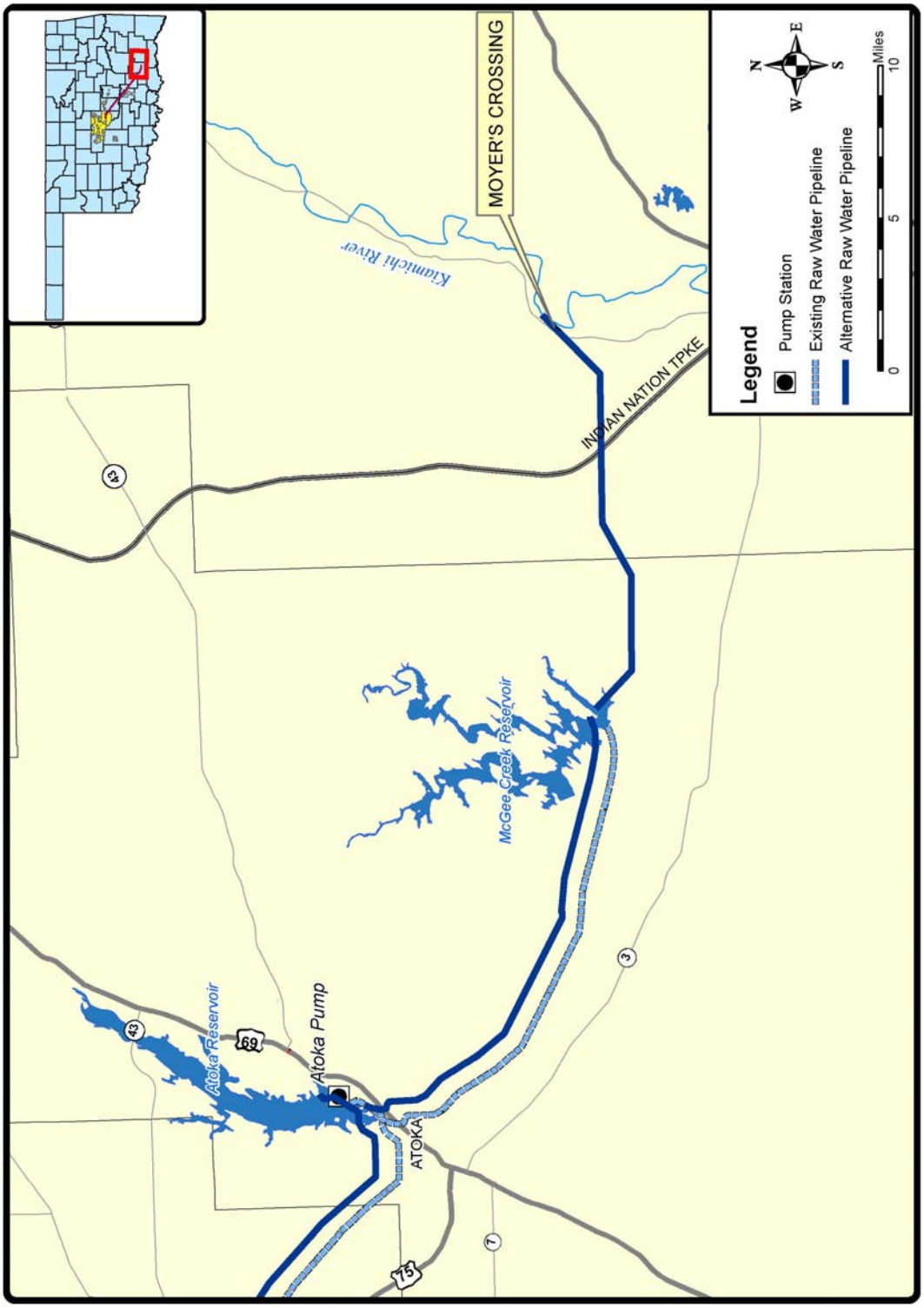


Figure 7-4
Raw Water Transmission from Moyers to Atoka Lake

Figure 7-5
Raw Water Transmission from Highway 3 to Atoka Lake

7.3.4 Hugo Lake

As with the options of the Kiamichi River at Moyer's Crossing and Highway 3, McGee Creek Reservoir is located between the potential new source at Hugo Lake and Atoka Lake. Hugo Lake is the longest route of the four source options, as it is located both south and east of the Kiamichi River at Highway 3. The concept level alignment begins with an intake structure located in the northern end of Hugo Lake and runs west to Highway 3. The alignment then follows the same route to McGee Creek Reservoir as the previous option from the Kiamichi River at Highway 3. A plan view of the conceptual route is presented in **Figure 7-6**.

The primary infrastructure components required to convey flows from the Kiamichi River at Highway 3 to McGee Creek Reservoir include:

- 31.8 miles of 90-inch diameter pipe
- 10,200 horsepower pump station
- 7,600 horsepower pump station
- Intake structure at Hugo Lake

Presented in 2009 dollars, the opinion of probable capital cost for raw water transmission from the Hugo Lake to a storage tank at McGee Creek Reservoir is $256 million and the probable total cost for project implementation is $307 million. Additional supporting detail is provided in **Appendix B**.

7.4 New Parallel Atoka McGee Creek Pipelines

As discussed in Section 4, the performance and operation of the existing Atoka Pipeline has been analyzed in detail in previous engineering reports completed for Oklahoma City. For this study, as discussed in Section 4, sizing of a parallel Atoka Pipeline, parallel McGee Creek Pipeline, and booster pump stations were determined based on the previous analyses conducted by Oklahoma City and future demands projected by project participants. As discussed in Section 7.3, additional conveyance capacity of 195 mgd for the new parallel Atoka Pipeline was derived based on the average day demand in 2060 and extrapolated to 195 mgd in 2070 to provide a buffer for implementation of additional future conveyance capacity.

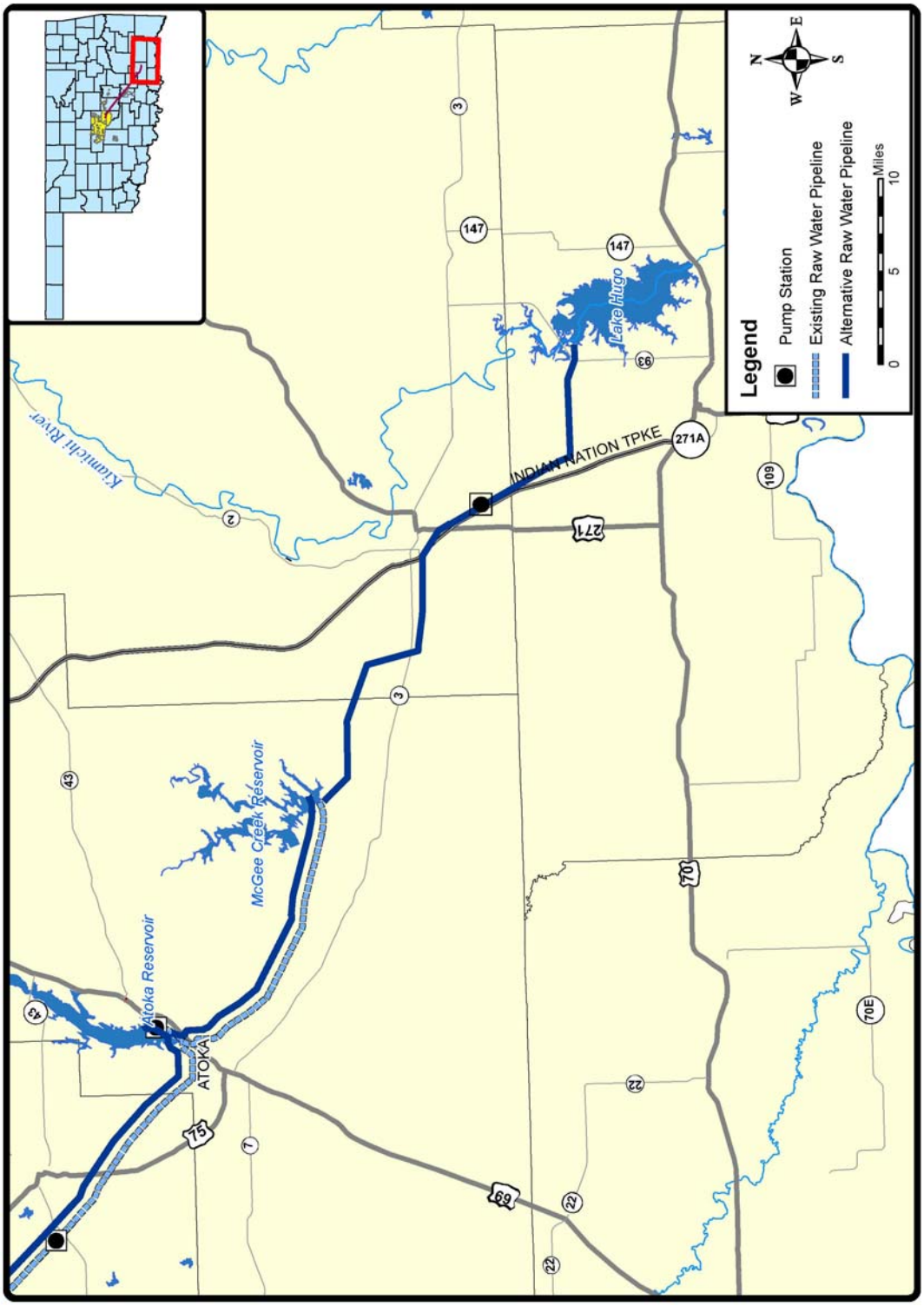


Figure 7-6
Raw Water Transmission from Hugo Lake to Atoka Lake

The design flow of 195 mgd for the pipeline was based on projected average day demand information provided by the participants, and an assumed capacity of 90 mgd from the existing Atoka Pipeline (see Figure 7-1). Based on this design flow, pipeline diameters of 90 inches or 84 inches will convey the design flow with average velocities of 6.8 feet per second and 7.8 feet per second, respectively. The use of twin 60-inch diameter pipes (in addition to the existing 60 inch) would produce an average velocity of 7.7 feet per second for this design flow. Twin 60-inch pipes would provide an opportunity to implement the pipeline capacity in two phases, but would consume additional space in the easement over a single larger-diameter pipeline. Both the 84-inch single and 60 inch twin configurations violate the maximum velocity criteria used in this study and are described for comparison purposes. The 90-inch single configuration has been used for final costing for this study. Review and refinement of the pipeline size should be completed during engineering design to confirm anticipated performance and evaluate the cost versus benefit of alternate design options. Alternative design options would include more detailed evaluation of elements such as pipe size, operating velocities, operating pressure, head loss, pipe wall thickness, surge control, and pump size.

Another component of the facility sizing included booster pump stations. For planning purposes it was assumed that six new booster pump stations will be constructed at the same locations as the existing Atoka Pipeline pump stations to maximize use of existing sites and power availability. The required horsepower of each pump station was estimated based on the total dynamic head at each location, computed using the profile of the existing Atoka Pipeline and the Hazen-Williams equation with a conservative long term 'C' value of 120. The horsepower required for each station was computed assuming a 65 percent combined motor and pump efficiency.

The Atoka Pipeline from Atoka Lake to Lake Stanley Draper is over 100 miles long. As a result, the probable capital cost of the improvements will be highly dependent on the pipe material and construction costs. Escalation of material costs in recent years is a factor affecting the probable capital cost of the improvements. Consideration of recent economic conditions and revised estimates of pipe installation are include in **Appendix C**. **Appendix C** also provides quantities and additional supporting detail for the opinion of probable cost for the single 90 inch parallel pipeline configuration. Based on the options considered and current cost data the anticipated capital cost for the Atoka Pipeline improvements total approximately $900 million in 2009 dollars. After adding 20% to account for project implementation, the total project cost, including both capital and implementation costs, for the Atoka Pipeline improvements are estimated to be $1.08 billion in 2009 dollars.

For the Kiamichi River and Hugo Lake source options the concept level pipeline alignments convey flows to McGee Creek Reservoir and then to Atoka Lake. In order to convey the projected average day flow of 155 mgd a new pipeline parallel to the existing McGee Creek Pipeline will be required. The parallel pipeline will also require a new booster pump station, which was assumed to be located at the same location as

the existing booster pump station. The anticipated capital cost for the parallel McGee Creek Pipeline improvements constructed as a single 90-inch diameter pipeline total approximately $117 million in 2009 dollars. After adding 20% to account for project implementation, the total project cost, including both capital and implementation costs, improvements are estimated to be $140 million in 2009 dollars.

7.5 Water Delivery Themes

As discussed in Section 4, three themes were formulated to bound the analysis for identifying distribution system infrastructure required to deliver water to each of the project participants:

- Theme D1: Regional treatment at (expanded) Stanley Draper WTP (centralized).
- Theme D2: New regional treatment plant at Lake Thunderbird (semi-centralized).
- Theme D3: Local treatment (decentralized)

The content of the distribution themes was formulated to consider distinctly different approaches that each offer opportunities and constraints with respect to capital cost, operational cost, implementation, phasing, reliability, and administration.

Conveyance of finished or raw water to project participants under each distribution theme will generally consist of water distribution pipelines and associated pump stations. The facilities included in each distribution theme were developed at a planning level of detail and are intended to meet regional conveyance needs to satisfy project demands in the year 2060. Please note that the infrastructure identified includes pipelines and pump stations needed to deliver treated or raw water to meet projected demands, but does not include improvements that may be needed within each participant's local distribution system to effectively receive the flows and distribute water to customers. Future planning and implementation should include review and analysis of the local distribution systems to identify each participant's additional infrastructure needs, such as local storage, water main and pump station capacity.

Routes for each segment of the distribution system were located based on information in available planning studies. In the absence of previous planning information the distribution routes were located along the shortest available route within existing roadway corridors to leverage existing right of way. In some cases multiple routes were identified for costing purposes and to provide alternatives for future consideration. **Figure 7-7** provides an overview of the routes included in all three distribution themes. **Appendix D** provides additional detail, including information for alternate routes to determine the lowest cost option for each segment.

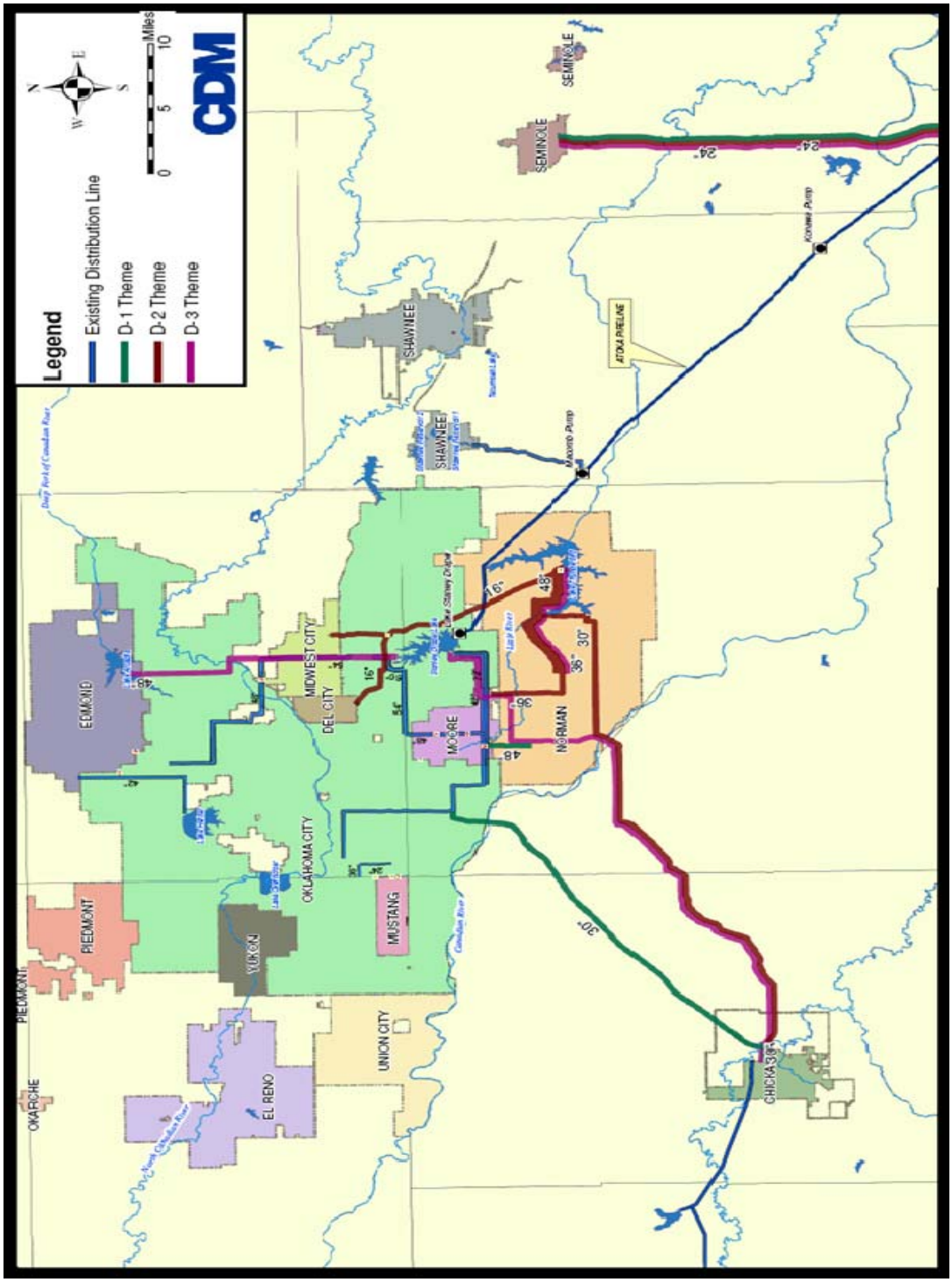


Figure 7-7
Central Oklahoma Proposed Distribution Routes

For planning purposes, design flows for regional distribution pipelines were based on maximum day demands that were estimated from average demands projected in the year 2060 by each participant. Maximum day demands were derived from past water use information provided by each participant. In all cases the maximum day demand was approximately twice the amount of the average day demand. Pipe sizes were then determined using an average flow velocity of 6 feet per second or less.

The locations of new pump stations along each distribution route was identified based on existing topography and maintaining maximum and minimum operating pressure of 150 psi and 15 psi, respectively. The required horsepower of each pump station was estimated based on the total dynamic head at each location computed using the profile of each pipeline and the Hazen-Williams equation with a conservative long term 'C' value of 120. The horsepower required for each station was computed assuming a 65 percent combined motor and pump efficiency.

It should be noted that institutional arrangements between the participants could have significant impacts on costs within the D2 and D3 themes. One example is the Del City and Midwest City supply configuration. Both cities currently share a supply line from Lake Thunderbird that bifurcates to the north with individual supply lines to each entity. Available information indicates that both cities could likely meet future supplies through continued sharing of these facilities with limited improvements. Therefore, true costs under an institutional sharing arrangement for D2 and D3 themes may actually be more reflective of D1 theme costs. Since these future potential institutional arrangements are outside of the scope of this planning study, costing for all participants was developed in a consistent matter and are best addressed through further study and on a case by case basis.

7.5.1 Theme D1 – Oklahoma Water Treatment Option

Figure 7-8 shows the location of the distribution pipelines that comprise Theme D1, and **Table 7-1** summarizes the pipe size, pipe length, pump stations, and capital cost required for regional water distribution to each project participant to meet projected 2060 demands. Additional detail for each segment and the opinion of probable cost is provided in **Appendix D**. Presented in 2009 dollars, the opinion of probable capital cost for Theme D1 water distribution is $121 million and the probable total cost for project implementation is $145 million.

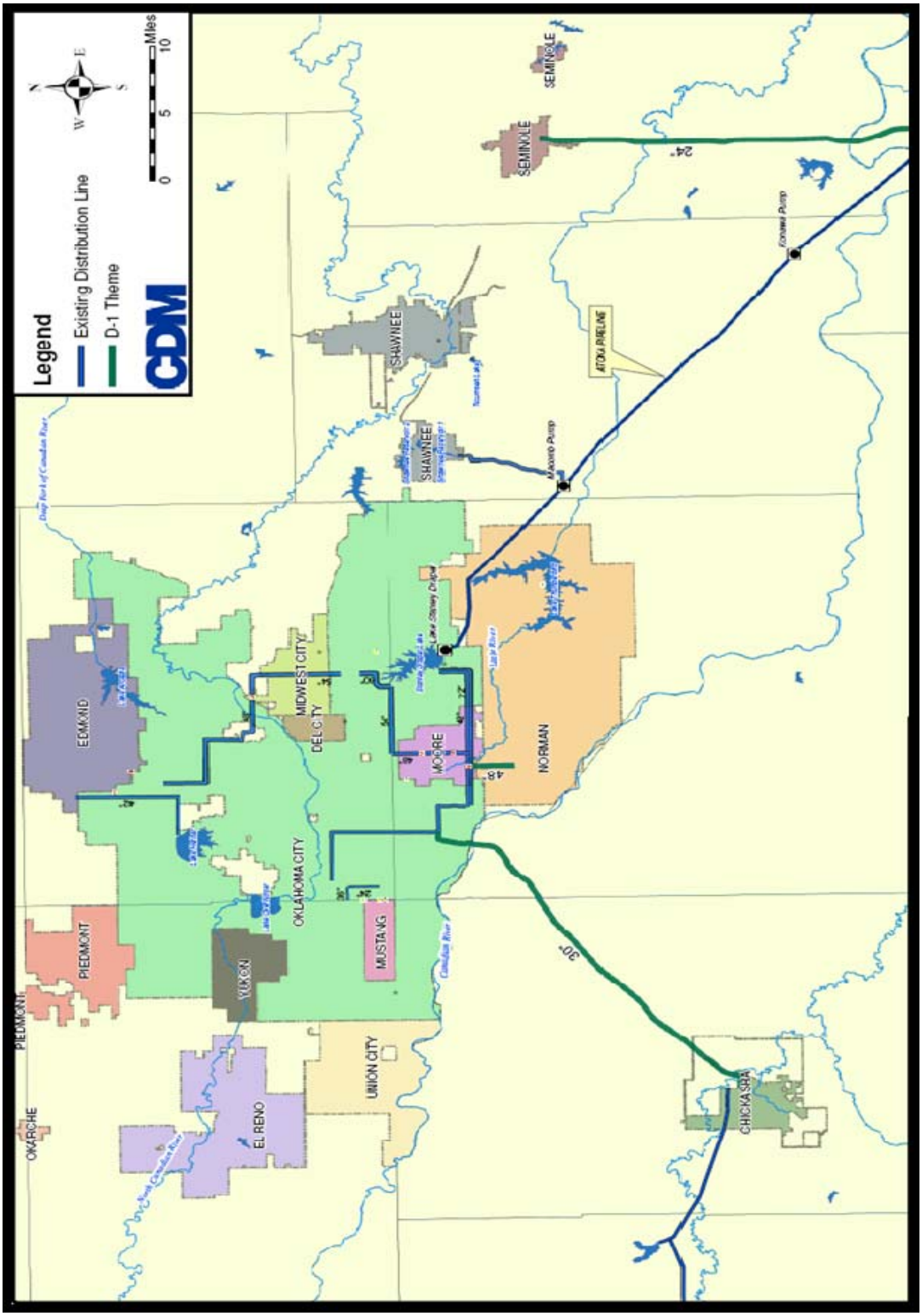


Figure 7-8
Central Oklahoma Proposed Routes – Theme D1

Participant	Pipeline Improvements	Pump Stations	Capital Cost 2009 Dollars (Millions)
Chickasha	29.3 miles of 30-inch pipe	#1: 1359 hp #2: 659 hp	$67.3
COWRA	Utilize existing infrastructure		$0
Del City	Utilize existing infrastructure		$0
Edmond	Utilize existing infrastructure		$0
Midwest City	Utilize existing infrastructure		$0
Moore	Utilize existing infrastructure		$0
Norman	3.1 miles of 48-inch pipe	#1: 496 hp	$16.7
Oklahoma City	Utilize existing infrastructure		$0
Seminole	25.8 miles of 24-inch pipe	#1: 747 hp #2: 292 hp	$36.8
Shawnee	Utilize existing infrastructure		$0
D1 Total Capital Cost			**$120.8**
D1 Total Project Cost with implementation			**$145.0**

Table 7-1
Distribution Theme D1 Feasibility Level Opinion of Probable Capital Cost for Regional Distribution Facilities

7.5.2 Theme D2 – Regional Water Treatment Option

Figure 7-9 shows the location of the distribution pipelines that comprise Theme D2, and **Table 7-2** summarizes the pipe size, pipe length, pump stations, and capital cost required for regional water distribution to each project participant to meet projected 2060 demands. Additional detail for each segment and the opinion of probable cost is provided in **Appendix D**. Presented in 2009 dollars, the opinion of probable capital cost for Theme D2 water distribution is $291 million and the probable total cost for project implementation is $ 350 million.

Participant	Pipeline Improvements	Pump Stations	Capital Cost 2008 Dollars (Millions)
Chickasha	31.9 miles of 30-inch pipe	#1: 1339 hp #2: 1395 hp #3: 1117 hp #4: 545 hp	$112.5
COWRA	Utilize existing infrastructure		$0
Del City	19.0 miles of 16-inch pipe	#1: 259 hp #2: 163 hp	$23.9
Edmond	Utilize existing infrastructure		$0
Midwest City	16.2 miles of 16-inch pipe	#1: 310 hp #2: 313 hp	$17.9
Moore	16.5 miles of 36-inch pipe	#1: 1885 hp #2: 423 hp	$51.7
Norman	10.3 miles of 48-inch pipe	#1: 3225 hp	$48.5
Oklahoma City	Utilize existing infrastructure		$0
Seminole	25.8 miles of 24-inch pipe	#1: 747 hp #2: 292 hp	$36.8
Shawnee	Utilize existing infrastructure		$0
D2 Total Capital Cost			**$291.3**
D2 Total Project Cost with implementation			**$349.6**

Table 7-2
Distribution Theme D2 Feasibility Level Opinion of Probable Capital Cost for Regional Distribution Facilities

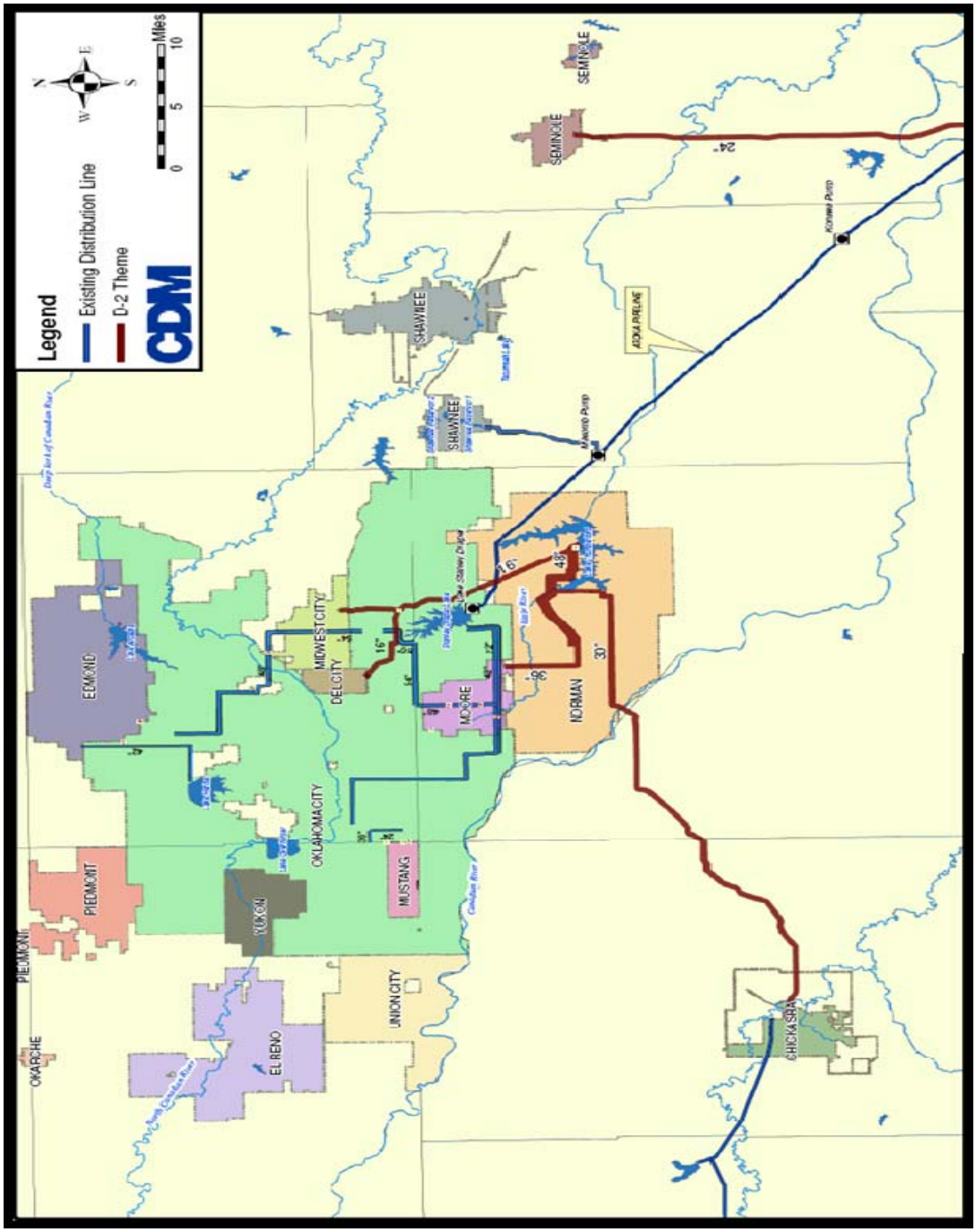


Figure 7-9
Central Oklahoma Proposed Distribution Routes – Theme D2

7.5.3 Theme D3 – Raw Water Delivery Option

Figure 7-10 shows the location of the distribution pipelines that comprise Theme D3, and **Table 7-3** summarizes the pipe size, pipe length, pump stations, and capital cost required for regional water distribution to each project participant to meet projected 2060 demands. Additional detail for each segment and the opinion of probable cost is provided in **Appendix D**. Presented in 2009 dollars, the opinion of probable capital cost for Theme D2 water distribution is $316 million and the probable total cost for project implementation is $379 million.

Participant	Pipeline Improvements	Pump Stations	Capital Cost 2008 Dollars (Millions)
Chickasha	31.9 miles of 30-inch pipe	#1: 2487 hp #2: 995 hp	$103.6
COWRA	Utilize existing infrastructure		$0
Del City	19.0 miles of 16-inch pipe	#1: 259 hp #2: 163 hp	$23.9
Edmond	17.8 miles of 48-inch pipe	#1: 1549 hp	$84.8
Midwest City	16.2 miles of 16-inch pipe	#1: 310 hp #2: 313 hp	$17.9
Moore	Utilize existing infrastructure		$0
Norman	10.3 miles of 48-inch pipe	#1: 1885 hp #2: 423 hp	$48.5
Oklahoma City	Utilize existing infrastructure		$0
Seminole	25.8 miles of 24-inch pipe	#1: 747 hp #2: 292 hp	$36.8
Shawnee	Utilize existing infrastructure		$0
D3 Total Capital Cost			**$315.6**
D3 Total Project Cost with implementation			**$378.7**

Table 7-3
Distribution Theme D3 Feasibility Level Opinion of Probable Capital Cost for Regional Distribution Facilities

7.6 Estimated Conveyance Summary

The pipeline lengths required to acquire adequate raw water to meet projected 2070 demands are significant. The Atoka Pipeline from Atoka Lake to Lake Stanley Draper is over 100 miles long, and the pipeline for each potential source to Atoka Lake ranges from approximately 30 miles to 50 miles in length. As a result, the probable capital cost of the improvements will be highly dependent on the pipe material and construction costs as well as the final alignment and configuration of facilities. Additional detail is provided in Appendix C, which includes a CDM memorandum dated March 4, 2009 that discusses the development and assumptions used for applicable unit capital costs.

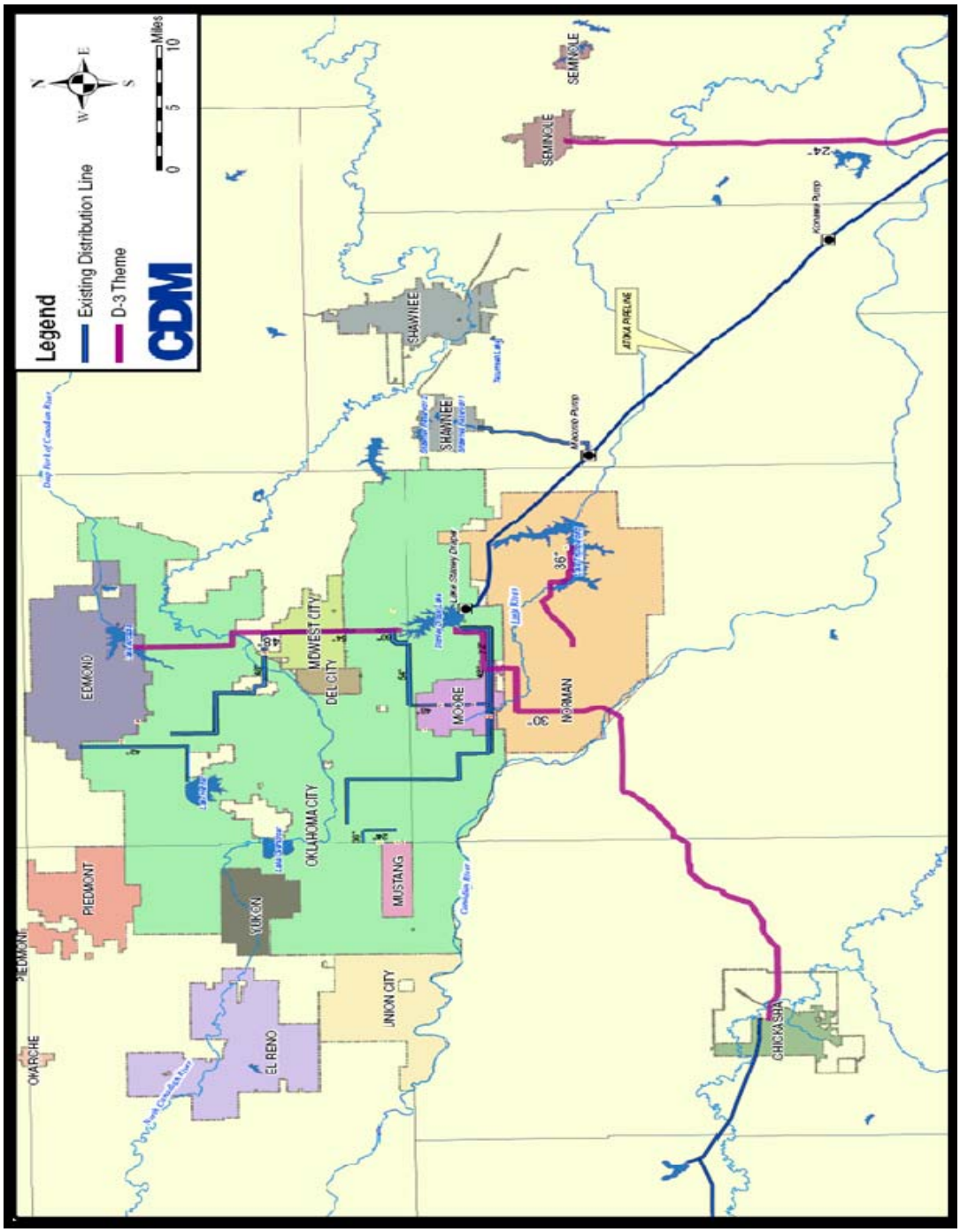


Figure 7-10
Central Oklahoma Proposed Distribution Routes – Theme D3

Table 7-4 feasibility level project costs (including implementation) in 2009 dollars for each raw water transmission segment from new supply source to terminal storage in the Oklahoma City metro area.

Transmission Alternative	Transmission Segment and Alternative Total	Project Cost 2008 Dollars (Billions)
1	Sardis Lake to Atoka Lake	$0.35
	Atoka Lake to Lake Stanley Draper	$1.08
	Alternative 1 Total	**$1.43**
2	Kiamichi (Moyers) to McGee Creek Reservoir	$0.16
	McGee Creek Reservoir to Atoka Lake	$0.14
	Atoka Lake to Lake Stanley Draper	$1.08
	Alternative 2 Total	**$1.38**
3	Kiamichi (Highway 3) to McGee Creek Reservoir	$0.26
	McGee Creek Reservoir to Atoka Lake	$0.14
	Atoka Lake to Lake Stanley Draper	$1.08
	Alternative 3 Total	**$1.48**
4	Hugo Lake to McGee Creek Reservoir	$0.31
	McGee Creek Reservoir to Atoka Lake	$0.14
	Atoka Lake to Lake Stanley Draper	$1.08
	Alternative 4 Total	**$1.53**

Table 7-4
Summary of Costs for Raw Water Transmission Alternatives

Table 7-5 summarizes in a matrix format the total project costs, which include both capital and project implementation costs for the 12 possible combinations derived from the four raw water transmission alternatives and three regional distribution themes for which costs were developed.

		Regional Distribution Themes (2008 Dollars, Presented in Billions)		
		Theme D1	**Theme D2**	**Theme D3**
Raw Water Transmission Alternative	**Alternative 1**	$1.58	$1.78	$1.81
	Alternative 2	$1.53	$1.73	$1.76
	Alternative 3	$1.63	$1.83	$1.86
	Alternative 4	$1.68	$1.88	$1.91

Table 7-5
Summary Matrix of Conveyance Infrastructure and Implementation Costs

Section 8
Estimated Operation and Maintenance Costs

8.1 Introduction

In addition to the capital cost estimates for the different project alternatives, operational and maintenance (O&M) costs were also estimated. The O&M costs include power costs for pumping, water treatment costs, and annual maintenance on the conveyance infrastructure. These costs were determined using the water supply simulation tool developed for this project. The scenario tool includes a conceptual-level network representation of the regional water system that allows for water supply-and-demand mass balance calculations to be performed on each pipeline in the system in order to determine the flow of water required to meet the projected demands. Pumping and treatment costs are then derived from the determined flow rates.

The assumptions and O&M cost estimating methodology are described further in the sections that follow. Additional information about the simulation tool can be found in **Appendix E** to this report.

8.2 Operation and Maintenance Cost Methodology

The O&M costs included in the estimates for the project alternatives were:

- Energy requirements for conveyance and distribution – including conveyance from the Kiamichi River Basin, through the Atoka Pipeline, and to the participating cities/agencies
- Maintenance costs for pipelines and pump stations
- Water treatment O&M costs

Using the computer-based water supply system simulation tool, the O&M costs were estimated for the system alternatives (i.e., different combinations of source water and delivery theme alternatives). Overall costs for each of these project alternatives were determined, and then the costs were allocated to each participating city/agency, based on its use of the regional project water.

The methodology for determining and allocating the O&M costs for the project alternatives is described here. All O&M costs were estimated in 2008 dollars and provided, with no inflation, for the financial analysis task. The use of the O&M costs in the financial analysis is explained in Section 10.

8.2.1 Estimates of Energy Requirements and Costs for Conveyance and Distribution

The primary component of the O&M costs were the electricity costs required for pumping. For this project, water is conveyed over 100 miles and lifted over 400 feet from the Kiamichi River Basin to central Oklahoma. Pumping costs were estimated from source water to delivery point using the water supply system simulation tool.

Based on the user-defined regional water demand projections, the simulation tool calculates the amount of flow required in each of the pipelines in the system network. The cost of pumping water through a pipe is a function of the flow rate and the physical attributes of the flow pathway (including: pipe diameter, length, elevation difference, and assumed material properties). Using the flow rates and physical attributes, the simulation tool calculates the estimated operational costs on a monthly time step throughout the duration of the simulation.

The formula used to calculate pumping costs in the simulation tool is derived through the following equations (see the list of variable names in the box to the right):

Where:

$\tau = unit\ elec\ price\ [\$/kWh]$

$\eta = pump\ efficiency$

$\Delta E = elevation\ head\ [ft]$

$Q = flow\ rate\ [AFM]$

$L = length\ [ft]$

$D = diameter\ [ft]$

$C = loss\ coefficient$

$t = pump\ duration\ [hr/mo]$

$\rho =$ Density (= 62.4 lb/ft3)

g = Accel. of gravity (= 32.2 ft/s2)

The cost of pumping is generally defined as:

$$Cost = \tau \cdot t \cdot Power$$

Pumping power for flow through a pipe is defined as:

$$Power = \frac{1}{\eta} \cdot Q \cdot TDH \cdot \rho \cdot g$$

The total dynamic head (TDH) is made up of the elevation head and the friction head:

$$TDH = \Delta E + h_f$$

Friction head is given by the equation:

$$h_f = \frac{3.012 \cdot V^{1.85} \cdot L}{C^{1.85} \cdot D^{1.165}} = \frac{4.709}{C^{1.85}} \cdot \frac{L}{D^{4.865}} \cdot Q^{1.85}$$

Substituting into the cost equation yields the following:

$$Cost = t \cdot \tau \cdot \left(\frac{1}{\eta} \cdot Q \cdot \rho \cdot g \cdot TDH \right)$$

And finally, converting units and simplifying the equation yields the final pumping cost formula:

$$Cost = 1.40 \times 10^{-3} \cdot \frac{\tau \cdot t}{\eta} \cdot Q_{AFM} \cdot \left[\Delta E_{ft} + \frac{10.44}{C^{1.85}} \cdot \frac{L_{ft}}{D_{in}^{4.865}} \cdot (Q_{AFM} \cdot 7.439)^{1.85} \right]$$

This formula was used for each pumped flow pathway and for each month during the simulation. Flow values in the tool were calculated as monthly volumes and the calculated pumping costs were then monthly operational costs. The monthly costs were allocated to the different cities/agencies based on their proportional usage of the pipeline for regional project water. More about the calculation of flow and the allocation equations in the tool can be found in **Appendix E.** Cost allocation to project participants as part of the financial analysis is described in detail in Section 9.

8.2.2 Maintenance Costs of Pipelines and Pump Stations

The annual maintenance costs for the pipelines and pump stations were assumed to be a fixed percentage of the initial capital cost for the facilities. For comparative purposes, an identical planning level annual maintenance percentage of 1.5 percent was used for all facilities.

8.2.3 Water Treatment Operation and Maintenance

Water treatment costs for the different project alternatives were calculated simply as the flow through each WTP multiplied by a unit treatment cost for that plant. Flow rates through each plant were determined by the simulation tool and unit treatment costs were either provided for the existing plants or else estimated based on other plants in the region (similar in size and process train). The assumed unit treatment costs for each plant in the system are shown in **Table 8-1**.

WTP	Unit Cost ($/AF)	Unit Cost ($/Kgal)
Chickasha WTP	$72	$0.22
Del City WTP	$72	$0.22
Edmond WTP	$117	$0.36
Midwest City WTP	$72	$0.22
(New) COWRA WTP	$117	$0.36
(New) Thunderbird WTP	$117	$0.36
Norman WTP	$72	$0.22
Shawnee WTP	$121	$0.37
Stanley Draper WTP	$117	$0.36
Tecumseh WTP	$121	$0.37
(New) Seminole WTP	$121	$0.37

Table 8-1
Unit Treatment Costs at WTPs

The flexibility of the simulation tool allows treatment costs to be calculated for any year through the planning horizon – based on the projected demands and the mass balance logic in the tool.

The water treatment costs were also allocated to each participating city/agency. For each delivery theme, it was specified which treatment plant provided the regional project water to each city/agency. Usage of each treatment plant for regional water was allocated to the cities/agencies in proportion to their individual usage.

8.3 Water Delivery Theme Assessment O&M

The estimated total pumping and treatment costs for the different project alternatives (combinations of source water and delivery theme alternatives) are presented in **Figure 8-1** below. The maintenance costs are not shown in this table because those costs are nearly the same for all of the alternatives. The difference between the alternatives can be better seen by looking only at the pumping and treatment costs.

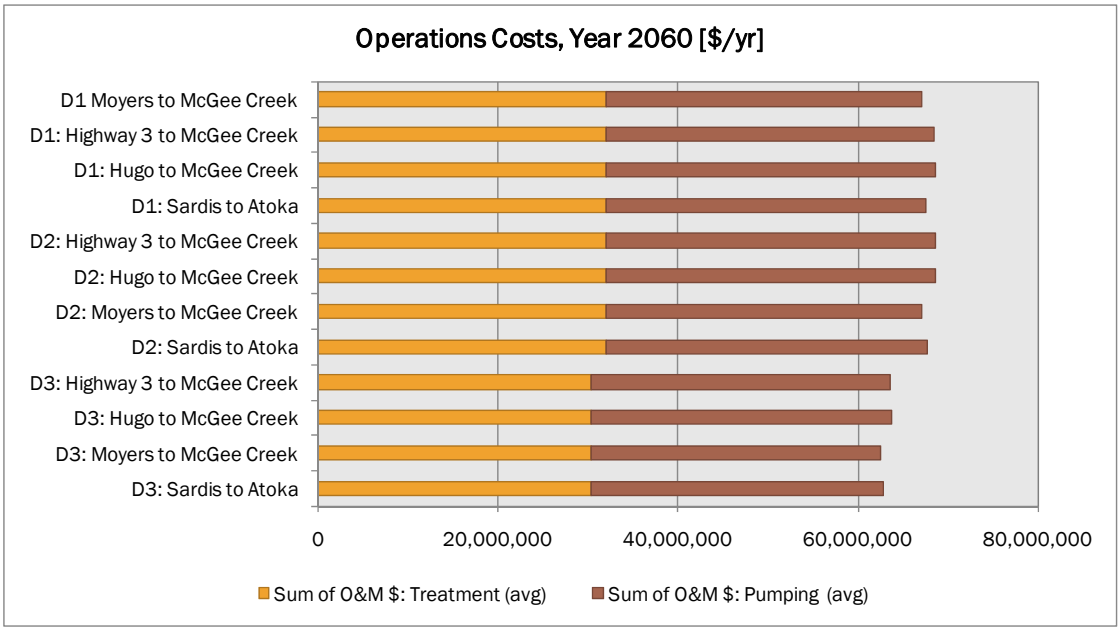


Figure 8-1
Year 2060 Operations Costs for Project Alternatives

As can be seen in **Figure 8-1**, the total pumping and treatment costs are similar for all of the alternatives in themes D1 and D2. However, each of the D3 alternatives has a lower total operations cost than the respective D1 and D2 alternatives. This lower cost is due to the fact that the theme D3 alternatives are the only ones that employ Arcadia Lake (used by the City of Edmond) as a terminal storage body. The hydrology and current operations of Arcadia Lake are such that there is considerable "additional" water available locally at Arcadia Lake that can be used in lieu of importing Southeast Regional water to meet demands. In that case, less water is required to be pumped through the Atoka Pipeline to the central Oklahoma cities. This is further indicated by looking at the total average monthly deliveries of water from southeast Oklahoma, as shown for 2060 in **Figure 8-2**.

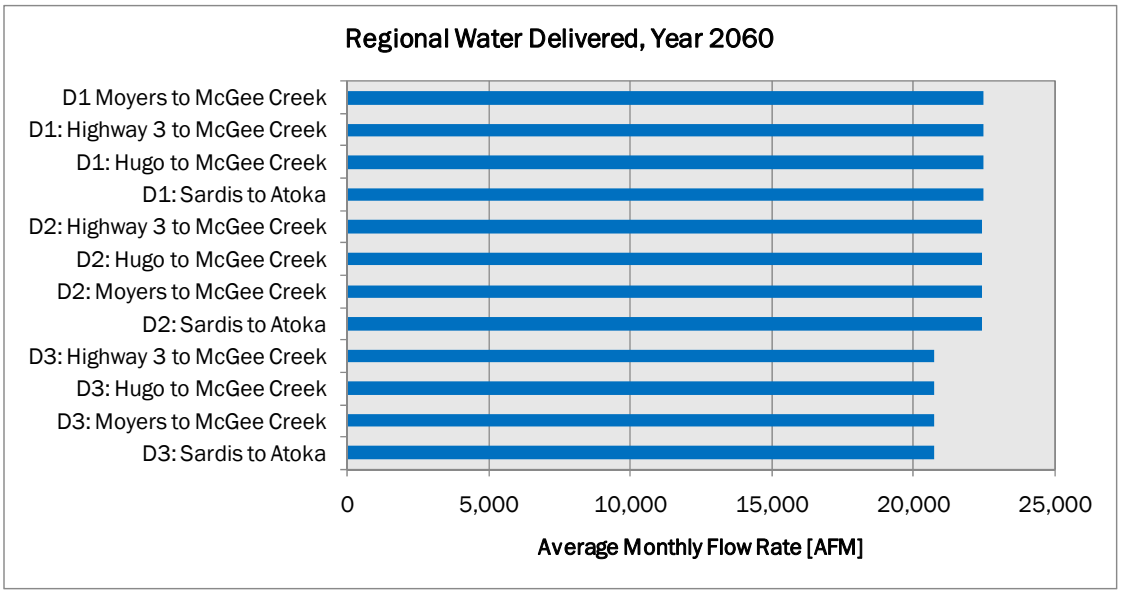


Figure 8-2
Year 2060 Regional Water Deliveries for Project Alternatives

The system simulation tool only constrains the operations of reservoirs to first supply any existing local rights at the reservoir, and then to try to maintain reservoir volume targets. With these limited constraints on Arcadia Lake, it appears that there is significant "local" water available at the lake that may be used as a water supply source. This may offset the need for importing water from the Kiamichi River Basin. Further study of the hydrologic, institutional, environmental, and legal factors related to further using water from Arcadia Lake will need to be undertaken in the future.

Because the purpose of this study was to examine and compare the different alternatives for bringing southeast Oklahoma water to the central region, it is misleading to compare the operations cost values when theme D3 is not bringing the same amount of water as themes D1 and D2 (though it is an interesting finding that Arcadia Lake may be able to offset the need for imported water for some cities). So, in order to compare the three delivery themes evenly in the rest of the analysis, the operations costs for theme D3 were assumed to be the same as those for D1(Section 11 of this report describes all of the factors and criteria included in the alternatives comparison portion of the project).

The basis of this assumption is that in the future, it is expected that all of the water originally projected for the regional water system will be required to come from the Kiamichi River Basin. In order to compare the distribution theme alternatives, it had to be assumed that the total water deliveries for the themes would be approximately the same (and not reduced as in the case for theme D3). Since the bulk of the cost of conveyance comes from pumping through the Atoka Pipeline (approximately 90 percent of total pumping costs – see **Table 8-2**), it was assumed that the pumping and treatment costs for theme D3 could be replaced with those of theme D1 (which

delivers all of the regional water through the Atoka Pipeline). This assumption was useful in comparing the project alternatives against all of the alternatives evaluation criteria.

System Segment	Annual Average	Monthly Average	% of Total
Source to Intermediate Storage (McGee, in this example)	$4,293,089	$357,757	8%
McGee Pipeline (to Atoka)	$1,396,243	$116,354	2%
Atoka Pipeline (existing and new)	$47,896,924	$3,991,410	86%
Terminal (Raw Water to terminal reservoirs)	$103,003	$8,584	<1%
Delivery (Raw water to treatment plants and treated water in central Oklahoma)	$2,237,731	$186,478	4%
TOTAL	**$55,926,990**	**$4,660,582**	**100%**

Table 8-2
Example Breakdown of Pumping Costs by System Segment

The total O&M cost values for the year 2060 (assuming D3 water deliveries from southeast to central Oklahoma equal D1 deliveries) are shown, including maintenance costs) in **Figure 8-3** below. Tables showing the O&M costs, allocated by city, can be found for all 12 of the project alternatives, in **Appendix F**.

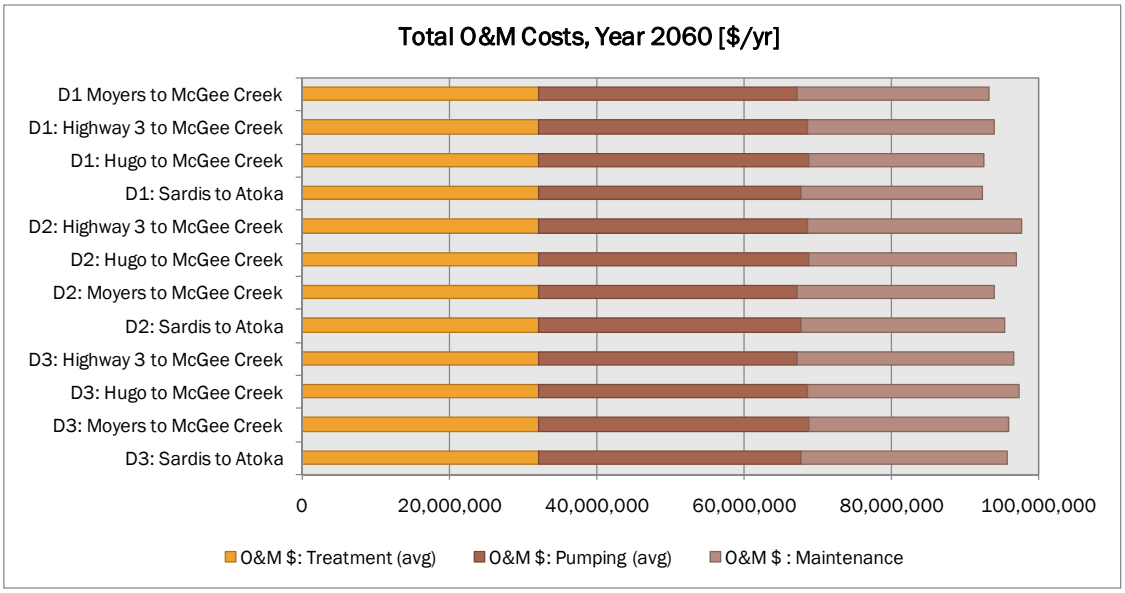


Figure 8-3
Total O&M Costs for Project Alternatives

Section 9
Project Cost Distribution to Participants

9.1 Introduction

As discussed in the previous sections, there were four (4) supply alternatives analyzed in conjunction with three distribution themes. This section will present a summary of the project costs as well as develop the allocation of them to the participants.

9.2 Summary of Project Costs – Transmission and Distribution Systems

The transmission system costs developed in Section 6 are summarized on **Table 9-1**. These costs include an allowance for contingency of 25 percent and an allowance for engineering, administration, environmental issue resolution and legal fees (project implementation) of 20 percent. The inclusion of the project implementation percent is normally calculated as an addition to the total construction costs (base construction costs plus contingency). In this instance, due to the preliminary nature of the construction costs, the contingency amount allows for items not normally identified at this stage of cost estimation, such that the contingency should be considered a normal cost item.

Transmission Segments	Base Construction Cost	Contingency (25%)	Total Construction Costs	Project Implementation (20%)	Total Project Costs
Allocated to All Participants					
Atoka Pipeline	$720,000,000	$180,000,000	$900,000,000	$180,000,000	$1,080,000,000
Supply Alternatives					
Sardis to Atoka	$232,000,000	$58,000,000	$290,000,000	$58,000,000	$348,000,000
Moyer's to McGee to Atoka	$208,000,000	$52,000,000	$260,000,000	$52,000,000	$312,000,000
Hwy 3 to McGee to Atoka	$272,000,000	$68,000,000	$340,000,000	$68,000,000	$408,000,000
Hugo to McGee to Atoka	$304,000,000	$76,000,000	$380,000,000	$76,000,000	$456,000,000

Table 9-1
Summary of Transmission and Supply Pipeline Costs

In addition to the transmission system, there are also distribution pipeline projects required. **Table 9-2** presents a summary of the distribution pipeline cost alternatives.

Distribution Alternatives	Base Construction Cost	Contingency (25%)	Total Construction Costs	Project Implementation (20%)	Total Project Costs
Distribution Pipelines - Theme D-1					
OKC to Chickasha	$53,867,200	$13,466,800	$67,334,000	$13,466,800	$80,800,800
OKC to Norman	$13,392,800	$3,348,200	$16,741,000	$3,348,200	$20,089,200
Atoka Pipeline to Seminole	$29,456,000	$7,364,000	$36,820,000	$7,364,000	$44,184,000
Distribution Pipelines - Theme D-2					
Lake Thunderbird WTP to Chickasha	$89,998,400	$22,499,600	$112,498,000	$22,499,600	$134,997,600
Lake Thunderbird WTP to Norman	$38,788,000	$9,697,000	$48,485,000	$9,697,000	$58,182,000
Lake Thunderbird WTP to Moore	$41,348,800	$10,337,200	$51,686,000	$10,337,200	$62,023,200
Atoka Pipeline to Seminole	$29,456,000	$7,364,000	$36,820,000	$7,364,000	$44,184,000
Distribution Pipelines - Theme D-3					
Stanley Draper Reservoir to Chickasha	$82,908,000	$20,727,000	$103,635,000	$20,727,000	$124,362,000
Stanley Draper Reservoir to Edmond	$67,878,400	$16,969,600	$84,848,000	$16,969,600	$101,817,600
Stanley Draper Reservoir to Norman	$38,788,000	$9,697,000	$48,485,000	$9,697,000	$58,182,000
Atoka Pipeline to Seminole	$29,456,000	$7,364,000	$36,820,000	$7,364,000	$44,184,000

Table 9-2
Summary of Distribution Pipeline Costs

9.3 Cost Allocation Methodology – Transmission System

The transmission system costs were allocated in a manner that is equitable between participants and is based on the portion of the capacity needed in 2060 per participant. In addition, the portion of the Atoka pipeline that serves Seminole and Shawnee is approximately five-sixths of the total pipeline and the costs were allocated accordingly. The remaining one-sixth of the Atoka pipeline costs were then allocated to the balance of the participants. The supply system costs (from the Sardis/Kiamichi River Basin) were allocated to all participants, separately from that of the Atoka pipeline.

The 2060 demand projections were previously presented on **Table 2-4**. The projections from **Tables 2-2 and 2-3** were converted from acre-feet-per-year (AFY) to million gallons per day (mgd). This was done in order to coordinate the demand projections with the existing facility capacities, which are in mgd units. **Table 9-3** presents the demand projections in terms of both AFY and mgd, with the existing pipeline facilities deducted from 2060 demands, with the assumption that the incremental needs will be met from the Southeast Oklahoma Regional Raw Water System (SEORRWS).

	AFY	mgd	Atoka/McGee Existing Facilities Capacity	Canadian Existing Facilities Capacity	New Atoka Capacity Needed
OKC	251,690	224.69	90.00	71.00	63.69
Norman	26,514	23.67	-	-	23.67
Chickasha	7,169	6.40	-	-	6.40
Del City	1,680	1.50	-	-	1.50
Midwest City	1,904	1.70	-	-	1.70
Moore	11,762	10.50	-	-	10.50
COWRA	22,403	20.00	-	-	20.00
Edmond	20,947	18.70	-	-	18.70
Seminole	4,481	4.00	-	-	4.00
Shawnee	4,481	4.00	-	-	4.00
Total	**353,031**	**315.16**	**90.00**	**71.00**	**154.16**

Table 9-3
Demand Projections (AFY and mgd) – Transmission Pipeline

The distribution pipeline costs were developed per participant, with no allocation of the costs required.

9.4 Cost Allocation Results per Participant – Transmission System

The transmission system pipeline costs for the area from Atoka to the Seminole/Shawnee delivery point are presented on **Table 9-4**. The costs of the Atoka pipeline for this section equal five-sixths of the $1,080,000,000 total.

	mgd	Percent	Project Costs
OKC	63.69	41.20%	$370,800,000
Norman	23.67	15.40%	138,600,000
Chickasha	6.40	4.20%	37,800,000
Del City	1.50	1.00%	9,000,000
Midwest City	1.70	1.10%	9,900,000
Moore	10.50	6.80%	61,200,000
COWRA	20.00	13.00%	117,000,000
Edmond	18.70	12.10%	108,900,000
Seminole	4.00	2.60%	23,400,000
Shawnee	4.00	2.60%	23,400,000
Total	**154.16**	**100.00%**	$900,000,000

Table 9-4
Transmission System Pipeline
Atoka to Seminole and Shawnee

The transmission system pipeline costs for the area from the Seminole/Shawnee delivery point to Stanley Draper are presented on **Table 9-5**. The costs of the Atoka pipeline for this section equals one-sixth of the $1,080,000,000 total.

	mgd	Percent	Project Cost
OKC	63.69	43.50%	$78,300,000
Norman	23.67	16.20%	29,160,000
Chickasha	6.40	4.40%	7,920,000
Del City	1.50	1.00%	1,800,000
Midwest City	1.70	1.20%	2,160,000
Moore	10.50	7.20%	12,960,000
COWRA	20.00	13.70%	24,660,000
Edmond	18.70	12.80%	23,040,000
Seminole	0.00	0.00%	-
Shawnee	0.00	0.00%	-
Total	146.16	100.00%	$180,000,000

Table 9-5
Transmission System Pipeline Seminole/Shawnee to Stanley Draper

In addition, there are four supply pipeline alternatives. The supply system pipeline costs for the Sardis to Atoka alternative are presented on **Table 9-6** and allocated to the participants. The estimated project costs for the Sardis to Atoka pipeline is $348 million in total.

Participant	mgd	Percent	Project Cost
OKC	63.69	41.20%	$143,376,000
Norman	23.67	15.40%	53,592,000
Chickasha	6.40	4.20%	14,616,000
Del City	1.50	1.00%	3,480,000
Midwest City	1.70	1.10%	3,828,000
Moore	10.50	6.80%	23,664,000
COWRA	20.00	13.00%	45,240,000
Edmond	18.70	12.10%	42,108,000
Seminole	4.00	2.60%	9,048,000
Shawnee	4.00	2.60%	9,048,000
Total	**154.16**	**100.00%**	$348,000,000

Table 9-6
Supply System Pipeline Sardis to Atoka

The supply system pipeline costs for the Moyer's Crossing to Atoka alternative are presented on **Table 9-7** and allocated to the participants. The estimated project costs

for the Moyer's Crossing to Atoka pipeline includes the pipeline from Moyer's Crossing to McGee Creek ($168 million) and from McGee Creek to Atoka ($144 million) and is estimated at $312 million in total.

Participants	mgd	Percent	Project Cost
OKC	63.69	41.20%	$128,544,000
Norman	23.67	15.40%	48,048,000
Chickasha	6.40	4.20%	13,104,000
Del City	1.50	1.00%	3,120,000
Midwest City	1.70	1.10%	3,432,000
Moore	10.50	6.80%	21,216,000
COWRA	20.00	13.00%	40,560,000
Edmond	18.70	12.10%	37,752,000
Seminole	4.00	2.60%	8,112,000
Shawnee	4.00	2.60%	8,112,000
Total	**154.16**	**100.00%**	$312,000,000

Table 9-7
Supply System Pipeline
Moyer's Crossing to Atoka

The supply system pipeline costs for the Highway 3 to Atoka alternative are presented on **Table 9-8** and allocated to the participants. The estimated project costs for the Highway 3 to Atoka pipeline includes the pipeline from Highway 3 to McGee Creek ($264 million) and from McGee Creek to Atoka ($144 million) and is estimated at $408,000,000 in total.

Participants	mgd	Percent	Project Cost
OKC	63.69	41.20%	$168,096,000
Norman	23.67	15.40%	62,832,000
Chickasha	6.40	4.20%	17,136,000
Del City	1.50	1.00%	4,080,000
Midwest City	1.70	1.10%	4,488,000
Moore	10.50	6.80%	27,744,000
COWRA	20.00	13.00%	53,040,000
Edmond	18.70	12.10%	49,368,000
Seminole	4.00	2.60%	10,608,000
Shawnee	4.00	2.60%	10,608,000
Total	**154.16**	**100.00%**	$408,000,000

Table 9-8
Supply System Pipeline Highway 3 to Atoka

The supply system pipeline costs for the Hugo to Atoka alternative are presented on **Table 9-9** and allocated to the participants. The estimated project costs for the Hugo to Atoka pipeline includes the pipeline from Hugo to McGee Creek ($312 million) and from McGee Creek to Atoka ($144 million) and is estimated at $456 million in total.

Participants	mgd	Percent	Project Cost
OKC	63.69	41.20%	$187,872,000
Norman	23.67	15.40%	$70,224,000
Chickasha	6.40	4.20%	$19,152,000
Del City	1.50	1.00%	$4,560,000
Midwest City	1.70	1.10%	$5,016,000
Moore	10.50	6.80%	$31,008,000
COWRA	20.00	13.00%	$59,280,000
Edmond	18.70	12.10%	$55,176,000
Seminole	4.00	2.60%	$11,856,000
Shawnee	4.00	2.60%	$11,856,000
Total	**154.16**	**100.00%**	$456,000,000

Table 9-9
Supply System Pipeline Hugo to Atoka

In addition to the project costs for the transmission system it is anticipated that the project participants will be required to alleviate some or all of the debt from the construction of Sardis r Lake. Each of the supply system alternatives above receive raw water either directly from Sardis Lake or from Sardis Lake releases to lower reaches of the Kiamichi River. For purposes of this Study, the total debt relief requirement was assumed to be$70 million. **Table 9-10** presents the allocation of the $70 million to the participants.

	mgd	Percent	Estimated Sardis Debt
OKC	63.69	41.20%	$28,840,000
Norman	23.67	15.40%	10,780,000
Chickasha	6.40	4.20%	2,940,000
Del City	1.50	1.00%	700,000
Midwest City	1.70	1.10%	770,000
Moore	10.50	6.80%	4,760,000
COWRA	20.00	13.00%	9,100,000
Edmond	18.70	12.10%	8,470,000
Seminole	4.00	2.60%	1,820,000
Shawnee	4.00	2.60%	1,820,000
Total	**154.16**	**100.00%**	**$70,000,000**

Table 9-10
Sardis Debt Repayment Assumption

9.5 Cost Allocation Methodology – Treatment Theme D1 (Regional WTP at Stanley Draper)

The treatment system costs were allocated in a manner that is equitable between participants and is based on the portion of the capacity needed in 2060 per participant in terms of maximum day demand. The peaking factor for the participants was approximately 2 times for all. Therefore, the average day demands (ADD) from **Table 9-3** were multiplied by 2 to calculate the maximum day demands (MDD) on **Table 9-11**. The exception to the peaking factor use is COWRA, with the quantity to be used set at 20 mgd. All participants are projected to receive treated water from Stanley Draper with the exception of Seminole and Shawnee.

Participants	ADD (mgd)	MDD (mgd)
OKC – Total Demand	208.69	417.38
Less: Existing S. Draper WTP		(150.00)
Less: Existing Hefner & Overholser WTPs		(100.00)
Net: OKC Treatment Demand		**167.38**
Other Participants		
Norman	23.67	47.34
Chickasha	6.40	12.80
Del City	1.50	3.00
Midwest City	1.70	3.40
Moore	10.50	21.00
COWRA	20.00	20.00
Edmond	18.70	37.40
Total Other Participants	**82.47**	**144.94**

Table 9-11
Stanley Draper Water Treatment Plant Demands – Theme D1

9.6 Cost Allocation Results per Participant – Treatment

The expansion of Stanley Draper Water Treatment Plant (WTP) for the Theme 1 Distribution System is based on a cost per gallon of capacity for construction. The construction cost for water treatment plants in excess of 30 mgd of capacity was estimated at $2.00 per gallon of capacity. For example, the estimated cost for a WTP with 10 mgd of capacity would be $20 million. Subsequent references to WTP unit costs are simplified as a cost "per gallon," referring to the estimated unit cost per gallon of treatment capacity. An additional 20 percent was added for implementation costs (engineering, administration, etc.) resulting in an estimated cost of $2.40 per gallon. Due to the fact that this is an existing WTP owned by OKC, there should be no negative impact (disproportionate increase in cost) from the allocation of the expansion costs. Therefore, the first layer of costs was calculated to be exclusively for OKC as presented on **Table 9-12.**

Theme D1: OKC Treatment	Stanley Draper WTP	Construction Cost
Stanley Draper WTP		
Existing Capacity-OKC (mgd)	250.00	
Projected Capacity-OKC (mgd)	417.38	
New Capacity for OKC (mgd)	167.38	
Unit Cost ($/gallon)	$2.40	$401,712,000
Additional Capacity-Others (mgd)	144.94	
Unit Cost ($/gallon)	$2.40	$347,856,000
Treatment Costs Total		**$749,568,000**

Table 9-12
Calculation of Stanley Draper WTP Expansion Costs Theme D1

The Stanley Draper WTP costs are presented for all participants on **Table 9-13**.

Participants	MDD (mgd)	Percent of Total	WTP Expansion Costs
OKC - Net Incremental Demand	**167.38**	**100%**	**$401,712,000**
Other Participants			
Norman	47.34	33%	$113,616,000
Chickasha	12.80	9%	30,720,000
Del City	3.00	2%	7,200,000
Midwest City	3.40	2%	8,160,000
Moore	21.00	14%	50,400,000
COWRA	20.00	14%	48,000,000
Edmond	37.40	26%	89,760,000
Total Other ParticipanRets	**144.94**	**100%**	**$347,856,000**

Table 9-13
Stanley Draper Water Treatment Plant Cost Allocation – Theme D1

9.7 Cost Allocation Methodology – Treatment Theme D2 (Regional WTP at Thunderbird)

The Thunderbird water treatment system costs were allocated in a manner that is equitable between participants and is based on the portion of the capacity needed in 2060 per participant in terms of maximum day demand. The peaking factor for the participants was approximately 2 times for all. Therefore, the average day demands (ADD) from **Table 9-3** were multiplied by 2 to calculate the maximum day demands (MDD) on **Table 9-14**. Only a portion of the participants are projected to receive treated water from Thunderbird, as presented on **Table 9-9**. The balance of the participants will provide their own water treatment plant expansions.

Participants	Average Day Demand (mgd)	Max Day Demand (mgd)
Participants		
Norman	23.67	47.34
Chickasha	6.40	12.80
Del City	1.50	3.00
Midwest City	1.70	3.40
Moore	10.50	21.00
Totals	**43.77**	**87.54**

Table 9-14
Thunderbird Regional Water Treatment Plant Demands Theme D2

9.8 Cost Allocation Results per Participant – Treatment Theme D2

The Thunderbird Regional Water Treatment Plant (WTP) for the Theme D2 Distribution System is based on a cost per gallon for construction. The construction cost for water treatment plants in excess of 30 mgd was estimated at $2.00 per gallon. An additional 20 percent was added for implementation costs (engineering, administration, etc.) resulting in an estimated cost of $2.40 per gallon.
In addition to the new Thunderbird Regional WTP, the other WTP's will also require expansion by 2060. The capital costs for these WTP's were calculated as presented on **Table 9-15**.

Water Treatment Plants	WTP Capacity	Construction Cost
Thunderbird Regional WTP		
Existing Capacity (mgd)	0	
Projected Capacity (mgd)	87.54	
Additional Capacity (mgd)	87.54	
Unit Cost ($/gallon)	$2.40	
Treatment Costs	$210,096,000	$210,096,000
COWRA Regional WTP		
Existing Capacity (mgd)	0	
Projected Capacity (mgd)	20.00	
Additional Capacity (mgd)	20.00	
Unit Cost ($/gallon)	$2.52	
Treatment Costs	$50,400,000	$50,400,000
Stanley Draper WTP		
Existing Capacity-OKC (mgd)	250.00	
Projected Capacity-OKC (mgd)	417.39	
Additional Capacity (mgd)	167.39	
Unit Cost ($/gallon	$2.40	
Treatment Costs	$401,712,000	$401,712,000
Edmond		
Existing Capacity (mgd)	0.00	
Projected Capacity (mgd)	37.40	
Additional Capacity (mgd)	37.40	
Unit Cost ($/gallon)	$2.40	
Treatment Costs	$89,760,000	$89,760,000

Table 9-15
Calculation of WTP Costs – Theme D2

The Thunderbird Regional WTP costs are presented for those participants on **Table 9-16**.

Thunderbird Regional WTP	MDD (mgd)	% of Total	WTP Costs
Norman	47.34	54.08%	$113,616,000
Del City	3.00	3.43%	7,200,000
Midwest City	3.40	3.88%	8,160,000
Moore	21.00	23.99%	50,400,000
Chickasha	12.80	14.62%	30,720,000
Total	**87.54**	**100.00%**	**$210,096,000**

Table 9-16
Thunderbird Regional WTP Cost Allocation – Theme D2

9.9 Cost Allocation Methodology – Treatment Theme D3 (No Regional WTPs)

The treatment costs for Distribution System Theme D3 were not allocated between participants as the treatment is being performed by each individual participant. The maximum day demands (MDD) were used to calculate the WTP costs per **Table 9-17**. The exception to the peaking factor use is COWRA, with the quantity to be used set at 20 mgd. The construction cost for water treatment plants in excess of 30 mgd was estimated at $2.00 per gallon. An additional 20 percent was added for implementation costs (engineering, administration, etc.) resulting in an estimated cost of $2.40 per gallon. The construction cost for water treatment plants between 10 and 30 mgd was estimated at $2.10 per gallon. An additional 20 percent was added for implementation costs (engineering, administration, etc.) resulting in an estimated cost of $2.52 per gallon. The construction cost for water treatment plants of less than 10 mgd was estimated at $2.25 per gallon. An additional 20 percent was added for implementation costs (engineering, administration, etc.) resulting in an estimated cost of $2.70 per gallon.

Participants/WTPs	WTP Capacity	Construction Cost
Norman		
Existing Capacity	0.00	
Projected Capacity	47.34	
Additional Capacity	47.34	
Unit Cost	$2.40	
Treatment Costs	$113,616,000	$113,616,000
Del City		
Existing Capacity	0.8	
Projected Capacity	3.00	
Additional Capacity	2.20	
Unit Cost	$2.70	
Treatment Costs	$5,940,000	$5,940,000
Midwest City		
Existing Capacity	2.90	
Projected Capacity	3.40	
Additional Capacity	0.50	
Unit Cost	$2.70	
Treatment Costs	$1,350,000	$1,350,000
Chickasha		
Existing Capacity	7.30	
Projected Capacity	12.80	
Additional Capacity	5.50	
Unit Cost	$2.70	
Treatment Costs	$14,850,000	$14,850,000

Table 9-17
Calculation of WTP Costs - Theme D3
(continued on next page)

Participants/WTPs	WTP Capacity	Construction Cost
Edmond		
Existing Capacity	0.00	
Projected Capacity	37.40	
Additional Capacity	37.40	
Unit Cost	$2.40	
Treatment Costs	$89,760,000	$89,760,000
Mustang Regional WTP		
Existing Capacity	0	
Projected Capacity	20.00	
Additional Capacity	20.00	
Unit Cost	$2.52	
Treatment Costs	$50,400,000	$50,400,000
Stanley Draper WTP		
Existing Capacity	250.00	
Projected Capacity	417.38	
Additional Capacity	167.38	
Unit Cost	$2.40	
Treatment Costs	$401,712,000	$401,712,000
Moore WTP		
Existing Capacity	0.00	
Projected Capacity	21.00	
Additional Capacity	21.00	
Unit Cost	$2.52	
Treatment Costs	$52,920,000	$52,920,000

Table 9-17
Calculation of WTP Costs – Theme D3

9.10 Cost Distribution Summary

The costs presented above per participant are summarized in this section. The preliminary preferred alternative (see description of process and results in Section 11) is being presented in this section with the supply of raw water coming from Moyer's Crossing and the Distribution System Theme D1 used. The additional alternatives are presented in **Appendix G. Table 9-18** presents the estimated costs for this alternative.

	Transmission - Atoka to Seminole & Shawnee (Table 9-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 9-5)	Supply - Moyers Crossing to Atoka (Table 9-7)	Sardis Debt Service (Table 9-10)	Distribution Pipeline - D1 (Table 9-2)	Stanley Draper WTP - D1 (Table 9-13)	Totals
OKC	$370,800,000	$78,300,000	$128,544,000	$28,840,000	$0	$401,712,000	$1,008,196,000
Norman	138,600,000	29,160,000	48,048,000	10,780,000	20,089,200	113,616,000	360,293,200
Chickasha	37,800,000	7,920,000	13,104,000	2,940,000	80,800,800	30,720,000	173,284,800
Del City	9,000,000	1,800,000	3,120,000	700,000	-	7,200,000	21,820,000
Midwest City	9,900,000	2,160,000	3,432,000	770,000	-	8,160,000	24,422,000
Moore	61,200,000	12,960,000	21,216,000	4,760,000	-	50,400,000	150,536,000
COWRA	117,000,000	24,660,000	40,560,000	9,100,000	-	48,000,000	239,320,000
Edmond	108,900,000	23,040,000	37,752,000	8,470,000	-	89,760,000	267,922,000
Seminole	23,400,000	-	8,112,000	1,820,000	44,184,000	-	77,516,000
Shawnee	23,400,000	-	8,112,000	1,820,000	-	-	33,332,000
Total	**$900,000,000**	**$180,000,000**	**$312,000,000**	**$70,000,000**	**$145,074,000**	**$749,568,000**	**$2,356,642,000**

Table 9-18
Preliminary Preferred Alternative
Supply from Moyers Crossing and Distribution D1

Section 10
Unit Cost Distribution for Participants

10.1 Introduction

The previous section developed the distribution of costs to participants. This section will provide an analysis of the impact of the costs on the individual participants. The capital costs from Section 9 will be analyzed and overall costs per 1,000 gallons developed per participant. The costs per participant will also be expressed as a cost per water connection, based on capital and operation and maintenance costs (existing and new).

10.2 Unit Cost Determination Approach

In terms of developing the costs for operation and maintenance over the study period, the first step is to determine the quantity to be treated. **Table 10-1** presents the quantities in 5 year increments from 2010 to 2060 per participant. It is also important to segregate the quantity that OKC is currently treating, estimated at 100 mgd, in order not to double count treatment costs and identify only incremental quantities.

The unit costs for treatment varied per treatment plant, based on the different Distribution System themes. **Table 10-2** presents the variable operating costs per 1,000 gallons for water treatment at the various water treatment plants per Distribution System theme. The source of these costs was presented in Section 8, with the costs identified on Table 8-1. The years being analyzed are 2020, 2040 and 2060. This analysis will capture the costs at the two extremes, the initial year (2020) when the participant demand is lowest and the final year (2060) when the participant demand is at build-out. The year 2040 is being analyzed in order to show both mid-period costs as well as a point in which any projects that are estimated as deferred are implemented. **Table 10-3** presents the variable operating costs per participant in years 2020, 2040 and 2060.

There are a number of projects that are estimated to be deferred due to the availability of existing water treatment plant facilities or pipelines. **Table 10-4** presents the projects assumed to be deferred per Distribution System theme**. Table 10-5** presents the costs for both immediate and deferred projects for the recommended alternative from **Table 9-18.**

Project Demand Projections (mgd)										
Year	**COWRA Total Water Demand (mgd)**	**Moore Total Water Demand (mgd)**	**Chickasha Total Water Demand (mgd)**	**Norman Total Water Demand (mgd)**	**Shawnee Total Water Demand (mgd)**	**Seminole Total Water Demand (mgd)**	**Del City Total Water Demand (mgd)**	**Edmond Total Water Demand (mgd)**	**Midwest City Total Water Demand (mgd)**	**Subtotal Non-OKC Participants**
2010	8.70	7.90	5.40	3.57	3.10	1.80	1.50	1.00	0.00	32.97
2015	11.40	8.10	5.50	3.01	3.20	2.00	1.50	2.60	0.00	37.31
2020	14.10	8.40	5.60	4.96	3.20	2.20	1.50	4.20	0.00	44.16
2025	16.90	8.70	5.70	7.00	3.30	2.50	1.50	5.80	0.00	51.40
2030	19.60	8.90	5.80	9.13	3.40	2.70	1.50	7.40	0.00	58.43
2035	20.00	9.20	5.90	11.34	3.50	2.90	1.50	9.00	0.10	63.44
2040	20.00	9.50	6.00	13.63	3.60	3.10	1.50	10.70	0.40	68.43
2045	20.00	9.70	6.10	16.01	3.70	3.30	1.50	12.30	0.70	73.31
2050	20.00	10.00	6.20	18.48	3.80	3.60	1.50	13.90	1.00	78.48
2055	20.00	10.30	6.30	21.48	3.90	3.80	1.50	15.50	1.30	84.08
2060	20.00	10.50	6.40	23.67	4.00	4.00	1.50	18.70	1.70	90.47

Project Demand Projections (mgd and 1,000 gallons)					
Year	**Subtotal Non-OKC Participants**	**OKC Water Demand (mgd)**	**Less: OKC Water Current Quantity Supplied (mgd)**	**Total Incremental Demand (mgd)**	**Total Incremental Demand (1,000 gallons)**
2010	32.97	108.66	100.00	41.63	15,193,831
2015	37.31	115.96	100.00	53.27	19,442,220
2020	44.16	123.73	100.00	67.89	24,780,110
2025	51.40	132.14	100.00	83.54	30,493,335
2030	58.43	141.12	100.00	99.55	36,335,260
2035	63.44	150.78	100.00	114.22	41,691,678
2040	68.43	161.20	100.00	129.63	47,315,775
2045	73.31	172.45	100.00	145.76	53,203,349
2050	78.48	184.53	100.00	163.01	59,500,336
2055	84.08	196.61	100.00	180.70	65,954,273
2060	90.47	208.69	100.00	199.17	72,696,560

Table 10-1
Project Demand Projections – Basis for Treatment O&M Costs

Distribution Themes	Cost/1,000 gallons
Distribution System - Theme D1	
Stanley Draper WTP	$0.36
Seminole WTP	$0.37
Shawnee WTP	$0.37
Distribution System - Theme D2	
Stanley Draper WTP	$0.36
Thunderbird Regional WTP	$0.36
COWRA Regional WTP	$0.36
Edmond WTP	$0.36
Seminole WTP	$0.37
Shawnee WTP	$0.37
Distribution System - Theme D3	
Stanley Draper WTP	$0.36
Norman WTP	$0.22
COWRA Regional WTP	$0.36
Edmond WTP	$0.36
Del City WTP	$0.22
Midwest City WTP	$0.22
Moore WTP	$0.36
Chickasha WTP	$0.22
Seminole WTP	$0.37
Shawnee WTP	$0.37

Table 10-2
Water Treatment Plant (WTP)
Variable Operating Costs per 1,000 Gallons

Participants	Demand 2020 (mgd)	Annual Variable Costs 2020	Demand 2040 (mgd)	Annual Variable Costs 2040	Demand 2060 (mgd)	Annual Variable Costs 2060
OKC ($0.36/1,000 gal.)	23.73	$3,118,000	61.20	$8,041,000	108.69	$14,282,000
Norman ($0.36/1,000 gal.)	4.96	$652,000	13.63	$1,791,000	23.67	$3,110,000
Chickasha ($0.36/1,000 gal.)	5.60	$736,000	6.00	$788,000	6.40	$841,000
Del City ($0.36/1,000 gal.)	1.50	$197,000	1.50	$197,000	1.50	$197,000
Midwest City ($0.36/1,000 gal.)	-	$0	0.40	$53,000	1.70	$223,000
Moore ($0.36/1,000 gal.)	8.40	$1,104,000	9.50	$1,248,000	10.50	$1,380,000
COWRA ($0.36/1,000 gal.)	14.10	$1,853,000	20.00	$2,629,000	20.00	$2,629,000
Edmond ($0.36/1,000 gal.)	4.20	$552,000	10.70	$1,406,000	18.70	$2,457,000
Seminole ($0.36/1,000 gal.)	2.20	$289,000	3.10	$407,000	4.00	$526,000
Shawnee ($0.37/1,000 gal.)	3.20	$432,000	3.60	$486,000	4.00	$540,000
Total	67.89		129.63		199.17	

Table 10-3
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Annual Variable Operating Costs

Distribution Themes	Deferred Projects
Distribution System - Theme D1	
Stanley Draper WTP	Deferred
OKC Pipeline to Norman	Deferred
Atoka Pipeline to Seminole	Deferred
Distribution System - Theme D2	
Stanley Draper WTP	Deferred
Thunderbird Pipeline to Del City	Deferred
Thunderbird Pipeline to Midwest City	Deferred
Thunderbird Pipeline to Norman	Deferred
Atoka Pipeline to Seminole	Deferred
Distribution System - Theme D3	
Stanley Draper WTP	Deferred
Norman WTP	Deferred
Mustang Regional WTP	Deferred
Edmond WTP	Deferred
OKC Pipeline to Norman	Deferred
OKC Pipeline to Del City	Deferred
OKC Pipeline to Midwest City	Deferred
OKC Pipeline to Edmond	Deferred
Atoka Pipeline to Seminole	Deferred

Table 10-4
Water Treatment Plant (WTP) and Pipeline Deferred Projects

The project costs shown on **Table 10-5** represent total capital costs per participant. In order to annualize these costs and categorize them as either immediate or deferred, the annual debt service payments are calculated. The assumptions regarding the calculation of the annual debt service payments are as follows:

- Term – 30 years
- Interest – 6 percent
- Issuance Costs – 1 percent
- Debt Service Reserve – 10 percent

Table 10-6 presents the annual debt service payments categorized as either immediate or deferred.

	Transmission - Atoka to Seminole & Shawnee (Table 9-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 9-5)	Supply - Moyers Crossing to Atoka (Table 9-7)	Sardis Debt Service (Table 9-10)	Distribution Pipeline - D1 Immediate (Table 9-2)	Distribution Pipeline - D1 Deferred (Table 9-2)	Stanley Draper WTP - D1 Deferred (Table 9-13)	Total Project Costs
OKC	$370,800,000	$78,300,000	$128,544,000	$28,840,000	$0	$0	$401,712,000	$1,008,196,000
Norman	138,600,000	29,160,000	48,048,000	10,780,000	-	20,089,200	113,616,000	360,293,200
Chickasha	37,800,000	7,920,000	13,104,000	2,940,000	80,800,800	-	30,720,000	173,284,800
Del City	9,000,000	1,800,000	3,120,000	700,000	-	-	7,200,000	21,820,000
Midwest City	9,900,000	2,160,000	3,432,000	770,000	-	-	8,160,000	24,422,000
Moore	61,200,000	12,960,000	21,216,000	4,760,000	-	-	50,400,000	150,536,000
COWRA	117,000,000	24,660,000	40,560,000	9,100,000	-	-	48,000,000	239,320,000
Edmond	108,900,000	23,040,000	37,752,000	8,470,000	-	-	89,760,000	267,922,000
Seminole	23,400,000	-	8,112,000	1,820,000	-	44,184,000	-	77,516,000
Shawnee	23,400,000	-	8,112,000	1,820,000	-	-	-	33,332,000
Total	**$900,000,000**	**$180,000,000**	**$312,000,000**	**$70,000,000**	**$80,800,800**	**$64,273,200**	**$749,568,000**	**$2,356,642,000**

Table 10-5
Recommended Alternative
Supply from Moyers Crossing and Distribution D1

Participants	Total Capital Costs Immediate (Table 10-5)	Total Capital Costs Deferred (Table 10-5)	Annual Debt Service - Immediate Projects	Annual Debt Service - Deferred Projects	Total Annual Debt Service
OKC	$606,484,000	$401,712,000	$48,907,000	$32,394,000	$81,301,000
Norman	226,588,000	133,705,200	18,272,000	10,782,000	29,054,000
Chickasha	142,564,800	30,720,000	11,496,000	2,477,000	13,973,000
Del City	14,620,000	7,200,000	1,179,000	581,000	1,760,000
Midwest City	16,262,000	8,160,000	1,311,000	658,000	1,969,000
Moore	100,136,000	50,400,000	8,075,000	4,064,000	12,139,000
COWRA	191,320,000	48,000,000	15,428,000	3,871,000	19,299,000
Edmond	178,162,000	89,760,000	14,367,000	7,238,000	21,605,000
Seminole	33,332,000	44,184,000	2,688,000	3,563,000	6,251,000
Shawnee	33,332,000	-	2,688,000	-	2,688,000
Total	$1,542,800,800	$813,841,200	$124,411,000	$65,628,000	$190,039,000

Table 10-6
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Annual Debt Service

10.3 Unit Cost Results for Participants

The annual variable operating costs and the annual debt service costs are presented per participant based on the above data. In addition, the pumping operating costs are included per Section 8 information. The existing annual costs (operating and debt service) are added to the new costs in arriving at total annual costs.

Table 10-7 presents the results of this analysis for OKC. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

OKC - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$606,484,000	$1,008,196,000	$1,008,196,000
Projected Annual Debt Service (Table 9-6)	$48,907,000	$81,301,000	$32,394,000
Coverage Requirement (20%)	9,781,400	16,260,200	6,478,800
O&M Costs Pumping	-	-	4,346,656
O&M Costs Allocated to Participant (Table 9-3)	3,118,000	8,041,000	14,282,000
Total New Costs	$61,806,400	$105,602,200	$57,501,456
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$123,000,844**	**$166,796,644**	**$118,695,900**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base*	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$123,000,844	$166,796,644	$118,695,900
Percent Increase in User Fee Revenue	38.30%	44.45%	-20.82%
Annual Charge per Connection - Existing (6,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$288.94	$301.79	$165.41
Monthly Charge per Connection - Projected	$24.08	$25.15	$13.78
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.14	$4.73	$1.45

* Annual customer growth assumption 1.3139%.

Table 10-7
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
OKC – Annual and Unit Costs

Table 10-8 presents the results of this analysis for Seminole. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Seminole - Moyers Crossing/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Table 9-6)	$33,332,000	$83,785,000	$83,785,000
Projected Annual Debt Service (Table 9-6)	$2,688,000	$6,251,000	$3,563,000
Coverage Requirement (20%)	537,600	1,250,200	712,600
O&M Costs Pumping	511,272	702,654	994,228
O&M Costs Allocated to Participant (Table 9-3)	297,000	419,000	540,000
Total New Costs	$4,033,872	$8,622,854	$5,809,828
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,856,467**	**$9,445,449**	**$6,632,423**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base*	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,856,467	$9,445,449	$6,632,423
Percent Increase in User Fee Revenue	429.78%	665.03%	298.85%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,352.22	$1,952.67	$1,018.02
Monthly Charge per Connection - Projected	**$112.69**	**$162.72**	**$84.84**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.02**	**$7.62**	**$3.98**

* Annual customer growth assumption 1.5%.

Table 10-8
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Seminole – Annual and Unit Costs

Table 10-9 presents the results of this analysis for Shawnee. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Shawnee - Moyers Crossing/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Table 9-6)	$33,332,000	$33,332,000	$33,332,000
Projected Annual Debt Service (Table 9-6)	$2,688,000	$2,688,000	$0
Coverage Requirement (20%)	537,600	537,600	-
O&M Costs Pumping	696,120	749,121	900,573
O&M Costs Allocated to Participant (Table 9-3)	432,000	486,000	540,000
Total New Costs	$4,353,720	$4,460,721	$1,440,573
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,105,903**	**$10,212,904**	**$7,192,756**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,105,903	$10,212,904	$7,192,756
Percent Increase in User Fee Revenue	138.14%	115.66%	36.10%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$658.41	$596.25	$376.30
Monthly Charge per Connection - Projected	**$54.87**	**$49.69**	**$31.36**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.73**	**$3.39**	**$0.99**

* Annual customer growth assumption 0.55%.

Table 10-9
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Shawnee – Annual and Unit Costs

Table 10-10 presents the results of this analysis for Edmond. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Edmond - Moyers Crossing/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Table 9-6)	$178,162,000	$267,908,848	$267,908,848
Projected Annual Debt Service (Table 9-6)	$14,367,000	$21,605,000	$7,238,000
Coverage Requirement (20%)	2,873,400	4,321,000	1,447,600
O&M Costs Pumping	907,864	2,206,948	4,166,476
O&M Costs Allocated to Participant (Table 9-3)	552,000	1,406,000	2,457,000
Total New Costs	$18,700,264	$29,538,948	$15,309,076
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$31,463,206**	**$42,301,890**	**$28,072,018**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$31,463,206	$42,301,890	$28,072,018
Percent Increase in User Fee Revenue	69.38%	59.39%	-25.97%
Annual Charge per Connection - Existing (6,000 gal./month)	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$462.82	$435.52	$202.29
Monthly Charge per Connection - Projected	**$38.57**	**$36.29**	**$16.86**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.20**	**$7.56**	**$2.24**

* Annual customer growth assumption 1.8%.

Table 10-10
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Edmond – Annual and Unit Costs

Table 10-11 presents the results of this analysis for Norman. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Norman - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$226,588,000	$366,805,912	$366,805,912
Projected Annual Debt Service (Table 9-6)	$18,272,000	$29,054,000	$10,782,000
Coverage Requirement (20%)	3,654,400	5,810,800	2,156,400
O&M Costs Pumping	1,072,577	2,819,013	5,324,799
O&M Costs Allocated to Participant (Table 9-3)	652,000	1,791,000	3,110,000
Total New Costs	**$23,650,977**	**$39,474,813**	**$21,373,199**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$32,267,521**	**$48,091,357**	**$29,989,743**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$32,267,521	$48,091,357	$29,989,743
Percent Increase in User Fee Revenue	87.31%	107.28%	-4.03%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$361.89	$400.46	$185.41
Monthly Charge per Connection - Projected	**$30.16**	**$33.37**	**$15.45**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.06**	**$7.93**	**$2.47**

* Annual customer growth assumption 1.5%.

Table 10-11
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Norman – Annual and Unit Costs

Table 10-12 presents the results of this analysis for Moore. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Moore - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$100,136,000	$150,575,120	$150,575,120
Projected Annual Debt Service (Table 9-6)	$8,075,000	$12,139,000	$4,064,000
Coverage Requirement (20%)	1,615,000	2,427,800	2,427,800
O&M Costs Pumping	1,815,727	1,959,440	2,339,465
O&M Costs Allocated to Participant (Table 9-3)	1,104,000	1,248,000	1,380,000
Total New Costs	**$12,609,727**	**$17,774,240**	**$10,211,265**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,281,510**	**$22,446,023**	**$14,883,048**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,281,510	$22,446,023	$14,883,048
Percent Increase in User Fee Revenue	130.46%	168.23%	59.38%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$710.74	$827.23	$491.51
Monthly Charge per Connection - Projected	**$59.23**	**$68.94**	**$40.96**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.11**	**$5.13**	**$2.66**

* Annual customer growth assumption 0.55%.

Table 10-12
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Moore – Annual and Unit Costs

Table 10-13 presents the results of this analysis for Chickashee. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Chickashee - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$152,172,000	$182,783,328	$182,783,328
Projected Annual Debt Service (Table 9-6)	$11,496,000	$13,973,000	$2,477,000
Coverage Requirement (20%)	2,299,200	2,794,600	495,400
O&M Costs Pumping	1,267,385	1,306,806	1,509,211
O&M Costs Allocated to Participant (Table 9-3)	736,000	788,000	841,000
Total New Costs	**$15,798,585**	**$18,862,406**	**$5,322,611**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$17,470,182**	**$20,534,003**	**$6,994,208**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$17,470,182	$20,534,003	$6,994,208
Percent Increase in User Fee Revenue	694.09%	580.81%	69.15%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,257.84	$1,078.40	$267.93
Monthly Charge per Connection - Projected	**$104.82**	**$89.87**	**$22.33**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$7.73**	**$8.61**	**$2.28**

* Annual customer growth assumption 1.59%.

Table 10-13
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Chickasha – Annual and Unit Costs

Table 10-14 presents the results of this analysis for Midwest City. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Midwest City - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$16,262,000	$24,262,688	$24,262,688
Projected Annual Debt Service (Table 9-6)	$1,311,000	$1,969,000	$658,000
Coverage Requirement (20%)	262,200	393,800	131,600
O&M Costs Pumping	-	82,503	378,771
O&M Costs Allocated to Participant (Table 9-3)	-	53,000	223,000
Total New Costs	**$1,573,200**	**$2,498,303**	**$1,391,371**
Projected Connections in Year 2020/2040/2060*	19,370	27,729	39,696
Incremental Cost per Connection	$81.22	$90.10	$35.05
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$380.14	$389.02	$333.97
Monthly Charge per Connection - Projected	**$31.68**	**$32.42**	**$27.83**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.11**	**$2.24**

* Annual customer growth assumption 2%.

Table 10-14
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Midwest City – Annual and Unit Costs

Table 10-15 presents the results of this analysis for Mustang. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Mustang is a participant of the COWRA group. The previous sections of this report treated the costs in total for COWRA. The cost for each COWRA participant is presented individually in this section. Mustang has requested 4.5 mgd in capacity in the project, or 22.5 percent of the 20 mgd total COWRA capacity. Therefore, the previous COWRA amounts will reflect 22.5 percent of the total.

Mustang - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$43,047,000	$53,847,929	$53,847,929
Projected Annual Debt Service (Table 9-6)	3,471,300	4,342,275	$870,975
Coverage Requirement (20%)	694,260	868,455	174,195
O&M Costs Pumping	762,098	1,043,019	1,117,508
O&M Costs Allocated to Participant (Table 9-3)	416,925	591,525	591,525
Total New Costs	**$5,344,583**	**$6,845,274**	**$2,754,203**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,149,593**	**$10,650,284**	**$6,559,213**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,149,593	$10,650,284	$6,559,213
Percent Increase in User Fee Revenue	269.48%	183.81%	15.35%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,008.68	$774.81	$314.90
Monthly Charge per Connection - Projected	**$84.06**	**$64.57**	**$26.24**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.90**	**$6.48**	**$3.99**

* Annual customer growth assumption 2.1%.

Table 10-15
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Mustang – Annual and Unit Costs

Table 10-16 presents the results of this analysis for El Reno. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

El Reno is a participant of the COWRA group. The previous sections of this report treated the costs in total for COWRA. The cost for each COWRA participant is presented individually in this section. El Reno has requested 4.5 mgd in capacity in

the project, or 22.5 percent of the 20 mgd total COWRA capacity. Therefore, the previous COWRA amounts will reflect 22.5 percent of the total.

El Reno - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$43,047,000	$53,847,929	$53,847,929
Projected Annual Debt Service (Table 9-6)	$3,471,300	$4,342,275	$870,975
Coverage Requirement (20%)	694,260	868,455	174,195
O&M Costs Pumping	762,098	1,043,019	1,117,508
O&M Costs Allocated to Participant (Table 9-3)	416,925	591,525	591,525
Total New Costs	**$5,344,583**	**$6,845,274**	**$2,754,203**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,590,754**	**$10,091,445**	**$6,000,374**
Existing User Fee Revenues - Increased for 2020/2040/2060* Customer Base	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,590,754	$10,091,445	$6,000,374
Percent Increase in User Fee Revenue	182.06%	144.55%	7.33%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$838.73	$727.20	$319.15
Monthly Charge per Connection - Projected	**$69.89**	**$60.60**	**$26.60**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.42**	**$6.14**	**$3.65**

* Annual customer growth assumption 1.53%.

Table 10-16
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
El Reno – Annual and Unit Costs

Table 10-17 presents the results of this analysis for Yukon. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Yukon is a participant of the COWRA group. The previous sections of this report treated the costs in total for COWRA. The cost for each COWRA participant is presented individually in this section. Yukon has requested 7 mgd in capacity in the

project, or 35 percent of the 20 mgd total COWRA capacity. Therefore, the previous COWRA amounts will reflect 22.5 percent of the total.

Yukon - Moyers/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Table 9-6)	$66,962,000	$83,763,445	$83,763,445
Projected Annual Debt Service (Table 9-6)	$5,399,800	$6,754,650	$1,354,850
Coverage Requirement (20%)	1,079,960	1,350,930	270,970
O&M Costs Pumping	1,185,486	1,622,475	1,738,346
O&M Costs Allocated to Participant (Table 9-3)	648,550	920,150	920,150
Total New Costs	**$8,313,796**	**$10,648,205**	**$4,284,316**
Projected Connections in Year 2020/2040/2060*	10,683	15,874	23,588
Incremental Cost per Connection	$778.26	$670.80	$181.63
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,067.94	$960.48	$471.31
Monthly Charge per Connection - Projected	**$88.99**	**$80.04**	**$39.28**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.18**	**$6.48**	**$2.61**

* Annual customer growth assumption 2%.

Table 10-17
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Yukon – Annual and Unit Costs

Table 10-18 presents the results of this analysis for Calumet. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Calumet is a participant of the COWRA group. The previous sections of this report treated the costs in total for COWRA. The cost for each COWRA participant is presented individually in this section. Calumet has requested 0.5 mgd in capacity in the project, or 2.5 percent of the 20 mgd total COWRA capacity. Therefore, the previous COWRA amounts will reflect 22.5 percent of the total.

Calumet - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$4,783,000	$5,983,103	$5,983,103
Projected Annual Debt Service (Table 9-6)	$385,700	$482,475	$96,775
Coverage Requirement (20%)	77,140	96,495	19,355
O&M Costs Pumping	84,678	115,891	124,168
O&M Costs Allocated to Participant (Table 9-3)	46,325	65,725	65,725
Total New Costs	**$593,843**	**$760,586**	**$306,023**
Projected Connections in Year 2020/2040/2060*	400	507	642
Incremental Cost per Connection	$1,484.61	$1,500.85	$476.64
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,802.61	$1,818.85	$794.64
Monthly Charge per Connection - Projected	**$150.22**	**$151.57**	**$66.22**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.62**	**$4.17**	**$1.68**

* Annual customer growth assumption 1.19%.

Table 10-18
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Calumet – Annual and Unit Costs

Table 10-19 presents the results of this analysis for Okarche. The projected cost per residence is based on an average monthly use of 6,000 gallons, with the existing rate multiplied by the incremental percent required for the project (shown for 2020, 2040, 2060). The project costs are also calculated as a cost per 1,000 gallons for the same years.

Okarche is a participant of the COWRA group. The previous sections of this report treated the costs in total for COWRA. The cost for each COWRA participant is presented individually in this section. Okarche has requested 0.5 mgd in capacity in the project, or 2.5 percent of the 20 mgd total COWRA capacity. Therefore, the previous COWRA amounts will reflect 22.5 percent of the total.

Okarche - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)	Treated Water - Immediate & Deferred Projects (Year 2040)	Treated Water - Immediate & Deferred Projects (Year 2060)
Capital Costs Allocated to Participant (Table 9-6)	$4,783,000	$5,983,103	$5,983,103
Projected Annual Debt Service (Table 9-6)	$385,700	$482,475	$96,775
Coverage Requirement (20%)	77,140	96,495	19,355
O&M Costs Pumping	84,678	115,891	124,168
O&M Costs Allocated to Participant (Table 9-3)	46,325	65,725	65,725
Total New Costs	**$593,843**	**$760,586**	**$306,023**
Projected Connections in Year 2020/2040/2060*	768	1,089	1,543
Incremental Cost per Connection	$773.23	$698.63	$198.29
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,276.99	$1,202.39	$702.05
Monthly Charge per Connection - Projected	**$106.42**	**$100.20**	**$58.50**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.62**	**$4.17**	**$1.68**

* Annual customer growth assumption 1.76%.

Table 10-19
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
Okarche – Annual and Unit Costs

10.4 Unit Cost Summary

There were two elements of unit costs presented above; a monthly charge per connection and a cost of the project per 1,000 gallons. **Table 10-20** presents a comparison of the monthly cost per connection for all participants. **Table 10-21** presents a comparison of the cost of the project per 1,000 gallons.

Summary of All Participants - Moyers/D1	Treated Water - Immediate Projects Only (Year 2020)		Treated Water - Immediate Projects Only (Year 2040)		Treated Water - Immediate Projects Only (Year 2060)	
Participants	**Monthly Charge per Connection - Existing**	**Monthly Charge per Connection - Projected**	**Monthly Charge per Connection - Existing**	**Monthly Charge per Connection - Projected**	**Monthly Charge per Connection - Existing**	**Monthly Charge per Connection - Projected**
OKC	$17.41	$24.08	$17.41	$25.15	$17.41	$13.78
Seminole	$21.27	$112.69	$21.27	$162.72	$21.27	$84.84
Shawnee	$23.04	$54.87	$23.04	$49.69	$23.04	$31.36
Edmond	$22.77	$38.57	$22.77	$36.29	$22.77	$16.86
Norman	$16.10	$30.16	$16.10	$33.37	$16.10	$15.45
Moore	$25.70	$59.23	$25.70	$68.94	$25.70	$40.96
Chickashee	$13.20	$104.82	$13.20	$89.87	$13.20	$22.33
Midwest City	$24.91	$31.68	$24.91	$32.42	$24.91	$27.83
Mustang	$22.75	$84.06	$22.75	$64.57	$22.75	$26.24
El Reno	$24.78	$69.89	$24.78	$60.60	$24.78	$26.60
Yukon	$24.14	$88.99	$24.14	$80.04	$24.14	$39.28
Calumet	$26.50	$150.22	$26.50	$151.57	$26.50	$66.22
Okarche	$41.98	$106.42	$41.98	$100.20	$41.98	$58.50

Table 10-20
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
All Participants – Monthly Cost/Connection

Participants	New Costs/1,000 Gallons (Year 2020)	New Costs/1,000 Gallons (Year 2040)	New Costs/1,000 Gallons (Year 2060)
OKC	$7.14	$4.73	$1.45
Seminole	$5.02	$7.62	$3.98
Shawnee	$3.73	$3.39	$0.99
Edmond	$12.20	$7.56	$2.24
Norman	$13.06	$7.93	$2.47
Moore	$4.11	$5.13	$2.66
Chickashee	$7.73	$8.61	$2.28
Midwest City	$0.00	$17.11	$2.24
Mustang	$7.90	$6.48	$3.99
El Reno	$7.42	$6.14	$3.65
Yukon	$7.18	$6.48	$2.61
Calumet	$4.62	$4.17	$1.68
Okarche	$4.62	$4.17	$1.68

Table 10-21
Recommended Alternative
Supply from Moyers Crossing and Distribution D1
All Participants – Annual Unit Costs (Tables 10-7 through 10-19)

Section 11
Comparison of Alternatives

11.1 Introduction

This section summarizes the process and method to compare the system-wide alternatives or system alternatives. System alternatives are composed of alternatives for the southeast Oklahoma part of the system (source alternatives and intermediate delivery alternatives) and the central Oklahoma part of the system (delivery alternatives). The source, intermediate delivery and delivery alternatives (the "building blocks" of the system alternatives) were described in Section 3.

The objective of the system alternative comparison and ranking was to define, in a defensible and transparent way, a viable system alternative as a starting point for subsequent phases of the project. Subsequent phases include environmental documentation, a selection of a definitive source selection, route and alignment verification and preliminary design. In order to identify a consented system alternative, a multi criteria ranking approach was selected. The process to implement that approach and the results of the process are presented in this section.

11.2 Alternatives Comparison Approach

In order to support the identification of a system alternative, a decision model was developed based on the Multi-Attribute Rating methodology. Developing such a decision model is wise when there are multiple alternatives that can be measured differently against multiple criteria, and when no single alternative is clearly the "best" in all areas. In these cases, systematizing the decision process by explicitly defining and weighting criteria and then giving scores to the alternatives for those criteria can make the ultimate decision easier and more objective.

For this study, developing a decision model proceeded along two parallel paths:

- Defining and characterizing alternatives; and
- Defining and weighting criteria.

Figure 11-1 shows a graphical simplification of the decision model process. Initially, the two paths are independent. The decision makers first identify what ranking criteria are important to consider in making their decision and the relative importance of those criteria. A parallel path in the decision process involves identifying and evaluating the various alternatives. The two paths eventually merge in the technical analysis where the alternatives are evaluated in terms of each one of the criteria (characterized in terms of costs, implementability, etc.). The decision model is the last step where the alternatives are compared against each other in terms of how well they meet the project criteria.

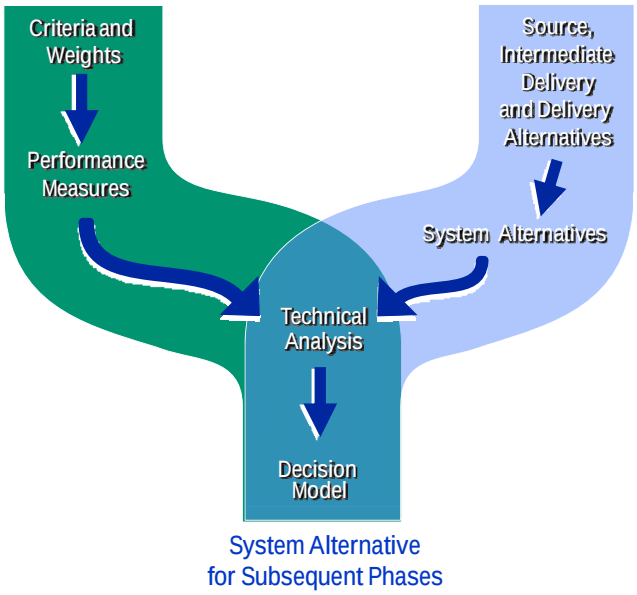


Figure 11-1
Alternative Analysis and Ranking Path

11.2.1 Defining the Ranking Criteria

Four decision criteria were identified by the cities as relevant for the system alternative evaluation and ranking. Criteria were defined to have the following properties:

- Relevant: They should distinguish between one alternative and another
- Measurable: They should be measured either quantitatively or qualitatively
- Non-Redundant: They should not duplicate the intent of one another
- Understandable: They should be easy to communicate

For each criterion, a performance measure is required. The performance measure indicates how well the criteria are being met. The performance measures can be quantitative (such as cost measured in dollars) or qualitative (such as implementation barrier measured in low, medium, high). Performance measures become the specific criteria by which the alternatives are compared against each other.

Five decision criteria were identified by the cities as relevant for the system alternative evaluation and ranking. One of the criteria related to regional opportunities was considered during the process but not used for ranking given that it did not play a role in differentiating system alternatives since all of them included regional solutions and opportunities. The four remaining criteria for evaluation and ranking are shown in **Figure 11-2** including their associated performance measures.

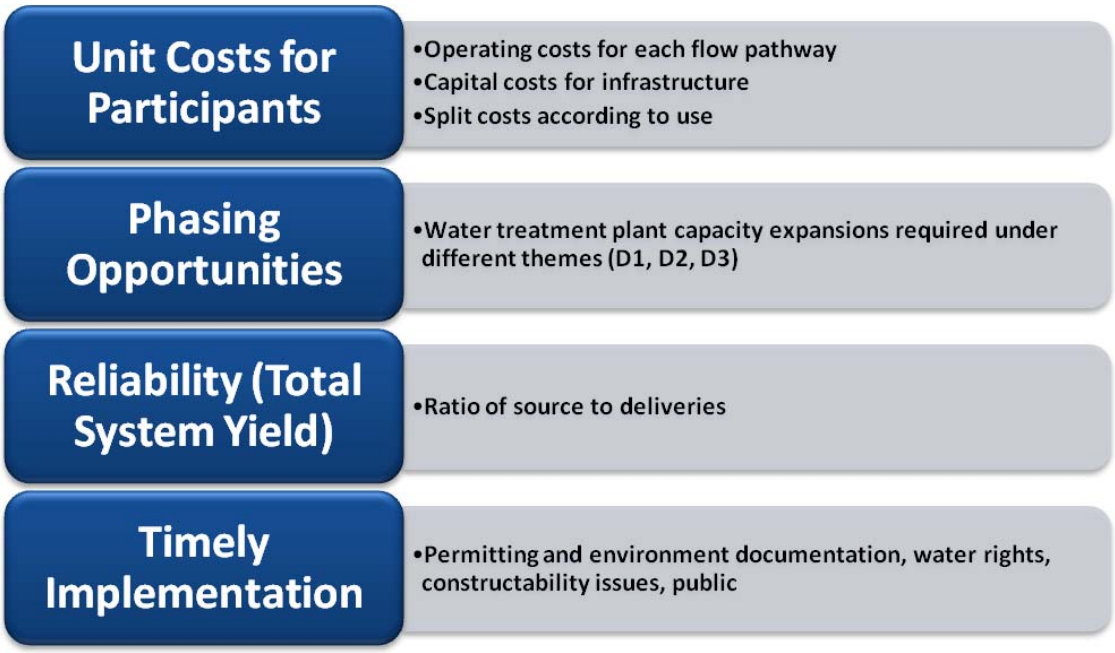


Figure 11-2
System Alternatives Evaluation Criteria and Associated Performance Measures

11.2.2 Weighting the Criteria

In order to determine the relative weights of the criteria, the cities participated in a weighting exercise where 100 points were allocated to the four criteria. The results of the individual (i.e., by city) weighting exercise were preserved instead of estimating an average weight for the group. This preservation of individual weights is an important element in the ranking process since the different cities value the criteria differently and a group average (for a heterogeneous group) typically results in weights that do not closely reflect the interests of any one of the individual participants. Results of the criteria weighting exercise are presented in **Figures 11-3** and **11-4** show the results of the weighting exercise. **Figure 11-3** shows that the criterion with the highest maximum, minimum and average weight was the Unit Cost, followed by the System Reliability. **Figure 11-4** shows that those two criteria were consistently in the top 2 criteria out of four. Every city consider these criteria as either top 1 or top 2, which turned out to have significant relevance in how the system alternatives ranked as presented later in the section.

11.2.3 Use of the Criteria in Evaluation and Ranking of the Alternatives

In order to use the decision model to rank the system alternatives, each system alternative had to be characterized in terms of the performance measures listed in **Figure 11-2** above. **Table 11-1** presents the performance measures and a description of how the values for each measure were estimated. As explained above and illustrated in the table, some of the performance measures were quantitative (resulting from the

engineering and cost analysis) and some were qualitative (using a unitless score based on engineering and planning judgment).

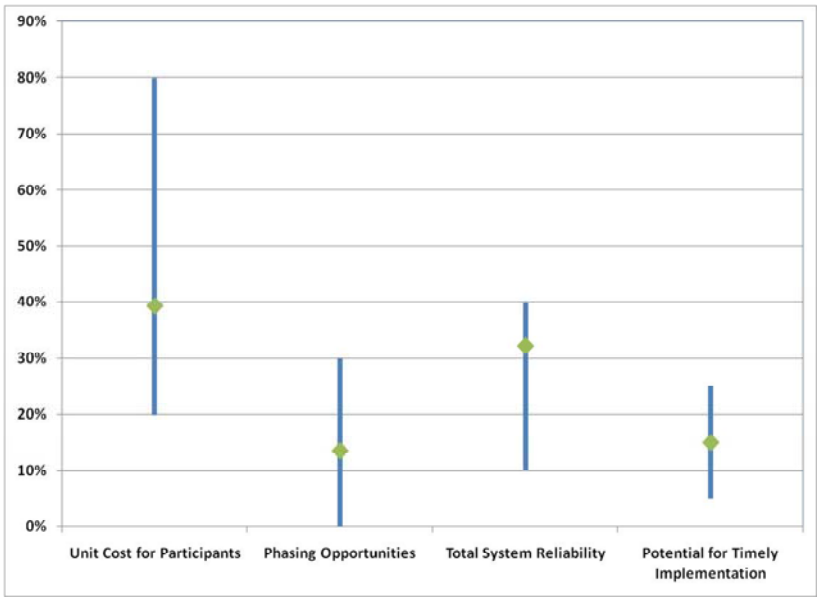


Figure 11-3
Maximum, Minimum and Average Weights Assigned to the Criteria by Participant Cities (average presented just for reference and not used in the ranking process)

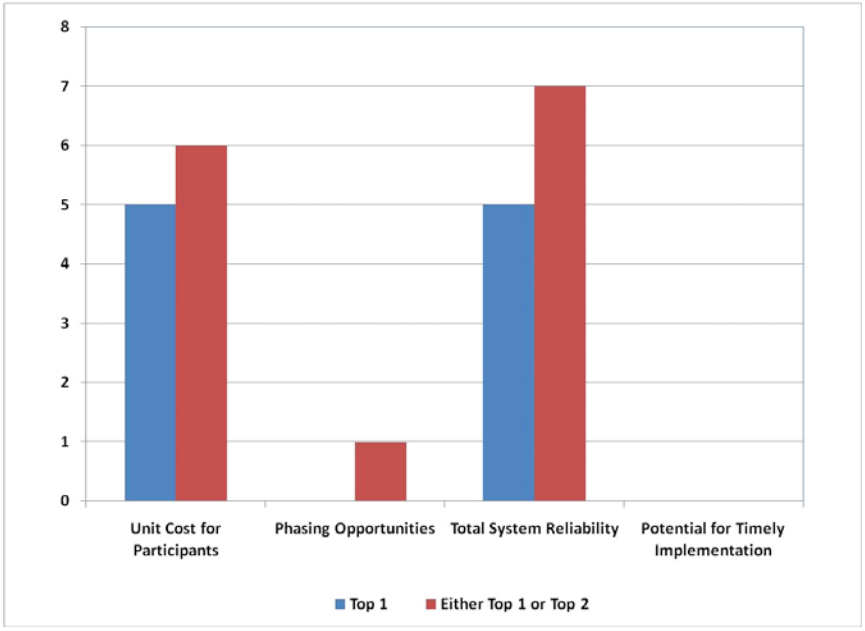


Figure 11-4
Number of Times Criteria is in the Top 1 or Top 2 According to the Weights Assigned by Participant Cities

Criteria	Performance Measure	Method to Estimate
Unit Cost for Participants	Capital Cost	Actual cost estimates described in Section 7
	O&M Cost	Actual cost estimates described in Section 8
System Reliability	Ratio of Source to Deliveries	Ratio of southeast Oklahoma system yield (source plus Atoka and McGee lake yields) to total water supplied in central Oklahoma
Phasing Opportunities	Phasing Potential	Qualitative score (1 to 5 scale) based on the actual estimates of water treatment plant capacity expansions from all plants included in the Delivery Alternatives
Timely Implementation	Public Perception	Qualitative score (1 to 5 scale) based on assumed public perception for each alternative
	Water Rights	Qualitative score (1 to 5 scale) based on knowledge of water right acquisition issues and vulnerability of source to pending water right allocations in southeast Oklahoma
	Constructability	Qualitative score (1 to 5 scale) based on routing analysis
	Permitting/Environmental	Qualitative score (1 to 5 scale) based on considerations describes in Section 6

Table 11-1
Performance Measures Estimates

11.3 System Alternatives

The permutations of source, intermediate delivery and delivery alternatives evaluated resulted in 12 system alternatives listed in **Table 11-2**. The table also includes the descriptor used in the analysis and the presentation of results, which is composed of a descriptor for source, intermediate delivery and delivery alternatives. The rest of the figures and tables in this section use the system alternatives descriptor included in **Table 11-2**.

System Alternative	Descriptor
Sardis – Atoka – D1	S_A_D1
Sardis – Atoka – D2	S_A_D2
Sardis – Atoka – D3	S_A_D3
Moyers Crossing – McGee – D1	M_MG_D1
Moyers Crossing – McGee – D2	M_MG_D2
Moyers Crossing – McGee – D3	M_MG_D3
Highway 3 - McGee – D1	HY_MG_D1
Highway 3 - McGee – D2	HY_MG_D2
Highway 3 - McGee – D3	HY_MG_D3
Hugo – McGee – D1	HG_MG_D1
Hugo – McGee – D2	HG_MG_D2
Hugo – McGee – D3	HG_MG_D3

Table 11-2
System Alternatives Analyzed and Descriptor Used in the Presentation of Results

11.4 Results of Evaluation and Ranking

11.4.1 Scenario Model

A systems model was developed to provide information to the various cities on every performance measure and generate the required inputs to the decision model. The Scenario Model's key outputs were:

- Reliability of the system for each city, measured as an individual city's demand on the regional system compared to the water delivered by the regional system
- Operation and maintenance costs of the overall system, from source to delivery
- Water treatment capacity expansions required under each delivery theme (D1, D2, D3)

Additional output included the capital costs allocation for the cities and the performance measures associated with environmental/permitting and timely implementation. These additional outputs however, were not estimated in the model but provided to the model as an input and converted into output after simple calculations.

The Scenario Model included functionality to add different demands for each city, include or exclude different cities as participants, run any demand year projected between 2010 and 2060, and select different combinations of source, intermediate delivery and delivery alternatives to construct system alternatives. The model was programmed to simulate demands vs. supply on a monthly unit time, for every hydrology type between 1935 and 1971 (consistent with the period of record used in the water availability analysis described in Section 4). The scenario model is described in detail in **Appendix G** and **Figure 11-5** includes a screenshot of one main panel of the model.

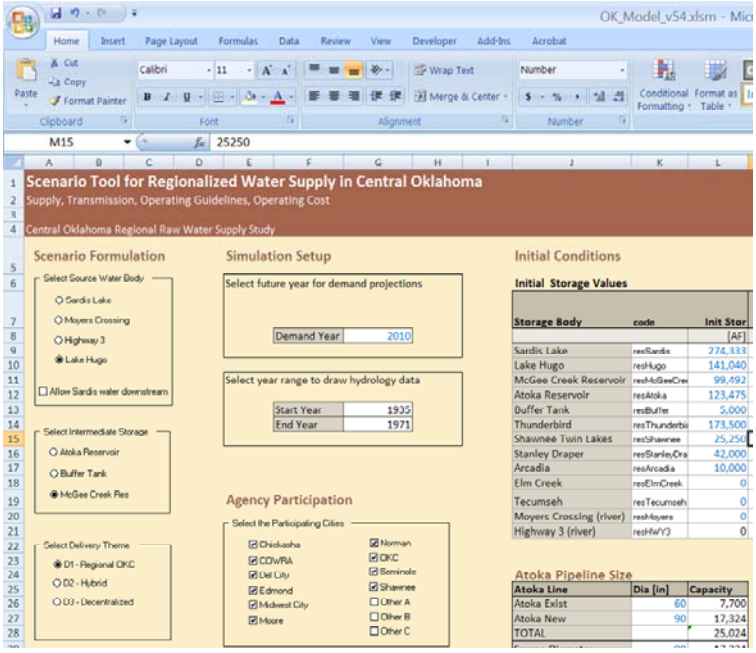


Figure 11-5
Screen Shot of the Scenario Model Used in System Alternatives Analysis

11.4.2 System Alternative Analysis Results

Costs to Participants

The capital and operation and maintenance costs associated with the alternatives were described in Sections 7 and 8. The system-wide costs, however, were not used in the individual ranking for each city. The costs for specific participant cities were developed based on the system-wide costs as described in Sections 9 and 10. The cost to participants on a capital and operation and maintenance basis, were used along the weights for a specific city.

System Reliability

The Scenario Tool estimated that every system alternative was able to fully meet the demands of each city (expectations from each city from the regional system), for every year simulated including 2060 and with no need for additional terminal storage (storage of raw water from southeast Oklahoma in central Oklahoma reservoirs). Based on that result, every alternative is a reliable alternative. As explained in **Table 11-1**, however, reliability was measured in terms of the ratio of the source availability to the total system delivery in order to account for uncertainty in estimated demands (demands could be higher than projected or local supplies could be lower than assumed into the future). In addition to uncertainty in demands, significant uncertainty can be present in the supply used in the analysis associates with pending water right allocations, dry periods more extreme than the driest period on record, and methodology inherent errors in the synthesis of the hydrology for the reservoirs in the system and water availability model.

The use of water availability compared to water supply requirements gives the decision-makers the opportunity to observe the sources (and system alternatives) that provide a more conservative position (more water available than it is assumed to be needed in this project). The system alternatives ranking takes into account that "buffer" inherent in the water sources.

Table 11-3 presents the ratios estimated for each of the system alternatives. In general, the Sardis alternatives are marginal in meeting the demands (ratios close to 1.0) as compared to the rest of the sources. It is important to mention that the ratios for all sources downstream of Sardis were estimated with the assumption that Sardis released could be controlled and will be available for supplementing the sources. This operating scheme and the resulting yields were explained in Section 4.

Phasing Opportunities

The Scenario Tool estimated the water treatment needs at each one of the treatment plant included in the system for each of the delivery teams. Then the model compared the treatment needs (for years starting in 2010, and continuing on to 2015, 2020, and 2025) with existing water treatment plant capacities. The result was used to define a qualitative phasing potential score for each system alternative, presented in **Table 11-3**. The scores are lower for the D2 theme due to the earlier need for additional capacity, driven by the nature of the theme were new plants are constructed to supply treated water to the participant cities.

Timely Implementation

Implementation was evaluated as a function of four elements, each included as a performance measure (**Table 11-1**). The performance measures on public perception, water rights, constructability and permitting/environmental were given scores for both southeast Oklahoma and central Oklahoma since the issues associated with the project and the projects themselves are different in the two parts of the state (delivery infrastructure in central Oklahoma vs. diversion and conveyance infrastructure in southeast Oklahoma). The resulting performance measure score used in the ranking was the average of the two scores.

Environmental/permitting considerations were described in Section 6. Public perception scores were assigned based on the anticipated responses to different elements of the project and constructability scores were defined based on routing analysis.

For water rights, the score was assigned based on knowledge of water right acquisition issues and vulnerability of source to pending water right allocations in southeast Oklahoma.

Summary of Criteria

With the exception of the costs performance measure, all other performance measure values are the same for all cities in the ranking process. A summary of results of all non-economic criteria are presented in **Table 11-3**.

Alternatives	Reliability (Source Over Delivery)	Public Perception	Water Rights	Constructability	Permitting/ Environmental	Phasing Potential
S_A_D1	1.1	2.5	2.5	4.5	3.5	3
S_A_D2	1.1	2.5	2.5	3.5	2.5	2
S_A_D3	1.2	3	2.5	2.5	2.5	3
M_MG_D1	2.4	3	3.5	4	3	3
M_MG_D2	2.4	3	3.5	3	2	2
M_MG_D3	2.6	3.5	3.5	2	2	3
HY_MG_D1	2.3	3.5	2.5	4	4	3
HY_MG_D2	2.3	3.5	2.5	3	3	2
HY_MG_D3	2.4	4	2.5	2	3	3
HG_MG_D1	2.4	3	2	4.5	4.5	3
HG_MG_D2	2.4	3	2	3.5	3.5	2
HG_MG_D3	2.6	3.5	2	2.5	3.5	3

Table 11-3
Summary of Non-Economic Performance Measures Used for the System Alternative Ranking

11.4.3 System Alternative Ranking

The ranking of system alternatives was developed for each participant city using their individual weights for the criteria and their individual cost allocation results using a commercial tool called CDP (decision support software developed by Infoharvest, Inc.). Because the Scenario model outputs and all performance measures have different units (e.g., reliability measured in AFY/AFY, cost measured in dollars, constructability in unitless score) a normalization of the performance was developed using the ranking tool which converted raw performance measured in different units into standardized scores. This technique is called multi-attribute rating and is illustrated in **Figure 11-6**.

Step 1 is to compare the raw performance of a given objective for all the alternatives. In this example, Alternative 6 has a raw cost (or performance) of $10 million.

Step 2 standardizes the raw performance score for each objective into comparable numeric scores (the higher the score the better the performance). In this example, Alternative 6 has relatively high costs when compared to the other alternatives, so the standardized score for this objective (between 0 and 10) is 3.4, a fairly low performance.

Steps 3 and 4 calculate the partial score for the alternative, based on the standardized score and the weight for the objective being calculated. In this example, the cost objective was given a weight of 9 percent (out of a possible 100 percent). The partial score for this objective is represents the standardized score (3.4) multiplied by the objective weight (0.09) which equals 0.306.

Step 5 plots the partial score of 0.306 for Alternative 6, and this procedure repeats for all of the other objectives for Alternative 6 until a total score for the project is calculated [see Step 6].

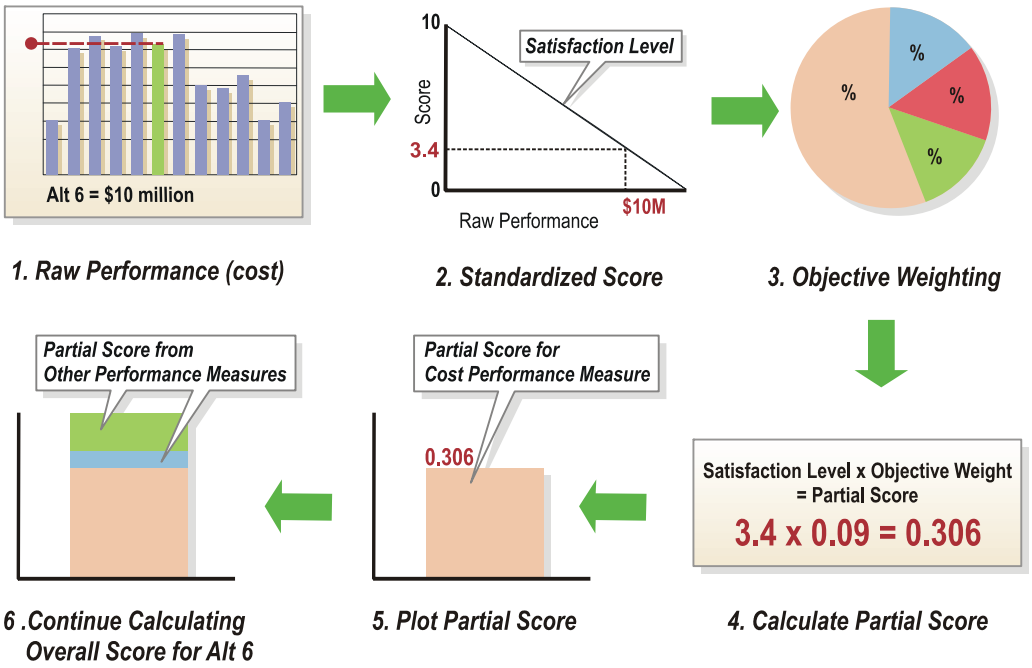


Figure 11-6
Example of the Multi-Attribute Rating Method

Using this technique a figure like the example presented in **Figure 11-7** was developed for each participant city.

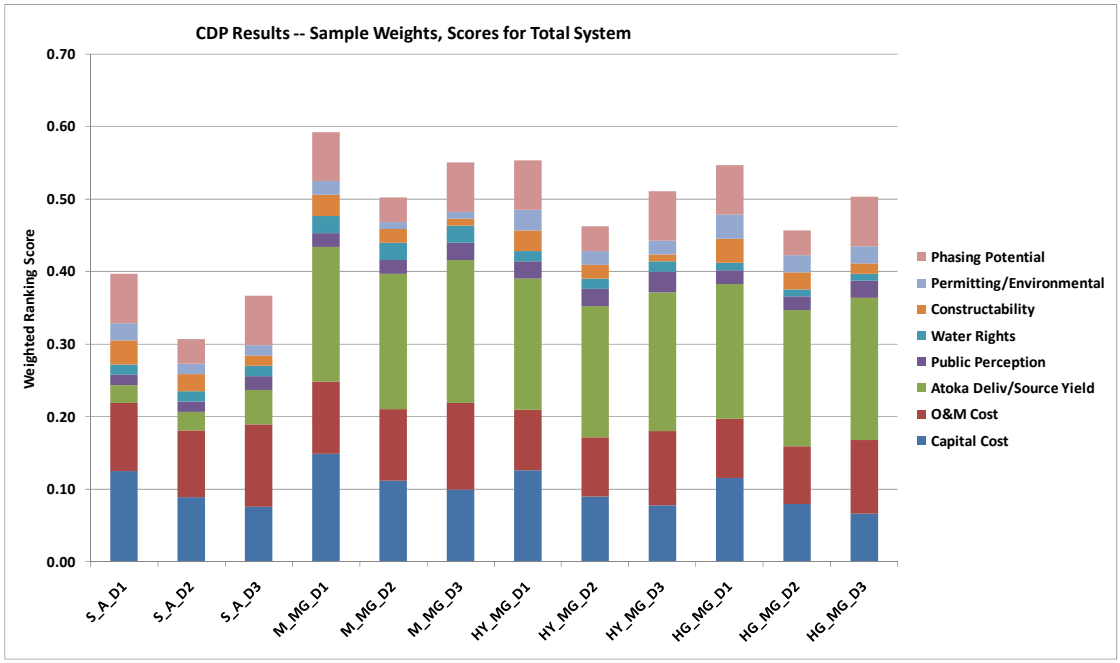


Figure 11-7
Ranking Stack Bar Showing the Contribution of Each Performance Measure to a Total Weighted Ranking Score

In the sample **Figure 11-7**, Alternatives with Moyers as a source perform better (have higher ranking scores). Generally, D1 as the delivery theme is also preferred over D3 and D2. These two trends (Moyers as apparent preferred source and D1 as apparent preferred delivery theme) can also be observed in **Figure 11-8**, where the weighted scores of each alternative have been tabulated for each participant city. The numbers in the cells are not relevant to the figure, but the cells have been conditionally formatted to with the color green for higher scores (preferred) and red as lower scores (not desirable). As the figure indicates D1 delivery and is generally preferred for each source alternative. Sardis is generally the least preferred source alternative, which is a result mostly driven by the reliability performance measure.

Figure 11-8 is driven by both, the individual weights assigned by each city and the performance measure values for all alternatives. The relevance of the individual weights is illustrated by comparing City G (the actual name of cities has been omitted to preserve anonymity) to other cities. City G gave a much higher weight to the cost criterion, making D2 significantly less desirable than D3 and D1 for a given source and all D2 alternatives less desirable than Sardis D1 and D3.

Regarding the reliability score of Sardis alternatives, driving the ranking scores low, it is important to keep in mind that the other sources (Moyers, Highway 3 and Hugo) all include Sardis releases making their reliability scores significantly higher. When Sardis is not available for releases to supplement the other sources, all sources are

relatively similar in yield as explained in Section 4. This highlights the importance of Sardis as a key part of the system.

The preference of D1 theme over the other two is due to the lower costs (particularly capital) associated with it. The costs of D1 may be higher than the costs used in this study. The assumption of existing treated water infrastructure being available for future deliveries will need to be tested in subsequent phases of the project with hydraulic modeling of the delivery systems.

Results of the alternative comparison point to the alternative with Moyers as a source, McGee Creek Reservoir as intermediate delivery and D1 as the delivery theme as the preliminary preferred alternative. This preliminary preferred alternative can serve as a starting point for subsequent phases on this project.

	S_A_D1	S_A_D2	S_A_D3	M_MG_D1	M_MG_D2	M_MG_D3	HY_MG_D1	HY_MG_D2	HY_MG_D3	HG_MG_D1	HG_MG_D2	HG_MG_D3
City A	0.36	0.28	0.33	0.57	0.49	0.53	0.55	0.48	0.51	0.56	0.48	0.52
City B	0.42	0.28	0.37	0.58	0.44	0.53	0.57	0.43	0.51	0.57	0.43	0.52
City C	0.39	0.24	0.36	0.61	0.47	0.57	0.59	0.44	0.54	0.59	0.44	0.54
City D	0.40	0.28	0.38	0.58	0.46	0.54	0.55	0.43	0.51	0.55	0.42	0.51
City E	0.35	0.35	0.38	0.57	0.56	0.58	0.53	0.53	0.54	0.52	0.52	0.54
City F	0.33	0.29	0.34	0.56	0.53	0.56	0.51	0.48	0.51	0.51	0.47	0.50
City G	0.65	0.28	0.68	0.73	0.35	0.75	0.69	0.31	0.71	0.68	0.30	0.70
Average	0.40	0.31	0.37	0.59	0.50	0.55	0.55	0.46	0.51	0.55	0.46	0.50

Figure 11-8
Color Ranking Map for All System Alternatives and All Participant Cities
[red indicates less desirable alternatives (lower ranking scores)
and green indicates preferred alternatives]

Section 12
Schedule of Future Activities

12.1 Introduction

Section 2 reported that the parallel Atoka Pipeline will need to be operational by 2020 in order to meet the participants' water supply needs. Storage rights from Sardis Lake should be acquired prior to the construction of any improvements. In addition, the infrastructure and additional water rights to deliver water from one of the four source water alternatives needs to be in place by 2030 to meet the participants' projected water demands.

In order to accomplish the 2020 and 2030 targets, a series of actions and projects will have to occur. These can be categorized as follows:

- Organizational
- Environmental & Permitting
- Water Rights
- Public Outreach
- Engineering & Construction
- Funding/Financing

This section reviews the major steps necessary to be able to operate the new Atoka Pipeline by 2020 and receive water from the selected diversion location by 2030.

12.2 Organizational Activities

To date, a group of metro area cities has collaborated to investigate the feasibility of bringing water from Southeast Oklahoma into the Oklahoma City metropolitan region as a long-term water supply source. This water will complement those supplies already secured and OCWUT's existing Atoka pipeline infrastructure. It is the intent of the participants, using the results from this report, to decide upon their individual participation in a proposed Oklahoma Regional Water Utility Trust to collectively acquire and deliver additional long-term water resources. To accomplish this goal, the following key organizational activities will be required:

- Oklahoma Regional Water Utility Trust (ORWUT) Formation – Participants will have to form the trust, establish a schedule of events and milestones needed for the project's success, and adopt a governance structure to manage and operate the project once it is in place.

- Agree upon the final Source Water Alternative – This report reviews feasible options, needed infrastructure, and probable costs. Results have pointed to some alternatives seemingly preferred, based on the set of criteria that was developed for the project evaluation, but the study does not recommend a source water alternative. Participants in the project will make a decision upon the preferred alternative following the completion of this report and subsequent work on the

environmental, permitting, water rights, engineering and public outreach areas described below.

- Execution of Local Agreements – With ORWUT formed, local agreements between the newly formed Trust and each participant will be required. These agreements will define each participant's commitment to ORWUT and establish the means of water delivery from the trust (either treated or raw) and other operational and management details.

- Individual Water Model Updates and Local Capital Program Planning – Participants will need to review their individual long-term water plans to ensure that their commitments to the trust meet their long-term community needs appropriately. In addition, each participant will need to review their systems' ability to receive and deliver water from the project at the rates projected through 2060. The system performance review through the development of a water system hydraulic model will ensure that future capital improvements in the future will adequately meet the long-term system demands.

- Individual Cost of Service Studies and Rate Adjustments – Participants will need to review their individual water rate structures to ensure that adequate revenue is available to meet the cost of participating in the ORWUT. Rate adjustments to meet the added cost of the long-term supply may be necessary. Depending on the financing options for the project, the timing and implementation of rate adjustments may be different for different project participants.

- Individual Water Plan Updates – Participants will need to review their long-term Water Plans to ensure that participating in ORWUT, at their chosen level of commitment, will adequately meet their systems' long-term needs. Projected demands were provided by participants' staff during the development of this study. Prior to executing a long-term local agreement with the newly formed ORWUT, Participants should review and update their individual long-term water supply plans.

12.3 Environmental and Permitting Activities

Due to the size and complexity of this project, it is anticipated that extensive environmental and permitting activities will be required prior to ultimate approval. These tasks, outlined in Section 6, should start as soon as possible. Initial discussions should commence immediately with state and federal environmental permitting agencies to more closely identify permitting requirements and timeframes. An EIS may be required for project implementation. With some EIS processes now taking 5 or more years to complete, environmental permitting can become the critical-path schedule item for water infrastructure projects.

Permitting requirements may help guide the selection of a source water alternative. The endangered and threatened species of mussels in the Moyer's region of the Kiamichi River may be a directing concern whereby water withdrawal impacts may

exceed to benefits of utilizing this region of the river. It is recommended that detailed environmental studies be initiated as soon as ORWUT members decide upon the source water alternative, to allow adequate time for environmental studies in the Kiamichi River Basin. Needed studies along the final pipeline alignment should start as soon as the route is finalized.

12.4 Water Rights Activities

Projections provided in Section 2 show that existing and pending OCWUT water permits are not adequate to meet the projected 2060 demands of the participants. To ensure adequate water supplies prior to construction of the project, it is recommended that water rights be secured at adequate levels to meet participant needs through 2060. The following tasks will be required:

- Establish the Final Cost for the Sardis Lake Debt Conflict Resolution – In this report it was assumed that the debt relief required for Sardis Lake will equal $70 million. The participants should initiate discussions with the USACE and OWRB to determine the final debt relief amount and take the necessary steps to resolve it.

- Amend Pending Sardis Lake Permit Application from 80,000 AFY to Meet Projected Needs – OCWUT has a pending permit request for water from Sardis Lake. This permit request was submitted following completion of the 2003 Water Plan update and is pending at this time. Additional rights beyond 80,000 AF will be needed to meet the 2060 demands of the participants.

- Acquire Storage Rights to Sardis Lake – With the outstanding debt issue resolved and the permit application amended and approved, it is recommended that storage rights in Sardis Lake be confirmed. ORWUT should initiate all necessary actions, working with USACE and OWRB, to secure these storage rights.

- Amend Permit Application to Reflect the Selected Source Alternative Diversion Point – The final source alternative and associated diversion point will have to be established based on the preferences of ORWUT participants. If the selected source alternative is not a direct diversion from Sardis Lake, the pending permit application may need to be amended to reflect the selected location. It is anticipated that this action would require OWRB approval.

12.5 Public Outreach Activities

Public communication of the project's benefit to all Oklahomans will be required to enhance public understanding and address any concerns that may surface. Given the project visibility, the details of a public outreach strategy need to be defined early in the process so the project can proceed with management that adheres to a well defined strategy.

12.6 Engineering and Construction Activities

Multiple engineering related tasks are required for the implementation of this project. Following are the activities, in general categories, required to be completed prior to the delivery of water by 2020.

- Finalize Route Analysis for Preferred Alternative
- Acquire Final Alignment and any Other Needed Easements
- Perform Site Surveys of Final Source Water Line Alignment
- Perform Site Survey of Existing Atoka Alignment
- Preliminary Design Activities to Support the Permitting Process
- Design Pump and Pipeline – Atoka Alignment
- Design Source Water Intake Structure
- Design Pump and Pipeline – Preferred Alignment

12.7 Funding and Financing Activities

In order to proceed forward with the various elements of this project, adequate funding will be required. Both short-term and long-term project funding will be needed. Initially, short-term project deliverables consisting of the Environmental and Permitting Activities, Water Rights Activities, Public Outreach, and Engineering tasks will need a funding source. The details regarding the establishment of the funding source or sources will be presented in a combination of the ORWUT establishing document and the local agreements.

The local agreements may also consist of two phases, with the first phase used to address the short-term project deliverables addressed above. The second phase of the agreement process would then address the route acquisition and construction costs and whether the participant is to receive water as an owner or a wholesale customer using either raw or treated water.

Due to the large project cost, it will be important for ORWUT to obtain firm agreements prior to securing financing. The strength of these agreements will then depend on the ability of each participant to demonstrate that their rates and fees are sufficient to provide for the capital being provided and also for their portion of the operation and maintenance costs. Therefore, it will be important for each participant to provide adequate rates and fees through a rate study or rate adjustment ordinance or resolution.

The specifics of the funding source, whether in total by ORWUT or individually per participant, will be determined within the local agreements.

12.8 Summary of Activities

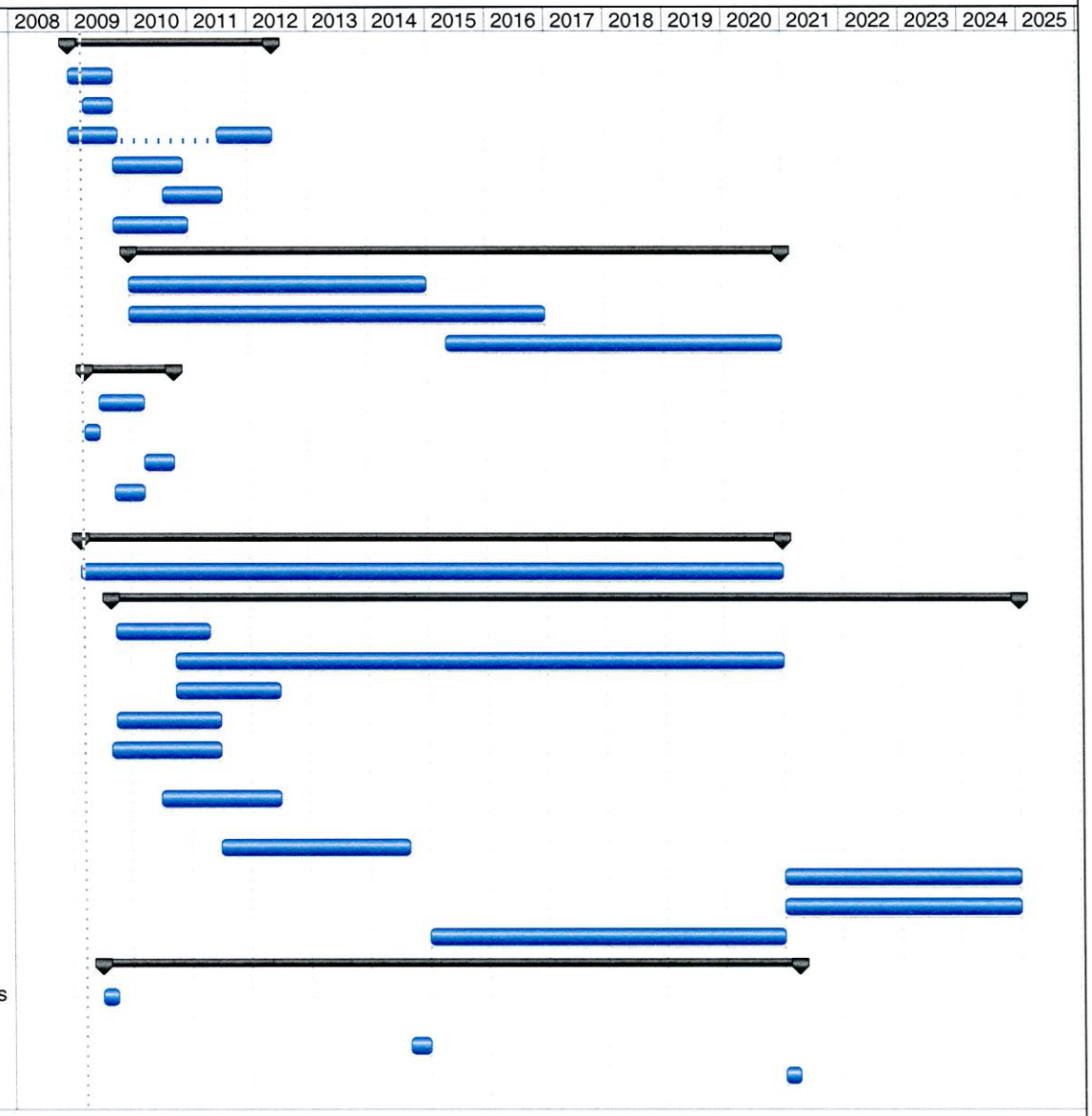
Formation of ORWUT will provide a single focal point for all subsequent project implementation activities. Through initial discussions with state and federal regulatory agencies and consideration of the findings of this study, the participants will be able to select a source of supply alternative for implementation. That in turn

will facilitate initiation of major project permitting, engineering, and funding/financing activities, significant portions of which can and should proceed in parallel. Through those actions and the other key activities described herein, the participants will be on track to meet the metro area's 2060 water delivery needs.

The series of projects necessary to have the Atoka Pipeline operational in 2020 are outlined in **Figure 12-1**. The overall project needs were divided into the following six categories, as previously outlined in this section: Organization Activities, Environmental and Permitting Activities, Water Rights Activities, Public Outreach Activities, Engineering and Construction Activities, and Funding and Financing Activities.

Regional Water Supply Study for Central Oklahoma

ID	Task Name
1	**Organizational Activities**
2	Oklahoma Regional Water Trust Formation
3	Agree Upon Source Water Alternative
4	Execution of Local Agreements
5	Individual Water Model Updates
6	Individual Cost and Sevice Studies and Pre-Bond Issuance Update
7	Individual Water Plan Updates
8	**Environmental Permitting Activities**
9	Atoka Pipeline Environmental Permitting
10	Source Water Alternative Environmental Permitting
11	Source Water Pipeline Permitting
12	**Water Rights Activities**
13	Establish Final Costs for the Lake Sardis Debt Conflict Resolution
14	Amend Pending Sardis Lake Permit Application
15	Acquire Storage Righst to Sardis Lake
16	Amend Permit Application to Reflect the Source Alternative Diversion Point
17	**Public Outreach Activities**
18	Statewide Public Outreach Activities
19	**Engineering and Construction Activities**
20	Finalize Route Analysis for Preferred Alternative
21	Acquire Final Alignment and any Other Needed Easements
22	Perform Site Surveys for Final Source Water Line Alignment
23	Perform Site Surveys of Existing Atoka Alignment
24	Preliminary Design Activities to Support Permitting Process - Atoka Pipeline
25	Preliminary Design Activities to Support Permitting Process - Source Water Alternative
26	Design Pump and Pipeline Atoka Alignment
27	Design Source Water Intake Structure
28	Design Pump and Pipeline Preferred Alignment
29	Atoka Pipeline and Pump Station Construction
30	**Funding and Financing Activities**
31	Bond Issue #1 - to Finance Environmental & Permitting, Water Rights and Engineering Activities
32	Bond Issue #2 - to Finance Construction Activities for Atoka Pipeline
33	Bond Issue #3 - to Finance Construction Activities for Source Water Pipeline



Section 13
Summary of Economic and Non-Economic Findings

13.1 Introduction

This section summarizes the overall Economic and Non-Economic findings resulting from the investigations completed in this study. During Workshop #4, project participants directed CDM to not provide a recommendation on a preferred alternative. Instead, the goal was to provide a comprehensive comparison of alternatives using both the Economic and Non-Economic findings of this study. The information from this comparison, then, can be used by the project participants to distinguish preferred alternatives from those less broadly favorable. It is understood that final decisions regarding diversion locations and other project elements may vary in the future as more knowledge is gained. A summary of the overall findings follows.

13.2 Findings of Economic Review of Alternatives – Capital Costs

Under the conditions assumed in this study, the least capital cost solution is the scenario that includes diversion of water from the Kiamichi River at Moyers Crossing and delivering it to participants under distribution Theme D1. Distribution Theme D1 focuses on centralized treatment and distribution of treated water to project participants. Details of the capital cost estimates and assumptions, including results, are provided in Section 7 of this report. Operationally, this alternative would likely be coupled with coordinated management of Sardis Lake to supplement Kiamichi River flows during periods of low flow.

13.3 Findings of Economic Review of Alternatives – Operation and Maintenance

Under the conditions assumed in this study, the least operational cost solution is the scenario that includes diversion of water from Moyers Crossing and delivering it to participants under distribution Theme D3. Distribution Theme D3 distributes raw water to several terminal storage and treatment facilities, using a more localized treatment approach. Details of the operation and maintenance cost estimates and assumptions, including results, are provided in Section 8 of this report. Again, this alternative would likely be coupled with coordinated management of Sardis Lake to supplement Kiamichi River flows during periods of low flow.

13.4 Findings of Economic Review of Alternatives – Unit Cost Distribution to Participants

Under the conditions assumed in this study, the solution with the least overall impact on water rates is the Moyers Crossing/Theme D1 scenario. Individual participants

may view other scenarios more favorably based on their individual rate implications, but the Moyers Crossing/Theme D1 scenario is most favorable to the participants collectively. Details of the Unit Cost Distribution to Participants calculations and assumptions, including results, are provided in Sections 9 and 10 of this report.

13.5 Comparison of Alternatives – Non-Economic Considerations

The project alternatives were also compared using non-economic criteria established and weighted by the project participants. The non-economic criteria used in this analysis included the following:

- Unit Costs to Participants
- Phasing Opportunities
- Reliability (Total System Yield)
- Timely Implementation

The weighted comparison identified Moyers Crossing and Theme D1 as the source water and distribution alternatives, respectively, that best meet the participants' non-economic criteria and priorities. Details of the evaluation, including results, are provided in Section 11 of this report.

13.6 Summary of Alternatives Comparison

Figure 13-1 reflects the weighted multi-objective comparison of the supply and delivery alternatives, as presented originally in Section 11 as **Figure 11-8**. It summarizes the economic and non-economic findings above, indicating that the Moyer's Crossing supply alternative is generally favorable when combining different criteria, and that the D1 or D3 delivery alternatives are generally preferred when compared with the composite criteria scores. The Moyer's Crossing alternative would likely be coupled with coordinated management of Sardis Lake to supplement Kiamichi River flows during periods of low flow.

Moyers Crossing performed favorably with the project participants' economic and non-economic criteria and priorities. However, there may be significant environmental challenges, as described in Section 6, which could ultimately lead to the implement of a different source alternative. The implementation schedule provided in Section 12 of this report provides insights into the next steps needed to move toward final selection of and implementation of a diversion location.

Distribution Themes D1 and D3 performed well in non-economic evaluations while Theme D1 was identified as the least capital cost alternative. This finding will likely result in project participants establishing a hybrid distribution theme which best serves the individual and collective needs of all participants.

	S_A_D1	S_A_D2	S_A_D3	M_MG_D1	M_MG_D2	M_MG_D3	HY_MG_D1	HY_MG_D2	HY_MG_D3	HG_MG_D1	HG_MG_D2	HG_MG_D3
City A	0.36	0.28	0.33	0.57	0.49	0.53	0.55	0.48	0.51	0.56	0.48	0.52
City B	0.42	0.28	0.37	0.58	0.44	0.53	0.57	0.43	0.51	0.57	0.43	0.52
City C	0.39	0.24	0.36	0.61	0.47	0.57	0.59	0.44	0.54	0.59	0.44	0.54
City D	0.40	0.28	0.38	0.58	0.46	0.54	0.55	0.43	0.51	0.55	0.42	0.51
City E	0.35	0.35	0.38	0.57	0.56	0.58	0.53	0.53	0.54	0.52	0.52	0.54
City F	0.33	0.29	0.34	0.56	0.53	0.56	0.51	0.48	0.51	0.51	0.47	0.50
City G	0.65	0.28	0.68	0.73	0.35	0.75	0.69	0.31	0.71	0.68	0.30	0.70
Average	0.40	0.31	0.37	0.59	0.50	0.55	0.55	0.46	0.51	0.55	0.46	0.50

Figure 13-1
Color Ranking Map for All System Alternatives and All Participant Cities
[red indicates less desirable alternatives (lower ranking scores)
and green indicates preferred alternatives]

Appendix A

Sampled Water Quality Summary

Mean Surface Water Quality Values - Potential Receiving and Source Waters

Mean	NH_3 (mg/L)	Kj-N (mg/L)	NO_2-NO_3 (mg/L)	Total Nitrogen (mg/L)	Ortho-P (mg/L)	T-P (mg/L)	True Color	Alkalinity (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L $CaCO_3$)	Chlor-a (mg/m^3)	Turbidity (NTU)	Secchi (cm)	Temp (C)	pH	Specific Conductivity (uS/cm)	TDS (g/L)
Receiving Waters - All Data																		
Arcadia	0.106	0.765	0.149	0.931	0.021	0.067	43.75	124.83	32.73	32.77	145.40	21.01	36.18	66.93	17.82	8.13	394.45	0.312
Shawnee #1	0.055	0.350	0.050	0.345	0.012	0.019	23.40	98.93	15.15	13.95	No Data	2.56	20.57	66.36	16.29	7.98	249.58	0.160
Shawnee #2	0.053	0.477	0.057	0.607	0.011	0.021	38.00	84.35	11.04	14.65	93.85	3.42	16.25	77.72	19.60	7.93	211.66	0.135
Stanley Draper	0.051	0.294	0.050	0.294	0.007	0.014	34.35	34.62	10.00	17.08	40.68	2.33	14.35	110.11	16.64	7.61	93.98	0.060
Thunderbird	0.052	0.845	0.064	0.817	0.015	0.050	27.96	161.83	22.40	17.96	172.07	15.66	25.87	54.26	16.27	8.17	393.50	0.252
Receiving Waters - Spring																		
Arcadia	0.058	0.794	0.286	1.080	0.040	0.082	68.70	126.50	34.98	35.43	133.00	9.41	55.00	69.40	14.30	7.97	410.25	0.263
Shawnee #1	0.070	0.516	No Data	No Data	0.025	0.033	44.40	90.82	14.48	23.66	No Data	3.22	55.20	34.60	24.35	7.89	239.12	0.153
Shawnee #2	0.060	0.476	0.070	0.614	0.020	0.032	68.30	81.08	11.57	21.17	91.40	3.37	26.60	48.20	19.43	7.80	219.78	0.141
Stanley Draper	0.052	0.165	0.050	0.288	0.007	0.015	30.30	33.02	10.00	17.69	40.68	3.15	16.10	98.40	13.79	7.49	90.74	0.058
Thunderbird	0.056	0.644	0.104	0.784	0.020	0.070	47.71	166.50	23.44	25.46	179.29	4.31	35.43	41.43	10.82	7.88	398.56	0.255
Receiving Waters - Summer																		
Arcadia	0.186	0.760	0.050	0.810	0.015	0.081	67.10	128.70	27.02	33.17	137.40	23.01	54.63	56.10	27.06	7.93	388.08	0.248
Shawnee #1	0.050	0.250	No Data	No Data	0.008	0.013	21.20	89.06	12.70	12.54	No Data	2.48	11.00	63.00	27.33	8.24	233.48	0.149
Shawnee #2	0.050	0.310	No Data	No Data	0.008	0.017	26.40	83.41	10.88	12.90	86.00	3.30	8.70	102.70	27.40	8.21	200.02	0.128
Stanley Draper	0.050	0.302	0.050	0.346	0.007	0.016	52.80	35.73	10.00	20.49	No Data	2.20	20.10	92.80	26.49	7.71	102.13	0.065
Thunderbird	0.050	0.741	0.050	0.784	0.009	0.043	27.64	154.36	19.93	16.77	152.43	17.01	21.92	75.17	25.54	8.21	402.37	0.258
Receiving Waters - Fall																		
Arcadia	0.084	0.892	0.050	0.854	0.015	0.068	23.50	118.60	32.94	29.67	149.40	29.62	26.40	44.40	23.71	8.34	377.79	0.512
Shawnee #1	No Data	0.210	0.050	0.260	0.008	0.016	19.80	120.20	17.86	10.32	No Data	3.34	13.00	No Data	16.39	7.93	271.14	0.174
Shawnee #2	0.050	0.561	0.050	0.570	0.006	0.016	31.30	86.99	10.64	10.35	109.60	4.62	11.90	95.20	23.91	7.73	212.54	0.136
Stanley Draper	0.050	0.200	0.050	0.226	0.006	0.013	29.70	34.95	10.00	13.14	No Data	2.09	9.30	120.80	19.34	7.64	89.66	0.057
Thunderbird	0.050	0.970	0.050	0.924	0.016	0.054	23.29	160.86	22.70	14.22	178.71	24.37	26.79	45.64	23.37	8.33	383.44	0.245
Receiving Waters - Winter																		
Arcadia	0.096	0.612	0.170	0.952	0.013	0.036	15.70	125.50	35.99	32.79	161.80	22.02	8.70	97.80	6.22	8.30	400.01	0.246
Shawnee #1	0.050	0.374	0.050	0.430	0.010	0.017	18.33	97.83	15.29	12.40	No Data	2.10	14.73	81.00	7.57	7.92	251.85	0.161
Shawnee #2	0.052	0.476	0.050	0.636	0.008	0.018	20.20	85.91	10.99	13.32	88.40	2.34	17.80	71.71	7.36	7.85	215.53	0.138
Stanley Draper	0.050	0.511	0.050	0.316	0.007	0.013	24.60	34.76	10.00	16.90	No Data	1.88	11.90	119.80	6.96	7.59	93.39	0.060
Thunderbird	0.050	1.002	0.051	0.776	0.016	0.033	13.14	164.00	23.01	15.13	177.86	17.16	19.07	61.29	7.32	8.27	391.55	0.251
Source Waters - All Data																		
Atoka	0.057	0.585	0.138	0.724	0.036	0.074	162.18	25.70	10.00	43.94	40.70	7.73	73.35	26.63	17.39	7.47	71.82	0.046
Hugo	0.057	0.533	0.065	0.614	0.022	0.061	121.83	18.54	10.00	19.09	25.67	11.32	39.09	37.06	17.80	7.21	61.35	0.040
McGee Cr.	0.050	0.334	0.135	0.491	0.006	0.015	35.23	15.78	10.00	12.64	28.00	2.85	6.75	153.48	18.43	6.92	34.36	0.022
Sardis	0.052	0.417	0.052	0.515	0.011	0.029	68.40	15.32	10.00	12.82	35.07	6.24	18.77	70.29	16.21	7.22	49.49	0.033
Kiamichi R @ Antlers	0.057	0.499	0.079	0.605	0.018	0.051	N/A	15.01	10.00	15.33	29.32	N/A	30.43	N/A	19.07	7.39	45.32	0.029
Source - Spring																		
Atoka	0.076	0.533	0.226	0.782	0.046	0.083	183.89	27.88	10.00	51.80	45.00	5.08	108.30	25.10	14.22	7.33	75.61	0.048
Hugo	0.064	0.461	0.055	0.516	0.033	0.077	188.50	19.30	10.00	24.31	27.00	3.78	62.40	23.70	20.03	7.05	52.98	0.037
McGee Cr.	0.050	0.338	0.190	0.560	0.006	0.013	32.90	15.39	10.00	11.50	32.00	2.51	7.60	156.50	14.97	7.01	30.45	0.019
Sardis	0.050	0.508	0.054	0.562	0.016	0.037	114.40	14.20	10.00	14.74	18.00	6.20	28.20	56.20	19.34	7.08	48.68	0.031
Kiamichi R @ Antlers	0.053	0.392	0.083	0.486	0.011	0.041	N/A	11.88	10.00	15.24	19.27	N/A	22.64	N/A	18.86	7.43	39.25	0.025
Source - Summer																		
Atoka	0.050	0.597	0.050	0.682	0.032	0.078	198.00	23.97	10.00	36.61	44.20	11.15	57.60	30.25	31.37	7.36	65.86	0.042
Hugo	0.050	0.642	0.050	0.692	0.024	0.067	103.60	23.80	10.00	16.56	No Data	10.20	38.20	31.80	28.73	7.05	82.16	0.053
McGee Cr.	0.050	0.315	0.050	0.372	0.005	0.015	38.10	16.76	10.00	10.10	27.60	4.56	2.80	181.00	30.10	6.81	33.68	0.022
Sardis	0.050	0.652	0.050	0.702	0.010	0.027	58.00	26.60	10.00	11.26	No Data	6.88	14.80	83.80	29.17	7.14	49.78	0.032
Kiamichi R @ Antlers	0.054	0.605	0.071	0.698	0.011	0.060	N/A	15.86	10.00	14.11	23.91	N/A	33.63	N/A	28.59	7.48	29.71	0.020
Source - Fall																		
Atoka	0.050	0.488	0.050	0.542	0.022	0.064	128.40	27.95	10.00	31.94	37.80	7.46	53.70	26.20	18.49	7.61	78.09	0.050
Hugo	0.064	0.690	0.114	0.724	0.017	0.050	76.60	20.09	10.00	16.93	28.40	9.62	23.80	48.00	17.94	7.44	64.28	0.041
McGee Cr.	0.050	0.270	0.050	0.372	0.006	0.013	24.60	14.85	10.00	11.32	21.40	2.94	4.50	159.70	19.70	6.93	39.51	0.025
Sardis	0.056	0.352	No Data	No Data	0.009	0.023	21.60	13.74	10.00	10.60	No Data	5.56	11.20	77.00	No Data	No Data	No Data	No Data
Kiamichi R @ Antlers	0.068	0.685	0.108	0.807	0.036	0.078	N/A	15.47	10.00	16.87	17.98	N/A	48.30	N/A	21.42	7.23	55.53	0.036
Source - Winter																		
Atoka	0.050	0.721	0.224	0.888	0.047	0.070	140.60	23.22	10.00	56.18	35.80	7.23	73.80	25.70	5.45	7.55	65.94	0.042
Hugo	0.050	0.392	0.050	0.620	0.016	0.053	109.50	13.61	10.00	17.31	21.60	17.36	31.50	43.38	7.99	7.23	55.13	0.035
McGee Cr.	0.050	0.414	0.250	0.660	0.008	0.018	45.30	16.10	10.00	17.63	31.00	1.40	12.10	116.70	6.60	6.91	33.14	0.021
Sardis	0.050	0.301	0.050	0.374	0.009	0.025	56.80	12.84	10.00	12.81	43.60	6.27	16.33	72.93	9.82	7.34	53.49	0.034
Kiamichi R @ Antlers	0.053	0.308	0.115	0.425	0.010	0.025	N/A	18.00	10.00	14.61	62.04	N/A	15.63	N/A	8.22	7.33	56.54	0.036

Median Surface Water Quality Values - Potential Receiving and Source Waters

Median Value	NH_3 (mg/L)	Kj-N (mg/L)	NO_2-NO_3 (mg/L)	Total Nitrogen (mg/L)	Ortho-P (mg/L)	T-P (mg/L)	True Color	Alkalinity (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L $CaCO_3$)	Chlor-a (mg/m^3)	Turbidity (NTU)	Secchi (cm)	Temp (C)	pH	Specific Conductivity (uS/cm)	TDS (g/L)
Receiving Waters - All Data																		
Arcadia	0.070	0.795	0.105	0.925	0.009	0.050	20.00	125.50	29.50	30.70	149.00	20.95	12.95	62.50	19.93	8.20	418.50	0.268
Shawnee #1	0.050	0.340	0.050	0.365	0.008	0.015	20.00	95.50	14.05	11.80	No Data	2.55	13.50	65.00	16.25	7.94	238.95	0.153
Shawnee #2	0.050	0.470	0.050	0.580	0.006	0.018	31.00	84.00	10.90	10.70	89.50	3.10	13.50	81.00	23.96	7.86	214.00	0.137
Stanley Draper	0.050	0.240	0.050	0.295	0.006	0.014	30.00	31.55	10.00	16.90	40.80	2.27	11.50	102.00	16.12	7.60	94.95	0.061
Thunderbird	0.050	0.760	0.050	0.810	0.012	0.039	18.00	163.00	20.30	17.30	178.00	13.20	20.00	58.00	14.05	8.18	399.00	0.255
Receiving Waters - Spring																		
Arcadia	0.050	0.765	0.270	0.980	0.014	0.047	23.50	126.50	30.65	32.55	152.00	7.37	12.00	74.00	14.08	7.99	432.10	0.277
Shawnee #1	0.070	0.510	No Data	No Data	0.022	0.033	47.00	91.20	14.50	25.00	No Data	3.20	48.00	35.00	24.50	7.88	239.00	0.153
Shawnee #2	0.060	0.490	0.070	0.620	0.018	0.030	64.00	82.35	11.45	17.70	90.00	3.07	20.00	46.50	19.54	7.83	220.80	0.141
Stanley Draper	0.050	0.190	0.050	0.290	0.007	0.015	24.50	27.10	10.00	17.65	40.80	3.20	14.00	88.00	13.72	7.48	90.95	0.058
Thunderbird	0.050	0.630	0.080	0.700	0.015	0.034	27.50	164.00	22.85	22.85	179.00	3.35	29.00	32.50	10.73	7.91	391.60	0.251
Receiving Waters - Summer																		
Arcadia	0.050	0.800	0.050	0.850	0.009	0.055	45.50	125.50	25.40	30.70	136.00	26.45	16.65	55.00	27.04	7.91	371.50	0.238
Shawnee #1	0.050	0.230	No Data	No Data	0.008	0.014	22.00	88.90	12.70	12.60	No Data	2.50	11.00	63.00	27.47	8.24	233.60	0.150
Shawnee #2	0.050	0.310	No Data	No Data	0.006	0.015	23.00	84.55	10.90	12.80	85.00	3.30	6.50	110.00	27.30	8.19	215.15	0.138
Stanley Draper	0.050	0.300	0.050	0.340	0.007	0.015	47.00	35.30	10.00	20.20	No Data	2.35	19.50	100.00	26.76	7.91	102.80	0.066
Thunderbird	0.050	0.780	0.050	0.780	0.008	0.039	27.00	148.00	20.30	17.30	152.00	17.80	15.00	75.00	26.06	8.24	399.00	0.255
Receiving Waters - Fall																		
Arcadia	0.080	0.865	0.050	0.850	0.010	0.062	18.00	121.00	33.60	31.50	148.00	27.35	22.50	49.00	23.36	8.32	420.00	0.268
Shawnee #1		0.200	0.050	0.250	0.007	0.015	20.00	128.00	17.90	10.30	No Data	4.10	11.00		16.26	7.93	271.10	0.174
Shawnee #2	0.050	0.520	0.050	0.570	0.006	0.016	31.50	88.85	10.45	10.40	109.00	5.11	11.00	104.00	23.87	7.75	212.50	0.136
Stanley Draper	0.050	0.190	0.050	0.220	0.005	0.013	31.00	33.45	10.00	13.00	No Data	2.05	9.00	112.50	19.42	7.72	90.00	0.058
Thunderbird	0.050	0.980	0.050	0.910	0.012	0.052	19.50	158.00	20.90	16.20	179.00	23.60	23.00	47.50	23.48	8.34	384.95	0.246
Receiving Waters - Winter																		
Arcadia	0.080	0.605	0.170	0.960	0.009	0.040	17.00	126.50	33.00	33.00	164.00	23.90	9.00	90.00	6.15	8.34	401.20	0.249
Shawnee #1	0.050	0.370	0.050	0.420	0.006	0.014	16.00	95.70	13.70	11.20	No Data	1.80	14.00	81.00	7.55	7.90	230.40	0.147
Shawnee #2	0.050	0.435	0.050	0.550	0.007	0.018	19.50	87.70	10.95	12.95	88.00	2.17	14.50	46.00	7.15	7.89	216.90	0.139
Stanley Draper	0.050	0.255	0.050	0.310	0.007	0.013	24.00	34.25	10.00	16.90	No Data	1.85	11.50	115.00	7.01	7.56	93.60	0.060
Thunderbird	0.050	0.745	0.050	0.780	0.018	0.034	12.50	164.50	23.05	15.20	186.00	18.30	18.50	64.00	7.58	8.26	395.65	0.253
Source Waters - All Data																		
Atoka	0.050	0.560	0.085	0.700	0.035	0.064	155.00	23.30	10.00	42.00	40.00	6.90	62.00	25.00	15.00	7.53	76.00	0.049
Hugo	0.050	0.550	0.050	0.610	0.019	0.058	110.00	17.00	10.00	16.50	27.00	9.66	32.00	40.00	18.28	7.20	60.00	0.038
McGee	0.050	0.335	0.100	0.475	0.005	0.014	24.00	14.50	10.00	11.15	29.00	2.43	6.00	150.00	17.03	6.90	38.90	0.025
Sardis	0.050	0.360	0.050	0.480	0.011	0.028	66.00	13.70	10.00	11.10	37.00	5.70	17.00	72.00	14.17	7.24	50.50	0.033
Kiamichi R. @ Antlers	0.050	0.410	0.050	0.540	0.012	0.036	N/A	13.50	10.00	13.80	18.00	N/A	18.00	N/A	18.60	7.39	46.00	0.030
Source - Spring																		
Atoka	0.070	0.510	0.240	0.760	0.044	0.061	203.00	26.00	10.00	42.00	42.00	3.94	67.50	27.50	14.20	7.29	79.20	0.051
Hugo	0.050	0.470	0.050	0.530	0.030	0.078	182.50	18.50	10.00	22.75	27.00	4.20	60.50	22.00	20.29	7.00	59.00	0.038
McGee Cr.	0.050	0.350	0.190	0.550	0.006	0.013	29.50	14.00	10.00	11.40	32.00	2.72	8.00	144.00	14.83	6.99	25.35	0.016
Sardis	0.050	0.460	0.050	0.520	0.015	0.034	120.00	13.50	10.00	14.95	18.00	6.10	26.50	55.50	19.42	7.07	48.40	0.031
Kiamichi R @ Antlers	0.050	0.380	0.050	0.430	0.012	0.032	N/A	11.00	10.00	14.40	18.00	N/A	18.00	N/A	17.54	7.53	39.00	0.025
Source - Summer																		
Atoka	0.050	0.595	0.050	0.650	0.032	0.082	202.50	23.70	10.00	36.15	45.00	9.81	58.00	30.50	31.36	7.24	64.50	0.041
Hugo	0.050	0.560	0.050	0.610	0.024	0.072	106.00	25.00	10.00	16.50	No Data	12.00	40.00	30.00	28.78	7.00	82.00	0.053
McGee Cr.	0.050	0.320	0.050	0.370	0.005	0.015	37.50	15.45	10.00	10.00	28.00	4.09	3.00	167.50	30.22	6.74	45.90	0.029
Sardis	0.050	0.540	0.050	0.590	0.010	0.028	58.00	28.00	10.00	11.00	No Data	6.60	14.00	90.00	29.44	7.22	55.20	0.035
Kiamichi R @ Antlers	0.050	0.510	0.050	0.580	0.008	0.050	N/A	16.00	10.00	10.00	12.00	N/A	19.50	N/A	28.48	7.41	28.40	0.020
Source - Fall																		
Atoka	0.050	0.470	0.050	0.510	0.024	0.056	134.50	24.25	10.00	30.60	39.00	6.75	49.50	25.00	18.81	7.60	78.25	0.050
Hugo	0.060	0.625	0.100	0.710	0.015	0.050	80.00	19.40	10.00	15.95	29.00	9.45	22.50	48.00	18.04	7.28	65.25	0.042
McGee Cr.	0.050	0.285	0.050	0.360	0.006	0.013	23.00	13.00	10.00	10.85	22.00	2.64	4.00	165.00	19.85	6.89	39.50	0.025
Sardis	0.060	0.350	No Data	No Data	0.009	0.022	22.00	13.70	10.00	10.60	No Data	6.30	11.00	84.00	No Data	No Data	No Data	No Data
Kiamichi R @ Antlers	0.050	0.725	0.050	0.800	0.013	0.035	N/A	12.50	10.00	12.00	17.00	N/A	21.00	N/A	21.95	7.07	50.25	0.032
Source - Winter																		
Atoka	0.050	0.730	0.260	0.990	0.043	0.065	116.00	20.70	10.00	50.50	34.00	7.64	70.00	22.50	5.46	7.61	57.40	0.037
Hugo	0.050	0.480	0.050	0.630	0.016	0.055	111.00	10.90	10.00	17.45	21.00	18.70	31.00	43.50	8.16	7.33	54.05	0.035
McGee Cr.	0.050	0.390	0.270	0.660	0.006	0.016	29.50	14.40	10.00	13.60	31.00	1.29	8.50	109.50	6.90	6.93	37.30	0.024
Sardis	0.050	0.460	0.050	0.520	0.015	0.034	120.00	13.50	10.00	14.95	18.00	6.10	26.50	55.50	19.42	7.07	48.40	0.031
Kiamichi R @ Antlers	0.050	0.355	0.110	0.485	0.010	0.026	N/A	16.60	10.00	13.35	26.35	N/A	16.50	N/A	7.83	7.43	63.95	0.041

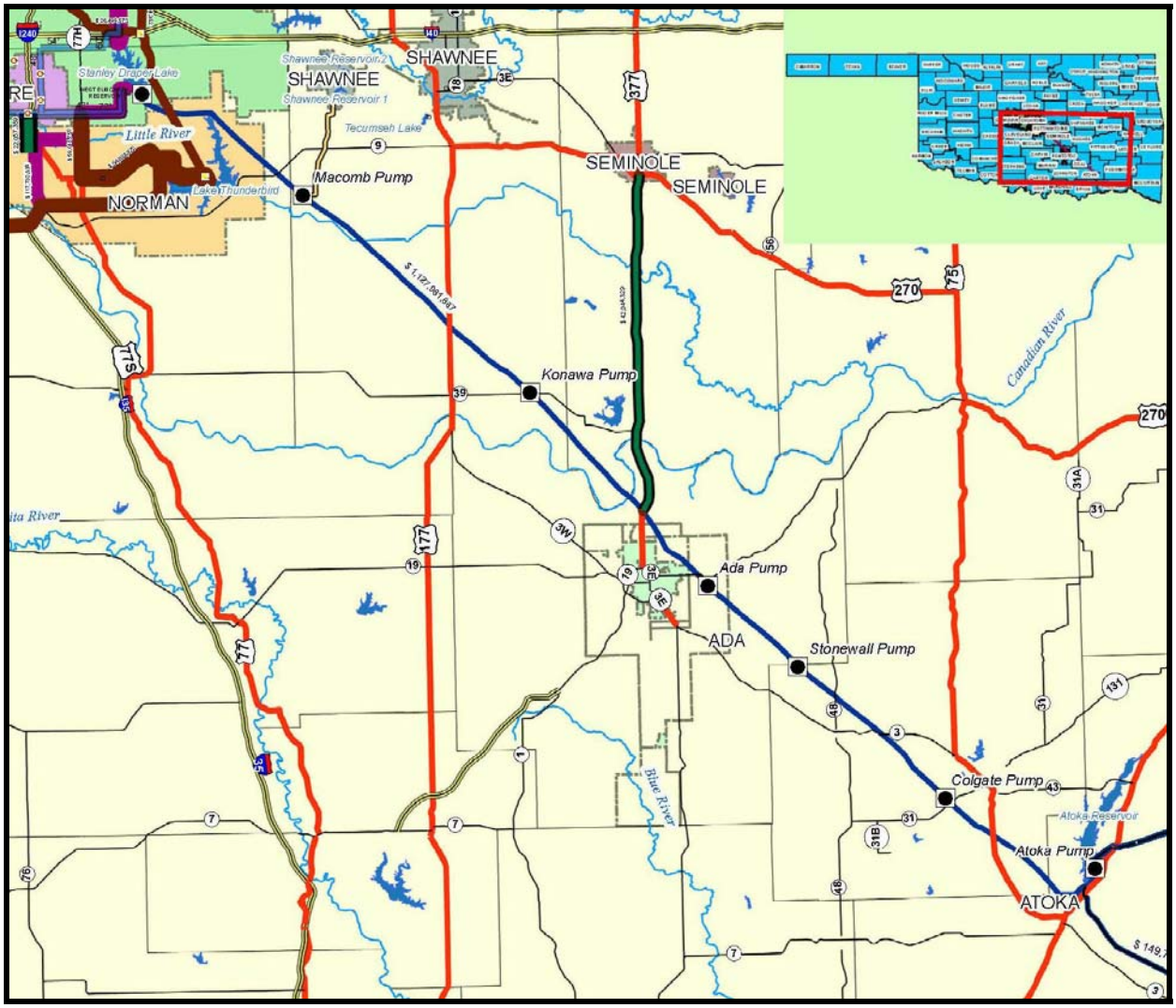
Maximum/Minimum Surface Water Quality Values - Potential Receiving and Source Waters

Max/Min Value	NH_3 (mg/L)		Kj-N (mg/L)		NO_2-NO_3 (mg/L)		Total Nitrogen (mg/L)		Ortho-P (mg/L)		T-P (mg/L)		True Color		Alkalinity (mg/L)		Chloride (mg/L)		Sulfate (mg/L)		Hardness (mg/L $CaCO_3$)		Chlor-a (mg/m^3)		Turbidity (NTU)		Secchi (cm)		Temp (C)		pH		Specific Conductivity (uS/cm)		TDS (g/L)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Receiving Waters - All Data																																				
Arcadia	0.050	0.730	0.400	1.390	0.050	0.460	0.490	1.850	0.005	0.188	0.025	0.276	9.00	300.00	88.00	158.00	13.70	53.60	20.00	72.40	98.00	165.00	1.84	46.00	6.00	353.00	8.00	150.00	3.23	29.43	7.35	8.53	216.20	484.10	0.138	2.700
Shawnee #1	0.050	0.050	0.160	0.620	0.050	0.050	0.210	0.490	0.005	0.050	0.007	0.070	9.00	56.00	88.40	133.00	12.60	18.90	10.00	31.40	No Data	No Data	0.10	6.10	8.00	97.00	27.00	115.00	6.58	27.58	7.81	8.30	227.30	280.60	0.146	0.180
Shawnee #2	0.050	0.070	0.290	1.150	0.050	0.080	0.500	1.020	0.005	0.044	0.010	0.065	9.00	95.00	71.00	93.80	10.00	13.40	10.00	37.30	81.00	120.00	0.10	7.46	3.00	59.00	8.00	168.00	6.66	28.54	7.63	8.62	52.80	230.60	0.034	0.148
Stanley Draper	0.050	0.060	0.050	3.110	0.050	0.050	0.210	0.380	0.005	0.010	0.010	0.022	16.00	77.00	20.00	57.00	10.00	10.00	11.80	22.80	39.20	41.90	0.10	4.70	4.00	35.00	45.00	182.00	4.90	29.72	7.08	8.18	70.00	112.50	0.045	0.072
Thunderbird	0.050	0.090	0.450	4.370	0.050	0.270	0.640	1.180	0.005	0.060	0.023	0.429	5.00	201.00	135.00	193.00	17.80	28.50	10.00	47.60	112.00	203.00	1.77	38.40	7.00	127.00	4.00	150.00	5.68	26.83	7.43	8.57	314.80	441.40	0.202	0.283
Receiving Waters - Spring																																				
Arcadia	0.050	0.080	0.490	1.390	0.190	0.460	0.740	1.850	0.005	0.188	0.034	0.231	16.00	300.00	89.00	150.00	18.10	51.20	26.70	56.70	98.00	155.00	1.84	20.60	7.00	295.00	8.00	134.00	10.72	18.18	7.68	8.20	216.20	484.10	0.138	0.310
Shawnee #1	0.050	0.080	0.410	0.610	No Data	No Data	No Data	No Data	0.020	0.034	0.028	0.044	31.00	56.00	89.30	92.30	14.00	14.90	17.00	31.40	No Data	No Data	2.70	3.60	34.00	97.00	27.00	43.00	23.96	24.63	7.85	7.95	238.70	240.00	0.153	0.153
Shawnee #2	0.050	0.070	0.300	0.600	0.060	0.080	0.530	0.680	0.006	0.044	0.014	0.065	47.00	95.00	74.00	84.00	10.00	13.40	10.00	37.30	88.00	98.00	2.48	5.10	12.00	59.00	8.00	86.00	13.62	25.17	7.67	7.88	205.00	230.60	0.131	0.148
Stanley Draper	0.050	0.060	0.050	0.250	0.050	0.050	0.280	0.300	0.005	0.010	0.010	0.022	16.00	51.00	20.00	57.00	10.00	10.00	14.60	21.20	39.20	41.90	0.10	4.70	4.00	34.00	45.00	167.00	8.28	19.37	7.27	7.77	84.20	96.40	0.054	0.062
Thunderbird	0.050	0.090	0.530	0.910	0.050	0.270	0.640	1.180	0.010	0.034	0.025	0.429	9.00	201.00	148.00	188.00	19.40	27.80	17.70	47.60	163.00	203.00	1.77	12.60	12.00	127.00	11.00	72.00	7.47	14.32	7.43	8.15	367.50	440.30	0.235	0.282
Receiving Waters - Summer																																				
Arcadia	0.050	0.730	0.440	1.220	0.050	0.050	0.490	1.270	0.005	0.072	0.042	0.276	22.00	250.00	88.00	158.00	13.70	34.00	25.50	72.40	132.00	143.00	10.20	34.10	7.00	353.00	10.00	132.00	23.78	29.43	7.35	8.41	262.00	460.90	0.168	0.295
Shawnee #1	0.050	0.050	0.220	0.330	No Data	No Data	No Data	No Data	0.007	0.011	0.012	0.015	20.00	22.00	88.40	89.60	12.60	12.80	12.20	12.90	No Data	No Data	2.10	2.70	9.00	13.00	60.00	68.00	26.83	27.58	8.18	8.30	233.00	234.00	0.149	0.150
Shawnee #2	0.050	0.050	0.290	0.330	No Data	No Data	No Data	No Data	0.005	0.014	0.014	0.023	20.00	36.00	73.00	88.00	10.70	11.00	12.10	13.70	81.00	90.00	2.80	3.80	3.00	22.00	38.00	135.00	26.34	28.54	8.09	8.62	52.80	223.60	0.034	0.143
Stanley Draper	0.050	0.050	0.260	0.330	0.050	0.050	0.310	0.380	0.005	0.010	0.012	0.021	40.00	77.00	29.40	43.00	10.00	10.00	18.80	22.80	No Data	No Data	1.24	2.90	9.00	35.00	67.00	102.00	22.57	29.72	7.08	8.18	90.80	112.50	0.058	0.072
Thunderbird	0.050	0.050	0.490	0.970	0.050	0.050	0.640	1.020	0.005	0.030	0.028	0.087	11.00	67.00	139.00	170.00	17.80	20.40	13.60	22.90	150.00	158.00	7.69	32.60	7.00	77.00	4.00	150.00	23.99	26.83	8.06	8.31	385.90	412.20	0.247	0.264
Receiving Waters - Fall																																				
Arcadia	0.060	0.140	0.750	1.090	0.050	0.050	0.800	0.940	0.008	0.047	0.051	0.117	14.00	51.00	106.00	130.00	26.60	39.10	20.00	38.10	146.00	155.00	17.90	46.00	11.00	57.00	18.00	62.00	21.68	25.82	8.21	8.47	313.40	424.00	0.201	2.700
Shawnee #1	No Data	No Data	0.160	0.280	0.050	0.050	0.210	0.330	0.007	0.010	0.014	0.019	18.00	23.00	96.00	133.00	17.80	17.90	10.00	10.60	No Data	No Data	0.10	4.50	10.00	19.00			16.22	16.69	7.90	7.95	270.50	271.90	0.173	0.174
Shawnee #2	0.050	0.050	0.390	1.150	0.050	0.050	0.540	0.590	0.005	0.006	0.013	0.019	23.00	38.00	71.00	93.80	10.00	11.60	10.00	10.70	96.00	120.00	0.10	7.46	6.00	22.00	76.00	105.00	23.76	24.15	7.63	7.78	212.00	213.20	0.136	0.136
Stanley Draper	0.050	0.050	0.160	0.300	0.050	0.050	0.210	0.240	0.005	0.007	0.012	0.018	22.00	39.00	29.10	47.00	10.00	10.00	11.80	14.80	No Data	No Data	1.70	2.50	5.00	16.00	69.00	182.00	12.74	25.69	7.27	7.93	70.00	108.60	0.045	0.070
Thunderbird	0.050	0.050	0.790	1.250	0.050	0.050	0.840	1.030	0.007	0.060		0.087	11.00	58.00	135.00	187.00	18.20	27.90	10.00	18.20	172.00	186.00	11.10	38.40	7.00	67.00	19.00	70.00	19.86	26.04	8.04	8.57	314.80	441.40	0.202	0.283
Receiving Waters - Winter																																				
Arcadia	0.080	0.140	0.400	0.830	0.160	0.180	0.900	1.010	0.008	0.025	0.025	0.048	9.00	18.00	113.00	138.00	23.80	53.60	26.00	41.20	153.00	165.00	5.44	36.70	6.00	11.00	64.00	150.00	3.23	9.17	7.95	8.53	340.70	469.50	0.200	0.301
Shawnee #1	0.050	0.050	0.240	0.620	0.050	0.050	0.400	0.490	0.005	0.050	0.007	0.070	9.00	34.00	92.90	111.00	12.60	18.90	10.00	16.80	No Data	No Data	0.10	6.10	8.00	21.00	52.00	115.00	6.58	10.58	7.81	8.03	227.30	280.60	0.146	0.180
Shawnee #2	0.050	0.060	0.330	0.970	0.050	0.050	0.500	1.020	0.005	0.013	0.010	0.030	9.00	31.00	81.00	88.90	10.00	12.10	10.00	18.10	87.00	92.00	0.83	4.00	5.00	40.00	36.00	168.00	6.66	8.82	7.74	7.94	212.00	217.90	0.135	0.139
Stanley Draper	0.050	0.050	0.050	3.110	0.050	0.050	0.280	0.360	0.005	0.009	0.011	0.016	22.00	29.00	30.30	41.00	10.00	10.00	16.60	17.10	No Data	No Data	0.90	3.20	6.00	21.00	83.00	159.00	4.90	8.75	7.47	7.79	83.10	103.00	0.053	0.066
Thunderbird	0.050	0.050	0.450	4.370	0.050	0.060	0.710	0.830	0.009	0.023	0.023	0.042	5.00	25.00	143.00	193.00	17.90	28.50	12.00	18.10	112.00	199.00	5.20	29.50	10.00	36.00	40.00	70.00	5.68	8.64	8.08	8.54	348.40	434.70	0.223	0.278
Source Waters- All Data																																				
Atoka	0.050	0.110	0.300	1.110	0.050	0.320	0.460	1.060	0.006	0.102	0.039	0.198	44.00	282.00	12.40	45.00	10.00	10.00	19.80	121.00	30.00	53.00	0.10	23.20	18.00	302.00	6.00	50.00	4.73	33.09	6.39	8.31	47.70	125.90	0.031	0.081
Hugo	0.050	0.120	0.050	1.060	0.050	0.190	0.400	1.100	0.010	0.054	0.042	0.097	53.00	227.00	10.00	30.00	10.00	10.00	10.40	37.50	17.00	33.00	2.60	28.00	20.00	85.00	16.00	57.00	6.07	28.97	6.79	8.22	1.00	82.80	0.027	0.053
McGee Cr.	0.050	0.050	0.160	0.540	0.050	0.300	0.320	0.820	0.005	0.020	0.006	0.042	9.00	143.00	11.90	30.00	10.00	10.00	10.00	33.80	20.00	38.00	0.38	9.81	2.00	35.00	50.00	235.00	4.19	31.28	6.19	7.63	8.20	47.00	0.005	0.030
Sardis	0.050	0.050	0.220	1.010	0.050	0.060	0.290	1.060	0.005	0.024	0.016	0.054	20.00	183.00	6.00	39.00	10.00	10.00	10.00	25.50	16.00	57.00	2.56	14.20	7.00	40.00	32.00	98.00	7.71	29.53	6.82	7.68	0.00	60.00	0.017	0.038
Kiamichi R @ Antlers	0.050	0.200	0.050	1.510	0.050	0.130	0.160	1.630	0.005	0.121	0.012	0.270	N/A	N/A	1.00	42.00	10.00	10.00	10.00	31.60	2.50	324.00	N/A	N/A	2.00	173.00	N/A	N/A	5.27	22.90	6.50	8.68	0.10	100.00	0.000	0.064
Source - Spring																																				
Atoka	0.050	0.110	0.300	0.750	0.180	0.240	0.710	0.880	0.037	0.061	0.048	0.198	97.00	282.00	13.30	45.00	10.00	10.00	40.30	121.00	40.00	53.00	0.10	12.60	56.00	302.00	6.00	40.00	12.90	15.19	7.24	7.65	57.40	92.00	0.037	0.059
Hugo	0.050	0.120	0.350	0.610	0.050	0.070	0.400	0.660	0.019	0.054	0.052	0.097	152.00	227.00	15.00	26.00	10.00	10.00	13.90	37.50	23.00	33.00	2.60	5.10	45.00	85.00	16.00	37.00	18.28	20.71	6.79	7.63	1.00	60.50	0.036	0.039
McGee Cr.	0.050	0.050	0.160	0.540	0.180	0.200	0.500	0.640	0.005	0.011	0.011	0.018	16.00	51.00	12.80	22.00	10.00	10.00	10.60	12.80	30.00	33.00	0.80	4.41	5.00	10.00	131.00	220.00	13.74	16.09	6.80	7.63	8.20	44.60	0.005	0.029
Sardis	0.050	0.050	0.260	1.010	0.050	0.060	0.310	1.060	0.013	0.024	0.030	0.054	80.00	183.00	9.00	21.00	10.00	10.00	11.60	20.40	16.00	20.00	4.50	7.80	23.00	38.00	32.00	80.00	15.79	22.21	6.82	7.43	47.00	51.20	0.030	0.033
Kiamichi R @ Antlers	0.050	0.070	0.170	0.900	0.050	0.230	0.270	1.130	0.005	0.017	0.012	0.140	N/A	N/A	5.70	22.00	10.00	10.00	10.00	26.40	2.50	35.00	N/A	N/A	5.00	75.00	N/A	N/A	11.72	28.23	6.86	7.93	0.10	84.00	0.000	0.054
Source - Summer																																				
Atoka	0.050	0.050	0.440	0.720	0.050	0.050	0.580	0.770	0.006	0.060	0.046	0.109	132.00	250.00	12.40	35.00	10.00	10.00	19.80	53.80	35.00	48.00	3.00	23.20	18.00	97.00	8.00	50.00	29.09	33.09	6.39	8.31	47.70	87.10	0.031	0.056
Hugo	0.050	0.050	0.400	1.050	0.050	0.050	0.450	1.100	0.019	0.028	0.051	0.074	93.00	110.00	21.00	26.00	10.00	10.00	15.50	17.80	0.00	0.00	6.00	13.00	30.00	45.00	24.00	40.00	28.48	28.97	6.89	7.29	81.60	82.80	0.052	0.053
McGee Cr.	0.050	0.050	0.270	0.350	0.050	0.050	0.320	0.400	0.005	0.005	0.010	0.027	20.00	60.00	13.70	22.00	10.00	10.00	10.00	10.30	25.00	30.00	1.50	9.81	2.00	3.00	150.00	235.00	28.96	31.28	6.19	7.54	14.50	47.00	0.009	0.030
Sardis	0.050	0.050	0.430	0.910	0.050	0.050	0.480	0.960	0.009	0.011	0.025	0.028	49.00	69.00	18.00	39.00	10.00	10.00	10.40	13.00	No Data	No Data	4.90	8.40	14.00	17.00	64.00	97.00	28.00	29.53	6.84	7.25	26.80	56.50	0.017	0.036
Kiamichi R @ Antlers	0.050	0.080	0.310	1.510	0.050	0.120	0.360	1.630	0.006	0.025	0.039	0.147	N/A	N/A	8.00	27.00	10.00	10.00	10.00	23.40	9.40	62.00	N/A	N/A	2.00	144.00	N/A	N/A	24.30	33.90	7.09	7.98	0.20	50.00	0.000	0.032
Source - Fall																																				
Atoka	0.050	0.050	0.410	0.590	0.050	0.050	0.460	0.640	0.014	0.027	0.043	0.105	80.00	168.00	22.50	39.00	10.00	10.00	28.00	41.90	34.00	40.00	2.20	12.80	38.00	78.00	20.00	40.00	14.25	21.55	7.28	8.02	75.10	80.70	0.048	0.052
Hugo	0.060	0.070	0.550	1.060	0.060	0.190	0.680	0.830	0.010	0.039	0.044	0.053	53.00	100.00	10.00	30.00	10.00	10.00	10.90	32.30	25.00	31.00	2.94	18.50	20.00	31.00	40.00	57.00	16.76	18.43	7.20	8.22	57.40	72.20	0.037	0.046
McGee Cr.	0.050	0.050	0.170	0.400	0.050	0.050	0.320	0.450	0.005	0.007	0.006	0.022	14.00	38.00	12.10	22.00	10.00	10.00	10.00	13.70	20.00	23.00	0.40	6.80	3.00	7.00	111.00	210.00	16.81	22.16	6.74	7.22	38.10	41.00	0.024	0.026
Sardis	0.050	0.060	0.290	0.400	No Data	No Data	No Data	No Data	0.009	0.010	0.021	0.026	20.00	22.00	13.30	14.20	10.00	10.00	10.30	10.90	No Data	No Data	3.10	6.40	10.00	12.00	63.00	90.00	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Kiamichi R @ Antlers	0.050	0.200	0.050	1.160	0.050	0.340	0.190	1.460	0.005	0.121	0.019	0.270	N/A	N/A	8.80	26.00	10.00	10.00	10.00	31.60	3.50	36.00	N/A	N/A	6.00	173.00	N/A	N/A	15.53	27.77	6.51	8.68	23.00	99.00	0.023	0.063
Source - Winter																																				
Atoka	0.050	0.050	0.530	1.110	0.120	0.320	0.690	1.060	0.022	0.102	0.039	0.129	44.00	271.00	16.00	33.00	10.00	10.00	42.60	81.10	30.00	48.00	1.21	18.70	46.00	136.00	10.00	48.00	4.73	6.31	7.14	7.81	49.90	125.90	0.032	0.081
Hugo	0.050	0.050	0.050	0.630	0.050	0.050	0.550	0.680	0.012	0.021	0.042	0.063	88.00	123.00	10.00	23.00	10.00	10.00	10.40	24.00	17.00	29.00	2.80	28.00	29.00	36.00	34.00	51.00	6.07	9.07	6.80	7.53	41.40	68.50	0.027	0.044
McGee Cr.	0.050	0.050	0.350	0.520	0.150	0.300	0.540	0.820	0.005	0.020	0.011	0.042	9.00	143.00	11.90	30.00	10.00	10.00	10.80	33.80	24.00	38.00	0.38	2.50	5.00	35.00	50.00	169.00	4.19	8.21	6.63	7.21	24.20	39.00	0.016	0.025
Sardis	0.050	0.050	0.220	0.430	0.050	0.050	0.290	0.480	0.005	0.022	0.016	0.046	23.00	150.00	6.00	22.00	10.00	10.00	10.00	25.50	26.00	57.00	2.56	14.20	7.00	40.00	43.00	98.00	7.71	12.55	6.95	7.68	43.30	60.00	0.028	0.038
Kiamichi R @ Antlers	0.050	0.070	0.060	0.490	0.050	0.190	0.160	0.540	0.005	0.013	0.013	0.037	N/A	N/A	1.00	42.00	10.00	10.00	10.00	26.50	3.00	324.00	N/A	N/A	6.00	28.00	N/A	N/A	5.27	13.26	6.50	7.79	7.30	100.00	0.005	0.064

Appendix B

Opinion of Probable cost for Source Alternatives / Detailed Maps of Source Routes

Lake Atoka to Lake Stanley Draper



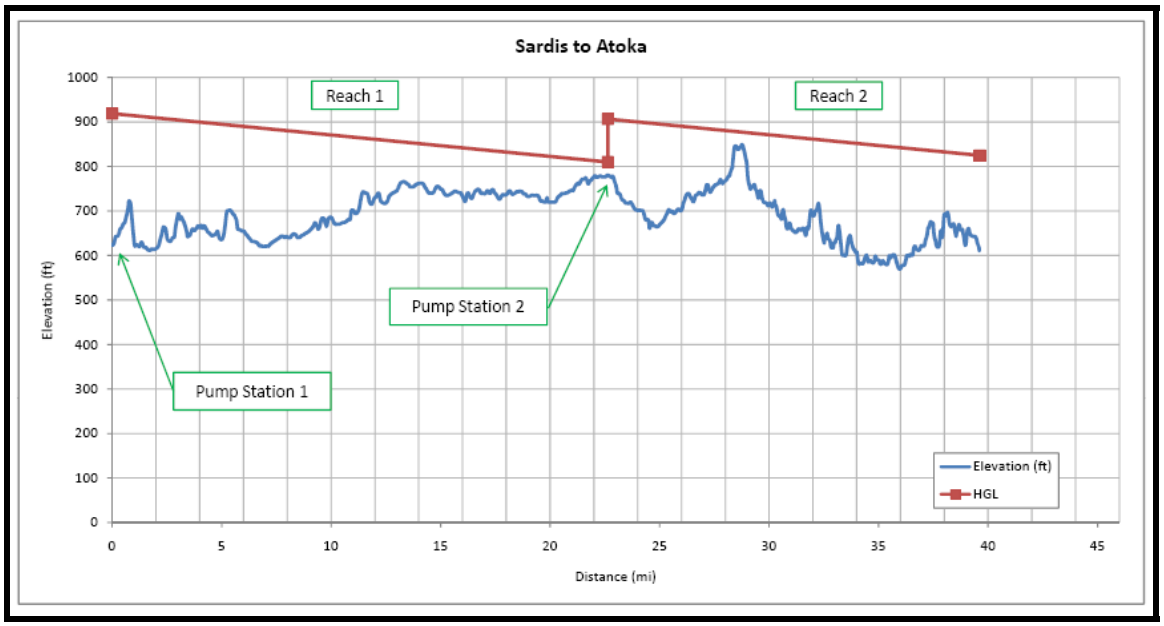
Length (miles)	Design Flow (mgd)	Diameter (inches)	Capital Cost (2008 $)
98.6	184	90	$900,000,000

PS Atoka (hp)	PS Colgate (hp)	PS Stonewall (hp)	PS Ada (hp)	PS Konawa (hp)	PS Macomb (hp)
13100	9300	13400	9800	8400	10100

Project: Lake Atoka to Stanley Draper Lake

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	90-inch	587,070	LF	$1,119.84	$657,424,469
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	90-inch		LF	$1,297.75	$0
3	Pipe installed by tunneling	90-inch	3,325	LF	$7,936.88	$26,390,126
4	Pipe installed in River Crossings	90-inch	6,445	LF	$1,810.30	$11,667,384
5	Clearing and Grubbing in Forested Areas along route		116	AC	$5,242.03	$608,075
6	Pump Station #1		13,100	hp	$2,758.85	$36,140,935
7	Pump Station #2		9,300	hp	$2,758.85	$25,657,305
8	Pump Station #3		13,400	hp	$2,758.85	$36,968,590
9	Pump Station #4		9,800	hp	$2,758.85	$27,036,730
10	Pump Station #5		8,400	hp	$2,758.85	$23,174,340
11	Pump Station #6		10,150	hp	$2,758.85	$28,002,328
12	Balancing Tanks		5	EA	$3,693,799.00	$18,468,995
13	Intake Structure		1	EA	$5,506,022.00	$5,506,022
14	No. of railroad crossings			EA		
15	Total no. of road crossings, including major and minor roads			EA		
16	No. of major road crossings			EA		
17	Total no. of stream crossings, including intermittent streams and major streams			EA		
18	No. of major stream crossings			EA		
	Total					**$897,045,298**

Sardis Lake to Lake Atoka

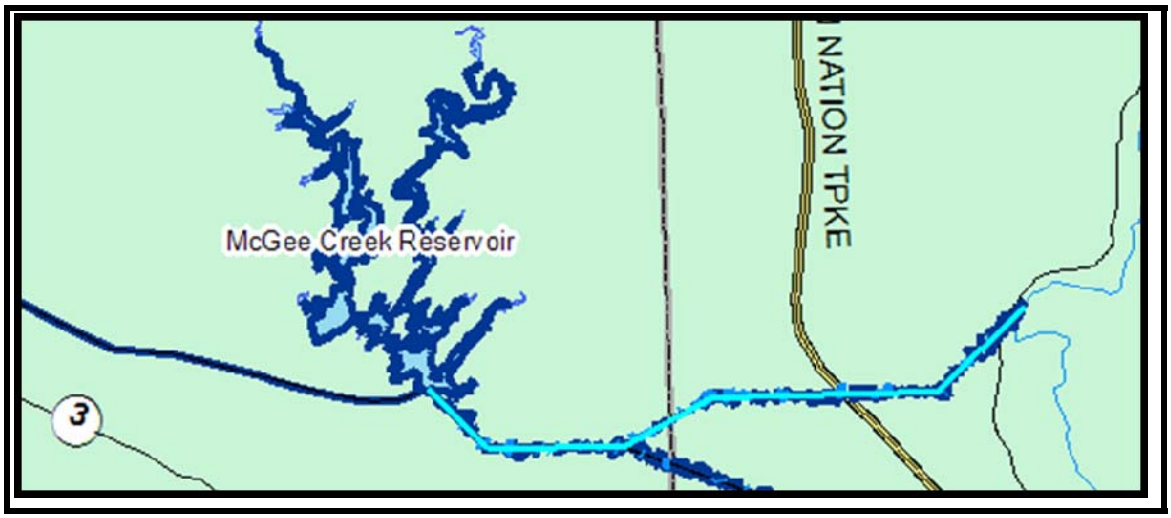


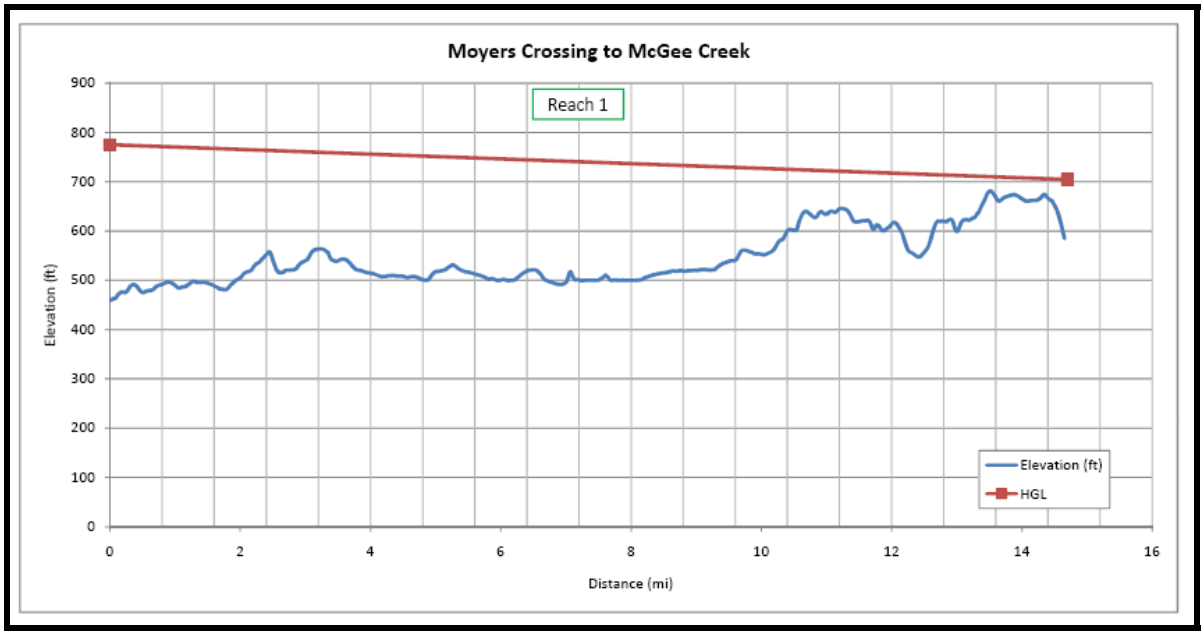
Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Pump Station 2 (hp)	Capital Cost (2008 $)
39.6	160	90	11,200	4,000	$290,000,000

Project: Lake Sardis to Lake Atoka

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	90-inch	200,147	LF	$1,119.84	$224,132,327
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	90-inch	3,000	LF	$1,297.75	$3,893,250
3	Pipe installed by tunneling	90-inch	1,200	LF	$7,936.88	$9,524,256
4	Pipe installed in River Crossings	90-inch	4,750	LF	$1,810.30	$8,598,925
5	Clearing and Grubbing in Forested Areas along route		156	AC	$5,242.03	$818,915
6	Pump Station #1		11,226	hp	$2,758.85	$30,970,850
7	Pump Station #2		3,977	hp	$2,758.85	$10,971,946
8	Intake Structure		1	EA	$5,506,022	$5,506,022
9	No. of railroad crossings		1	EA		
10	Total no. of road crossings, including major and minor roads		41	EA		
11	No. of major road crossings		5	EA		
12	Total no. of stream crossings, including intermittent streams and major streams		60	EA		
13	No. of major stream crossings		19	EA		
		Total				**$294,416,492**

Kiamichi River (Moyers) to McGee Creek Reservoir



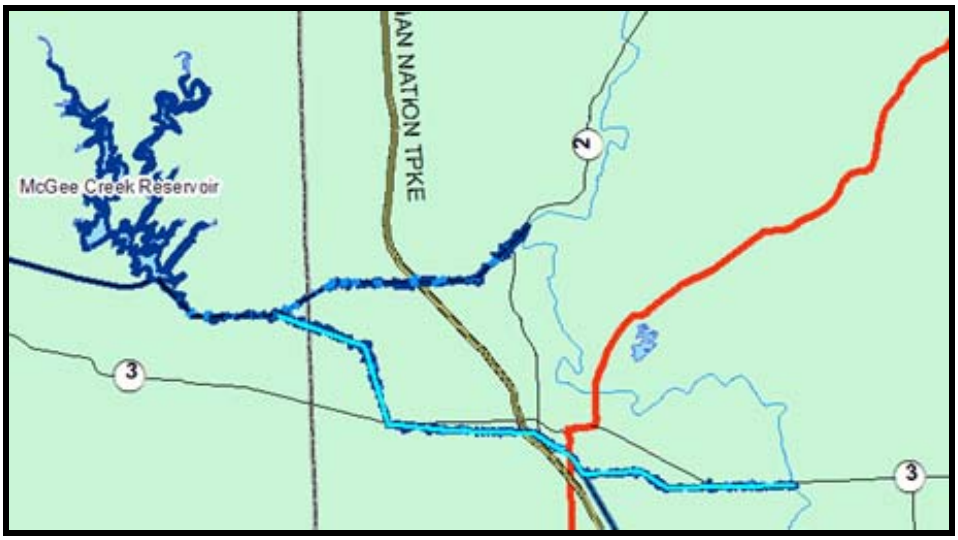


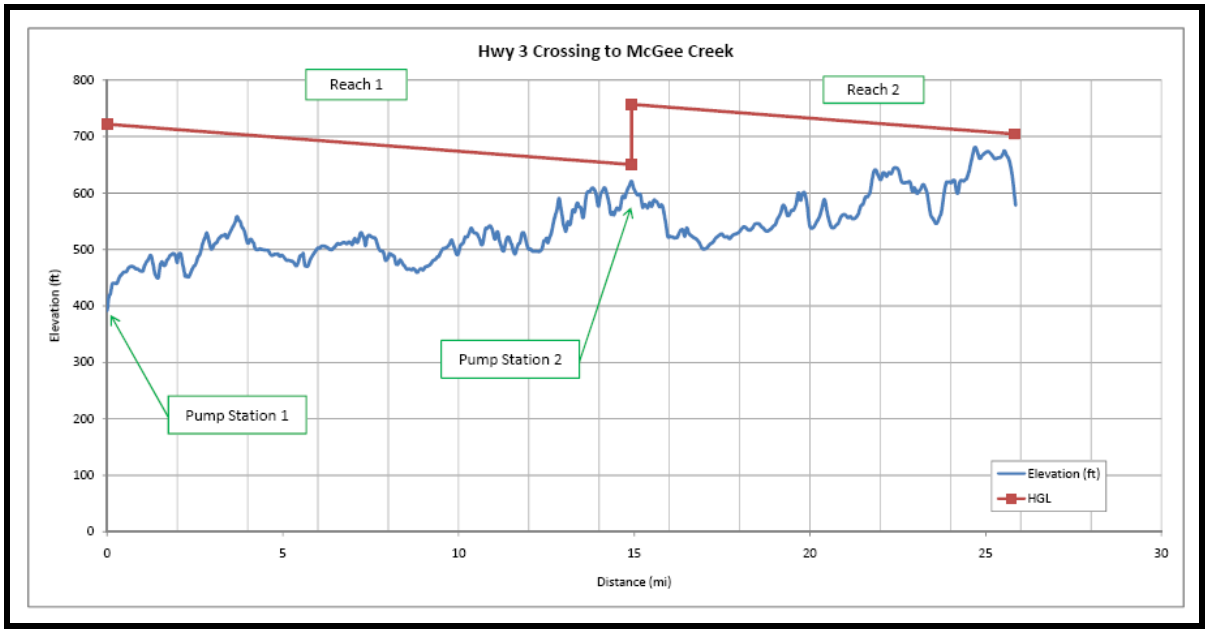
Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
14.7	160	90	12,000	$140,000,000

Project: Kiamichi River at Moyers Crossing to McGee Creek Reservoir

Item No.	Description	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	71,528	LF	$1,119.84	$80,099,570
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	0	LF	$1,297.75	$0
3	Pipe installed by tunneling	600	LF	$7,936.88	$4,762,128
4	Pipe installed in River Crossings	5,250	LF	$1,810.30	$9,504,075
5	Clearing and Grubbing in Forested Areas along route	56	AC	$5,242.03	$292,661
6	Pump Station #1	12,039	hp	$2,758.85	$33,213,795
7	Intake Structure	1	EA	$5,506,022	$5,506,022
8	Storage Tank near McGee Creek Reservoir	1	EA	$2,300,000	$2,300,000
9	No. of railroad crossings	1	EA		
10	Total no. of road crossings, including major and minor roads	14	EA		
11	No. of major road crossings	2	EA		
12	Total no. of stream crossings, including intermittent streams and major streams	21	EA		
13	No. of major stream crossings	10	EA		
	Total				**$135,678,251**

Kiamichi River (Highway 3) to McGee Creek Reservoir



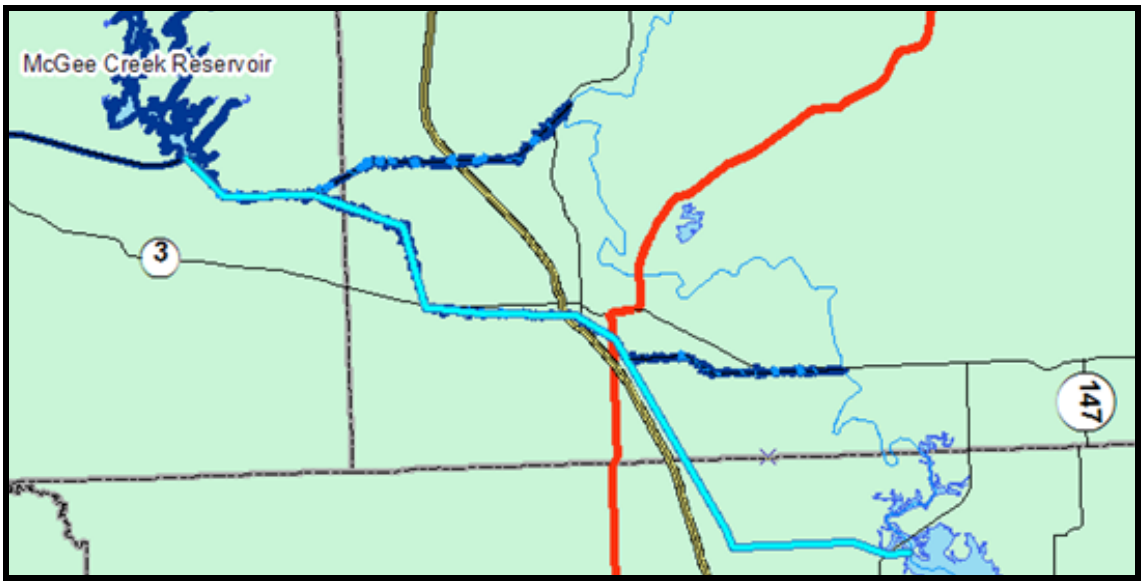


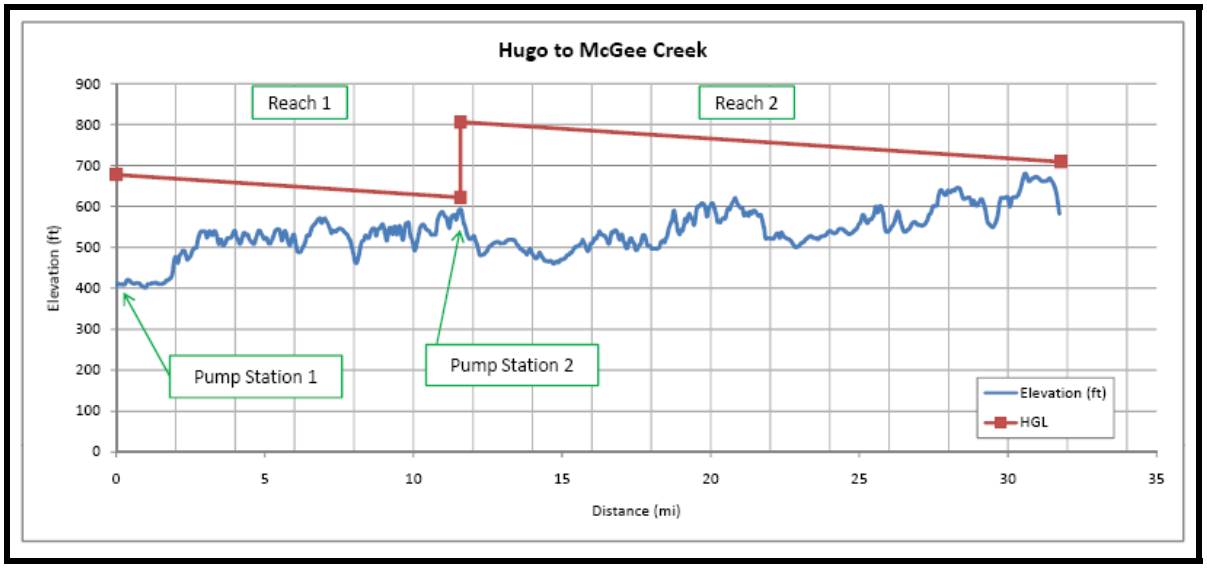
Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Pump Station 2 (hp)	Capital Cost (2008 $)
25.8	160	90	12,600	4,400	$220,000,000

Project: Kiamichi River at Highway 3 to McGee Creek Reservoir

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	90-inch	132,774	LF	$1,119.84	$148,685,144
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	90-inch	0	LF	$1,297.75	$0
3	Pipe installed by tunneling	90-inch	1,000	LF	$7,936.88	$7,936,880
4	Pipe installed in River Crossings	90-inch	2,750	LF	$1,810.30	$4,978,325
5	Clearing and Grubbing in Forested Areas along route		104	AC	$5,242.03	$543,253
6	Pump Station #1		12,636	hp	$2,758.85	$34,860,829
7	Pump Station #2		4,405	hp	$2,758.85	$12,152,734
8	Intake Structure		1	EA	$5,506,022	$5,506,022
9	Storage Tank near McGee Creek Reservoir - 6 Million Gallon		1	EA	$2,300,000	$2,300,000
10	No. of railroad crossings		1	EA		
11	Total no. of road crossings, including major and minor roads		30	EA		
12	No. of major road crossings		4	EA		
13	Total no. of stream crossings, including intermittent streams and major streams		44	EA		
14	No. of major stream crossings		11	EA		
		Total				**$216,963,187**

Lake Hugo to McGee Creek Reservoir



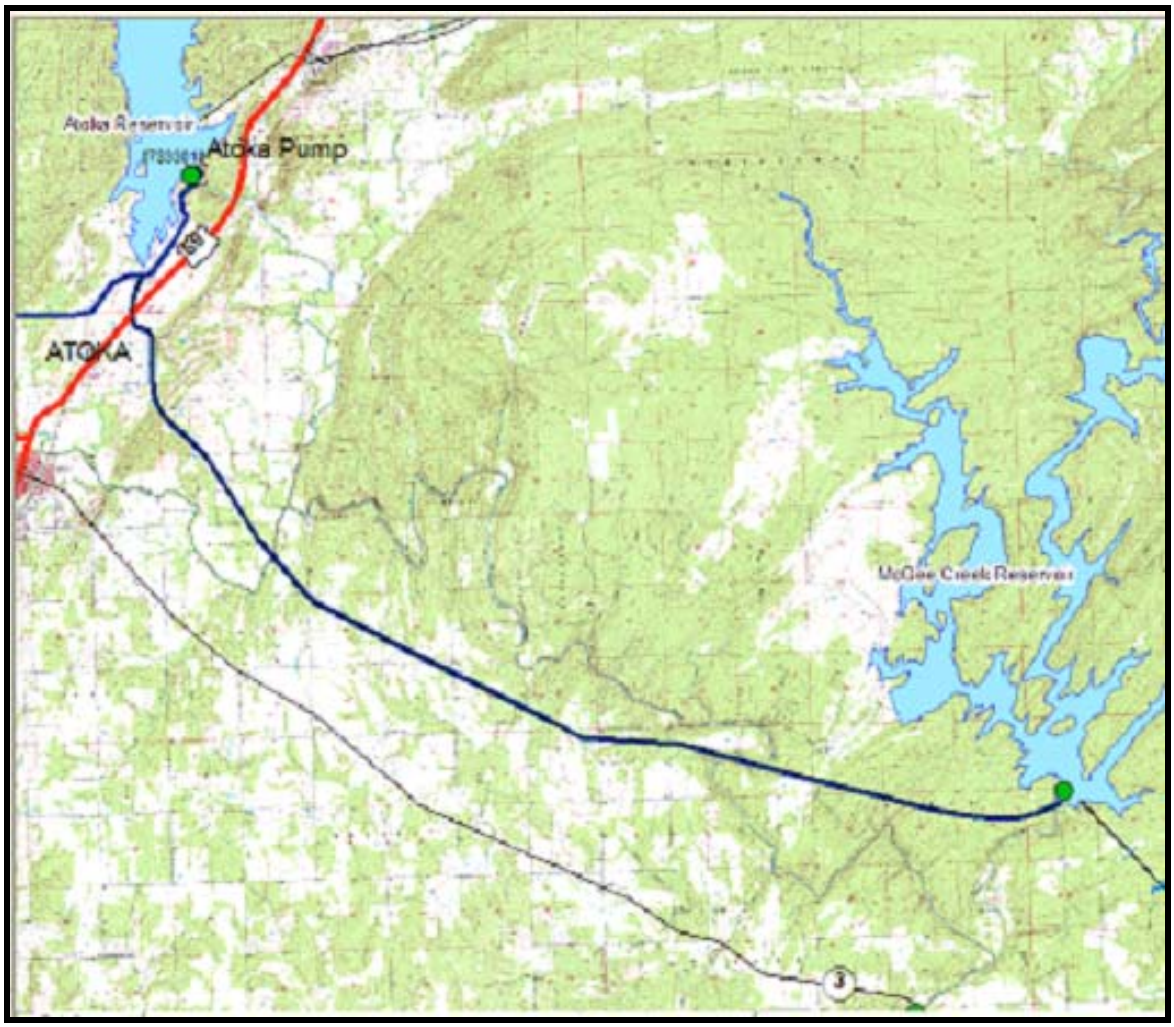


Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Pump Station 2 (hp)	Capital Cost (2008 $)
31.8	160	90	10,200	7,600	$260,000,000

Project: Lake Hugo to McGee Creek Reservoir

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	90-inch	162,567	LF	$1,119.84	$182,049,294
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	90-inch	0	LF	$1,297.75	$0
3	Pipe installed by tunneling	90-inch	1,200	LF	$7,936.88	$9,524,256
4	Pipe installed in River Crossings	90-inch	3,750	LF	$1,810.30	$6,788,625
5	Clearing and Grubbing in Forested Areas along route		127	AC	$5,242.03	$665,156
6	Pump Station #1		10,226	hp	$2,758.85	$28,212,000
7	Pump Station #2		7,612	hp	$2,758.85	$21,000,366
8	Intake Structure		1	EA	$5,506,022	$5,506,022
9	Storage Tank near McGee Creek Reservoir - 6 Million Gallon		1	EA	$2,300,000	$2,300,000
10	No. of railroad crossings		1	EA		
11	Total no. of road crossings, including major and minor roads		32	EA		
12	No. of major road crossings		5	EA		
13	Total no. of stream crossings, including intermittent streams and major streams		50	EA		
14	No. of major stream crossings		15	EA		
		Total				**$256,045,719**

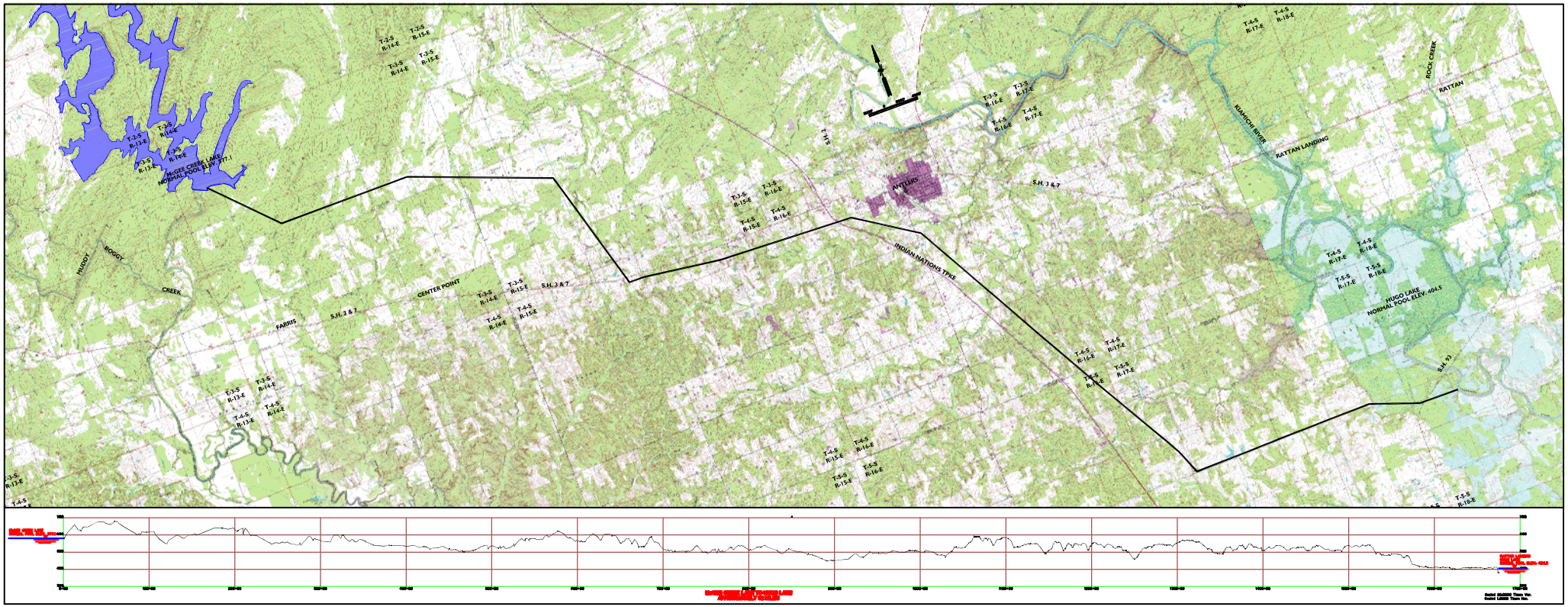
McGee Creek Reservoir to Lake Atoka

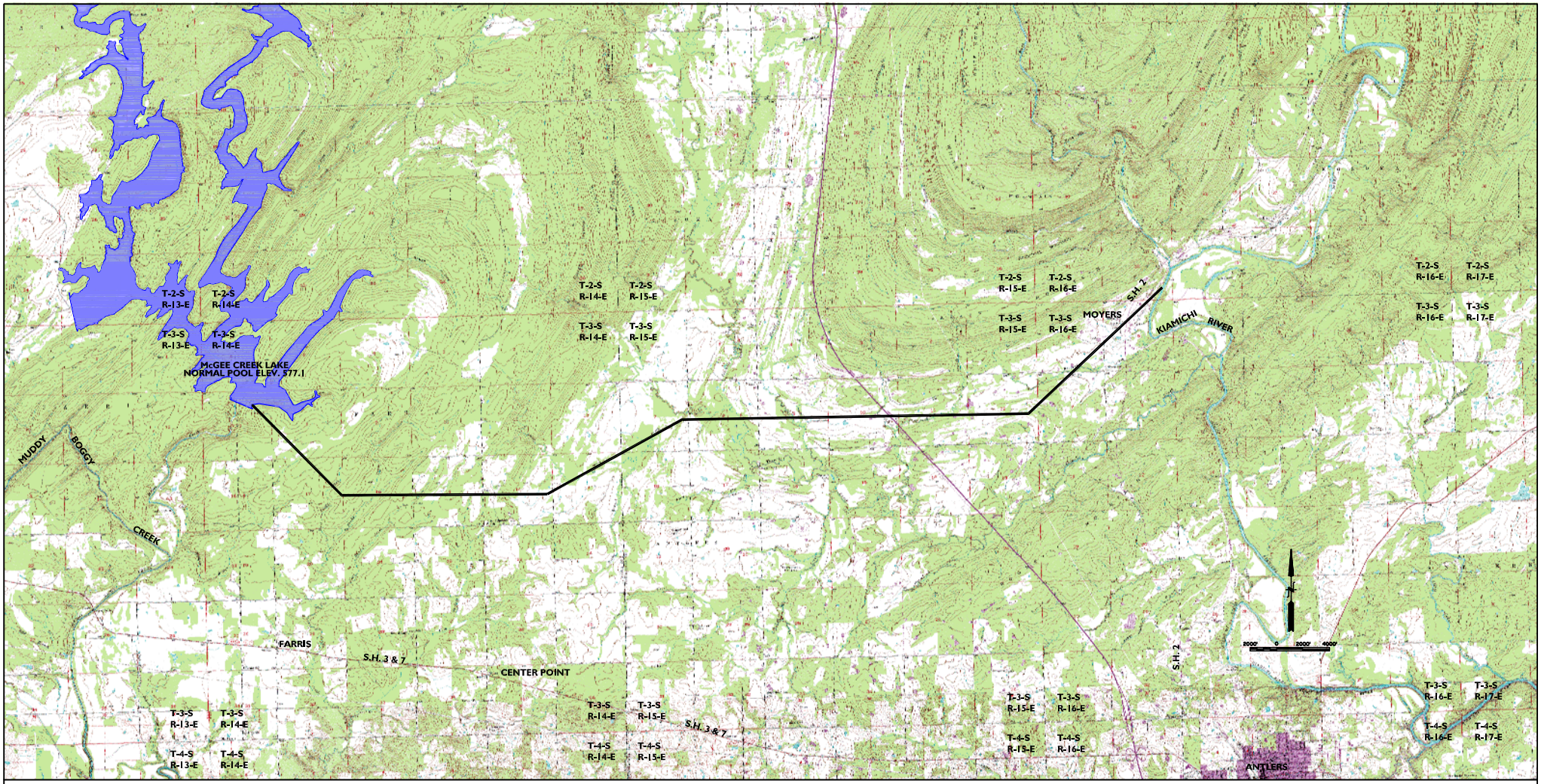


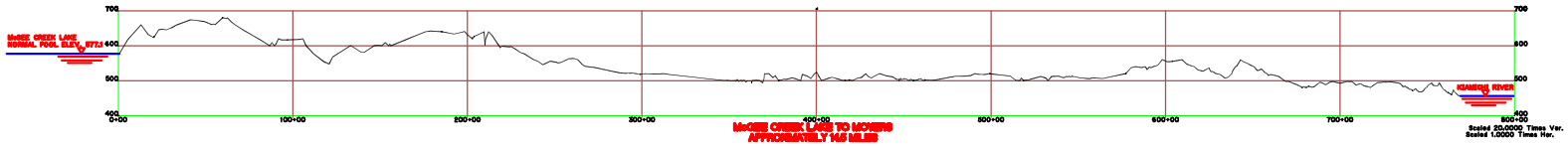
Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
16.5	160	90	3,700	$120,000,000

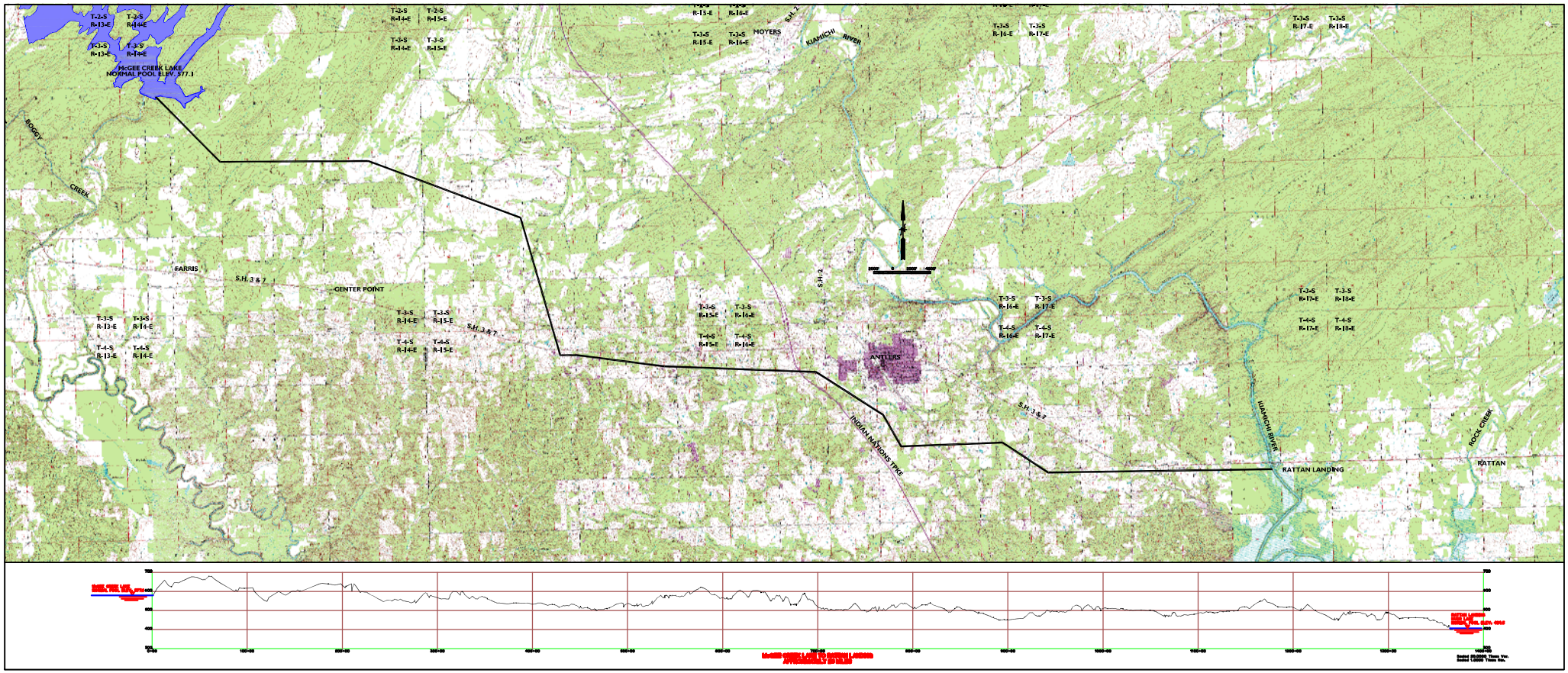
Project: McGee Creek Reservoir to Lake Atoka

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	90-inch	85,670	LF	$1,119.84	$95,936,693
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	90-inch	0	LF	$1,297.75	$0
3	Pipe installed by tunneling	90-inch	200	LF	$7,936.88	$1,587,376
4	Pipe installed in River Crossings	90-inch	1,250	LF	$1,810.30	$2,262,875
5	Clearing and Grubbing in Forested Areas along route		67	AC	$5,242.03	$350,525
6	Pump Station #1		3,715	hp	$2,758.85	$10,249,128
7	Intake Structure		1	EA	$5,506,022	$5,506,022
8	No. of railroad crossings		0	EA		
9	Total no. of road crossings, including major and minor roads		20	EA		
10	No. of major road crossings		1	EA		
11	Total no. of stream crossings, including intermittent streams and major streams		26	EA		
12	No. of major stream crossings		5	EA		
	Total					**$115,892,619**


T-2-S R-13-E
T-2-S R-14-E
T-2-S R-15-E
T-3-S R-13-E
T-3-S R-14-E
T-3-S R-15-E
T-3-S R-16-E
T-3-S R-17-E
T-4-S R-13-E
T-4-S R-14-E
T-4-S R-15-E
T-4-S R-16-E
T-4-S R-17-E
T-4-S R-18-E
T-5-S R-15-E
T-5-S R-16-E
T-5-S R-17-E
T-5-S R-18-E
McGEE CREEK LAKE
NORMAL POOL ELEV. 777.1
MUDDY BOGGY CREEK
PARRIS
S.H. 3 & 7
CENTER POINT
ANTLERS
INDIAN NATIONS TRAIL
KIAMICHI RIVER
RATTAN LANDING
RATTAN
ROCK CREEK
HUGO LAKE
NORMAL POOL ELEV. 404.5
S.H. 93


T-2-S R-13-E
T-2-S R-14-E
T-3-S R-13-E
T-3-S R-14-E
McGEE CREEK LAKE
NORMAL POOL ELEV. 577.1
T-2-S R-14-E
T-2-S R-15-E
T-3-S R-14-E
T-3-S R-15-E
T-2-S R-15-E
T-2-S R-16-E
T-3-S R-15-E
T-3-S R-16-E
MOYERS
S.H. 2
KIAMICHI RIVER
T-2-S R-16-E
T-2-S R-17-E
T-3-S R-16-E
T-3-S R-17-E
MUDDY
BOGGY
CREEK
FARRIS
S.H. 3 & 7
CENTER POINT
T-3-S R-13-E
T-3-S R-14-E
T-4-S R-13-E
T-4-S R-14-E
T-3-S R-14-E
T-3-S R-15-E
T-4-S R-14-E
T-4-S R-15-E
S.H. 3 & 7
T-3-S R-15-E
T-3-S R-16-E
T-4-S R-15-E
T-4-S R-16-E
S.H. 2
ANTLERS
T-3-S R-16-E
T-3-S R-17-E
T-4-S R-16-E
T-4-S R-17-E
N
2000' 0 2000' 4000'


McGEE CREEK LAKE
NORMAL POOL ELEV. 577.1
700
600
500
400
0+00
100+00
200+00
300+00
400+00
500+00
600+00
700+00
800+00
KIAMICHI RIVER
McGEE CREEK LAKE TO MOYERS
APPROXIMATELY 14.0 MILES
Scaled 20,000'D Times Ver.
Scaled 1,000'D Times Hor.


McGEE CREEK LAKE
NORMAL POOL ELEV. 577.1
BOGGY
CREEK
FARRIS
S.H. 3 & 7
CENTER POINT
MOYERS
S.H. 2
KIAMICHI RIVER
ANTLERS
INDIAN NATIONS TPKE
KIAMICHI RIVER
RATTAN LANDING
ROCK CREEK
RATTAN
T-2-S R-13-E
T-2-S R-14-E
T-2-S R-15-E
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T-2-S R-17-E
T-2-S R-18-E
T-3-S R-13-E
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T-3-S R-18-E
T-4-S R-13-E
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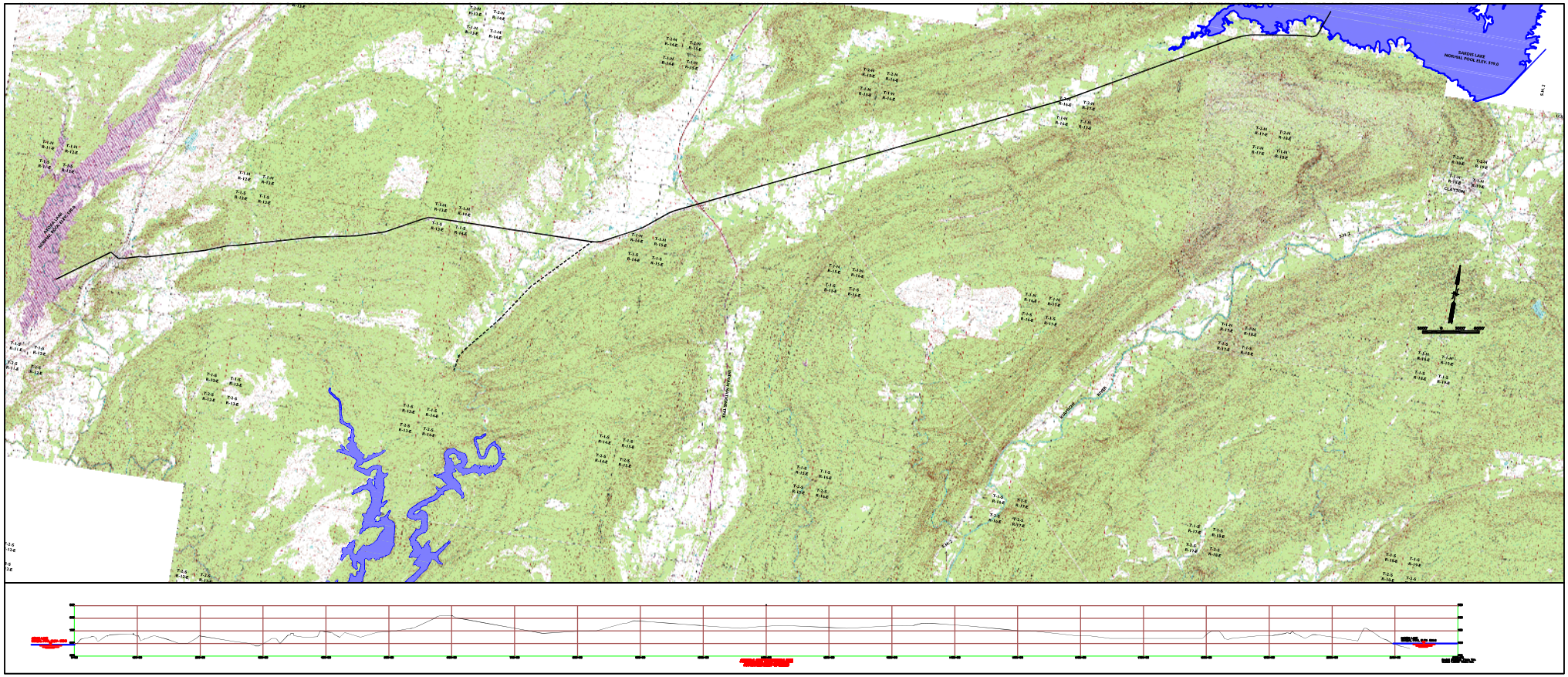
T-4-S R-18-E


DARDIS LAKE
NORMAL POOL ELEV. 590.0
CLAYTON
LONDON
RIVER
NORTH WASHINGTON
SNR 3

Appendix C

Opinion of Probable Cost for Atoka Pipeline Alternatives

CDM

Memorandum

To: *WC-602 – Project Team*

From: *Tom Charles – CDM*

Date: *March 4, 2009*

Subject: *Feasibility Level Opinions of Probable Cost for Atoka Pipeline Improvements*

This memorandum summarizes the opinion of probable capital cost for improvements to the Atoka pipeline considered during the WC-602 – Regional Raw Water Supply Infrastructure Study. The information presented in this document is essentially an application of the policies, procedures and basis of cost discussed in previous memoranda dated September 4, 2008, September 26, 2008, but updated to include the latest pricing information and costing assumptions.

Background

In order to meet demands projected by the project participants through 2060, improvements to the existing Atoka pipeline will be needed to convey raw water from Lake Atoka to the Oklahoma City metro area. The raw water supply considered for this analysis includes supply from Lake Atoka, McGee Creek reservoir, and raw water transmitted from other potential water supply sources in Southeast Oklahoma. Regardless of the source, transmission of additional supply from Southeast Oklahoma to the metro area will require expansion of the existing Atoka pipeline capacity. Supporting information is included to present the basis for sizing the Atoka pipeline and pump station improvements.

Facility Sizing

The performance and operation of the existing Atoka pipeline has been analyzed in detail in previous engineering reports completed for Oklahoma City. Sizing for this study for a parallel Atoka pipeline and booster pump stations was determined based on the previous analyses and recommended planning level design criteria. The design flow of 195 mgd for the pipeline was based on projected average day demand information provided by the project participants and an assumed capacity of 90 mgd from the existing Atoka pipeline (even if future upgrades are required). Based on this design flow, pipeline diameters of 90 inches or 84 inches would result in average velocity of 6.4 feet per second and 7.4 feet per second,

respectively. The use of twin 60-inch pipes (in addition to the existing 60 inch) would produce an average velocity of 7.25 feet per second for this design flow. Only the 90 inch size would meet the preliminary hydraulic criteria established in this study and is, therefore, the configuration used to establish finalized costing. However review and refinement of the pipeline size should be completed during engineering design to confirm anticipated performance and evaluate the cost versus benefit of alternate design operation. For example, perhaps a smaller pipe size that requires higher velocities and head losses, higher operating pressure, greater wall thickness, more robust surge control, and larger pumps would be more desirable and cost-effective than a larger pipe size.

Another component of the facility sizing included booster pump stations. For planning purposes it was assumed that six new booster pump stations will be located in parallel with the existing Atoka pipeline pump stations at the same locations as the existing facilities (to maximize use of existing sites and power availability). The required horsepower of each pump station was estimated based on the total dynamic head at each location, computed using the profile of the existing Atoka pipeline and the Hazen-Williams equation with a conservative long term 'C' value of 120. The horsepower required for each station was computed assuming a 65% combined motor and pump efficiency.

Pipeline and Costs

The Atoka pipeline from Lake Atoka to Lake Stanley Draper is over 100 miles long. As a result, the probable capital cost of the improvements will be highly dependent on the pipe material and construction costs. Escalation of material costs in recent years, and especially since December 2007 is a significant driving factor affecting the probable capital cost of the improvements. Recent volatility in commodity pricing associated with worldwide reductions in demand and other economic concerns have reduced pricing, but this could be a short impact relative to the cost planning of the Atoka pipeline and related projects. Multiple opinions of probable cost were developed to examine sensitivity to pipe size and material.

Recent discussions with pipe manufacturers and suppliers indicate that materials pricing provided to CDM in 2008 are still valid for long term planning purposes, despite recent economic upheaval. Therefore, only minimal adjustment to material costing was applied to finalized opinions of probable cost for the Atoka Pipeline (90 inch configuration). CDM evaluated anticipated rates of installation (construction) for the Atoka project under, primarily, rural conditions and concluded that assumptions made in earlier (2008) versions of the opinion of probable cost were too conservative. Adjustments made to the final opinion of probable cost include an anticipated average installation rate of approximately 300 linear feet per work day. Similar adjustments have also been applied to other aspects of the source and transmission cost opinions summarized elsewhere in the study.

Atoka Pipeline Capital Costs

In addition to the pipeline itself, the opinion of probable capital cost for the Atoka pipeline improvements includes six booster pump stations, storage tanks for flow balancing, blowoffs, air release vaults and intake/outlet structures at Atoka and Stanley Draper, respectively. Quantities and additional detail are provided in the attachment. The probable capital cost includes a 25% contingency. Based on the options considered and current cost data, the anticipated capital cost for the Atoka pipeline improvements constructed as a single 90-inch pipeline is just under $900,000,000 in 2009 dollars.

Attachment 1

Updated Opinion of Probable Cost

For

Atoka Raw Water Pipeline Project

Atoka Raw Water Pipeline Project
City of Oklahome City, Oklahoma
Opinion of Probable Construction Cost - February, 2009

Project name	Atoka Oklahoma City OK
Job size	596840 lf
ENR 20 City CCI	February 2009 8533
Notes	This is an Opinion of Probable Construction Cost only, as defined by the documents provided at the level of design indicated above. CDM has no control over the cost of labor, materials, equipment, or services furnished, over schedules, over contractor's methods of determining prices, competitive bidding (at least 3 each - both prime bidders and major subcontractors), market conditions or negotiating terms. CDM does not guarantee that this opinion will not vary from actual cost, or contractor's bids. There are not any costs provided for: Change Orders, Design Engineering, Construction Oversight, Client Costs, Finance or Funding Costs, Legal Fees, Land Acquisition or temporary/permanent Easements, Operations, or any other costs associated with this project that are not specifically part of the bidding contractor's proposed scope. Assumptions: Single interior and exterior weld inside mortar patch and tape wrap joints Spoils are spread in place No rock excavation is required. Only nominal dewatering is needed. No consideration for contaminated soils or hazardous materials (e.g. asbestos, lead) Based on a 40 hour work week with no overtime. Pipe budget pricing per American Spiralweld Pipe, D/t 240 wall thickness, tape coated. Tax is material exempt. Sand bedding & pipe zone material 25% contingency no escalation Pump Staion cost basis is $1750 / horsepower

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
01 90" Pipeline installed in rural areas -open cut										
02315.300 Trenching										
Survey & Stake Pipeline	587,070 lf	14,664	0.10 /lf	58,707	-	-	-	73,371	115,667	0.20 /lf
Trenching Excavator- 240 HP Average Exc.	4,995,676 cy	489,004	-	-	-	726,299	-	1,215,302	1,966,746	0.39 /cy
Trench Bedding-Excavator- 240 HP	104,232 cy	20,406	-	-	-	22,809	-	43,214	69,723	0.67 /cy
Trench Pipe Zone Backfill-Excavator- 240 HP	1,651,214 cy	323,259	-	-	-	361,329	-	684,588	1,104,535	0.67 /cy
Trench Native Backfill- Loader C938 3cy	2,257,095 cy	315,730	-	-	-	296,721	-	612,451	986,290	0.44 /cy
Sand Bedding/Zone/Engineered Fill Material	104,232 cy	-	10.56 /cy	1,100,691	-	-	-	1,100,691	1,735,222	16.65 /cy
Sand Bedding/Zone/Engineered Fill Material	1,651,214 cy	-	10.56 /cy	17,436,816	-	-	-	17,436,816	27,488,863	16.65 /cy
Spread Trench Spoils/Stockpile Cat 466 Loader/Backhoe 95hp (80cy/ch)	2,738,581 cy	266,264	-	-	-	169,764	-	436,028	699,274	0.26 /cy
Pipe Test	587,070 lf	65,683	0.80 /lf	469,656	-	-	-	535,339	843,953	1.44 /lf
Trenching		**1,495,010**		**19,065,870**		**1,576,920**		**22,137,800**	**35,010,274**	
02315.500 Excavation Spoils										
EXCAVATION SPOILS (Grand Total)	***2,738,581 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Trenching Spoils (Summary)	***2,738,581 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
15220.213 AWWA C200 WSP CML										
Unload Care & Protect AWWA Fabricated Pipe & Fittings	***323,229,001 lbs***		**-**	**-**	**-**		**-**			***/lbs***
Weight of AWWA C200 WSP Pipe (Zero Cost Item)	***323,229,001 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Layout AWWA WSP Pipe & Fitting	587,070 lf	41,799	-	-	-	-	-	41,799	65,896	0.11 /lf
Steel Pipe Equipment- Cat 325 Excavator	7,346 ch	66,874	-	-	-	415,894	-	482,768	790,189	107.57 /ch
400 amp Welder for Steel Pipe	152,638 ch	-	-	-	-	1,624,834	-	1,624,834	2,675,263	17.53 /ch
90" Ext/Single Joint/Weld Pipe, 9/16", (0.5625 in.)	11,742 ea	1,337,649	-	-	-		972,179	2,309,828	3,709,459	315.91 /ea
90" Int/Single Joint/Weld Pipe, 9/16", (0.5625 in.)	11,742 ea	1,337,649	-	-	-		972,179	2,309,828	3,709,459	315.91 /ea
90" AWWA C200 WSP CML, 9/16", (0.5625 in.)	587,070 lf	1,671,975	652.00 /lf	382,769,640	-	-	-	384,441,615	606,066,094	1,032.36 /lf
90" Interior/Joint Mortar Patch	11,742 ea	334,412	-	-	-	-	52,839	387,251	614,194	52.31 /ea
90" Exterior/Joint Tape Wrap	11,742 ea	250,809	-	-	-	-	563,616	814,425	1,323,381	112.70 /ea
AWWA C200 WSP CML		**5,041,168**		**382,769,640**		**2,040,727**	**2,560,813**	**392,412,348**	**618,953,935**	
01 90" Pipeline installed in rural areas -open cut	**587,070 lf**	**6,536,177**	**684.48 /lf**	**401,835,510**		**3,617,648**	**2,560,813**	**414,550,148**	**653,964,209**	**1,113.95 /lf**
02 90" Pipeline installed by Tunneling										
02441.000 Tunneling										
Mobilize/Demobilize tunneling Crew	1 ls	-	-	-	335,550	-	-	335,550	528,989	528,989.25 /ls
clear & Grub	1 ls	-	-	-	35,580	-	-	35,580	56,091	56,091.30 /ls
Field office setup	1 ls	-	-	-	60,805	-	-	60,805	95,858	95,858.12 /ls
Working trench	1 ls	-	-	-	90,347	-	-	90,347	142,431	142,430.61 /ls
Recieiving Shaft	1 ls	-	-	-	443,612	-	-	443,612	699,347	699,347.26 /ls
TBM assembly and launch	1 ls	-	-	-	438,574	-	-	438,574	691,405	691,404.93 /ls
tunnel drive	1 ls	-	-	-	4,262,447	-	-	4,262,447	6,719,680	6,719,679.93 /ls
initial liner construction	1 ls	-	-	-	1,650,547	-	-	1,650,547	2,602,061	2,602,061.10 /ls
final liner construction	1 ls	-	-	-	9,340,877	-	-	9,340,877	14,725,744	14,725,744.07 /ls
Demob	1 ls	-	-	-	81,513	-	-	81,513	128,504	128,503.94 /ls
Tunneling	**3,325 lf**		**/lf**		**16,739,852**			**16,739,852**	**26,390,111**	**7,936.88 /lf**
02 90" Pipeline installed by Tunneling	**3,325 lf**		**/lf**		**16,739,852**			**16,739,852**	**26,390,111**	**7,936.88 /lf**
03 Pipeline installed in River Crossing										
02240.200 Well Point System										
Survey & Layout Wellpoints	6,445 lf	963	-	-	-	-	-	963	1,663	0.26 /lf
Design Dewatering System	4 acre	-	-	-	22,195	-	-	22,195	34,990	7,882.42 /acre
Mobilize Dewatering Equipment	1 ea	-	-	-	1,000	-	-	1,000	1,576	1,576.47 /ea
Install Operate & Removal of Sys 2" @ 5'o/c,1000' header,10"d first mo	6,445 lf	505,507	37.50 /lf	241,688	-	-	-	747,194	1,290,019	200.16 /lf
Install Operate & Removal of Sys 2" @ 5'o/c,1000' header,10"d thrafter	19,335 lfmo	421,256	18.70 /lfmo	361,565	-	-	-	782,820	1,351,526	69.90 /lfmo
Install Discharge Pipe- 10"	100 lf	611	17.74 /lf	1,774	-	-	-	2,385	4,118	41.18 /lf
Remove Discharge Pipe	100 lf	40	-	-	-	-	-	40	69	0.69 /lf
Well Point System		**928,376**		**605,026**	**23,195**			**1,556,598**	**2,683,962**	
02310.100 Site Earthwork										
Mobilize & Return Grading Equipment (8hr each way)	4 ea	1,003	-	-	-	6,773	-	7,776	13,899	3,474.82 /ea
Mobilize & Return Grading Equipment (8hr each way)	4 ea	1,003	-	-	-	6,773	-	7,776	13,899	3,474.81 /ea
CUT to STOCKPILE (Summary)	***15,000 CY***	**-**	**-**	**-**	**-**	**-**				***/CY***
Cut/Stockpile- Excavator 138HP/1.25cy	15,000 cy	7,283	-	-	-	36,837	-	44,120	78,751	5.25 /cy
FILL from IMPORT (Summary)	***15,000 CY***	**-**	**-**	**-**	**-**	**-**				***/CY***
Fill/Import Load Cat 320 Excavator 140hp	15,000 cy	5,873	-	-	-	13,368	-	19,241	34,156	2.28 /cy
Fill/Import- Loader 3cy/CP323 Compactor	15,000 cy	49,691	-	-	-	131,579	-	181,270	322,171	21.48 /cy
IMPORT MATERIAL (Summary)	***15,000 0***	**-**	**-**	**-**	**-**	**-**				***/0***
Import Earth Fill	15,000 cy	-	7.00 /cy	105,000	78,000	-	-	183,000	304,247	20.28 /cy
Cut/Stockpile Haul 18cy Rear Dump	15,000 cy	18,179	-	-	-	59,575	-	77,754	138,412	9.23 /cy
Fill/Import Haul 18cy Rear Dump	15,000 cy	18,179	-	-	-	59,575	-	77,754	138,412	9.23 /cy
Site Earthwork		**101,212**		**105,000**	**78,000**	**314,480**		**598,692**	**1,043,946**	
02315.300 Trenching										
Survey & Stake Pipeline	6,445 lf	161	0.10 /lf	645	-	-	-	805	1,270	0.20 /lf
Trenching Excavator- 240 HP Average Exc.	54,844 cy	5,368	-	-	-	7,973	-	13,342	21,591	0.39 /cy
Trench Bedding-Excavator- 240 HP	1,144 cy	224	-	-	-	250	-	474	765	0.67 /cy
Trench Pipe Zone Backfill-Excavator- 240 HP	18,127 cy	3,549	-	-	-	3,967	-	7,516	12,126	0.67 /cy
Trench Native Backfill- Loader C938 3cy	24,779 cy	3,466	-	-	-	3,257	-	6,724	10,828	0.44 /cy
Sand Bedding/Zone/Engineered Fill Material	1,144 cy	-	10.56 /cy	12,084	-	-	-	12,084	19,050	16.65 /cy

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
02315.300 Trenching										
Sand Bedding/Zone/Engineered Fill Material	18,127 cy	-	10.56 /cy	191,426	-	-	-	191,426	301,780	16.65 /cy
Spread Trench Spoils/Stockpile Cat 466 Loader/Backhoe 95hp (80cy/ch)	30,065 cy	2,923	-	-	-	1,864	-	4,787	7,677	0.26 /cy
Pipe Test	6,445 lf	721	0.80 /lf	5,156	-	-	-	5,877	9,265	1.44 /lf
Trenching		16,413		209,310		17,312		243,034	384,352	
02315.500 Excavation Spoils										
EXCAVATION SPOILS (Grand Total)	*30,065 cy*	-	-	-	-	-				*/cy*
EXCAVATION SPOILS (Grand Total)	*15,000 cy*	-	-	-	-	-				*/cy*
Site Grading Spoils (Summary)	*15,000 cy*	-	-	-	-	-				*/cy*
Trenching Spoils (Summary)	*30,065 cy*	-	-	-	-	-				*/cy*
02910.100 Topsoil & Soil Prep										
Machine Rake	5,055,680 sf	-	-	-	202,227	-	-	202,227	318,808	0.06 /sf
Hand Rake	5,055,680 sf	-	-	-	252,784	-	-	252,784	398,510	0.08 /sf
Topsoil & Soil Prep					455,011			455,011	717,318	
15220.213 AWWA C200 WSP CML										
Unload Care & Protect AWWA Fabricated Pipe & Fittings	3,548,488 lbs	1,214	-	-	-		-	1,214	1,913	0.00 /lbs
Weight of AWWA C200 WSP Pipe (Zero Cost Item)	*3,548,488 lbs*	-	-	-	-	-				*/lbs*
Layout AWWA WSP Pipe & Fitting	6,445 lf	459	-	-	-	-	-	459	723	0.11 /lf
Steel Pipe Equipment- Cat 325 Excavator	81 ch	737	-	-	-	4,586	-	5,323	8,713	107.57 /ch
400 amp Welder for Steel Pipe	1,676 ch	-	-	-	-	17,838	-	17,838	29,370	17.53 /ch
90" Ext/Single Joint/Weld Pipe, 9/16", (0.5625 in.)	129 ea	14,696	-	-	-		10,681	25,376	40,753	315.91 /ea
90" Int/Single Joint/Weld Pipe, 9/16", (0.5625 in.)	258 ea	29,391	-	-	-		21,361	50,752	81,506	315.91 /ea
90" AWWA C200 WSP CML, 9/16", (0.5625 in.)	6,445 lf	18,355	652.00 /lf	4,202,140	-	-	-	4,220,495	6,653,544	1,032.36 /lf
90" Interior/Joint Mortar Patch	129 ea	3,674	-	-	-	-	581	4,254	6,748	52.31 /ea
90" Exterior/Joint Tape Wrap	129 ea	2,755	-	-	-	-	6,192	8,947	14,539	112.70 /ea
AWWA C200 WSP CML		71,282		4,202,140		22,424	38,814	4,334,660	6,837,808	
03 Pipeline installed in River Crossing	**6,445 lf**	**1,117,282**	**794.64 /lf**	**5,121,476**	**556,206**	**354,216**	**38,814**	**7,187,995**	**11,667,385**	**1,810.30 /lf**
04 Clearing and Grubbing in Forested Areas along Route										
02230.200 Clear & Grub										
Clear & Grub Heavy Trees, 20ac - 250ac	116 ac	86,848	-	-	-	132,797	-	219,646	388,510	3,349.23 /ac
Clear & Grub		86,848				132,797		219,646	388,510	
02990.100 Restore Disturbed Area										
Native Seeding	5,055,680 sf	-	-	-	139,275	-	-	139,275	219,565	0.04 /sf
Restore Disturbed Area					139,275			139,275	219,565	
04 Clearing and Grubbing in Forested Areas along Route	**116 ac**	**86,848**	**/ac**		**139,275**	**132,797**		**358,920**	**608,075**	**5,242.03 /ac**
05 Pump Station #1										
11210.000 PUMPS										
Pump Station #1	13,100 hp	-	-	-	22,925,000	-	-	22,925,000	36,140,898	2,758.85 /hp
PUMPS			/ea		22,925,000			22,925,000	36,140,898	/ea
05 Pump Station #1	**13,100 hp**		**/hp**		**22,925,000**			**22,925,000**	**36,140,898**	**2,758.85 /hp**
06 Pump Station #2										
11210.000 PUMPS										
Pump Station #2	9,300 hp	-	-	-	16,275,000	-	-	16,275,000	25,657,279	2,758.85 /hp
PUMPS			/ea		16,275,000			16,275,000	25,657,279	/ea
06 Pump Station #2	**9,300 hp**		**/hp**		**16,275,000**			**16,275,000**	**25,657,279**	**2,758.85 /hp**
07 Pump Station #3										
11210.000 PUMPS										
Pump Station #3	13,400 hp	-	-	-	23,450,000	-	-	23,450,000	36,968,552	2,758.85 /hp
PUMPS			/ea		23,450,000			23,450,000	36,968,552	/ea
07 Pump Station #3	**13,400 hp**		**/hp**		**23,450,000**			**23,450,000**	**36,968,552**	**2,758.85 /hp**
08 Pump Station #4										
11210.000 PUMPS										
Pump Station #4	9,800 hp	-	-	-	17,150,000	-	-	17,150,000	27,036,702	2,758.85 /hp
PUMPS			/ea		17,150,000			17,150,000	27,036,702	/ea
08 Pump Station #4	**9,800 hp**		**/hp**		**17,150,000**			**17,150,000**	**27,036,702**	**2,758.85 /hp**
09 Pump Station #5										
11210.000 PUMPS										
Pump Station #5	8,400 hp	-	-	-	14,700,000	-	-	14,700,000	23,174,316	2,758.85 /hp
PUMPS			/ea		14,700,000			14,700,000	23,174,316	/ea
09 Pump Station #5	**8,400 hp**		**/hp**		**14,700,000**			**14,700,000**	**23,174,316**	**2,758.85 /hp**
10 Pump Station #6										
11210.000 PUMPS										
Pump Station #6	10,150 hp	-	-	-	17,762,500	-	-	17,762,500	28,002,299	2,758.85 /hp
PUMPS			/ea		17,762,500			17,762,500	28,002,299	/ea
10 Pump Station #6	**10,150 hp**		**/hp**		**17,762,500**			**17,762,500**	**28,002,299**	**2,758.85 /hp**
11 Balancing Tanks										

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
02720.005 Temporary Unbound Base										
Geotextile Fabric u/Temporary Base	6,039 sy	1,643	2.07 /sy	12,500	-	1,919	-	16,062	27,865	4.61 /sy
Place Temporary Base- Dozer D4/CP323 Compactor	4,026 cy	26,673	-	-	-	50,281	-	76,955	136,381	33.88 /cy
ASTM D448 # 57 Stone (1.00- No. 4)	4,026 cy	-	19.36 /cy	77,941	25,766	-	-	103,707	175,184	43.51 /cy
Temporary Unbound Base		**28,316**		**90,441**	**25,766**	**52,201**		**196,724**	**339,430**	
13219.100 CROM Concrete Tank										
6 MG Prestressed Crom Tank	5 ea	-	-	-	11,500,000	-	-	11,500,000	18,129,567	3,625,913.43 /ea
CROM Concrete Tank			**/mg**		**11,500,000**			**11,500,000**	**18,129,567**	**/mg**
11 Balancing Tanks	**5 ea**	**28,316**	**18,088.21 /ea**	**90,441**	**11,525,766**	**52,201**		**11,696,724**	**18,468,997**	**3,693,799.41 /ea**
12 Blowoffs										
09910.100 Paint Pipe/Valve/Equip										
Pipe Painting Preparation/Small Tools & Consumables	3,695 sf	411	-	-	-	-	92	503	875	0.24 /sf
Paint 12" Pipe	1,176 lf	2,028	1.24 /lf	1,462	-	-	-	3,489	6,024	5.12 /lf
Paint Pipe/Valve/Equip		**2,439**	**/LS**	**1,462**			**92**	**3,993**	**6,900**	**/LS**
15112.200 AWWA Butterfly Valves										
Butterfly Valve, Worm Gear, NO, Wafer, 12"	98 ea	11,685	750.00 /ea	73,500	-	-	-	85,185	134,293	1,370.33 /ea
AWWA Butterfly Valves		**11,685**		**73,500**				**85,185**	**134,293**	
1511Z.000 Valve Accessories										
5.0' Depth- Cast Iron Valve Box (Top/Bottom/Lid + Base)	98 ea	5,582	184.00 /ea	18,032	-	-	-	23,614	37,227	379.87 /ea
Valve Accessories		**5,582**		**18,032**				**23,614**	**37,227**	
15120.300 Bolt & Gaskets Sets										
Unload & Inventory Nut/Bolt & Gasket Sets	98 ea	371	-	-	-	-	-	371	585	5.97 /ea
12-0/0" 150# 304 Stainless Steel Bolt Sets	98 ea	-	115.00 /ea	11,270	-	-	-	11,270	17,767	181.30 /ea
12-0/0" Full Faced CIR Gasket 1/8"	98 ea	-	18.50 /ea	1,813	-	-	-	1,813	2,857	29.16 /ea
Bolt & Gaskets Sets		**371**		**13,083**				**13,454**	**21,209**	
15220.332 A53 Mortar Lined BW Pipe										
Unload Care & Protect Pipe/Fittings	97,251 lbs	366	-	-	-	636	-	1,002	1,624	0.02 /lbs
Weight of Pipe (Zero Cost Item)	***62,951 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Weight of Fittings (Zero Cost Item)	***34,300 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Layout Pipe & Fitting	1,176 lf	335	-	-	-	-	-	335	528	0.45 /lf
Steel Pipe Equipment- Cat 320 Excavator	42 ch	1,542	-	-	-	7,798	-	9,339	15,269	360.66 /ch
300 amp Welder for Steel Pipe	42 ch	-	-	-	-	542	-	542	893	21.09 /ch
A53 CW Schd. 40 Pipe BW- Mortar Lined, 12"	588 lf	9,143	160.59 /lf	94,427	-	-	-	103,570	163,277	277.68 /lf
A53 Sch-40 90 EL BW- Mortar Lined, 12"	196 ea	51,110	396.00 /ea	77,616	-	-		128,726	202,934	1,035.38 /ea
Weld Neck Flange Stnd/XS Class 150, 12"	98 ea	16,118	109.90 /ea	10,770	-	-		26,888	42,389	432.54 /ea
A53 Mortar Lined BW Pipe		**78,614**		**182,813**		**8,976**		**270,403**	**426,914**	
12 Blowoffs	**98 ea**	**98,690**	**2,947.85 /ea**	**288,889**		**8,976**	**92**	**396,648**	**626,543**	**6,393.29 /ea**
13 Air Release Vaults										
02539.010 Sanitary Sewer Manholes										
Unload Care & Protect Manhole	213 ea	3,772	-	-	-	-	-	3,772	6,513	30.58 /ea
Place & Shape Manhole Base - 72"	213 ea	45,267	-	-	-	-	55,891	101,158	178,560	838.31 /ea
Manhole 72" x 6' Deep	213 ea	67,106	2,700.00 /ea	575,100	-	101,987	-	744,193	1,291,977	6,065.62 /ea
Sanitary Sewer Manholes		**116,145**	**/Ea**	**575,100**		**101,987**	**55,891**	**849,123**	**1,477,049**	**/Ea**
09910.100 Paint Pipe/Valve/Equip										
Valve Painting Preparation/Small Tools & Consumables	335 sf	37	0.03 /sf	8	-	-	-	46	79	0.24 /sf
Paint 6" Valves	213 ea	2,962	2.50 /ea	532	-	-	-	3,494	6,032	28.32 /ea
Paint Pipe/Valve/Equip		**2,999**	**/LS**	**540**				**3,539**	**6,110**	**/LS**
15113.410 GV Solid Wedge Disc CI/DI										
Gate Valve, Solid Wedges, flg, 6"	213 ea	23,399	270.00 /ea	57,510	-	-	-	80,909	127,552	598.84 /ea
GV Solid Wedge Disc CI/DI		**23,399**		**57,510**				**80,909**	**127,552**	
15119.600 Air/Vacuum Relief Valve										
Air Release Valve, 6.00"	213 ea	17,105	1,850.00 /ea	394,050	-	-	-	411,155	648,179	3,043.09 /ea
Air/Vacuum Relief Valve		**17,105**		**394,050**				**411,155**	**648,179**	
15120.300 Bolt & Gaskets Sets										
Unload & Inventory Nut/Bolt & Gasket Sets	213 ea	806	-	-	-	-	-	806	1,271	5.97 /ea
6-0/0" 150# 304 Stainless Steel Bolt Sets	426 ea	-	50.00 /ea	21,300	-	-	-	21,300	33,579	78.82 /ea
6-0/0" 150# 304 Stainless Steel Bolt Sets	213 ea	-	50.00 /ea	10,650	-	-	-	10,650	16,790	78.82 /ea
6-0/0" Full Faced CIR Gasket 1/8"	426 ea	-	6.62 /ea	2,818	-	-	-	2,818	4,443	10.43 /ea
6-0/0" Full Faced CIR Gasket 1/8"	213 ea	-	6.62 /ea	1,409	-	-	-	1,409	2,221	10.43 /ea
Bolt & Gaskets Sets		**806**		**36,177**				**36,983**	**58,304**	
15220.322 A53 CW Pipe- BW (36.10)										
Unload Care & Protect Pipe/Fittings	63,568 lbs	239	-	-	-	416	-	655	1,061	0.02 /lbs
Weight of Pipe (Zero Cost Item)	***48,487 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Weight of Fittings (Zero Cost Item)	***15,080 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Layout Pipe & Fitting	2,556 lf	728	-	-	-	-	-	728	1,148	0.45 /lf
Galvanize Steel Pipe	63,568 lbs	-	0.50 /lbs	31,784	-	-	-	31,784	50,107	0.79 /lbs
A53 CW Schd. 40 Pipe BW, 6"	1,917 lf	16,816	12.33 /lf	23,638	-	-	-	40,453	63,774	33.27 /lf
A53 Sch-40 90 EL BW, 6"	426 ea	53,419	60.33 /ea	25,701	-	-		79,120	124,731	292.80 /ea
Weld Neck Flange Stnd/XS Class 150, 6"	213 ea	18,174	29.35 /ea	6,252	-	-		24,426	38,507	180.78 /ea
A53 CW Pipe- BW (36.10)		**89,377**		**87,374**		**416**		**177,166**	**279,328**	

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
13 Air Release Vaults	**213 ea**	**249,831**	**5,402.59 /ea**	**1,150,751**		**102,403**	**55,891**	**1,558,875**	**2,596,522**	**12,190.24 /ea**
14 Air/Vac Vaults										
02539.010 Sanitary Sewer Manholes										
Unload Care & Protect Manhole	18 ea	319	-	-	-	-	-	319	550	30.58 /ea
Place & Shape Manhole Base - 72"	18 ea	3,825	-	-	-	-	4,723	8,549	15,090	838.31 /ea
Manhole 72" x 6' Deep	18 ea	5,671	2,700.00 /ea	48,600	-	8,619	-	62,890	109,181	6,065.62 /ea
Sanitary Sewer Manholes		**9,815**	**/Ea**	**48,600**		**8,619**	**4,723**	**71,757**	**124,821**	**/Ea**
09910.100 Paint Pipe/Valve/Equip										
Valve Painting Preparation/Small Tools & Consumables	28 sf	3	0.03 /sf	1	-	-	-	4	7	0.24 /sf
Paint 6" Valves	18 ea	250	2.50 /ea	45	-	-	-	295	510	28.32 /ea
Paint Pipe/Valve/Equip		**253**	**/LS**	**46**				**299**	**516**	**/LS**
15113.410 GV Solid Wedge Disc CI/DI										
Gate Valve, Solid Wedges, flg, 6"	18 ea	1,977	270.00 /ea	4,860	-	-	-	6,837	10,779	598.84 /ea
GV Solid Wedge Disc CI/DI		**1,977**		**4,860**				**6,837**	**10,779**	
15119.600 Air/Vacuum Relief Valve										
Combination ARV/AVV (CAV) Valve, 6.00"	18 ea	4,130	2,224.00 /ea	40,032	-	-	-	44,162	69,620	3,867.81 /ea
Air/Vacuum Relief Valve		**4,130**		**40,032**				**44,162**	**69,620**	
15120.300 Bolt & Gaskets Sets										
Unload & Inventory Nut/Bolt & Gasket Sets	18 ea	68	-	-	-	-	-	68	107	5.97 /ea
6-0/0" 150# 304 Stainless Steel Bolt Sets	36 ea	-	50.00 /ea	1,800	-	-	-	1,800	2,838	78.82 /ea
6-0/0" 150# 304 Stainless Steel Bolt Sets	18 ea	-	50.00 /ea	900	-	-	-	900	1,419	78.82 /ea
6-0/0" Full Faced CIR Gasket 1/8"	36 ea	-	6.62 /ea	238	-	-	-	238	375	10.43 /ea
6-0/0" Full Faced CIR Gasket 1/8"	18 ea	-	6.62 /ea	119	-	-	-	119	188	10.43 /ea
Bolt & Gaskets Sets		**68**		**3,057**				**3,125**	**4,927**	
15220.322 A53 CW Pipe- BW (36.10)										
Unload Care & Protect Pipe/Fittings	5,372 lbs	20	-	-	-	35	-	55	90	0.02 /lbs
Weight of Pipe (Zero Cost Item)	***4,098 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Weight of Fittings (Zero Cost Item)	***1,274 lbs***	**-**	**-**	**-**	**-**	**-**				***/lbs***
Layout Pipe & Fitting	216 lf	62	-	-	-	-	-	62	97	0.45 /lf
Galvanize Steel Pipe	5,372 lbs	-	0.50 /lbs	2,686	-	-	-	2,686	4,234	0.79 /lbs
A53 CW Schd. 40 Pipe BW, 6"	162 lf	1,421	12.33 /lf	1,998	-	-	-	3,419	5,389	33.27 /lf
A53 Sch-40 90 EL BW, 6"	36 ea	4,514	60.33 /ea	2,172	-	-		6,686	10,541	292.80 /ea
Weld Neck Flange Stnd/XS Class 150, 6"	18 ea	1,536	29.35 /ea	528	-	-		2,064	3,254	180.79 /ea
A53 CW Pipe- BW (36.10)		**7,553**		**7,384**		**35**		**14,972**	**23,605**	
14 Air/Vac Vaults	**18 ea**	**23,797**	**5,776.59 /ea**	**103,979**		**8,654**	**4,723**	**141,152**	**234,269**	**13,014.96 /ea**
15 Outlet/Inlet Structure										
01220.000 Proj. Specific Allowances										
Mobilization/Demobilization	1 ls	-	-	-	200,000	-	-	200,000	315,297	315,296.79 /ls
Proj. Specific Allowances					**200,000**			**200,000**	**315,297**	
02240.200 Well Point System										
Install, Operate & Removal of Wellpoint Dewatering System	1,800 lf	-	-	-	40,000	-	-	40,000	63,059	35.03 /lf
Well Point System					**40,000**			**40,000**	**63,059**	
02310.100 Site Earthwork										
Mobilize & Return Grading Equipment (8hr each way)	4 ea	1,785	-	-	-	12,054	-	13,840	24,738	6,184.41 /ea
CUT to STOCKPILE (Summary)	***10,000 CY***	**-**	**-**	**-**	**-**	**-**				***/CY***
Cut/Stockpile- Scraper Self-Load 14/17 CY	10,000 cy	17,282	-	-	-	93,878	-	111,160	198,487	19.85 /cy
Site Earthwork		**19,068**				**105,932**		**125,000**	**223,225**	
02315.100 Structure Excavation										
Mobilize & Return Excavation Equipment (8hr each way)	2 ea	1,036	-	-	-	6,992	-	8,028	14,349	7,174.39 /ea
Excavate- Excavator 240HP/2.25cy	1,228 cy	1,231	-	-	-	6,225	-	7,455	13,307	10.84 /cy
FINE GRADE (Summary)	***279 SF***	**-**	**-**	**-**	**-**	**-**				***/SF***
Fine Grade- Dozer D4	279 sf	6	-	-	-	11	-	18	31	0.11 /sf
Structure Excavation		**2,272**				**13,228**		**15,500**	**27,687**	
02315.200 Foundation Excavation										
EXCAVATE to STOCKPILE (Summary)	***13 CY***	**-**	**-**	**-**	**-**	**-**				***/CY***
Excavate Load Cat 466 Loader/Backhoe 95hp	13 cy	8	-	-	-	12	-	20	32	2.37 /cy
BACKFILL from STOCKPILE (Summary)	***9 CY***	**-**	**-**	**-**	**-**	**-**				***/CY***
Foundation Subgrade- Scarify & Recompact/Proof Roll	120 sf	30	-	-	-	30	-	60	96	0.80 /sf
Backfill Load Cat 466 Backhoe 95hp	9 cy	55	-	-	-	56	-	111	179	20.87 /cy
Excavate- Backhoe 1.5cy	13 cy	36	-	-	-	75	-	111	180	13.53 /cy
Excavate Haul 10cy Rear Dump	13 cy	32	-	-	-	79	-	111	181	13.56 /cy
Backfill Haul 10cy Rear Dump	9 cy	21	-	-	-	51	-	72	117	13.56 /cy
Backfill- Backhoe 1.5cy/Trench Cmpctr	9 cy	35	-	-	-	68	-	103	167	19.47 /cy
Foundation Excavation		**216**				**371**		**587**	**952**	
02315.500 Excavation Spoils										
EXCAVATION SPOILS (Grand Total)	***5 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
EXCAVATION SPOILS (Grand Total)	***1,228 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
EXCAVATION SPOILS (Grand Total)	***10,000 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Site Grading Spoils (Summary)	***10,000 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Structure Excavation Spoils (Sub Total)	***1,228 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
02315.500 Excavation Spoils										
Foundation Excavation Spoils (Summary)	***5 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Load Spoils Cat 466 Loader/Backhoe 95hp (80cy/ch)	5 cy	3	-	-	-	4	-	7	12	2.60 /cy
Load Spoils Cat 320 Excavator 140hp (120cy/ch)	1,228 cy	481	-	-	-	1,094	-	1,575	2,795	2.28 /cy
Excavation Spoils		**483**				**1,098**		**1,582**	**2,808**	
02441.000 Tunneling										
90" Microtunnel	400 lf	-	-	-	2,272,800	-	-	2,272,800	3,583,033	8,957.58 /lf
Tunneling			**/lf**		**2,272,800**			**2,272,800**	**3,583,033**	**/lf**
02465.500 Drilled Piers										
Layout Drilled Piers	24 ea	221	-	-	-	-	-	221	381	15.88 /ea
Mobilize Drilling Equipment	3 ls	-	-	-	15,000	-	-	15,000	23,647	7,882.43 /ls
Drill 24 inch x 41 Ft. Caisson	960 lf	-	-	-	10,560	-	-	10,560	16,648	17.34 /lf
Drilled Pier Stockpile Excess Rubber Tired Loader 2.50 CY	112 cy	107	-	-	-	183	-	290	513	4.59 /cy
Drilled Pier Load Disposal- Rubber Tired Loader 2.50 CY	112 cy	31	-	-	-	53	-	85	150	1.34 /cy
Disposal Haul,12 cy Truck, 1 Mile Round Trip	112 cy	54	-	-	-	330	-	384	687	6.15 /cy
Drilled Piers		**413**			**25,560**	**566**		**26,539**	**42,025**	
03000.005 Concrete in Place										
Concrete: Pipe Encasement	1,187 cy	58,383	190.00 /cy	225,519	-	38,273	-	322,175	510,583	430.17 /cy
Concrete in Place		**58,383**	**/LS**	**225,519**		**38,273**		**322,175**	**510,583**	**/LS**
03110.010 Total Formwork & Hoisting										
Total Formwork	***176 csf***	**-**	**-**	**-**	**-**	**-**				***/csf***
Total Formwork	***96 csf***	**-**	**-**	**-**	**-**	**-**				***/csf***
Total Formwork	***11,762 csf***	**-**	**-**	**-**	**-**	**-**				***/csf***
Total Formwork	***864 csf***	**-**	**-**	**-**	**-**	**-**				***/csf***
Total Formwork	***1,041 csf***	**-**	**-**	**-**	**-**	**-**				***/csf***
03110.200 Foundation Formwork										
Foundation Form Oil & Hardware	96 sf	-	0.25 /sf	24	-	-	-	24	38	0.39 /sf
Foundation Form Hoisting	96 sf	-	-	-	-	62	-	62	102	1.06 /sf
Fine Grade Foundation	64 sf	7	-	-	-	-	-	7	11	0.17 /sf
Column/Pad Footing < 24" 3 Form Use	96 sf	484	0.99 /sf	95	-	-	-	580	914	9.52 /sf
Foundation Formwork		**491**	**/csf**	**119**		**62**		**673**	**1,065**	**/csf**
03110.300 Slab-on-Grade Formwork										
Slab-on-Grade Form Oil & Hardware	176 sf	-	0.25 /sf	44	-	-	-	44	69	0.39 /sf
Slab-on-Grade Form Hoisting	176 sf	-	-	-	-	23	-	23	37	0.21 /sf
Hand Fine Grade SOG	616 sf	66	-	-	-	-	-	66	104	0.17 /sf
Circular Slab-on-Grade < 24" 3 Form Use	176 sf	888	0.78 /sf	136	-	-	-	1,025	1,615	9.18 /sf
Chamfer Strip	88 lf	-	0.28 /lf	24	-	-	-	24	38	0.43 /lf
PVC Waterstop Ribbed w/Center Bulb 3/8"x 9"	78 lf	87	5.57 /lf	434	-	-	-	521	821	10.52 /lf
Slab-on-Grade Formwork		**1,041**	**/csf**	**639**		**23**		**1,702**	**2,685**	**/csf**
03112.200 Walls-Lumber Formed										
Lumber Wall Form Oil & Hardware	11,762 sf	-	0.36 /sf	4,270	-	-	-	4,270	6,731	0.57 /sf
Lumber Wall Form Oil & Hardware	864 sf	-	0.36 /sf	314	-	-	-	314	494	0.57 /sf
Lumber Wall Form Hoisting	11,762 sf	1,502	-	-	-	3,409	-	4,911	7,980	0.68 /sf
Lumber Wall Form Hoisting	864 sf	110	-	-	-	250	-	361	586	0.68 /sf
Starter Walls or Wall Dowell Rebar Template	163 lf	1,649	2.07 /lf	338	-	-	-	1,987	3,133	19.18 /lf
Wall-Lumber Formed > 20 Ft- 3 Form Use	864 sf	3,139	1.09 /sf	943	-	-	-	4,082	6,436	7.45 /sf
Curved Wall-Lumber Formed > 20 Ft- 3 Form Use	11,762 sf	71,233	1.52 /sf	17,857	-	-	-	89,090	140,448	11.94 /sf
Blast Clean Wall Construction Joints	980 sf	435	0.42 /sf	412	-	790	-	1,636	2,635	2.69 /sf
Blast Clean Wall Construction Joints	360 sf	160	0.42 /sf	151	-	290	-	601	968	2.69 /sf
Bulkheads/Construction Joints/Wall Ends	288 sf	2,616	2.53 /sf	729	-	-	-	3,345	5,273	18.31 /sf
Chamfer Strip	288 lf	-	0.28 /lf	79	-	-	-	79	125	0.43 /lf
PVC Waterstop Ribbed w/Center Bulb 3/8"x 9"	490 lf	544	5.57 /lf	2,727	-	-	-	3,271	5,157	10.52 /lf
Walls-Lumber Formed		**81,388**	**/csf**	**27,819**		**4,739**		**113,946**	**179,966**	**/csf**
03114.300 Elevated Slab Formwork										
Elevated Slab Form Oil & Hardware	527 csf	-	0.15 /csf	79	-	-	-	79	125	0.24 /csf
Elevated Slab Form Hoisting	527 sf	468	-	-	-	1,061	-	1,529	2,485	4.71 /sf
Slab Edge < 8" 3 Form Use	154 sf	777	0.80 /sf	123	-	-	-	901	1,420	9.22 /sf
Floor Slab x 8" 3 Form Uses	360 sf	545	0.73 /sf	261	-	-	-	806	1,271	3.53 /sf
Blast Clean Slab Construction Joints	13 sf	3	0.46 /sf	6	-	5	-	14	23	1.74 /sf
Slab Const Joints < 12"	13 sf	94	3.47 /sf	46	-	-	-	140	221	16.60 /sf
Elevated Slab Formwork		**1,887**	**/csf**	**516**		**1,067**		**3,470**	**5,545**	**/csf**
03114.920 Slab Shoring-Scaffold										
Slab Shore Hoisting	360 sf	28	-	-	-	21	-	49	79	0.22 /sf
Install Shoring System- 8" Slab Soffit > 30 Ft AFF	360 sf	472	-	-	-	-	-	472	745	2.07 /sf
Rent Slab Shoring System- 8" Slab Soffit > 30 Ft AFF	720 sfmo	-	-	-	2,160	-	-	2,160	3,405	4.73 /sfmo
Slab Shoring-Scaffold		**500**	**/sf**		**2,160**	**21**		**2,681**	**4,229**	**/sf**
03210.100 Reinforcing Steel										
Rebar Accesories/Unload & Store	6 tn	12	10.00 /tn	57	-		-	69	109	19.15 /tn
Rebar Accesories/Unload & Store	6 tn	32	10.00 /tn	56	-	78	-	165	266	47.60 /tn
Rebar Accesories/Unload & Store	1 tn	3	10.00 /tn	6	-	8	-	18	28	47.64 /tn
Rebar Accesories/Unload & Store	54 tn	309	10.00 /tn	545	-	757	-	1,611	2,592	47.60 /tn
Rebar Accesories/Unload & Store	4 tn	23	10.00 /tn	40	-	56	-	118	190	47.59 /tn
Rebar Accesories/Unload & Store	1 tn	6	10.00 /tn	11	-	15	-	33	53	47.60 /tn
Drilled Pier Rebar	6 tn	2,631	1,400.00 /tn	7,819	-	-	-	10,450	16,474	2,949.69 /tn

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
03210.100 Reinforcing Steel										
Foundation Rebar	1 tn	331	1,400.00 /tn	830	-	-	-	1,162	1,831	3,088.13 /tn
SOG Rebar	6 tn	3,186	1,400.00 /tn	7,981	-	-	-	11,167	17,605	3,088.09 /tn
Wall Rebar	54 tn	30,432	1,400.00 /tn	76,236	-	-	-	106,667	168,159	3,088.09 /tn
Wall Rebar	4 tn	2,235	1,400.00 /tn	5,600	-	-	-	7,835	12,352	3,088.09 /tn
Elevated Slab Rebar	1 tn	621	1,400.00 /tn	1,555	-	-	-	2,176	3,431	3,088.10 /tn
Reinforcing Steel		**39,821**		**100,736**		**914**		**141,471**	**223,091**	
03310.100 Foundation Place/Finish										
Total Foundation Concrete	***112 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Foundation Concrete	***5 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Pump Place Drilled Piers	112 cy	1,059	-	-	-	-	-	1,059	1,670	14.95 /cy
Truck Place Isolated Footing	5 cy	82	-	-	-	-	-	82	129	27.18 /cy
Float Finish @ Foundation	75 sf	10	-	-	-	-	-	10	16	0.22 /sf
Float Finish @ Foundation	64 sf	9	-	-	-	-	-	9	14	0.22 /sf
Water Base Non-Residual Cure	75 sf	3	0.04 /sf	3	-	-	-	6	9	0.12 /sf
Water Base Non-Residual Cure	160 sf	6	0.04 /sf	6	-	-	-	12	20	0.12 /sf
Concrete Pump- 75' Boom (23m)	112 cy	-	-	-	1,216	-	218	1,434	2,276	20.38 /cy
Foundation Place/Finish		**1,170**	**/cy**	**9**	**1,216**		**218**	**2,613**	**4,134**	**/cy**
03310.200 Slab-on-Grade Place/Fin										
Total SOG Concrete	***46 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Pump Place Slab on Grade	46 cy	183	-	-	-	-	-	183	288	6.32 /cy
Float Finish @ SOG	616 sf	106	-	-	-	-	-	106	167	0.27 /sf
Water Base Non-Residual Cure	616 sf	22	0.04 /sf	24	-	-	-	46	72	0.12 /sf
Concrete Pump- 92' Boom (28m)	46 cy	-	-	-	497	-	89	586	929	20.38 /cy
Slab-on-Grade Place/Fin		**311**	**/cy**	**24**	**497**		**89**	**920**	**1,456**	**/cy**
03310.500 Wall Place/Finish										
Total Wall Concrete	***436 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Wall Concrete	***32 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Pump Place Walls	436 cy	7,511	-	-	-	-	-	7,511	11,841	27.18 /cy
Pump Place Walls	32 cy	552	-	-	-	-	-	552	870	27.18 /cy
Grout Bed for Horizontal Construction Joint	163 lf	175	0.56 /lf	91	-	-	-	267	421	2.57 /lf
Grout Bed for Horizontal Construction Joint	12 lf	13	0.56 /lf	7	-	-	-	20	31	2.57 /lf
Trowel Finish @ Wall Top	327 sf	105	-	-	-	-	-	105	166	0.51 /sf
Trowel Finish @ Wall Top	24 sf	8	-	-	-	-	-	8	12	0.51 /sf
Point & Patch Walls	11,762 sf	5,052	0.01 /sf	118	-	-	-	5,170	8,150	0.69 /sf
Point & Patch Walls	864 sf	371	0.01 /sf	9	-	-	-	380	599	0.69 /sf
Water Base Non-Residual Cure	12,089 sf	428	0.04 /sf	465	-	-	-	894	1,409	0.12 /sf
Water Base Non-Residual Cure	888 sf	31	0.04 /sf	34	-	-	-	66	103	0.12 /sf
Concrete Pump- 92' Boom (28m)	436 cy	-	-	-	7,115	-	849	7,965	12,616	28.96 /cy
Concrete Pump- 92' Boom (28m)	32 cy	-	-	-	523	-	62	585	927	28.96 /cy
Wall Place/Finish		**14,247**	**/cy**	**724**	**7,638**		**912**	**23,521**	**37,145**	**/cy**
03310.700 Elev. Slab Place & Finish										
Total Elevated Slab Concrete	***9 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Pump Place Suspended Slab	9 cy	115	-	-	-	-	-	115	181	20.39 /cy
Float Finish @ Slab	360 sf	50	-	-	-	-	-	50	78	0.22 /sf
Water Base Non-Residual Cure	360 sf	12	0.04 /sf	14	-	-	-	26	41	0.12 /sf
Concrete Pump- 92' Boom (28m)	9 cy	-	-	-	62	-	17	80	127	14.24 /cy
Elev. Slab Place & Finish		**177**	**/cy**	**14**	**62**		**17**	**270**	**428**	**/cy**
03310.900 Total Concrete Pumping										
Total Concrete Pumping (Summary)	***46 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Concrete Pumping (Summary)	***112 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Concrete Pumping (Summary)	***436 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Concrete Pumping (Summary)	***32 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Concrete Pumping (Summary)	***9 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
03320.000 Redi-Mix Concrete Mat.										
Total Redi-Mix Concrete (Summary)	***46 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Redi-Mix Concrete (Summary)	***112 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Redi-Mix Concrete (Summary)	***5 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Redi-Mix Concrete (Summary)	***436 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Redi-Mix Concrete (Summary)	***32 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
Total Redi-Mix Concrete (Summary)	***9 cy***	**-**	**-**	**-**	**-**	**-**				***/cy***
4000 psi Concrete	112 cy	-	113.40 /cy	12,667	-	-	-	12,667	19,969	178.77 /cy
4000 psi Concrete- Central Region	46 cy	-	113.40 /cy	5,172	-	-	-	5,172	8,154	178.78 /cy
4000 psi Concrete- Central Region	5 cy	-	113.40 /cy	538	-	-	-	538	848	178.77 /cy
4000 psi Concrete- Central Region	436 cy	-	113.40 /cy	49,401	-	-	-	49,401	77,880	178.77 /cy
4000 psi Concrete- Central Region	32 cy	-	113.40 /cy	3,629	-	-	-	3,629	5,721	178.77 /cy
4000 psi Concrete- Central Region	9 cy	-	113.39 /cy	1,008	-	-	-	1,008	1,589	178.77 /cy
Redi-Mix Concrete Mat.			**/cy**	**72,415**				**72,415**	**114,160**	**/cy**
05140.020 Aluminum Wide Flange Beam										
10 x7 x10.286 Alum. WF	60 lf	1,206	30.86 /lf	1,851	-	113	-	3,170	5,481	91.35 /lf

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Cost/Unit	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Amount	Grand Total	Grand Total Unit Price
Aluminum Wide Flange Beam		**1,206**		**1,851**		**113**		**3,170**	**5,481**	
05140.080 Aluminum Angles										
3 x3 x5/16 Alum. Angle	80 lf	234	6.25 /lf	500	-	22	-	756	1,306	16.33 /lf
Aluminum Angles		**234**		**500**		**22**		**756**	**1,306**	
05520.000 Handrail/Railing										
2 Rail-Handrail Alum. w/Toe	224 lf	1,575	50.00 /lf	11,200	-	-	-	12,775	22,055	98.46 /lf
Handrail Post Anchors	128 ea	900	5.00 /ea	640	-	-	-	1,540	2,659	20.77 /ea
Handrail/Railing		**2,475**	**/lf**	**11,840**				**14,315**	**24,714**	**/lf**
05530.310 Swage Lok Grating I Bar										
1-1/2 Swage Lok I Bar Type IB	452 sf	2,161	20.80 /sf	9,402	-	-	-	11,562	19,962	44.16 /sf
Swage Lok Grating I Bar		**2,161**	**/sf**	**9,402**				**11,562**	**19,962**	**/sf**
11281.000 Stop Logs										
Unload & Protect Stop Log Assembly	1 lot	8,065	-	-	-	4,781	-	12,846	20,586	20,585.76 /lot
Blockout for Stop Log Frame	53 lf	6,332	-	-	-	-	-	6,332	9,983	188.36 /lf
Grout Blockout for Stop Log Frame	53 lf	13,488	-	-	-	-	6,884	20,372	32,598	615.06 /lf
Stop Logs >100 SF	120 sf	11,470	-	-	-	-	-	11,470	18,083	150.69 /sf
Stainless Steel Anchor Bolts/Sleeve 1/2" x 8"	56 ea	7,342	-	-	-	-	11,638	18,979	30,735	548.85 /ea
Stop Logs		**46,697**	**/ea**			**4,781**	**18,522**	**70,000**	**111,985**	**/ea**
15 Outlet/Inlet Structure	**1 ls**	**274,642**	**452,126.11 /ls**	**452,126**	**2,549,933**	**171,210**	**19,758**	**3,467,669**	**5,506,022**	**5,506,021.75 /ls**

Estimate Totals

Description	Amount	Totals	Hours	Rate
Labor	13,462,741		314,652 hrs	
Material	645,067,528			
Subcontract	226,656,687			
Equipment	7,433,389		191,895 hrs	
Other	4,421,834			
Subtotal Direct Cost	**897,042,179**	**897,042,179**		
Indirect Costs:				
Subtotal Prior to OH&P		**897,042,179**		
Subtotal Cost, Today's Dollars		**897,042,179**		
Escalation				
Based on 7% per year				
Current $ Value				
Total Construction Cost		**897,042,179**		
Total		***897,042,179***		

Appendix D

Opinion of Probable Cost for Distribution Themes

Distribution Theme D1

Decision Model Reference No.	Segment	Participant	Origin	Destination	Water line type	Distance (miles)	Diameter (inches)	Pump Stations (hp)	Capital Cost	Capital Cost Contingency (25%)	Total Capital Cost	Project Implementation (20%)	Annual Maintenance Cost (1.5%)	Comment
2	D-1.4a	Chickasha	OKC (starts at OKC proposed OKC connection to Chickasha)	Chickasha	Proposed treated waterline	29.3	30	#1:1359 #2:659	$53,866,969	$13,466,742	$67,333,711	$13,466,742	$1,010,006	
New	D 1.1	COWRA	OKC	COWRA					$0	$0	$0	$0	$0	Utilize existing infrastructure
		Del City	OKC	Del City						$0	$0	$0	$0	Utilize existing infrastructure
		Edmond	OKC	Edmond						$0	$0	$0	$0	Utilize existing infrastructure
		Midwest City	OKC	Midwest City						$0	$0	$0	$0	Utilize existing infrastructure
7	D-1.5	Norman	OKC	Norman	Proposed treated waterline	3.1	48	#1:496	$13,392,631	$3,348,158	$16,740,789	$3,348,158	$251,112	
		Moore	OKC	Moore						$0	$0	$0	$0	Utilize existing infrastructure
		Oklahoma City	OKC	OKC						$0	$0	$0	$0	Utilize existing infrastructure
19	D-1.6c	Seminole	Atoka Pipeline	Seminole	Proposed raw waterline	25.8	24	#1:747 #2:292	$29,455,737	$7,363,934	$36,819,671	$7,363,934	$552,295	
		Shawnee	Atoka Pipeline	Shawnee						$0	$0	$0	$0	Utilize existing infrastructure
Totals									$42,848,368	$10,712,092	$120,894,171	$24,178,834	$1,813,413	

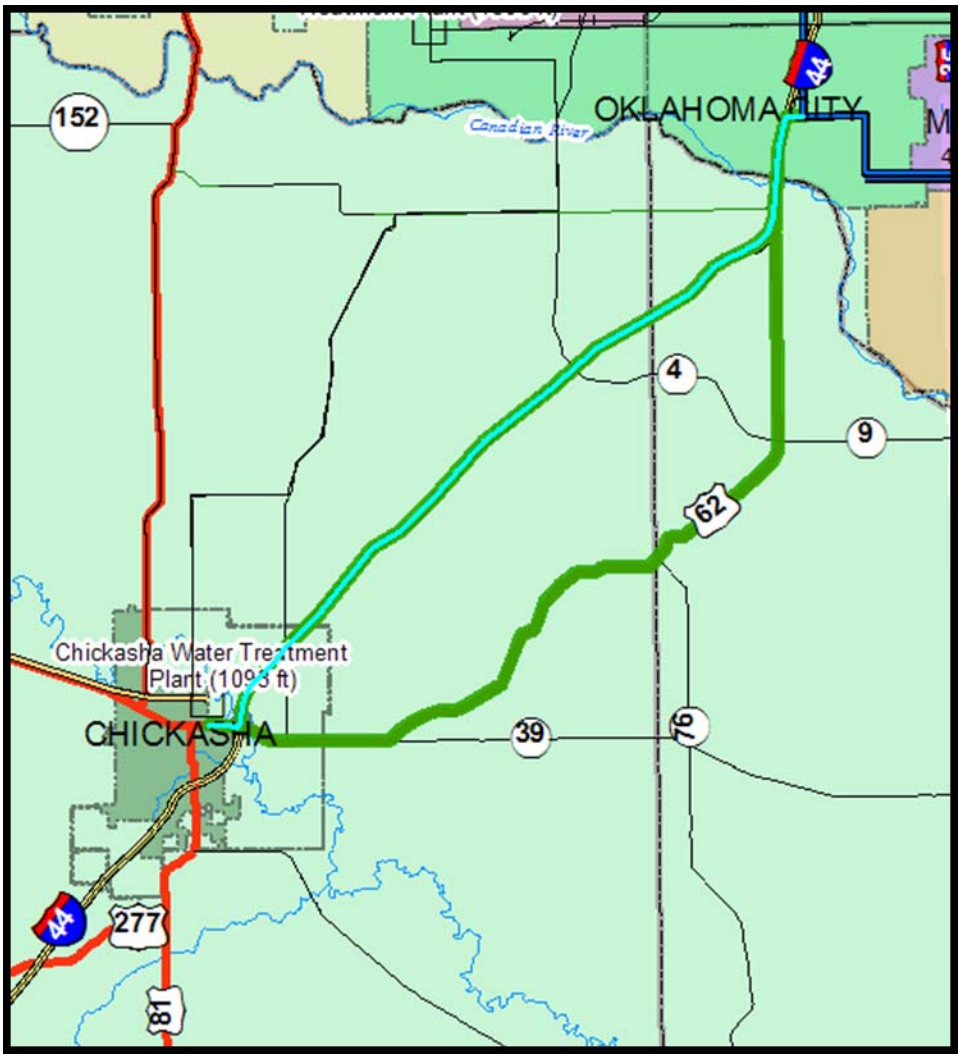
Distribution Theme D2

Decision Model Reference No.	Segment	Participant	Origin	Destination	Water line type	Distance (miles)	Diameter (inches)	Pump Stations (hp)	Capital Cost	Capital Cost Contingency (25%)	Total Capital Cost	Project Implementation (20%)	Annual Maintenance Cost (1.5%)	Comment
9	D-2.4	Chickasha	Lake Thunderbird WTP	Chickasha	Proposed treated waterline (regional)	39.4	30	#1:1339 #2:1395 #3: 1117 #4: 545	$89,998,730	$22,499,682	$112,498,412	$22,499,682	$1,687,476	
New	D 1.1	COWRA	OKC	COWRA					$0	$0	$0	$0	$0	Utilize existing infrastructure
12	D-2.7	Del City	Lake Thunderbird WTP	Del City	Proposed treated waterline (regional)	19.0	16	#1:259 #2:163	$19,109,984	$4,777,496	$23,887,480	$4,777,496	$358,312	
		Edmond	OKC	Edmond						$0	$0	$0	$0	Utilize existing infrastructure
11	D-2.6	Midwest City	Lake Thunderbird WTP	Midwest City	Proposed treated waterline (regional)	16.2	16	#1:310 #2:313	$14,353,914	$3,588,479	$17,942,393	$3,588,479	$269,136	
10	D-2.5	Norman	Lake Thunderbird WTP	Norman	Proposed treated waterline (regional)	10.3	48	#1:3225	$38,790,741	$9,697,685	$48,488,426	$9,697,685	$727,326	
13	D-2.8	Moore	Lake Thunderbird WTP	Moore	Proposed treated waterline (regional)	16.5	36	#1:1885 #2:423	$41,348,468	$10,337,117	$51,685,585	$10,337,117	$775,284	
		Oklahoma City	OKC	OKC						$0	$0	$0	$0	Utilize existing infrastructure
19	D-2.9c	Seminole	Atoka Pipeline	Seminole	Proposed raw waterline	25.8	24	#1:747 #2:292	$29,455,737	$7,363,934	$36,819,671	$7,363,934	$552,295	
		Shawnee	Atoka Pipeline	Shawnee						$0	$0	$0	$0	Utilize existing infrastructure
Totals									$233,057,574	$58,264,394	$291,321,968	$58,264,394	$4,369,830	

Distribution Theme D3

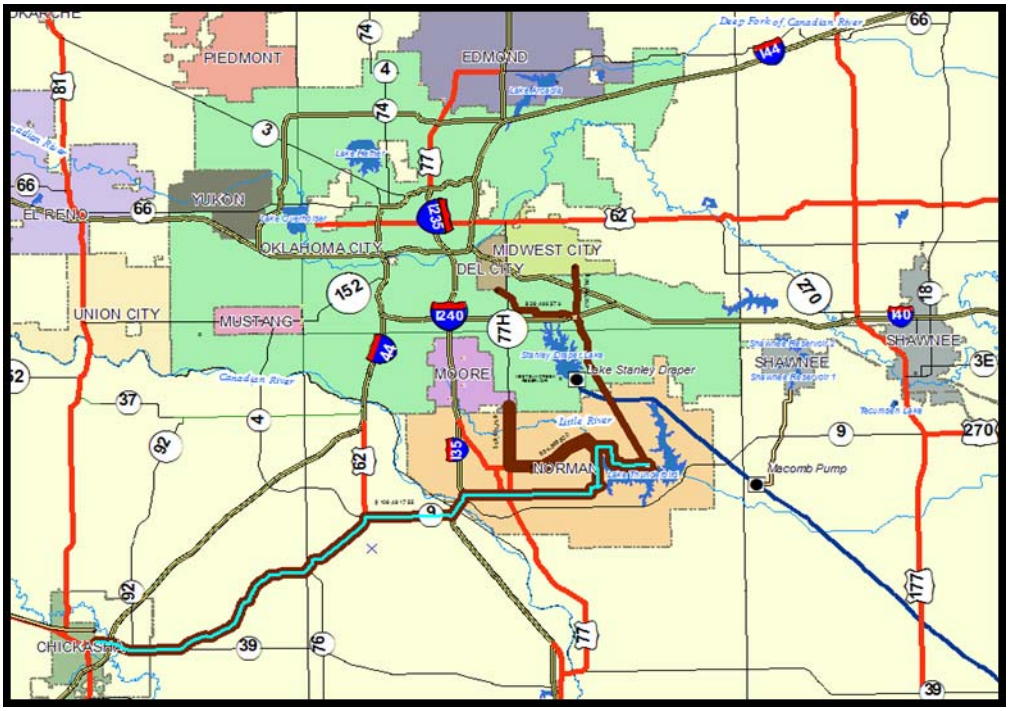
Decision Model Reference No.	Segment	Participant	Origin	Destination	Water line type	Distance (miles)	Diameter (inches)	Pump Stations (hp)	Capital Cost	Capital Cost Contingency (25%)	Total Capital Cost	Project Implementation (20%)	Annual Maintenance Cost (1.5%)	Comment
9	D-3.4	Chickasha	Stanley Draper	Chickasha	Proposed raw waterline	45.8	30	#1:2487 #2:995	$82,908,154	$20,727,038	$103,635,192	$20,727,038	$1,554,528	
New	D 1.1	COWRA	OKC	COWRA					$0	$0	$0	$0	$0	Utilize existing infrastructure
12	D-3.7	Del City	Lake Thunderbird WTP	Del City	Proposed raw waterline	19.0	16	#1:259 #2:163	$19,109,984	$4,777,496	$23,887,480	$4,777,496	$358,312	
18	D-3.9	Edmond	Stanley Draper	Arcadia	Proposed raw waterline	17.8	48	#1:1549	$67,878,344	$16,969,586	$84,847,931	$16,969,586	$1,272,719	
11	D-3.6	Midwest City	Lake Thunderbird WTP	Midwest City	Proposed raw waterline	16.2	16	#1:310 #2:313	$14,353,914	$3,588,479	$17,942,393	$3,588,479	$269,136	
13	D-3.8	Moore	OKC	Moore					$0	$0	$0	$0	$0	Utilize existing infrastructure
10	D-3.5	Norman	Lake Thunderbird WTP	Norman	Proposed raw waterline	10.3	36	#1:1885 #2:423	$38,788,003	$9,697,001	$48,485,003	$9,697,001	$727,275	
		Oklahoma City	OKC	OKC					$0	$0	$0	$0	$0	Utilize existing infrastructure
19	D-2.9c	Seminole	Atoka Pipeline	Seminole	Proposed raw waterline	25.8	24	#1:747 #2:292	$29,455,737	$7,363,934	$36,819,671	$7,363,934	$552,295	
		Shawnee	Atoka Pipeline	Shawnee					$0	$0	$0	$0	$0	Utilize existing infrastructure
Totals									$252,494,136	$63,123,534	$315,617,671	$63,123,534	$4,734,265	

OKC to Chickasha
Option D-1



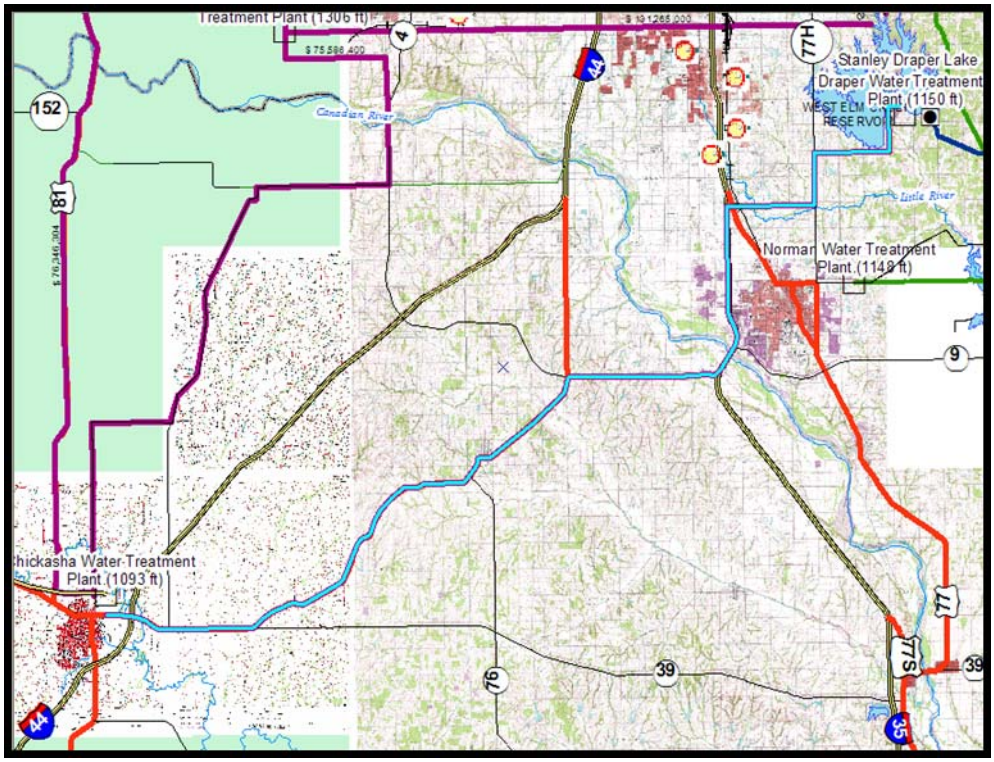
Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-1.4a	29.3	17	30	#1 – 1,395 #2 – 659	$67,334,000
D-1.4b	34.2	17	30	#1 – 1,470 #2 – 1,071	$76,875,000

Lake Thunderbird to Chickasha
Option D-2



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-2.4	47.4	17	30	#1 – 1,339 #2 – 1,.395 #3 – 1,117 #4 - 545	$112,498,000

Stanley Draper to Chickasha
Option D-3



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-3.4	45.8	17	30	#1 – 2,487 #2 – 995	$103,635,000

Chicaksha

Project: OKC to Chickasha (D-1.4a)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	30-inch	131,925	LF	$ 272.81	$ 35,990,576
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	30-inch	13,204	LF	$ 300.00	$ 3,961,200
3	R&R Asphalt Roadway	30-inch	13,204	LF	$ 90.00	$ 1,188,360
4	Tunneling	30-inch	500	LF	$ 1,224.39	$ 612,194
5	Pipe installed in River Crossings	30-inch	9,000	LF	$ 847.44	$ 7,626,945
6	Pump Station #1		1,359	hp	$ 2,223.83	$ 3,022,188
7	Pump Station #2		659	hp	$ 2,223.83	$ 1,465,506
8	No. of railroad crossings		0	EA		
9	No. of road crossings		2	EA		
10	No. of stream crossings		36	EA		
	Subtotal					**$ 53,866,969**
	Contingencies (25%)					$ 13,466,742
	Subtotal					$ 67,333,711
	Total					**$ 67,333,711**

Annual O & M Costs (1.5 percent of Capital Cost): **$1,010,006**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Project: OKC to Chickasha (D-1.4b)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	30-inch	159,541	LF	$ 272.81	$ 43,524,521
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	30-inch	12,106	LF	$ 300.00	$ 3,631,800
3	R&R Asphalt Roadway	30-inch	12,106	LF	$ 90.00	$ 1,089,540
4	Tunneling	30-inch	500	LF	$ 1,224.39	$ 612,194
5	Pipe installed in River Crossings	30-inch	8,250	LF	$ 847.44	$ 6,991,366
6	Pump Station #1		1,470	hp	$ 2,223.83	$ 3,269,033
7	Pump Station #2		1,071	hp	$ 2,223.83	$ 2,381,724
8	No. of railroad crossings		0	EA		
9	No. of road crossings		2	EA		
10	No. of stream crossings		33	EA		
	Subtotal					**$ 61,500,180**
	Contingencies (25%)					$ 15,375,045
	Subtotal					$ 76,875,224
	Total					**$ 76,875,224**

Annual O & M Costs (1.5 percent of Capital Cost): **$1,153,128**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Project: Lake Thunderbird to Chickasha (D-2.4)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	30-inch	211,257	LF	$ 272.81	$ 57,633,209
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	30-inch	24,142	LF	$ 300.00	$ 7,242,600
3	R&R Asphalt Roadway	30-inch	24,142	LF	$ 90.00	$ 2,172,780
4	Tunneling	30-inch	1,250	LF	$ 1,224.39	$ 1,530,486
5	Pipe installed in River Crossings	30-inch	13,750	LF	$ 847.44	$ 11,652,277
6	Pump Station #1		1,339	hp	$ 2,221.88	$ 2,975,095
7	Pump Station #2		1,395	hp	$ 2,221.88	$ 3,099,520
8	Pump Station #3		1,117	hp	$ 2,221.88	$ 2,481,838
9	Pump Station #4		545	hp	$ 2,221.88	$ 1,210,924
10	No. of railroad crossings		0	EA		
11	No. of road crossings		5	EA		
12	No. of stream crossings		55	EA		
	Subtotal					**$ 89,998,730**
	Contingencies (25%)					$ 22,499,682
	Subtotal					$ 112,498,412
	Total					**$ 112,498,412**

Annual O & M Costs (1.5 percent of Capital Cost): **$1,687,476**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

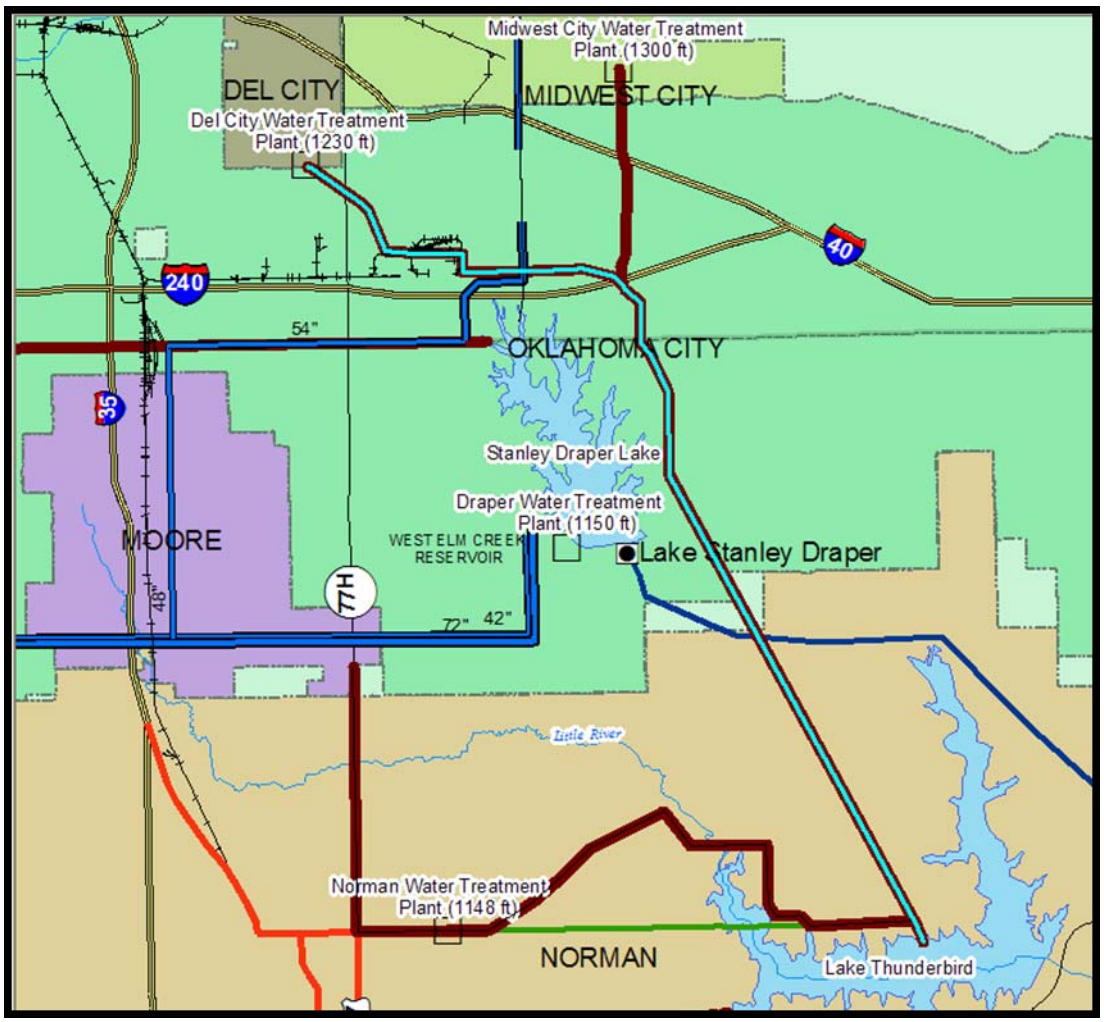
Project: Stanley Draper to Chickasha (D-3.4)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	30-inch	197,056	LF	$ 272.81	$ 53,759,022
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	30-inch	31,500	LF	$ 300.00	$ 9,450,000
3	R&R Asphalt Roadway	30-inch	4,000	LF	$ 90.00	$ 360,000
4	Tunneling	30-inch	1,000	LF	$ 1,224.39	$ 1,224,389
5	Pipe installed in River Crossings	30-inch	12,250	LF	$ 847.44	$ 10,381,119
6	Pump Station #1		2,487	hp	$ 2,221.03	$ 5,523,700
7	Pump Station #2		995	hp	$ 2,221.03	$ 2,209,924
8	No. of railroad crossings		1	EA		
9	No. of road crossings		4	EA		
10	No. of stream crossings		49	EA		
	Subtotal					**$ 82,908,154**
	Contingencies (25%)					$ 20,727,038
	Subtotal					$ 103,635,192
	Total					**$ 103,635,192**

Annual O & M Costs (1.5 percent of Capital Cost): **$1,554,528**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Lake Thunderbird to Del City
Option D-2, D-3



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-2.7 D-3.7	19.0	3	16	#1 – 259 #2 - 163	$23,887,000

Del City

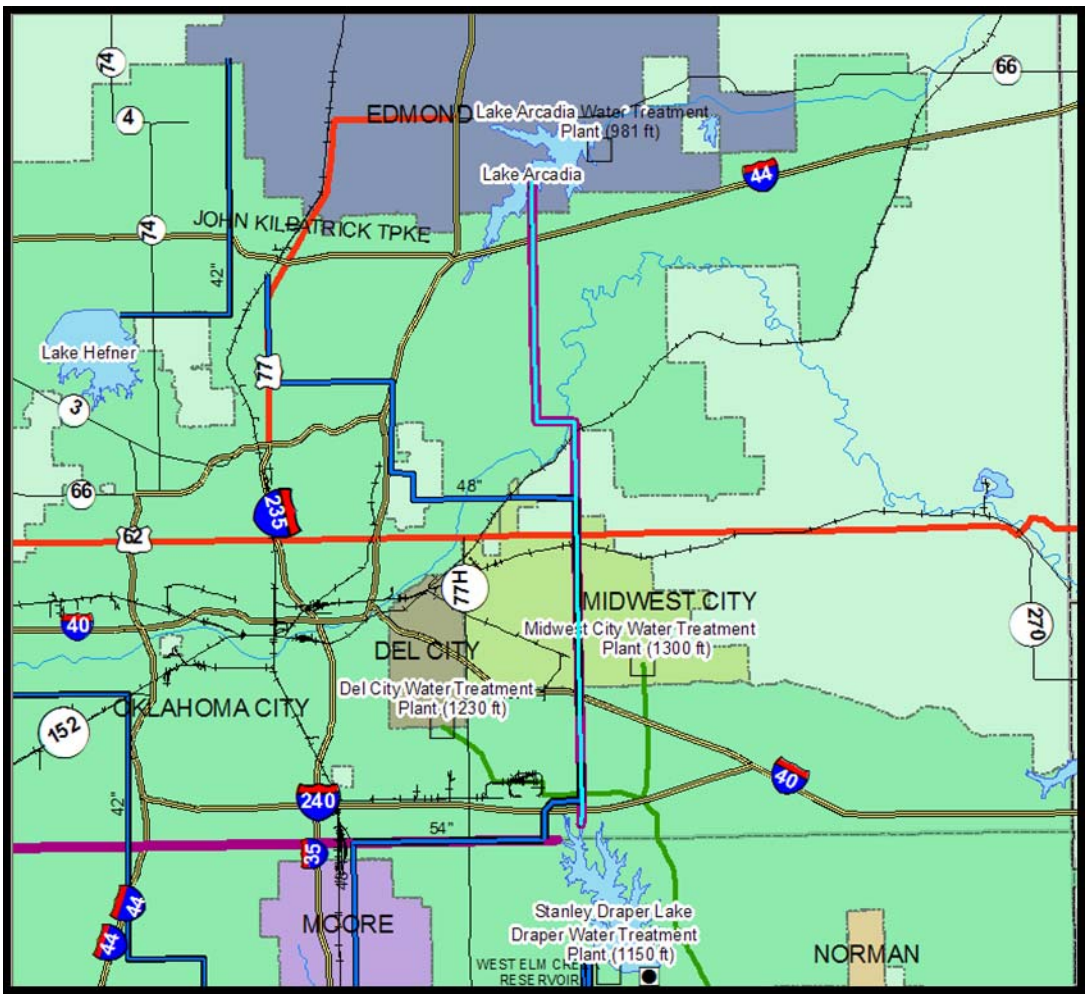
Project: Lake Thunderbird to Del City (D-2.7, D-3.7)

Item No.	Description	Pipe Diameter	Quantity	Units		Unit Cost		Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	16-inches	73,002	LF	$	128.52	$	9,382,365
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	16-inches	19,272	LF	$	141.00	$	2,717,352
3	R&R Asphalt Roadway	16-inches	19,272	LF	$	70.99	$	1,368,085
4	Tunneling	16-inches	1,600	LF	$	720.00	$	1,152,000
5	Pipe installed in River Crossings	16-inches	6,250	LF	$	546.98	$	3,418,603
6	Pump Station #1		259	hp	$	2,539.29	$	657,676
7	Pump Station #2		163	hp	$	2,539.29	$	413,904
8	No. of railroad crossings			EA				
9	No. of road crossings			EA				
10	No. of stream crossings			EA				
	Subtotal						**$**	**19,109,984**
	Contingencies (25%)						$	4,777,496
	Subtotal						$	23,887,480
	Total						**$**	**23,887,480**

Annual O & M Costs (1.5 percent of Capital Cost): **$358,312**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Edmond
Stanley Draper to Arcadia
Option D-3



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-3.9	17.8	41	48	#1 – 1,549	$84,848,000

Edmond

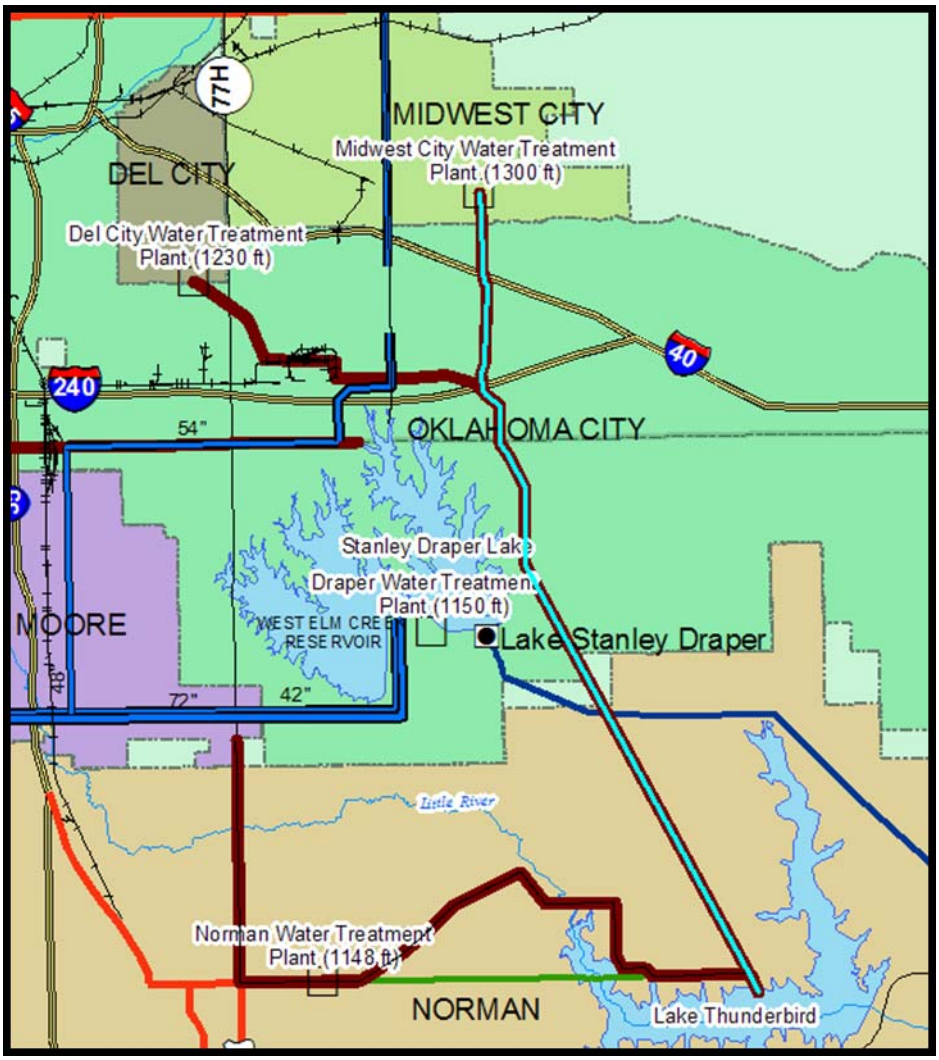
Project: Stanley Draper to Arcadia Lake (D-3.9)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	48-inch	34,388	LF	$ 545.00	$ 18,741,460
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	48-inch	55,687	LF	$ 600.00	$ 33,412,200
3	R&R Asphalt Roadway	48-inch	55,687	LF	$ 130.00	$ 7,239,310
4	Tunneling	48-inch	800	LF	$ 2,000.00	$ 1,600,000
5	Pipe installed in River Crossings	48-inch	3,250	LF	$ 1,060.00	$ 3,445,000
6	Pump Station #1		1,549	hp	$ 2,221.03	$ 3,440,374
7	Pump Station #2			hp		$ -
8	No. of railroad crossings		0	EA		
9	No. of road crossings		4	EA		
10	No. of stream crossings		13	EA		
	Subtotal					**$ 67,878,344**
	Contingencies (25%)					$ 16,969,586
	Subtotal					$ 84,847,931
	Total					**$ 84,847,931**

Annual O & M Costs (1.5 percent of Capital Cost): **$1,272,719**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Lake Thunderbird to Midwest City
Option D-2, D-3



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-2.6 D-3.6	16.2	4	16	#1 – 310 #2 - 313	$17,942,000

Midwest City

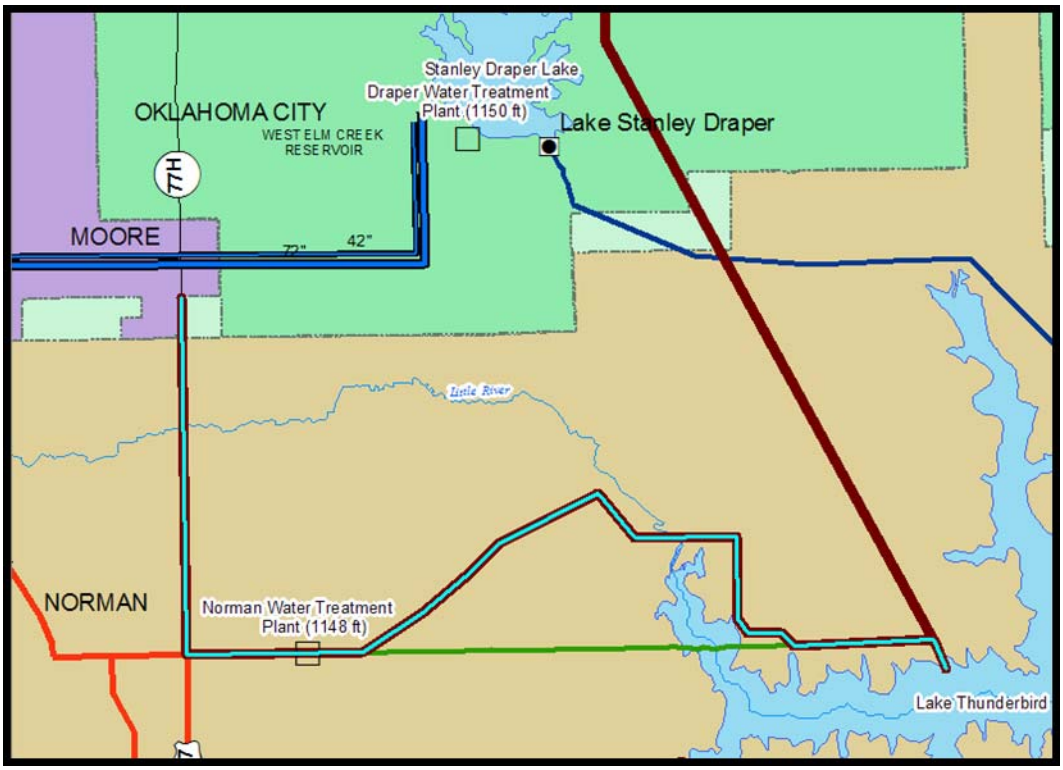
Project: Lake Thunderbird to Midwest City (D-2.6, D-3.6)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	16-inch	81,175	LF	$ 128.52	$ 10,432,775
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	16-inch	0	LF	$ -	$ -
3	R&R Asphalt Roadway	16-inch	0	LF	$ -	$ -
4	Tunneling	16-inch	400	LF	$ 720.00	$ 288,000
5	Pipe installed in River Crossings	16-inch	3,750	LF	$ 546.98	$ 2,051,162
6	Pump Station #1		310	hp	$ 2,539.29	$ 787,180
7	Pump Station #2		313	hp	$ 2,539.29	$ 794,798
8	No. of railroad crossings		0	EA		
9	No. of road crossings		2	EA		
10	No. of stream crossings		15	EA		
	Subtotal					**$ 14,353,914**
	Contingencies (25%)					$ 3,588,479
	Subtotal					$ 17,942,393
	Total					**$ 17,942,393**

Annual O & M Costs (1.5 percent of Capital Cost): **$269,136**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Lake Thunderbird to Moore
Option D-2



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-2.8	16.5	23	36	#1 – 1,885 #2 - 423	$51,686,000

Moore

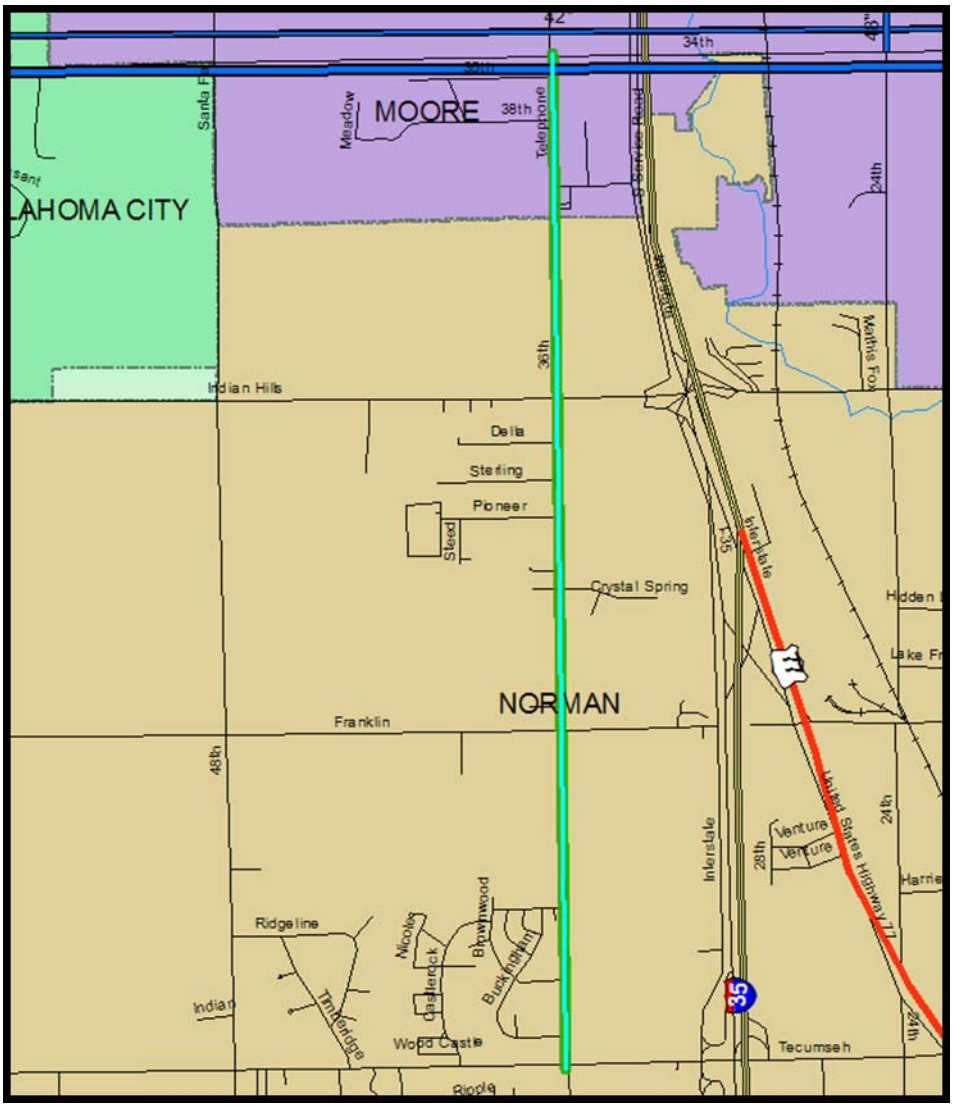
Owner:
Project: Lake Thunderbird to Moore (D-2.8)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	36-inches	67,107	LF	$ 356.19	$ 23,902,918
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	36-inches	14,850	LF	$ 392.00	$ 5,821,200
3	R&R Asphalt Roadway	36-inches	14,850	LF	$ 114.00	$ 1,692,900
4	Tunneling	36-inches	200	LF	$ 1,450.00	$ 290,000
5	Pipe installed in River Crossings	36-inches	4,750	LF	$ 922.00	$ 4,379,500
6	Pump Station #1		1,885	hp	$ 2,221.88	$ 4,188,241
7	Pump Station #2		423	hp	$ 2,538.32	$ 1,073,709
8	No. of railroad crossings		0	EA		
9	No. of road crossings		1	EA		
10	No. of stream crossings		19	EA		
	Subtotal					**$ 41,348,468**
	Contingencies (25%)					$ 10,337,117
	Subtotal					$ 51,685,585
	Total					**$ 51,685,585**

Annual O & M Costs (1.5 percent of Capital Cost): **$775,284**

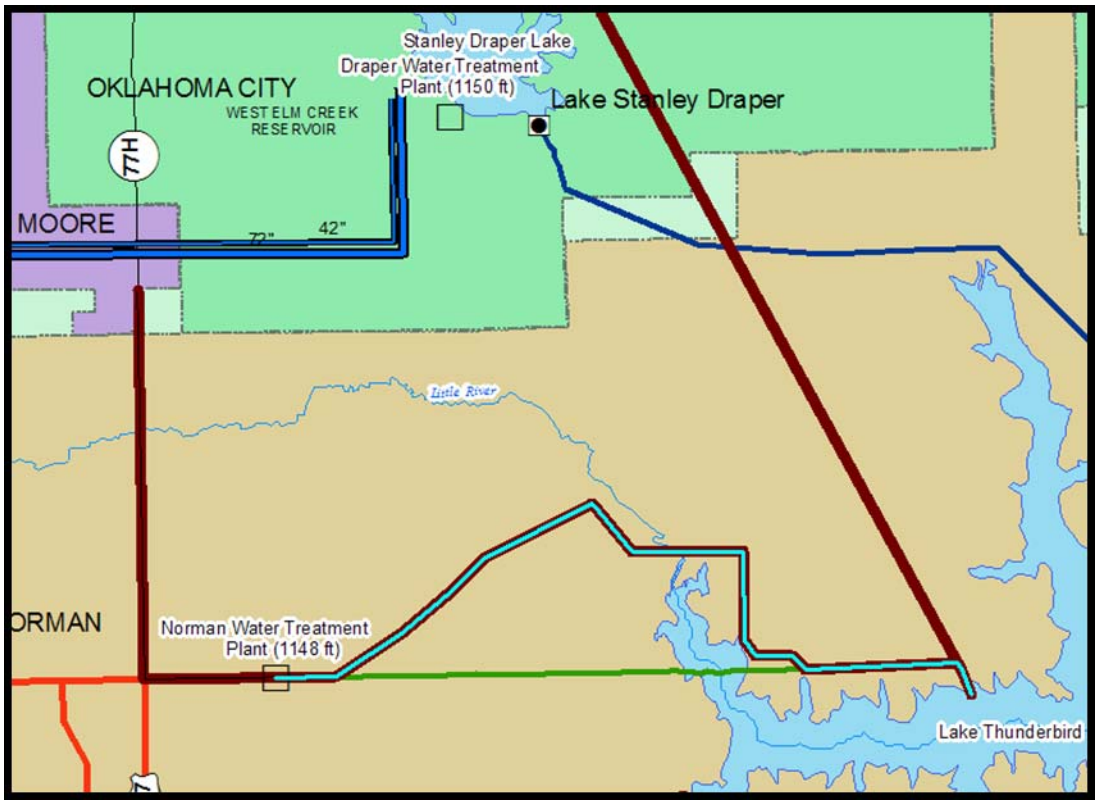
Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

OKC to Norman
Option D-1



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-1.5	3.1	48	48	#1 – 496	$16,741,000

Lake Thunderbird to Norman
Option D-2, D-3



Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-2.5 D-3.5	10.3	48	48	#1 – 3,225	$48,485,000

Norman

Project: OKC to Norman (D-1.5)

Item No.	Description	Pipe Diameter	Quantity	Units		Unit Cost		Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	48-inch	0	LF	$	-	$	-
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	48-inch	14,657	LF	$	600.00	$	8,794,200
3	R&R Asphalt Roadway	48-inch	14,657	LF	$	130.00	$	1,905,410
4	Tunneling	48-inch	0	LF	$	-	$	-
5	Pipe installed in River Crossings	48-inch	1,500	LF	$	1,060.00	$	1,590,000
6	Pump Station #1		496	hp	$	2,223.83	$	1,103,021
7	Pump Station #2			hp	$	-	$	-
8	No. of railroad crossings		0	EA				
9	No. of road crossings		0	EA				
10	No. of stream crossings		6	EA				
	Subtotal						**$**	**13,392,631**
	Contingencies (25%)						$	3,348,158
	Subtotal						$	16,740,789
	Total						**$**	**16,740,789**

Annual O & M Costs (1.5 percent of Capital Cost): **$251,112**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Owner:
Project: OKC to Norman (D-2.5)

Item No.	Description	Pipe Diameter	Quantity	Units		Unit Cost		Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	48-inch	50,687	LF	$	545.51	$	27,650,184
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	48-inch	0	LF	$	-	$	-
3	R&R Asphalt Roadway	48-inch	0	LF	$	-	$	-
4	Tunneling	48-inch	0	LF	$	-	$	-
5	Pipe installed in River Crossings	48-inch	3,750	LF	$	1,060.00	$	3,975,000
6	Pump Station #1		3,225	hp	$	2,221.88	$	7,165,558
7	Pump Station #2			hp			$	-
8	No. of railroad crossings		0	EA				
9	No. of road crossings		0	EA				
10	No. of stream crossings		15	EA				
	Subtotal						**$**	**38,790,741**
	Contingencies (25%)						$	9,697,685
	Subtotal						$	48,488,426
	Total						**$**	**48,488,426**

Annual O & M Costs (1.5 percent of Capital Cost): **$727,326**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Owner:
Project: Lake Thunderbird to Norman (D-3.5)

Item No.	Description	Pipe Diameter	Quantity	Units		Unit Cost		Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	48-inch	50,687	LF	$	545.51	$	27,650,184
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	48-inch	0	LF	$	-	$	-
3	R&R Asphalt Roadway	48-inch	0	LF	$	-	$	-
4	Tunneling	48-inch	0	LF	$	-	$	-
5	Pipe installed in River Crossings	48-inch	3,750	LF	$	1,060.00	$	3,975,000
6	Pump Station #1		3,225	hp	$	2,221.03	$	7,162,819
7	Pump Station #2			hp			$	-
8	No. of railroad crossings		0	EA				
9	No. of road crossings		0	EA				
10	No. of stream crossings		15	EA				
	Subtotal						**$**	**38,788,003**
	Contingencies (25%)						$	9,697,001
	Subtotal						$	48,485,003
	Total						**$**	**48,485,003**

Annual O & M Costs (1.5 percent of Capital Cost): **$727,275**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Atoka to Seminole
Option D-1, D-2, D-3

Segment	Length (miles)	Design Flow (mgd)	Diameter (inches)	Pump Station 1 (hp)	Capital Cost (2008 $)
D-1.6a D-2.9a D-3.10a	31.5	9	24	#1 – 661 #2 – 328	$48,117,000
D-1.6b D-2.9b D-3.10b	30.6	9	24	#1 – 730 #2 – 480	$47,550,000
D-1.6c D-2.9c D-3.10c	25.8	9	24	#1 – 747 #2 – 292	$36,820,000

Seminole

Project: Atoka Pipeline to Twin Lakes (D-1.6a, D-2.9a, D-3.10a)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	24-inch	156,499	LF	$ 194.99	$ 30,516,477
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	24-inch	3,721	LF	$ 214.00	$ 796,294
3	R&R Asphalt Roadway	24-inch	3,721	LF	$ 82.00	$ 305,122
4	Tunneling	24-inch	600	LF	$ 975.00	$ 585,000
5	Pipe installed in River Crossings	24-inch	5,500	LF	$ 725.00	$ 3,987,500
6	Pump Station #1		661	hp	$ 2,223.83	$ 1,469,953
7	Pump Station #2		328	hp	$ 2,541.52	$ 833,619
8	No. of railroad crossings		0	EA		
9	No. of road crossings		3	EA		
10	No. of stream crossings		22	EA		
	Subtotal					**$ 38,493,965**
	Contingencies (25%)					$ 9,623,491
	Subtotal					$ 48,117,456
	Total					**$ 48,117,456**

Annual O & M Costs (1.5 percent of Capital Cost): **$721,762**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Owner:
Project: Atoka to Seminole (D-1.6b, D-2.9b, D-3.10b)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	24-inch	151,637	LF	$ 194.99	$ 29,568,413
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	24-inch	3,471	LF	$ 214.00	$ 742,794
3	R&R Asphalt Roadway	24-inch	3,471	LF	$ 82.00	$ 284,622
4	Tunneling	24-inch	600	LF	$ 975.00	$ 585,000
5	Pipe installed in River Crossings	24-inch	5,750	LF	$ 725.00	$ 4,168,750
6	Pump Station #1		730	hp	$ 2,223.83	$ 1,623,398
7	Pump Station #2		480	hp	$ 2,223.83	$ 1,067,439
8	No. of railroad crossings		0	EA		
9	No. of road crossings		3	EA		
10	No. of stream crossings		23	EA		
	Subtotal					**$ 38,040,416**
	Contingencies (25%)					$ 9,510,104
	Subtotal					$ 47,550,520
	Total					**$ 47,550,520**

Annual O & M Costs (1.5 percent of Capital Cost): **$713,258**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Owner:
Project: Atoka to Seminole (D-1.6c, D-2.9c, D-3.10c)

Item No.	Description	Pipe Diameter	Quantity	Units	Unit Cost	Amount
1	Pipeline Installed by Open Cut Excavation in Rural Areas	24-inch	133,346	LF	$ 194.99	$ 26,001,764
2	Pipeline Installed by Open Cut Excavation in Urban/Paved Areas	24-inch	2,240	LF	$ 214.00	$ 479,360
3	R&R Asphalt Roadway	24-inch	2,240	LF	$ 82.00	$ 183,680
4	Tunneling	24-inch	400	LF	$ 975.00	$ 390,000
5	Pipe installed in River Crossings	24-inch	0	LF	$ -	$ -
6	Pump Station #1		747	hp	$ 2,221.88	$ 1,659,743
7	Pump Station #2		292	hp	$ 2,538.32	$ 741,189
8	No. of railroad crossings		0	EA		
9	No. of road crossings		2	EA		
10	No. of stream crossings		0	EA		
	Subtotal					**$ 29,455,737**
	Contingencies (25%)					$ 7,363,934
	Subtotal					$ 36,819,671
	Total					**$ 36,819,671**

Annual O & M Costs (1.5 percent of Capital Cost): **$552,295**

Notes:
1. Power Costs Excluded from Annual O & M Costs (see decision support model for these costs).
2. Major Crossing Costs are included as costs per LF in tunneling and river crossing items.

Appendix E

Water Supply System Simulation Tool

Appendix E
Water Supply System Simulation Tool

E.1 Introduction and Purpose of Tool

The water supply system simulation tool (hereafter referred to as simulation tool, or tool) was developed as flexible model that could allow the simulation of the performance of regional water supply and conveyance system. It is intended to be used as a decision making tool to compare different project alternatives and run scenarios based on different assumptions about city/agency participation, system configuration, and demand projections.

The simulation tool uses local and regional water demand projections and uses mass balance logic to determine flow rates through all of the pipelines, water treatment plants, and reservoirs in the system. Operational costs associated with pumping and treating the regional water supplies can be determined from the model calculated flow rates. These costs are allocated to the different participating agencies to give an idea of the individual agency costs for participating in the regional supply project. Additionally, the performance of the system can be measured with respect to total flow rates, and reservoir storage volume levels under different hydrology conditions and demand scenarios.

The simulation tool was developed in Microsoft Excel because of its widespread familiarity and the ability of the diverse project team to interact with the tool. Within the self-contained Excel file are a user interface and data input screens, a calculation engine, and pre-formatted output screens. The simulation tool provides a great deal of flexibility in viewing the system performance data in myriad ways, as well as flexibility in setting up scenarios and expanding or modifying the model in the future.

The simulation tool is a complex model that includes a lot of functionality and flexibility for simulating different Southeast Oklahoma regional system scenarios and conveniently viewing and comparing output. This appendix is intended to give an overview of the tool functionality. In the sections that follow are notes and descriptions on the different tool functions and screens. Additionally, the Excel file that contains the tool is well documented, with most sheets indicating the calculations that take place therein and what is expected of the user on each sheet.

List of Topics Included in this Appendix:

- Introduction and Purpose of Tool
- Overview
- Simulation Tool Inputs
- Simulation Tool Calculations
    - Hydrology
    - Storage – Area – Elevation Curves
    - FlowTable and StorageTable

- Viewing Demand Data with Active Pivot Tables and Storing Data with the 'Master Pivot Table'
- Cost Calculations

- Simulation Tool Outputs
- Delivery Themes
- Auto Run Functionality for Multiple Simulations
- Advanced Aspects of the Simulation Tool
- Notes on Reservoir Logic
- List of Calculation Types

E.2 Overview

The simulation tool basically works by determining the amount of regional water required to flow each month through all of the pipelines in the regional water conveyance system and using the flow rates to determine the operational costs. Flow rates are determined starting with the projected demands at each city/agency and then working 'backwards up stream' through the network of delivery and conveyance pipelines. Flows are summed at all of the network branches to determine the combined flows in the larger pipelines. This type of mass balance analysis works from downstream – at the city/agency nodes, through the Atoka Pipeline, and to the upstream source water bodies in the Kiamichi River basin.

Additional logic at the system reservoirs control the simulated flows out of the reservoirs based on the hydrologic inflows and user-defined reservoir target volumes. The reservoirs can be programmed with rule curves to seasonally control the storage volumes. The mass balance then works on the projected demands and the reservoir logic.

Inflows of water to the system include the rainfall directly into the reservoirs and runoff from the watersheds. System outflows of water include evaporation, and delivery of treated water to the cities/agencies. All of the water in the system is accounted for in an overall mass balance. Water that enters the system (via rainfall/runoff) is accounted for as either accumulating in the system storage, being transferred to another part of the system, or leaving the system in one of the two previously mentioned outflows.

Figure E-2 shows a schematic of the regional water system. The schematic shows the network of flow pathways and nodes that make up the system. The node points can be cities/agencies (terminal delivery nodes), reservoirs (storage nodes), water treatment plants, or junctions (mass balance calculation nodes). The lines connecting the nodes are the pipelines. The simulation tool keeps track of the storage volume in each of the reservoirs every time period, and also determines the flow rate in each pipeline/pathway in every time period.

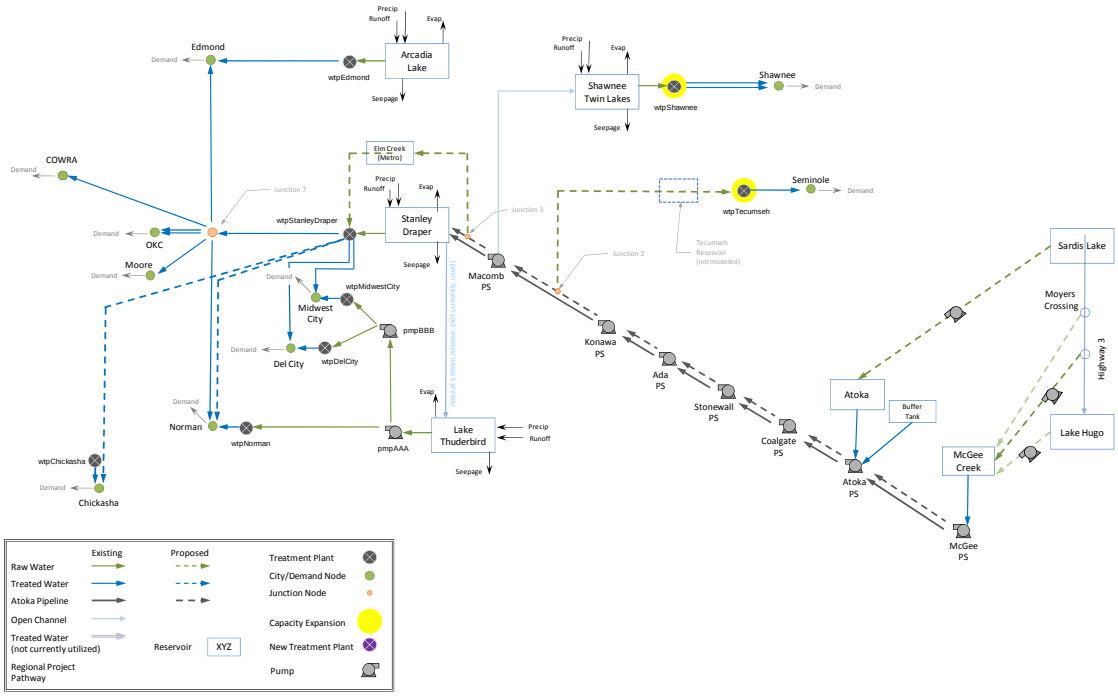


Figure E-1
System Schematic, Sample for Theme D1

Calculations in the model take place using a "database" approach, where all of the input data, system parameters, hydrology data, and calculation parameters are stored in individual tables. These tables then feed a set of master calculation tables made up of the "FlowTable" and "StorageTable" (described further below). Output is then displayed in additional tables. The database approach provides the benefits of orderly model organization and the ability to expand or modify the system with relative ease in the future. **Figure E-2** shows a diagram of the model structure and flow of information. The "Calculation Engine" in the center is made up the FlowTable and StorageTable. All of the other tables in the model either pass data to the Calculation Engine, or receive data from it. Some of these tables will be further described in the sections that follow. Information on the other tables can be found in the documentation contained within the simulation tool itself.

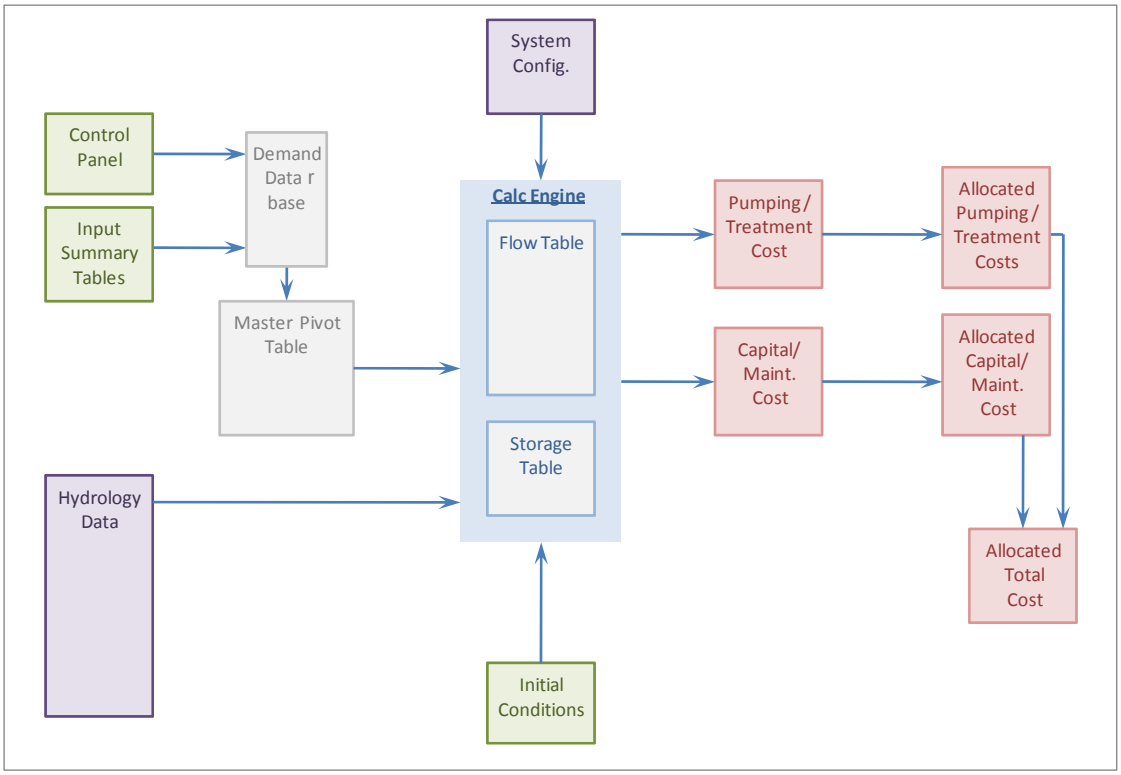


Figure E-2
Model Diagram Showing Structure and Flow of Information through Simulation Tool

E.3 Simulation Tool Inputs

The simulation tool requires the following inputs:

- Water Demands Projections – the tool is set up to receive demand projections in five-year increments through the planning horizon (ending in 2060). Demand projections are entered on the "Input Summary Tables" worksheet. *Regional Demand* projections are used to determine the amount of water to be brought in from the Kiamichi River basin. *Local Surface Supply* projections are used to simulate the effects of cities'/agencies' use of local surface reservoirs. The *Local Groundwater Supply* projections are included for "accounting" purposes, but currently do not impact the model mass balance or results.

  (Note that the five-year demand projections are interpolated to annual projected demand values in the tables found to the right of the input tables on the "Input Summary Tables" worksheet. Interpolation is done automatically using Excel worksheet functions).

- System Configuration – the flow network for any system configuration needs to be described by filling out the FlowTable and StorageTable. The network needs to be described for each delivery theme being analyzed. More information on these inputs is in the sections that follow.

- System/Network Parameters – Many of the mass balance and costing calculations in the tool require information about the network nodes and pathways. Information such as the pipeline diameters, lengths, friction coefficients, elevation differences, etc must be input for each flow pathway. Input of these parameters is done on the "NetworkParams" and "Elevations" worksheets (actually, input of the parameters takes place by delivery theme on the "ThemeConfig" worksheet. More information on delivery themes can be found below).

In addition to the input of demand projections and system parameters, the simulation tool also has the flexibility to run specific scenarios based on adjustments to the input data. Scenarios are set up using the "ControlPanel" worksheet. **Figure E-3** shows a screen shot of the control panel. The control panel includes the following possible scenario setup variables:

Figure E-3
Screen Shot of Simulation Tool Control Panel

- *Source Water Body Selection* – allows user to select the point along the Kiamichi River from which to draw the regional water supply. Each source has its own sustainable yield as well as costs associated with the infrastructure to bring the Kiamichi water to the Atoka Pipeline. For the source points downstream of Lake Sardis, there is the option to also allow releases from Lake Sardis to augment the supply at those points.

- *Intermediate Storage Body Selection* – allows the user to select the reservoir to use as buffering storage at the upstream end of the Atoka Pipeline.

- *Delivery Theme Selection* – allows the user to select among the three delivery themes. Selection of these options changes the network configuration on the delivery end of the system to match the selected theme. Visual Basic code runs when these options are changed to re-populate the FlowTable with the selected network (see notes on FlowTable below).

- *Demand Year Selection* - allows user to choose which projected demand year to simulate in the scenario. The tool is set up to run the monthly demand values for the selected demand year repeatedly for each year in the hydrologic record (see calculation notes below for more about the simulation methodology).

- *Agency Participation Selection* – allows the user to "turn on or off" the different cities/agencies in the Central Oklahoma region. This allows the analysis to be run under different cases when individual cities are either participating or not participating in the regional project.

Other inputs and controls on the control panel include:

- *Reservoir Initial Conditions* – for each of the reservoirs in the system this table holds the Initial Storage volume, the reservoir capacity and dead storage volumes, and the annual volumes of water dedicated to other local agencies (not included in this project).

- *Atoka Pipeline Size* - size and capacity of the existing and new Atoka Pipelines.

- *Regional Demand Sensitivity Factor* – this is a multiplier that can be added to scale the input regional demand projections. This variable is useful for performing sensitivity analysis on the demand projections. The factor is applied to all of the demand projections (i.e. equally to all cities/agencies).

- *Auto Run Button* - the simulation tool also has the capability to run a pre-programmed set of simulations, automatically. The button on the control panel initiates the automatic run. More on the Auto Run feature can be found below.

E.4 Simulation Tool Calculations

The simulation tool was developed in Microsoft Excel and includes many worksheets storing a lot of system data and performing a number of complex calculations. Many of the calculations in the model are relatively straightforward referencing or lookup functions. Using the database approach in the tool (described earlier) requires lookup and referencing functions in order to move data between the input tables, calculation tables, and output tables.

The core logical and mass balance equations in the simulation tool take place in the "Calculation Engine" section made up of the FlowTable and StorageTable. Between these two tables, all of the mass balance flow equations take place and the operation

of the reservoirs is simulated according to the operations logic. Cost calculations are derived from the flows in the FlowTable.

Brief notes on the core calculations driving the analysis are presented in the sections that follow.

E.4.1 Simulation Methodology for Projected Demands

The simulation tool was developed to examine the required regional system flows for a specific year in the future. But because of inherent uncertainties in hydrology and because of the buffering effects of reservoir storage on the required monthly flows, the tool was developed to simulate the specified demand year (and its associated demand projections) over all of the historic hydrology years.

The user selects a future demand year to analyze. The tool then runs a 50-year simulation using the demand projections for the selected year. The demand projections for the selected year are applied repeatedly each year in the simulation as the tool cycles through all of the hydrologic years on record. Each hydrologic year has the historic volumes of rainfall and runoff entering the system. The simulation tool then determines the behavior of the system given the specified demand year and subject to the range of hydrologic conditions. The result is an analysis of the system behavior (in terms of flow rates, reservoir levels, potential shortages, and operational costs) for a given level of regional demand but under a variety of hydrologic conditions.

E.4.2 Hydrology

As was just described, the simulation tool analyzes the system performance for a given demand level over the range of historic hydrology conditions. Data on rainfall, runoff, and evaporation was collected from USGS and other weather gauges in the region. The longest records possible were used in the model. In cases where data was not available, runoff data was synthesized using the Maintenance of Variance Extensions (MOVE) method and appropriate nearby reference gauges.

The hydrology data was used in the model as lookup tables feeding the flow rates into or out of the reservoirs.

E.4.3 Storage-Area-Elevation Curves

Relationships between reservoir storage volume and surface area or surface elevation were acquired from operating agency records (USACE, etc). These relationships were included in the model as lookup tables. The storage volumes determined throughout the simulation (based on the mass balance calculations and reservoir operating logic) were converted to surface area and elevation values. The reservoir surface area and elevations were used in calculating evaporation rates and pumping heads at the reservoirs.

E.4.4 FlowTable and StorageTable

The simulation tool is built to handle data effectively and to be intuitive to the user and flexible to future system changes. In order to achieve all of these goals, the tool is organized using a core 'database' approach to handle most of the calculations. There are two primary database tables that handle a majority of the model's calculations. These are the FlowTable and the StorageTable. The FlowTable literally represents all of the different flow pathways throughout the District's system. The StorageTable performs mass balance calculations on each component (or node) in the system – including reservoirs, treatment plans, and junction nodes. The mass balance is calculated as the existing storage volume plus inflows and minus outflows.

In addition to the FlowTable and StorageTable (FT/ST), there are many other tables in the model. All of these interact with either the FT/ST and each has its own specific purpose. Some of the other tables are input or output tables (as described earlier) and use simple referencing functions to move input data into the FT/ST, or else move output data out from the FT/ST. Other tables deal with linearization of relationships in the model (also as described above).

E.4.4.1 FlowTable

The FlowTable worksheet is the backbone for the model calculations. The FlowTable lists all of the flow pathways in the regional water system. Each of the rows listed on the FlowTable is and individual flow, as defined by its origin node (From column) and its destination node (To column). Each flow is described by a set of attributes (which make up the other columns in the FlowTable). Flow attributes are used to define how the flows are handled and calculated in the model and specify the types of calculations that are used to determine the value of the flow in the different time periods.

The "Type" attribute of the FlowTable is the most important attribute in determining how the flow is calculated in the model. Each of the flow types represents a different calculation that takes place to determine the flow. For each row in the FlowTable having the same "Type", the formula in the data section of the Flow Table is identical. This makes the calculations in the tool more consistent and easier to audit.

Table E-1 at the end of the appendix lists the calculation types used in the scenario tool and briefly describes what they do.

The formulas for the different flow types in the FlowTable perform different kinds of functions, including: referencing input data through LOOKUP functions and calculating values. The input values are referenced from the input tables on other worksheets (generally the input tables are defined with Named Ranges, so that they are easy to identify in the LOOKUP functions). Calculated values take place within the flow table and can include references to input data or references to other cells or combinations of cells in the FlowTable.

The FlowTable is an efficient way of managing the calculations and water mass balance in the model, but it contains a lot of unordered data and can be difficult to 'read' on its own. It is intended to function mostly in the background, performing calculations that are referenced to other, better organized output tables elsewhere in the model. That being said, the FlowTable will undoubtedly become useful to more advanced users, particularly during debugging, diagnosing, or drilling down into details. To aid in these endeavors, the flow table is set up as an Excel List whereby any of its columns can be sorted and/or filtered using the convenient drop-down menus in the header row of the table.

E.4.4.2 StorageTable

The tables on the StorageTable sheet enforce the mass balance on model components. Storage in each model component is calculated as the previous time step storage volume plus all of the inflows to that component, and minus all of the outflows. Inflows and Outflows are computed using logical (SUMIF) formulas on the data in the Flow Table. The generic mass balance equation used on the Storage Table is:

$$S_f = S_i + SUM(inflows) - Sum(outflows)$$

Other tables on the StorageTable sheet are used to account for the water in different ways. These different accountings are necessary for some of the logical conditions used in determining when to release water from different reservoirs. There are a lot of additional tables on the StorageTable sheet. They are well documented in the simulation tool itself and are not further discussed here.

Viewing Demand Data with Active Pivot Tables and Storing Data with the 'Master Pivot Table'

The user-defined demand projections are referenced into and stored in a data base table that can be read by Microsoft Excel's built in Pivot Tables. Pivot Tables are powerful tools that allow a lot of flexibility in looking at data in near-endless combinations. Pivot tables can also be a useful means of storing data and making it easily available from anywhere else in the model.

"Active" Pivot Tables on the "Pivot Table" and "Pivot Chart" worksheets allow the user to examine the demand projections with the full flexibility of Excel's built in Pivot Table features. These worksheets reference the database that stores the demand projections. These tables are termed "active" because they are intended to be manipulated by the user. (See the Excel help menus for more information on Pivot Table functionality.)

There is also a Pivot Table located on the "MasterPivot" worksheet. This table is intended to work operate in the background, and thus is not to be used by the general user. The Master Pivot Table stores all of the demand projection data in a manner

that makes all of the data available anywhere in the tool using the "GETPIVOTDATA(…)" worksheet function.

E.4.5 Cost Calculations

With respect to cost calculations, the Central OK Scenario Tool is set up to be able to do the following:

- Receive input of Capital Costs for pipelines and pump stations
- Calculate Capital Costs for new/expanded WTPs
- Allocate Capital Costs by city/agency based on facilities usage
- Calculate annual Operational (pumping) costs for water conveyance – from Source water, through Atoka Pipeline(s), and through the delivery pipelines.
- Calculate Treatment costs at the different WTPs (based on flow routed to the plants under the different delivery themes)
- Allocate Operational and Treatment Costs by city/agency based on the usage of pipelines and WTPs
- Calculate the annual Maintenance Costs for new infrastructure (pipelines/pump stations and WTPs) as an assumed percentage of the initial capital cost (currently 1.5 percent)
- Allocate Maintenance costs by city/agency

Below is a summary of the methodology used in the Central OK Scenario Tool to determine operational (pumping) costs for individual flow pathways in the system, and then to allocate those costs to the participating regional agencies.

E.4.5.1 O&M Cost Methodology

In general, the approach taken to calculate pumping costs for flow pathways in the scenario tool was to:

1. Define network layout and identify individual flow paths to be 'costed' (the layout is captured in the model schematics – see attached)
2. For each pathway identify the parameters relevant to the cost calculation (length, diameter, friction factor, elevation difference, flow rate)
3. Use 'textbook' hydraulics equations to determine pumping costs. See the derivation of the employed equation below. The formula was derived to be consistent with the units in the model: coefficients reflect unit conversions.

Note: The model used this formula for all of the flow pathways and determined the pumping costs for each month of the simulation.

Operational Pumping Cost Function

$$Cost = \tau \cdot t \cdot Power$$

$$Power = \frac{1}{\eta} \cdot Q \cdot TDH \cdot \rho \cdot g$$

$$TDH = \Delta E + h_f$$

$$h_f = \frac{3.012 \cdot V^{1.85} \cdot L}{C^{1.85} \cdot D^{1.165}} = \frac{4.709}{C^{1.85}} \cdot \frac{L}{D^{4.865}} \cdot Q^{1.85}$$

$$Cost = t \cdot \tau \cdot \left(\frac{1}{\eta} \cdot Q \cdot \rho \cdot g \cdot TDH \right)$$

Where:

$\tau = unit\ elec\ price\ [\$ / kWh]$

$\eta = pump\ efficiency$

$\Delta E = elevation\ head$

$Q = flow\ rate\ [AFM]$

$L = length\ [ft]$

$D = diameter\ [ft]$

$C = loss\ coefficient$

$t = pump\ duration\ [hr / mo]$

$$Cost = 1.40 \times 10^{-3} \cdot \frac{\tau \cdot t}{\eta} \cdot Q_{AFM} \cdot \left[\Delta E_{ft} + \frac{10.44}{C^{1.85}} \cdot \frac{L_{ft}}{D_{in}^{4.865}} \cdot (Q_{AFM} \cdot 7.439)^{1.85} \right]$$

$\rho = 62.4\ lb/ft^3$

$g = 32.2\ ft/s^2$

4. The above three steps calculated costs for individual flow pathways in the system, but some of those flow pathways were shared by different cities/agencies in the region. The next step was to allocate the costs proportionally by usage to the specific agencies.

   To do this, two methods were employed: one for flows upstream of the terminal reservoirs, and one for flows downstream of the terminal reservoirs (I can go into more detail as to why this distinction was necessary later, but for now suffice it to say that there had to be that distinction).

   The main idea for both methods was to determine a usage ratio for each city for each flow path (i.e. the ratio would indicate how much of the TOTAL flow in a pathway was being used by a single agency – ratio = 1.0 for an agency means that the entire flow is used by the agency, ratio =0.5 means half of the flow, etc).

   Notes on calculating the allocation ratio are presented later in the appendix.

5. With the pathway costs calculated (by flow) and the allocation ratios calculated (by flow), the next step was to combine these two and determine what portion of the cost of each pathway was paid by each city/agency. This was done by using the SUMPRODUCT function in excel to multiply the array of Average Monthly Flows by the array of Allocation Ratios (for each city).

E.5 Simulation Tool Outputs

The simulation tool was developed to provide much flexibility in viewing the system performance in order to answer a range of different questions. A number of useful output worksheets are described here:

- "Scenario Summary" sheet – this single sheet contains a summary of the most important output data for a scenario. It includes details on the scenario input values as well as comprehensive tables of system flows and costs broken down by city, reservoir, or water treatment plant. In addition are time series charts of system storage and flows. The summary sheet is formatted for printing or saving to a separate output file.

- "Cost Summary" sheet – this sheet contains a summary table of the capital and O&M costs by city for the simulation.

- "Alloc Costs" sheet – this sheet performs and displays the allocation of O&M costs by city for each time step in the simulation.

- "WTPs" sheet – this sheet contains the calculations of total flow through all of the water treatment plants. From the plant flow rates are derived the treatment costs. At the bottom of the sheet are tables calculating the additional plant capacities required and the capital costs for plant expansions.

E.6 Delivery Themes

The scenarios to be examined using the simulation tool include the selection of source water and intermediate storage bodies as well as the selection of a delivery theme. The source water and intermediate storage selection scenarios could be programmed in the model by using on/off checkboxes on the control panel and some worksheet level logical formulas. The selection of different delivery themes though required more complex programming because changing the downstream delivery theme required the network configuration to be altered (delivery themes specified which treatment plant and terminal storage body the different cities would use in the regional system – that required changes to the routing of regional water and changes to pipe sizes).

Because the system network configuration is described by the list of flows in the FlowTable (including the origin and destination nodes, flow type, and other flow attributes), programming the selection of different delivery themes relied on some Visual Basic code that swapped out the FlowTable list and inserted the selected FlowTable when the delivery theme option was changed. The Visual Basic code is relatively simple and simply involves copying and pasting the flow table values stored on the "ThemeConfig" worksheet onto the "FlowTable" worksheet. The FlowTable sheet already contains additional Visual Basic code that updates the formulas in the calculations portion of the table whenever the calculation type is changed. That code operates on the pasted list of flows and the FlowTable is updated

automatically. The user need only select the delivery theme from the radio buttons on the control panel (note that because of the large number of complex equations in the model, it may take several moments for the model to update when the delivery theme is changed).

Changing the delivery theme selection also changes the values in other tables besides the FlowTable. A few other tables, such as the System Configuration table and the Network Parameters table, depend on which theme is selected. These are updated similarly to the FlowTable, using simple Visual Basic code.

E.7 Auto Run Functionality for Multiple Simulations

Individual scenarios can be run by making changes to the control panel. When the simulation completes, the user may examine the output on any of the other worksheets. When it is useful to run multiple scenarios and compare the output, the user may use the Auto Run feature in the tool.

Auto Run automatically runs a series of pre-defined scenarios and stores the output in a separate file. The scenarios to run with Auto Run are set up as a list on an Auto Run Output Template file. The list of scenarios includes the selections for all of the main controls on the control panel (i.e. source body, intermediate storage body, delivery theme, demand year, etc). When in Auto Run mode, the simulation tool will go through each scenario setup on the list, run the simulation, and then store the output from the simulation into two files. One file compiles all of the simulation results into a searchable database that can be set up to feed Pivot Tables. The Pivot Tables on the Auto Run output data provide an extremely useful way to view and compare the scenario results quickly and flexibly. The other output file is just a log file that holds the "Scenario Summary" worksheet from each scenario run in a master output file. This file is useful documentation for the series of scenarios.

To run the simulation tool in Auto Run mode, a few conditions must be met:

- Open the current model file
- Open a clean version of: "autoOutTemplate.xls"
- Open a clean version of: "ScenarioRecords.xls"
- Turn off AutoSave for all three workbooks
- Setup the list of scenarios to run [on the "ScenarioList" sheet of the "autoOutTemplate.xls" file (include all attributes)]
- Click Auto Run button on Control Panel of model

E.8 Advanced Aspects of the Simulation Tool

There are other, more advanced aspects to the simulation tool that have to do with internal management of calculations, model validation and error checking, additional parameter flexibility, and advanced tool functionality. Some of these are described briefly in the sections below. Some additional documentation can be found in the simulation tool file itself.

E.8.1 Reservoir Rule Curves

The "Res Rules" worksheet allows the user to input seasonal (monthly) storage volume targets for each of the reservoir. The volume 'rules' are input as a percentage of the reservoir capacity. The percentage is converted to a volume and the tool operates the flows into and out of the reservoirs in order to maintain the rules. The rules impact whether regional water is delivered to a reservoir.

E.8.2 Allocation Ratios

Flows and costs through the facilities and infrastructure in the regional system need to be allocated to the cities/agencies that use them. The allocation needs to be based on the proportional use of those facilities. Both the capital and O&M costs need to be allocated in the model, but they required different allocation ratios – and the capital and O&M ratios are calculated in different places in the model.

E.8.2.1 Capital Cost Allocation Ratios

Capital cost allocation ratios are calculated on the "Cap Cost" worksheet. These ratios are defined as the average monthly flow delivered to the city divided by the total of the average monthly flows of all cities using the facility.

E.8.2.2 O&M Cost Allocation Ratios

The O&M cost allocation ratios are calculated on the "Alloc Ratios" worksheet. The terminal reservoirs in the system force the need to calculate O&M cost allocation ratios in two different ways (one method for flows upstream of terminal reservoirs and one method for those flows downstream). Note that the cost allocation ratios give a percent utilization of a specific flow pathway by a city (and for a given type water – regional or local)

Figure E-4 below shows a sample system of storage and flows. The red vertical line is drawn through a terminal reservoir. Cost Allocation ratios for flows on the left of the red line use one method (called the "Deliv") method in the simulation tool, while the flows on the right use another method (called the "Xfer" method).

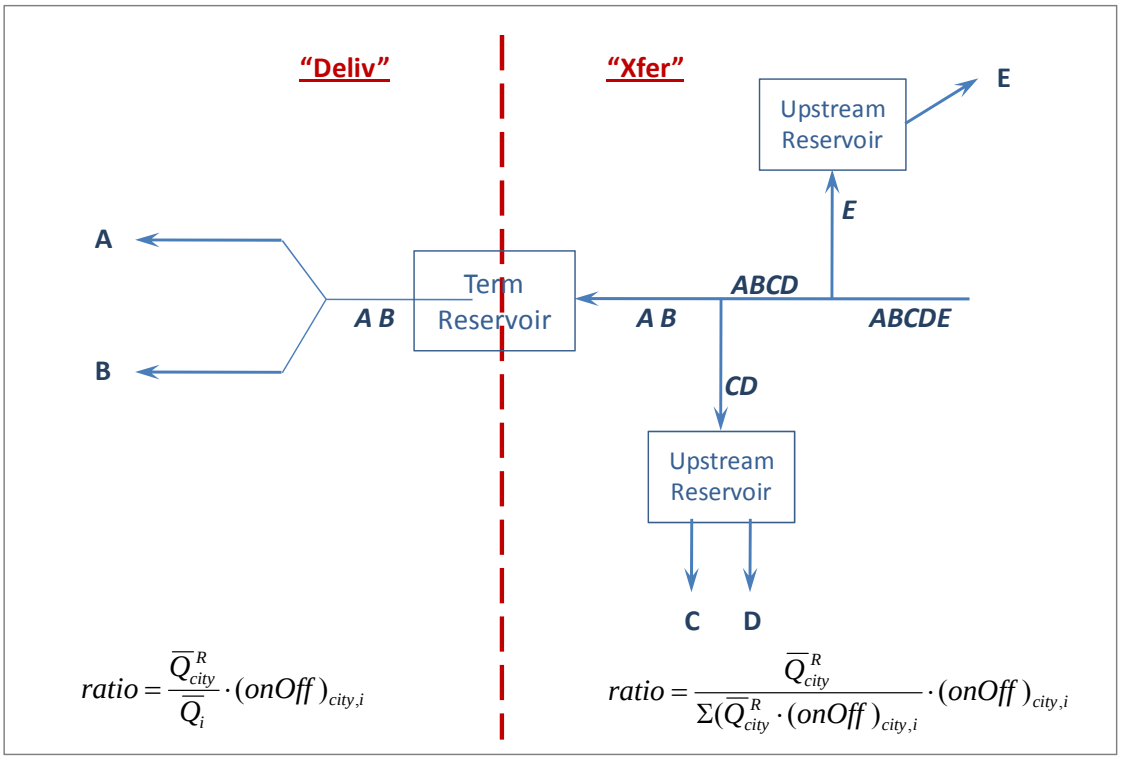


Figure E-4
Schematic Showing Need for Two Types of O&M Cost Allocation Ratios

Method One -- "Deliv" Method:

- Allocation ratio of flow path usage for a specific city (for regional water) is defined as the volume of regional water delivered to the city (averaged over the simulation) divided by the total average flow in the pathway over the simulation.

- This allocation ratio needs to use the path-specific flow because the flow may contain local waters. So the ratio will be the city-regional volume divided by the total volume in the flow.

$$ratio = \frac{\overline{Q}^R_{city}}{\overline{Q}_i} \cdot (onOff)_{city,i}$$

Where: Q^R_{city} = average Regional delivery to City (over simulation)
Q_i = average pathway flow (over simulation)
$(onOff)_{city,i}$ = binary utilization coefficient for flow path, i, and City (from def matrix)

Method Two -- "Xfer" Method:

- Allocation ratio of flow path usage for a specific city (for regional water) is defined as the volume of regional water delivered to the city (averaged over simulation)

divided by the SUM of the average volumes of water delivered to all cities that also utilize that flow path

- This must be calculated differently than the "Deliv" method because it is not certainly true that ΣQRcity equals Qi (i.e. sum of average regional flows to cities may not necessarily equal the average flow through a pathway).
- The reason that the flows may not be equal is that the terminal reservoirs provide some buffering, delays, and hydrologic contributions.
- Instead, the ratio is determined as the City's portion of the total (average) regional flows.
- NOTE: and the reason that this equation cannot be used downstream of the term reservoirs is that those flows may include local water – and this method does not account for that.
- NOTE: upstream flows will not have any Local water contributions.

$$ratio = \frac{\overline{Q}_{city}^{R}}{\Sigma(\overline{Q}_{city}^{R} \cdot (onOff)_{city,i}} \cdot (onOff)_{city,i}$$

E.8.3 Other Advanced Worksheets in the Simulation Tool

Some of the other worksheets in the model that are used for viewing deeper system details, debugging, or internal calculations are described here:

- "Dyn MB Table" sheet – this sheet contains the Dynamic Mass Balance Table which allows the user to select any node in the system and view all of the inflows and outflows to that node for all time steps in the simulation. Node selection is made using the drop down menu in the upper left of the sheet. Clicking the "Make Table" button runs some Visual Basic code that queries the FlowTable and builds the mass balance table.
- "Deficits" sheet – this sheet summarizes the deliveries of Local and Regional water to all of the cities/agencies. Any deficits from the projected demands are calculated and reported.
- "LocalRightsDeficit" sheet – this sheet reports the expected Local Rights for reservoir water for any use not included in the simulation tool. Any deficits are also reported.
- "Cumulative Storage" sheet – this sheet contains a plot for each reservoir showing the monthly storage volumes on an exceedance probability graph. The plots show the percent of time that each reservoir has storage volume greater than the value indicated on the x-axis.

- "Water Balance" sheet – this sheet has summary data to validate the overall system mass balance. All of the water flowing into the system is tabulated along with all of the water flowing out. The net flow of water in each time period is checked against the change in storage in each period. The two should be equal. By inspection, the user can check that the model is neither creating nor destroying water within the system. This was a useful sheet during the development of the tool, but may still be useful in the future during debugging or when making any changes/updates to the model structure.

- "Res Want Tables" sheet – this sheet groups all of the water demands at cities and reservoirs into tables that are used elsewhere as convenient lookup references.

- "System Config" sheet – this sheet is an important background calculation sheet. It stores some of the system logic details for the currently selected delivery theme. These include several matrices that define (using binary values) which reservoirs are connected to each other (and thus which upstream reservoir water is available to which downstream reservoirs), which reservoirs supply local and regional water to which cities, among other details. Each of these matrices must be defined differently for the delivery themes. Definition takes place on the "Theme Config" worksheet and the values for the active delivery theme are passed to the "System Config" worksheet when the theme is selected (using Visual Basic code).

E.8.4 Notes on Reservoir Logic

Because the reservoirs can store water and are not a simple "pass through" node in the mass balance equations, they require some particular logic to determine when they should release water and when they should store it for future use. Additionally, since a number of the reservoirs are connected to each other in series, the simulation tool needs to be able to simulate their operations in a coordinated manner – for instance, on a monthly time step it can be assumed that water in the selected source water body (or in the intermediate storage body) can be made available to any and all reservoirs connected to it downstream. Therefore when determining how much water can be delivered from a reservoir (and in particular during dry periods), it is important that the model know how much water in total is available to a given reservoir (including water stored in upstream reservoirs). At the same time the tool must ensure that the water is not over-allocated when there are multiple cities/agencies in parallel calling for water.

The complex logic governing the realistic operation of the reservoirs relies on a number of simple assumptions and relationships (described below and in the documentation in the simulation tool itself). These simple relationships are combined within the models in nested layers; and when multiple logical rules apply to multiple connected reservoirs, the simple relationships can combine into long and complex formulas. Many of the formulas used in the cells in the flow table turn out to be very complex with the various layers of logical rules.

Volume Type	Reservoir State (from Figure A-5)				Volume Definition
	A	B	C	D	
Storage	75	125	250	300	= Calculated by Mass Balance
Rule	100	100	100	100	= Input by User (percent, or volume curve)
Regional Want	40	40	40	40	= Based on Input Demand Projections
Local Want	10	10	10	10	= Based on Input Demand Projections
Available	-25	25	150	200	= Volume - Rule + Net(natural flows) (may be negative: local deficit)
Import	65	25	0	0	= Reg. Want - (Avail - (on/off) * Local Want) (non-negative)
Capacity	275	275	275	275	= Input by User
Spill	0	0	0	25	= Storage(final) - Capacity (non-negative)

Table E-2
Reservoir Logic: Volume Definitions and Sample Values

The Diagram in **Figure E-6** shows the logic behind the 'calling' of water from upstream system reservoirs. At the terminal reservoirs, the WANT volume is supplied as long as there is water available in any reservoir upstream (when available supply drops below the WANT volume, WANT is reduced to the volume available). Transfers from the Intermediate and Source reservoirs make up any local shortfalls at the terminal reservoirs.

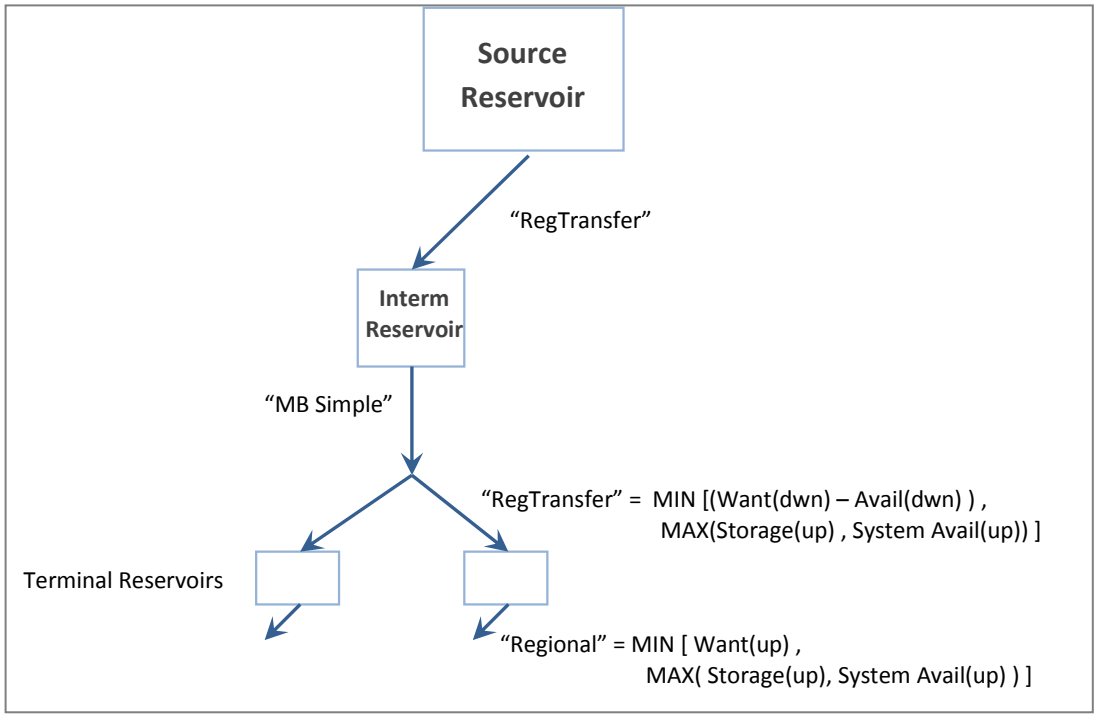


Figure E-6
Schematic Showing Logic behind "Calling" for Upstream Water

E.9 List of Calculation Types

Table E-3 lists the calculation types used in the FlowTable. Each type has a unique name. The names are listed as is a general description of how the calculation works in the simulation tool.

Calculation Type	Description
Delivery	Used to display/check total flows to city. Sums all flows to city.
LocalRights	Lookup of input values (on Control Panel sheet). Divided by 12 for monthly flows.
Local_limited	For local surface supplies, not connected to Regional System. Returns minimum of: ▪ "Local Surface Supply" via LocalWantCity table ▪ Allocation amount during shortage (this is the 'wanted' amount multiplied by ratio of resAvail/resWant Must be Non-Negative
Local_Unlimited	Retrieves "Local Surface Supply" via LocalWantCity table. No shortage assumed. Direct lookup. Assumes Local Projections are correct and available.
Regional	Calculates the amount of regional project water delivered to city. Regional water projections were provided by cities/agencies and are delivered as 'requested' when water is available. Regional flows are looked up from the Pivot Table database via the **RegioinalWantCity** table and subject to limits on the Available water in the nearest upstream reservoir. Thus, the model calls for upstream system water when there is not enough available water in the nearest reservoir. Returns the MINIMUM of the above and the available supply (defined as the MAXIMUM of either the system available storage for upstream reservoir or the actual storage volume in the upstream reservoir). The MAX condition above causes the model to first use upstream system storage and then use up the storage volume in the nearest upstream reservoir. This must be a non-negative value. Also multiplies by the ON/OFF variable for the given city. Note: see the "Calling for Transfer Water" diagrams below.

Table E-3
Calculation Types Used in the FlowTable
(continued on next page)

Calculation Type	Description
RegTransfer	Regional transfers are triggered by any deficit between avail water in reservoir and demands on reservoir during time period. Water will be "made up" through regional transfers. Sum of all reservoir outflows, MINUS reservoir avail volume. Returns the MINIMUM of the above and the available supply (defined as the MAXIMUM of either the system available storage for upstream reservoir or the actual storage volume in the upstream reservoir). The MAX condition above causes the model to first use upstream system storage and then use up the storage volume in the nearest upstream reservoir. This must be a non-negative value. Note: see the "Calling for Transfer Water" diagrams below.
Reg Transfer Terminal	Determines the amount of transfer water to be delivered to a Terminal Reservoir. The sum of all of these types of flows (i.e. SUMIF ("Transfer") determines the amount of flow in the Atoka pipeline. Selects the minimum of the Available water (system or local stored) and calculates the import/transfer amount. Depends on level of reservoir (i.e. uses IF statement on 'available water'). If Avail>0: assumes local supply "taken" first, subtract local water from available and import the difference as Regional. If Avail<0 Import ONLY Regional Want and any additional water required to bring volume to Rule Curve. Note that Local water will still be "taken" by system, but reservoir will end up below rule curve. See attached scanned page.
RegMB_Atoka	Controls flow volume out of Intermediate Storage bodies. Assume that Atoka and McGee are always connected. Draw regional water from closest Int stor body first (prioritize: 1 Atoka, 2 Buffer, 3 McGee) Formula multiplies first by On/Off "switch" cell in OnOff Int Stor column. Then uses SUMIF to find all of the flows labeled as "transfer" (in NatTransfer Col) – these are the total of transfer water. Then subtracts any RegMB_Atoka flows of higher priorty that have already been used to meet "transfer" demand. Each flow is checked against the system availability of the Int Stor Body.
MB Simple	Used when flow is the ONLY inflow to a node. Sums all of the outflows.
MB Reverse	Opposite to "MB Simple". Used when flow is the ONLY outflow to a node. Sums all of the inflows.
MB Complex	Full mass balance calculation. Sums all inflows minus all outflows (except outflow in question). Uses same formula as in Santa Clara Model (offset, etc)
Sardis Release	

Table E-3
Calculation Types Used in the FlowTable
(continued on next page)

Calculation Type	Description
Runoff	Looks up the date specific runoff flow to a reservoir in the Hydrology series. Runoff counts as a "natural" flow and is summed up when calculating the Available volume in a reservoir over a month.
Precip	Looks up the beginning of period reservoir surface area and multiplies by the date-specific precipitation value (in the Hydrology Series). Note that there are two Precip series – one for Central OK and the other for SE OK. Precip is considered a "natural" flow and is summed up when calculating the Available volume in a reservoir over a month.
Evap	Looks up the beginning of period reservoir surface area and multiplies by the date-specific evaporation value (in the Hydrology Series). Note that there are two Evap series – one for Central OK and the other for SE OK. Evap is considered a "natural" flow and is summed up when calculating the Available volume in a reservoir over a month.
Zero	Indicates a non-functioning flow
zz Spill	NOT handled in flow table. Calc'd indirectly on Storage Table.

Table E-3
Calculation Types Used in the FlowTable

Appendix F

Operations and Maintenance Cost Tables

O&M Cost Tables: By Participant, Soure Alternative, and Theme. Year: 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,245,040	$1,289,338	$735,840	$2,219,862
COWRA	$8,038,981	$3,442,378	$1,852,740	$2,743,862
Del City	$819,117	$330,117	$197,100	$291,900
Edmond	$2,293,529	$924,328	$551,880	$817,321
Midwest City	$0	$0	$0	$0
Moore	$4,587,058	$1,848,656	$1,103,760	$1,634,641
Norman	$3,039,842	$1,092,021	$651,744	$1,296,077
OKC	$25,784,524	$0	$10,392,898	$15,391,626
Seminole	$1,875,791	$519,896	$297,110	$1,058,785
Shawnee	$1,763,545	$708,664	$432,160	$622,721
TOTAL	**$52,447,427**	**$10,155,400**	**$16,215,232**	**$26,076,796**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D1, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$5,029,995	$1,319,015	$735,840	$2,975,140
COWRA	$7,882,057	$3,285,455	$1,852,740	$2,743,862
Del City	$1,264,117	$377,623	$197,100	$689,394
Edmond	$2,273,025	$903,824	$551,880	$817,321
Midwest City	$0	$0	$0	$0
Moore	$5,737,908	$2,114,271	$1,103,760	$2,519,878
Norman	$3,609,044	$1,168,601	$651,744	$1,788,699
OKC	$25,784,524	$0	$10,392,898	$15,391,626
Seminole	$1,865,051	$509,156	$297,110	$1,058,785
Shawnee	$1,743,508	$688,628	$432,160	$622,721
TOTAL	**$55,189,230**	**$10,366,573**	**$16,215,232**	**$28,607,425**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D2, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,666,659	$1,361,256	$449,680	$2,855,723
COWRA	$7,868,094	$3,271,492	$1,852,740	$2,743,862
Del City	$1,184,518	$374,674	$120,450	$689,394
Edmond	$3,878,679	$894,268	$551,880	$2,432,530
Midwest City	$0	$0	$0	$0
Moore	$4,605,775	$1,867,373	$1,103,760	$1,634,641
Norman	$3,395,481	$1,231,392	$398,288	$1,765,801
OKC	$25,784,524	$0	$10,392,898	$15,391,626
Seminole	$1,834,670	$478,775	$297,110	$1,058,785
Shawnee	$1,736,228	$681,347	$432,160	$622,721
TOTAL	**$54,954,627**	**$10,160,577**	**$15,598,966**	**$29,195,084**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D3, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,208,823	$1,288,028	$735,840	$2,184,955
COWRA	$7,947,790	$3,439,079	$1,852,740	$2,655,971
Del City	$809,416	$329,766	$197,100	$282,550
Edmond	$2,266,366	$923,345	$551,880	$791,140
Midwest City	$0	$0	$0	$0
Moore	$4,532,732	$1,846,691	$1,103,760	$1,582,281
Norman	$3,007,764	$1,090,861	$651,744	$1,265,160
OKC	$25,291,502	$0	$10,392,898	$14,898,604
Seminole	$1,861,563	$519,381	$297,110	$1,045,072
Shawnee	$1,742,849	$707,916	$432,160	$602,774
TOTAL	**$51,668,806**	**$10,145,067**	**$16,215,232**	**$25,308,507**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D1, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,993,769	$1,317,696	$735,840	$2,940,233
COWRA	$7,790,845	$3,282,133	$1,852,740	$2,655,971
Del City	$1,254,413	$377,270	$197,100	$680,044
Edmond	$2,245,855	$902,835	$551,880	$791,140
Midwest City	$0	$0	$0	$0
Moore	$5,683,569	$2,112,292	$1,103,760	$2,467,517
Norman	$3,576,959	$1,167,433	$651,744	$1,757,781
OKC	$25,291,502	$0	$10,392,898	$14,898,604
Seminole	$1,850,819	$508,638	$297,110	$1,045,072
Shawnee	$1,722,808	$687,874	$432,160	$602,774
TOTAL	**$54,410,539**	**$10,356,171**	**$16,215,232**	**$27,839,136**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D2, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,630,373	$1,359,877	$449,680	$2,820,816
COWRA	$7,776,731	$3,268,020	$1,852,740	$2,655,971
Del City	$1,174,799	$374,305	$120,450	$680,044
Edmond	$3,851,464	$893,234	$551,880	$2,406,350
Midwest City	$0	$0	$0	$0
Moore	$4,551,345	$1,865,305	$1,103,760	$1,582,281
Norman	$3,363,342	$1,230,171	$398,288	$1,734,883
OKC	$25,291,502	$0	$10,392,898	$14,898,604
Seminole	$1,820,415	$478,233	$297,110	$1,045,072
Shawnee	$1,715,493	$680,559	$432,160	$602,774
TOTAL	**$54,175,464**	**$10,149,703**	**$15,598,966**	**$28,426,795**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D3, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,117,767	$1,267,385	$735,840	$2,114,542
COWRA	$7,718,526	$3,387,104	$1,852,740	$2,478,681
Del City	$785,027	$324,237	$197,100	$263,689
Edmond	$2,198,074	$907,864	$551,880	$738,331
Midwest City	$0	$0	$0	$0
Moore	$4,396,148	$1,815,727	$1,103,760	$1,476,661
Norman	$2,927,115	$1,072,577	$651,744	$1,202,794
OKC	$24,296,997	$0	$10,392,898	$13,904,099
Seminole	$1,825,791	$511,272	$297,110	$1,017,410
Shawnee	$1,690,818	$696,120	$432,160	$562,538
TOTAL	**$49,956,263**	**$9,982,287**	**$16,215,232**	**$23,758,745**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D1, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,902,645	$1,296,985	$735,840	$2,869,820
COWRA	$7,561,407	$3,229,985	$1,852,740	$2,478,681
Del City	$1,230,005	$371,722	$197,100	$661,183
Edmond	$2,177,512	$887,301	$551,880	$738,331
Midwest City	$0	$0	$0	$0
Moore	$5,546,883	$2,081,225	$1,103,760	$2,361,897
Norman	$3,496,248	$1,149,089	$651,744	$1,695,416
OKC	$24,296,997	$0	$10,392,898	$13,904,099
Seminole	$1,815,020	$500,501	$297,110	$1,017,410
Shawnee	$1,670,737	$676,039	$432,160	$562,538
TOTAL	**$52,697,453**	**$10,192,848**	**$16,215,232**	**$26,289,374**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D2, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,540,677	$1,340,594	$449,680	$2,750,403
COWRA	$7,550,890	$3,219,468	$1,852,740	$2,478,681
Del City	$1,150,773	$369,140	$120,450	$661,183
Edmond	$3,784,192	$878,772	$551,880	$2,353,540
Midwest City	$0	$0	$0	$0
Moore	$4,416,801	$1,836,380	$1,103,760	$1,476,661
Norman	$3,283,897	$1,213,091	$398,288	$1,672,517
OKC	$24,296,997	$0	$10,392,898	$13,904,099
Seminole	$1,785,177	$470,658	$297,110	$1,017,410
Shawnee	$1,664,238	$669,540	$432,160	$562,538
TOTAL	**$52,473,642**	**$9,997,643**	**$15,598,966**	**$26,877,033**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D3, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,154,087	$1,263,066	$735,840	$2,155,181
COWRA	$7,809,972	$3,376,228	$1,852,740	$2,581,004
Del City	$794,755	$323,080	$197,100	$274,575
Edmond	$2,225,314	$904,624	$551,880	$768,810
Midwest City	$0	$0	$0	$0
Moore	$4,450,627	$1,809,248	$1,103,760	$1,537,620
Norman	$2,959,283	$1,068,751	$651,744	$1,238,788
OKC	$24,870,975	$0	$10,392,898	$14,478,077
Seminole	$1,840,060	$509,575	$297,110	$1,033,375
Shawnee	$1,711,571	$693,652	$432,160	$585,760
TOTAL	**$50,816,644**	**$9,948,223**	**$16,215,232**	**$24,653,189**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D1, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,938,761	$1,292,462	$735,840	$2,910,458
COWRA	$7,652,341	$3,218,597	$1,852,740	$2,581,004
Del City	$1,239,679	$370,510	$197,100	$672,069
Edmond	$2,204,599	$883,909	$551,880	$768,810
Midwest City	$0	$0	$0	$0
Moore	$5,601,056	$2,074,441	$1,103,760	$2,422,856
Norman	$3,528,237	$1,145,083	$651,744	$1,731,410
OKC	$24,870,975	$0	$10,392,898	$14,478,077
Seminole	$1,829,209	$498,724	$297,110	$1,033,375
Shawnee	$1,691,374	$673,455	$432,160	$585,760
TOTAL	**$53,556,231**	**$10,157,181**	**$16,215,232**	**$27,183,819**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D2, Year 2020

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,575,906	$1,335,184	$449,680	$2,791,042
COWRA	$7,639,592	$3,205,848	$1,852,740	$2,581,004
Del City	$1,160,209	$367,691	$120,450	$672,069
Edmond	$3,810,614	$874,714	$551,880	$2,384,020
Midwest City	$0	$0	$0	$0
Moore	$4,469,645	$1,828,266	$1,103,760	$1,537,620
Norman	$3,315,100	$1,208,300	$398,288	$1,708,512
OKC	$24,870,975	$0	$10,392,898	$14,478,077
Seminole	$1,799,017	$468,532	$297,110	$1,033,375
Shawnee	$1,684,369	$666,449	$432,160	$585,760
TOTAL	**$53,325,428**	**$9,954,985**	**$15,598,966**	**$27,771,478**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D3, Year 2020

O&M Cost Tables: By Participant, Soure Alternative, and Theme. Year: 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,169,908	$1,341,803	$788,400	$2,039,705
COWRA	$10,413,633	$4,752,326	$2,628,601	$3,032,706
Del City	$742,636	$318,135	$197,100	$227,401
Edmond	$5,297,467	$2,269,360	$1,405,980	$1,622,127
Midwest City	$198,036	$84,836	$52,560	$60,640
Moore	$4,703,359	$2,014,853	$1,248,300	$1,440,206
Norman	$7,086,674	$2,898,515	$1,790,982	$2,397,177
OKC	$25,407,312	$0	$11,796,867	$13,610,445
Seminole	$2,240,018	$720,736	$418,655	$1,100,627
Shawnee	$1,802,061	$770,119	$486,180	$545,762
TOTAL	**$62,061,105**	**$15,170,684**	**$20,813,625**	**$26,076,796**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D1, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,955,306	$1,371,923	$788,400	$2,794,983
COWRA	$10,181,908	$4,520,601	$2,628,601	$3,032,706
Del City	$1,187,031	$365,037	$197,100	$624,895
Edmond	$5,240,213	$2,212,107	$1,405,980	$1,622,127
Midwest City	$512,556	$95,690	$52,560	$364,306
Moore	$5,897,286	$2,323,544	$1,248,300	$2,325,442
Norman	$7,799,410	$3,118,629	$1,790,982	$2,889,799
OKC	$25,407,312	$0	$11,796,867	$13,610,445
Seminole	$2,223,431	$704,149	$418,655	$1,100,627
Shawnee	$1,776,202	$744,260	$486,180	$545,762
TOTAL	**$65,180,656**	**$15,455,941**	**$20,813,625**	**$28,911,090**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D2, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,533,551	$1,376,185	$481,800	$2,675,566
COWRA	$9,998,251	$4,336,944	$2,628,601	$3,032,706
Del City	$1,094,815	$349,470	$120,450	$624,895
Edmond	$6,738,113	$2,094,796	$1,405,980	$3,237,337
Midwest City	$492,277	$95,852	$32,120	$364,306
Moore	$4,637,714	$1,949,208	$1,248,300	$1,440,206
Norman	$7,174,621	$3,213,231	$1,094,489	$2,866,901
OKC	$25,407,312	$0	$11,796,867	$13,610,445
Seminole	$2,153,688	$634,406	$418,655	$1,100,627
Shawnee	$1,736,734	$704,791	$486,180	$545,762
TOTAL	**$63,967,075**	**$14,754,883**	**$19,713,442**	**$29,498,750**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D3, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,136,823	$1,337,854	$788,400	$2,010,569
COWRA	$10,303,323	$4,739,159	$2,628,601	$2,935,563
Del City	$734,364	$317,147	$197,100	$220,117
Edmond	$5,238,465	$2,262,317	$1,405,980	$1,570,167
Midwest City	$195,830	$84,573	$52,560	$58,698
Moore	$4,650,973	$2,008,600	$1,248,300	$1,394,074
Norman	$7,011,515	$2,889,544	$1,790,982	$2,330,989
OKC	$24,971,345	$0	$11,796,867	$13,174,478
Seminole	$2,222,924	$718,696	$418,655	$1,085,573
Shawnee	$1,782,210	$767,750	$486,180	$528,280
TOTAL	**$61,247,771**	**$15,125,640**	**$20,813,625**	**$25,308,507**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D1, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,922,223	$1,367,977	$788,400	$2,765,846
COWRA	$10,071,607	$4,507,444	$2,628,601	$2,935,563
Del City	$1,178,761	$364,050	$197,100	$617,610
Edmond	$5,181,216	$2,205,069	$1,405,980	$1,570,167
Midwest City	$510,350	$95,427	$52,560	$362,363
Moore	$5,844,905	$2,317,296	$1,248,300	$2,279,310
Norman	$7,724,257	$3,109,664	$1,790,982	$2,823,611
OKC	$24,971,345	$0	$11,796,867	$13,174,478
Seminole	$2,206,338	$702,110	$418,655	$1,085,573
Shawnee	$1,756,353	$741,892	$486,180	$528,280
TOTAL	**$64,367,355**	**$15,410,929**	**$20,813,625**	**$28,142,801**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D2, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,501,247	$1,373,017	$481,800	$2,646,430
COWRA	$9,890,546	$4,326,382	$2,628,601	$2,935,563
Del City	$1,086,739	$348,678	$120,450	$617,610
Edmond	$6,680,504	$2,089,147	$1,405,980	$3,185,377
Midwest City	$490,124	$95,641	$32,120	$362,363
Moore	$4,586,566	$1,944,192	$1,248,300	$1,394,074
Norman	$7,101,237	$3,206,035	$1,094,489	$2,800,713
OKC	$24,971,345	$0	$11,796,867	$13,174,478
Seminole	$2,136,997	$632,769	$418,655	$1,085,573
Shawnee	$1,717,351	$702,891	$486,180	$528,280
TOTAL	**$63,162,655**	**$14,718,752**	**$19,713,442**	**$28,730,461**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D3, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,047,002	$1,306,806	$788,400	$1,951,796
COWRA	$10,003,852	$4,635,642	$2,628,601	$2,739,609
Del City	$711,909	$309,385	$197,100	$205,424
Edmond	$5,078,284	$2,206,948	$1,405,980	$1,465,356
Midwest City	$189,842	$82,503	$52,560	$54,780
Moore	$4,508,757	$1,959,440	$1,248,300	$1,301,017
Norman	$6,807,473	$2,819,013	$1,790,982	$2,197,477
OKC	$24,091,928	$0	$11,796,867	$12,295,061
Seminole	$2,176,517	$702,654	$418,655	$1,055,207
Shawnee	$1,728,318	$749,121	$486,180	$493,017
TOTAL	**$59,343,882**	**$14,771,513**	**$20,813,625**	**$23,758,745**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D1, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,832,405	$1,336,932	$788,400	$2,707,074
COWRA	$9,772,146	$4,403,935	$2,628,601	$2,739,609
Del City	$1,156,306	$356,289	$197,100	$602,917
Edmond	$5,021,040	$2,149,704	$1,405,980	$1,465,356
Midwest City	$504,363	$93,358	$52,560	$358,445
Moore	$5,702,694	$2,268,140	$1,248,300	$2,186,253
Norman	$7,520,220	$3,039,139	$1,790,982	$2,690,099
OKC	$24,091,928	$0	$11,796,867	$12,295,061
Seminole	$2,159,932	$686,070	$418,655	$1,055,207
Shawnee	$1,702,462	$723,265	$486,180	$493,017
TOTAL	**$62,463,496**	**$15,056,832**	**$20,813,625**	**$26,593,039**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D2, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,415,732	$1,346,275	$481,800	$2,587,657
COWRA	$9,605,432	$4,237,221	$2,628,601	$2,739,609
Del City	$1,065,360	$341,993	$120,450	$602,917
Edmond	$6,528,003	$2,041,457	$1,405,980	$3,080,566
Midwest City	$484,423	$93,858	$32,120	$358,445
Moore	$4,451,168	$1,901,851	$1,248,300	$1,301,017
Norman	$6,906,976	$3,145,285	$1,094,489	$2,667,201
OKC	$24,091,928	$0	$11,796,867	$12,295,061
Seminole	$2,092,814	$618,952	$418,655	$1,055,207
Shawnee	$1,666,042	$686,845	$486,180	$493,017
TOTAL	**$61,307,877**	**$14,413,737**	**$19,713,442**	**$27,180,698**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D3, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,087,740	$1,313,623	$788,400	$1,985,717
COWRA	$10,139,677	$4,658,372	$2,628,601	$2,852,704
Del City	$722,094	$311,090	$197,100	$213,904
Edmond	$5,150,934	$2,219,106	$1,405,980	$1,525,848
Midwest City	$192,558	$82,957	$52,560	$57,041
Moore	$4,573,259	$1,970,235	$1,248,300	$1,354,725
Norman	$6,900,016	$2,834,500	$1,790,982	$2,274,534
OKC	$24,599,483	$0	$11,796,867	$12,802,616
Seminole	$2,197,565	$706,177	$418,655	$1,072,733
Shawnee	$1,752,760	$753,211	$486,180	$513,369
TOTAL	**$60,316,086**	**$14,849,271**	**$20,813,625**	**$24,653,189**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D1, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,873,140	$1,343,745	$788,400	$2,740,994
COWRA	$9,907,958	$4,426,653	$2,628,601	$2,852,704
Del City	$1,166,490	$357,992	$197,100	$611,397
Edmond	$5,093,683	$2,161,856	$1,405,980	$1,525,848
Midwest City	$507,078	$93,812	$52,560	$360,706
Moore	$5,767,190	$2,278,929	$1,248,300	$2,239,961
Norman	$7,612,755	$3,054,618	$1,790,982	$2,767,156
OKC	$24,599,483	$0	$11,796,867	$12,802,616
Seminole	$2,180,978	$689,590	$418,655	$1,072,733
Shawnee	$1,726,903	$727,353	$486,180	$513,369
TOTAL	**$63,435,658**	**$15,134,549**	**$20,813,625**	**$27,487,484**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D2, Year 2040

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,451,779	$1,348,401	$481,800	$2,621,578
COWRA	$9,725,616	$4,244,311	$2,628,601	$2,852,704
Del City	$1,074,372	$342,524	$120,450	$611,397
Edmond	$6,592,286	$2,045,249	$1,405,980	$3,141,057
Midwest City	$486,826	$94,000	$32,120	$360,706
Moore	$4,508,242	$1,905,217	$1,248,300	$1,354,725
Norman	$6,988,862	$3,150,116	$1,094,489	$2,744,257
OKC	$24,599,483	$0	$11,796,867	$12,802,616
Seminole	$2,111,439	$620,051	$418,655	$1,072,733
Shawnee	$1,687,670	$688,121	$486,180	$513,369
TOTAL	**$62,226,576**	**$14,437,990**	**$19,713,442**	**$28,075,143**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D3, Year 2040

O&M Cost Tables: By Participant, Soure Alternative, and Theme. Year: 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,175,554	$1,574,697	$840,960	$1,759,897
COWRA	$9,768,555	$5,171,392	$2,628,601	$1,968,563
Del City	$694,266	$349,557	$197,100	$147,608
Edmond	$8,655,180	$4,357,815	$2,457,180	$1,840,186
Midwest City	$786,835	$396,165	$223,380	$167,290
Moore	$4,859,861	$2,446,901	$1,379,700	$1,033,259
Norman	$11,342,483	$5,572,123	$3,110,238	$2,660,122
OKC	$49,961,897	$14,739,559	$20,139,693	$15,082,645
Seminole	$2,596,264	$1,033,400	$539,261	$1,023,603
Shawnee	$1,875,324	$941,501	$540,200	$393,623
TOTAL	**$94,716,218**	**$36,583,110**	**$32,056,313**	**$26,076,796**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D1, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,958,172	$1,602,037	$840,960	$2,515,175
COWRA	$9,553,328	$4,956,164	$2,628,601	$1,968,563
Del City	$1,137,345	$395,143	$197,100	$545,102
Edmond	$8,535,151	$4,237,786	$2,457,180	$1,840,186
Midwest City	$1,156,002	$461,667	$223,380	$470,955
Moore	$6,090,441	$2,792,246	$1,379,700	$1,918,496
Norman	$12,233,007	$5,970,025	$3,110,238	$3,152,744
OKC	$49,555,920	$14,333,582	$20,139,693	$15,082,645
Seminole	$2,570,634	$1,007,770	$539,261	$1,023,603
Shawnee	$1,840,301	$906,478	$540,200	$393,623
TOTAL	**$97,630,302**	**$36,662,899**	**$32,056,313**	**$28,911,090**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D2, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,459,114	$1,549,453	$513,920	$2,395,741
COWRA	$9,156,990	$4,559,882	$2,628,601	$1,968,507
Del City	$1,032,146	$366,599	$120,450	$545,098
Edmond	$9,767,515	$3,854,992	$2,457,180	$3,455,343
Midwest City	$1,035,218	$427,757	$136,510	$470,950
Moore	$4,676,355	$2,263,426	$1,379,700	$1,033,230
Norman	$10,757,054	$5,726,574	$1,900,701	$3,129,779
OKC	$48,260,221	$13,038,313	$20,139,693	$15,082,214
Seminole	$2,445,906	$881,430	$540,200	$1,024,276
Shawnee	$1,758,375	$824,563	$540,200	$393,611
TOTAL	**$93,348,894**	**$33,492,990**	**$30,357,155**	**$29,498,750**

Summary of Operations and Maintenance Cost: Hugo to McGee Creek, Theme D3, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,148,578	$1,568,616	$840,255	$1,739,707
COWRA	$9,684,059	$5,152,209	$2,626,397	$1,905,454
Del City	$687,964	$348,153	$196,935	$142,876
Edmond	$8,576,619	$4,340,307	$2,455,120	$1,781,192
Midwest City	$779,693	$394,573	$223,193	$161,927
Moore	$4,815,749	$2,437,071	$1,378,543	$1,000,135
Norman	$11,245,269	$5,552,190	$3,107,630	$2,585,449
OKC	$49,384,732	$14,662,808	$20,122,805	$14,599,118
Seminole	$2,581,025	$1,030,439	$539,261	$1,011,325
Shawnee	$1,860,059	$938,536	$540,200	$381,323
TOTAL	**$93,763,747**	**$36,424,903**	**$32,030,337**	**$25,308,507**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D1, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,933,811	$1,597,668	$840,960	$2,495,183
COWRA	$9,477,063	$4,944,102	$2,627,607	$1,905,353
Del City	$1,131,635	$394,119	$197,100	$540,416
Edmond	$8,460,770	$4,223,421	$2,456,251	$1,781,098
Midwest City	$1,149,531	$460,507	$223,380	$465,645
Moore	$6,050,474	$2,785,077	$1,379,700	$1,885,696
Norman	$12,142,908	$5,953,865	$3,110,238	$3,078,805
OKC	$49,007,734	$14,277,307	$20,132,079	$14,598,348
Seminole	$2,555,434	$1,005,044	$539,261	$1,011,130
Shawnee	$1,825,075	$903,747	$540,200	$381,128
TOTAL	**$96,734,434**	**$36,544,857**	**$32,046,775**	**$28,142,801**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D2, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,432,878	$1,543,357	$513,920	$2,375,601
COWRA	$9,074,982	$4,540,826	$2,628,601	$1,905,556
Del City	$1,025,976	$365,149	$120,450	$540,378
Edmond	$9,690,236	$3,836,559	$2,457,180	$3,396,497
Midwest City	$1,028,225	$426,114	$136,510	$465,600
Moore	$4,632,963	$2,253,075	$1,379,700	$1,000,188
Norman	$10,659,689	$5,703,694	$1,900,701	$3,055,294
OKC	$47,715,558	$12,975,966	$20,139,693	$14,599,899
Seminole	$2,423,497	$874,666	$538,407	$1,010,424
Shawnee	$1,741,845	$820,620	$540,200	$381,024
TOTAL	**$92,425,848**	**$33,340,026**	**$30,355,362**	**$28,730,461**

Summary of Operations and Maintenance Cost: Highway 3 to McGee Creek, Theme D3, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,049,186	$1,509,211	$840,960	$1,699,014
COWRA	$9,373,565	$4,966,704	$2,628,601	$1,778,260
Del City	$664,648	$334,209	$197,100	$133,339
Edmond	$8,285,949	$4,166,476	$2,457,180	$1,662,293
Midwest City	$753,268	$378,771	$223,380	$151,118
Moore	$4,652,538	$2,339,465	$1,379,700	$933,373
Norman	$10,869,987	$5,324,799	$3,110,238	$2,434,950
OKC	$47,856,672	$14,092,387	$20,139,693	$13,624,591
Seminole	$2,520,664	$994,228	$540,200	$986,236
Shawnee	$1,796,344	$900,573	$540,200	$355,571
TOTAL	**$90,822,820**	**$35,006,823**	**$32,057,252**	**$23,758,745**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D1, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,832,576	$1,537,324	$840,960	$2,454,292
COWRA	$9,157,289	$4,750,428	$2,628,601	$1,778,260
Del City	$1,107,908	$379,975	$197,100	$530,833
Edmond	$8,169,445	$4,049,972	$2,457,180	$1,662,293
Midwest City	$1,122,641	$444,478	$223,380	$454,783
Moore	$5,884,385	$2,686,076	$1,379,700	$1,818,609
Norman	$11,768,497	$5,730,687	$3,110,238	$2,927,572
OKC	$47,462,617	$13,698,333	$20,139,693	$13,624,591
Seminole	$2,495,743	$969,307	$540,200	$986,236
Shawnee	$1,762,075	$866,304	$540,200	$355,571
TOTAL	**$93,763,176**	**$35,112,884**	**$32,057,252**	**$26,593,039**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D2, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,342,142	$1,493,346	$513,920	$2,334,876
COWRA	$8,791,369	$4,384,508	$2,628,601	$1,778,260
Del City	$1,004,745	$353,463	$120,450	$530,833
Edmond	$9,425,916	$3,691,233	$2,457,180	$3,277,503
Midwest City	$1,004,163	$412,870	$136,510	$454,783
Moore	$4,484,548	$2,171,475	$1,379,700	$933,373
Norman	$10,324,666	$5,519,291	$1,900,701	$2,904,674
OKC	$46,248,709	$12,484,425	$20,139,693	$13,624,591
Seminole	$2,372,837	$846,401	$540,200	$986,236
Shawnee	$1,685,305	$789,535	$540,200	$355,571
TOTAL	**$89,684,400**	**$32,146,547**	**$30,357,155**	**$27,180,698**

Summary of Operations and Maintenance Cost: Moyers to McGee Creek, Theme D3, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,093,598	$1,530,139	$840,960	$1,722,500
COWRA	$9,512,387	$5,032,117	$2,628,601	$1,851,669
Del City	$675,058	$339,114	$197,100	$138,843
Edmond	$8,415,717	$4,227,623	$2,457,180	$1,730,915
Midwest City	$765,065	$384,329	$223,380	$157,356
Moore	$4,725,403	$2,373,799	$1,379,700	$971,904
Norman	$11,034,245	$5,402,198	$3,110,238	$2,521,809
OKC	$48,625,931	$14,299,207	$20,139,693	$14,187,031
Seminole	$2,548,422	$1,007,308	$540,200	$1,000,914
Shawnee	$1,824,102	$913,653	$540,200	$370,249
TOTAL	**$92,219,928**	**$35,509,487**	**$32,057,252**	**$24,653,189**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D1, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,876,988	$1,558,251	$840,960	$2,477,777
COWRA	$9,296,109	$4,815,839	$2,628,601	$1,851,669
Del City	$1,118,317	$384,880	$197,100	$536,337
Edmond	$8,299,212	$4,111,117	$2,457,180	$1,730,915
Midwest City	$1,134,438	$450,037	$223,380	$461,021
Moore	$5,957,249	$2,720,409	$1,379,700	$1,857,140
Norman	$11,932,753	$5,808,083	$3,110,238	$3,014,431
OKC	$48,231,871	$13,905,147	$20,139,693	$14,187,031
Seminole	$2,523,501	$982,387	$540,200	$1,000,914
Shawnee	$1,789,832	$879,383	$540,200	$370,249
TOTAL	**$95,160,270**	**$35,615,533**	**$32,057,252**	**$27,487,484**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D2, Year 2060

City/Agency	TOTAL O&M Costs	Operating Cost: Pumping (avg)	Operating Cost: Treatment (avg)	Maintenance Cost: Pipelines/ Pumps
	[$/yr]	[$/yr]	[$/yr]	[$/yr]
Chickasha	$4,383,203	$1,510,922	$513,920	$2,358,361
COWRA	$8,919,714	$4,439,444	$2,628,601	$1,851,669
Del City	$1,014,369	$357,582	$120,450	$536,337
Edmond	$9,545,891	$3,742,587	$2,457,180	$3,346,124
Midwest City	$1,015,070	$417,539	$136,510	$461,021
Moore	$4,551,914	$2,200,310	$1,379,700	$971,904
Norman	$10,476,528	$5,584,293	$1,900,701	$2,991,533
OKC	$46,984,844	$12,658,120	$20,139,693	$14,187,031
Seminole	$2,398,500	$857,386	$540,200	$1,000,914
Shawnee	$1,710,969	$800,519	$540,200	$370,249
TOTAL	**$91,001,001**	**$32,568,703**	**$30,357,155**	**$28,075,143**

Summary of Operations and Maintenance Cost: Sardis to Atoka, Theme D3, Year 2060

Appendix G

Cost Distribution Results for Participants

Appendix G
Cost Distribution Results for Participants

The results for the alternatives recommended and not recommended are presented in this Appendix. **Table G-1** presents the recommended alternative.

Appendix G-1

Recommended Alternative

Supply from Moyers Crossing and Distribution D1

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Moyers Crossing to Atoka (Table 8-7)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D1 Immediate (Table 8-2)	Distribution Pipeline - D1 Deferred (Table 8-2)	Stanley Draper WTP - D1 Deferred (Table 8-13)	Totals
OKC	$370,800,000	$78,300,000	$128,544,000	$28,840,000	$0	$0	$401,712,000	$1,008,196,000
Norman	138,600,000	29,160,000	48,048,000	10,780,000	-	20,089,200	113,616,000	360,293,200
Chickasha	37,800,000	7,920,000	13,104,000	2,940,000	80,800,800	-	30,720,000	173,284,800
Del City	9,000,000	1,800,000	3,120,000	700,000	-	-	7,200,000	21,820,000
Midwest City	9,900,000	2,160,000	3,432,000	770,000	-	-	8,160,000	24,422,000
Moore	61,200,000	12,960,000	21,216,000	4,760,000	-	-	50,400,000	150,536,000
COWRA	117,000,000	24,660,000	40,560,000	9,100,000	-	-	48,000,000	239,320,000
Edmond	108,900,000	23,040,000	37,752,000	8,470,000	-	-	89,760,000	267,922,000
Seminole	23,400,000	-	8,112,000	1,820,000	-	44,184,000	-	77,516,000
Shawnee	23,400,000	-	8,112,000	1,820,000	-	-	-	33,332,000
Total	**$900,000,000**	**$180,000,000**	**$312,000,000**	**$70,000,000**	**$80,800,800**	**$64,273,200**	**$749,568,000**	**$2,356,642,000**

Appendix G-2

Other Supply

Supply from Sardis and Distribution D1

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Sardis to Atoka (Table 8-6)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D1 (Table 8-2)	Stanley Draper WTP - D1 (Table 8-13)	Totals
OKC	$370,800,000	$78,300,000	$143,376,000	$28,840,000	$0	$401,712,000	$1,023,028,000
Norman	138,600,000	29,160,000	$53,592,000	10,780,000	20,089,200	113,616,000	365,837,200
Chickasha	37,800,000	7,920,000	$14,616,000	2,940,000	80,800,800	30,720,000	174,796,800
Del City	9,000,000	1,800,000	$3,480,000	700,000	-	7,200,000	22,180,000
Midwest City	9,900,000	2,160,000	$3,828,000	770,000	-	8,160,000	24,818,000
Moore	61,200,000	12,960,000	$23,664,000	4,760,000	-	50,400,000	152,984,000
COWRA	117,000,000	24,660,000	$45,240,000	9,100,000	-	48,000,000	244,000,000
Edmond	108,900,000	23,040,000	$42,108,000	8,470,000	-	89,760,000	272,278,000
Seminole	23,400,000	-	$9,048,000	1,820,000	44,184,000	-	78,452,000
Shawnee	23,400,000	-	$9,048,000	1,820,000	-	-	34,268,000
Total	**$900,000,000**	**$180,000,000**	**$348,000,000**	**$70,000,000**	**$145,074,000**	**$749,568,000**	**$2,392,642,000**

Appendix G-3

Other Supply Alternative

Supply from Highway 3 and Distribution D1

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Highway 3 to Atoka (Table 8-8)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D1 (Table 8-2)	Stanley Draper WTP - D1 (Table 8-13)	Totals
OKC	$370,800,000	$78,300,000	$168,096,000	$28,840,000	$0	$401,712,000	$1,047,748,000
Norman	138,600,000	29,160,000	$62,832,000	10,780,000	20,089,200	113,616,000	375,077,200
Chickasha	37,800,000	7,920,000	$17,136,000	2,940,000	80,800,800	30,720,000	177,316,800
Del City	9,000,000	1,800,000	$4,080,000	700,000	-	7,200,000	22,780,000
Midwest City	9,900,000	2,160,000	$4,488,000	770,000	-	8,160,000	25,478,000
Moore	61,200,000	12,960,000	$27,744,000	4,760,000	-	50,400,000	157,064,000
COWRA	117,000,000	24,660,000	$53,040,000	9,100,000	-	48,000,000	251,800,000
Edmond	108,900,000	23,040,000	$49,368,000	8,470,000	-	89,760,000	279,538,000
Seminole	23,400,000	-	$10,608,000	1,820,000	44,184,000	-	80,012,000
Shawnee	23,400,000	-	$10,608,000	1,820,000	-	-	35,828,000
Total	**$900,000,000**	**$180,000,000**	**$408,000,000**	**$70,000,000**	**$145,074,000**	**$749,568,000**	**$2,452,642,000**

Appendix G-4

Other Supply Alternative

Supply from Hugo and Distribution D1

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Hugo to Atoka (Table 8-9)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D1 (Table 8-2)	Stanley Draper WTP - D1 (Table 8-13)	Totals
OKC	$370,800,000	$78,300,000	$187,872,000	$28,840,000	$0	$401,712,000	$1,067,524,000
Norman	138,600,000	29,160,000	$70,224,000	10,780,000	20,089,200	113,616,000	382,469,200
Chickasha	37,800,000	7,920,000	$19,152,000	2,940,000	80,800,800	30,720,000	179,332,800
Del City	9,000,000	1,800,000	$4,560,000	700,000	-	7,200,000	23,260,000
Midwest City	9,900,000	2,160,000	$5,016,000	770,000	-	8,160,000	26,006,000
Moore	61,200,000	12,960,000	$31,008,000	4,760,000	-	50,400,000	160,328,000
COWRA	117,000,000	24,660,000	$59,280,000	9,100,000	-	48,000,000	258,040,000
Edmond	108,900,000	23,040,000	$55,176,000	8,470,000	-	89,760,000	285,346,000
Seminole	23,400,000	-	$11,856,000	1,820,000	44,184,000	-	81,260,000
Shawnee	23,400,000	-	$11,856,000	1,820,000	-	-	37,076,000
Total	**$900,000,000**	**$180,000,000**	**$456,000,000**	**$70,000,000**	**$145,074,000**	**$749,568,000**	**$2,500,642,000**

Table G-5

Recommended Alternative

Supply from Moyers Crossing and Distribution D2

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Moyers Crossing to Atoka (Table 8-7)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D2 (Table 8-2)	WTP - D2 (Tables 8-15 & 8-16)	Totals
OKC	$370,800,000	$78,300,000	$128,544,000	$28,840,000	$0	$401,712,000	$1,008,196,000
Norman	138,600,000	29,160,000	48,048,000	10,780,000	58,182,000	113,616,000	398,386,000
Chickasha	37,800,000	7,920,000	13,104,000	2,940,000	134,997,600	30,720,000	227,481,600
Del City	9,000,000	1,800,000	3,120,000	700,000	-	7,200,000	21,820,000
Midwest City	9,900,000	2,160,000	3,432,000	770,000	-	8,160,000	24,422,000
Moore	61,200,000	12,960,000	21,216,000	4,760,000	62,023,200	50,400,000	212,559,200
COWRA	117,000,000	24,660,000	40,560,000	9,100,000	-	50,400,000	241,720,000
Edmond	108,900,000	23,040,000	37,752,000	8,470,000	-	89,760,000	267,922,000
Seminole	23,400,000	-	8,112,000	1,820,000	44,184,000	-	77,516,000
Shawnee	23,400,000	-	8,112,000	1,820,000	-	-	33,332,000
Total	**$900,000,000**	**$180,000,000**	**$312,000,000**	**$70,000,000**	**$299,386,800**	**$751,968,000**	**$2,513,354,800**

Table G-6

Other Supply Alternative

Supply from Sardis and Distribution D2

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Sardis to Atoka (Table 8-6)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D2 (Table 8-2)	WTP - D2 (Tables 8-15 & 8-16)	Totals
OKC	$370,800,000	$78,300,000	$143,376,000	$28,840,000	$0	$401,712,000	$1,023,028,000
Norman	138,600,000	29,160,000	53,592,000	10,780,000	58,182,000	113,616,000	403,930,000
Chickasha	37,800,000	7,920,000	14,616,000	2,940,000	134,997,600	30,720,000	228,993,600
Del City	9,000,000	1,800,000	3,480,000	700,000	-	7,200,000	22,180,000
Midwest City	9,900,000	2,160,000	3,828,000	770,000	-	8,160,000	24,818,000
Moore	61,200,000	12,960,000	23,664,000	4,760,000	62,023,200	50,400,000	215,007,200
COWRA	117,000,000	24,660,000	45,240,000	9,100,000	-	50,400,000	246,400,000
Edmond	108,900,000	23,040,000	42,108,000	8,470,000	-	89,760,000	272,278,000
Seminole	23,400,000	-	9,048,000	1,820,000	44,184,000	-	78,452,000
Shawnee	23,400,000	-	9,048,000	1,820,000	-	-	34,268,000
Total	**$900,000,000**	**$180,000,000**	**$348,000,000**	**$70,000,000**	**$299,386,800**	**$751,968,000**	**$2,549,354,800**

Table G-7

Other Supply Alternative

Supply from Highway 3 and Distribution D2

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Highway 3 to Atoka (Table 8-8)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D2 (Table 8-2)	WTP - D2 (Tables 8-15 & 8-16)	Totals
OKC	$370,800,000	$78,300,000	$168,096,000	$28,840,000	$0	$401,712,000	$1,047,748,000
Norman	138,600,000	29,160,000	$62,832,000	10,780,000	58,182,000	113,616,000	413,170,000
Chickasha	37,800,000	7,920,000	$17,136,000	2,940,000	134,997,600	30,720,000	231,513,600
Del City	9,000,000	1,800,000	$4,080,000	700,000	-	7,200,000	22,780,000
Midwest City	9,900,000	2,160,000	$4,488,000	770,000	-	8,160,000	25,478,000
Moore	61,200,000	12,960,000	$27,744,000	4,760,000	62,023,200	50,400,000	219,087,200
COWRA	117,000,000	24,660,000	$53,040,000	9,100,000	-	50,400,000	254,200,000
Edmond	108,900,000	23,040,000	$49,368,000	8,470,000	-	89,760,000	279,538,000
Seminole	23,400,000	-	$10,608,000	1,820,000	44,184,000	-	80,012,000
Shawnee	23,400,000	-	$10,608,000	1,820,000	-	-	35,828,000
Total	**$900,000,000**	**$180,000,000**	**$408,000,000**	**$70,000,000**	**$299,386,800**	**$751,968,000**	**$2,609,354,800**

Table G-8

Other Supply Alternative

Supply from Hugo and Distribution D2

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Hugo to Atoka (Table 8-9)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D2 (Table 8-2)	WTP - D2 (Tables 8-15 & 8-16)	Totals
OKC	$370,800,000	$78,300,000	$187,872,000	$28,840,000	$0	$401,712,000	$1,067,524,000
Norman	138,600,000	29,160,000	$70,224,000	10,780,000	58,182,000	113,616,000	420,562,000
Chickasha	37,800,000	7,920,000	$19,152,000	2,940,000	134,997,600	30,720,000	233,529,600
Del City	9,000,000	1,800,000	$4,560,000	700,000	-	7,200,000	23,260,000
Midwest City	9,900,000	2,160,000	$5,016,000	770,000	-	8,160,000	26,006,000
Moore	61,200,000	12,960,000	$31,008,000	4,760,000	62,023,200	50,400,000	222,351,200
COWRA	117,000,000	24,660,000	$59,280,000	9,100,000	-	50,400,000	260,440,000
Edmond	108,900,000	23,040,000	$55,176,000	8,470,000	-	89,760,000	285,346,000
Seminole	23,400,000	-	$11,856,000	1,820,000	44,184,000	-	81,260,000
Shawnee	23,400,000	-	$11,856,000	1,820,000	-	-	37,076,000
Total	**$900,000,000**	**$180,000,000**	**$456,000,000**	**$70,000,000**	**$299,386,800**	**$751,968,000**	**$2,657,354,800**

Table G-9

Recommended Alternative

Supply from Moyers Crossing and Distribution D3

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Moyers Crossing to Atoka (Table 8-7)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D3 (Table 8-2)	WTP - D3 (Table 8-17)	Totals
OKC	$370,800,000	$78,300,000	$128,544,000	$28,840,000	$0	$401,712,000	$1,008,196,000
Norman	138,600,000	29,160,000	48,048,000	10,780,000	58,182,000	113,616,000	398,386,000
Chickasha	37,800,000	7,920,000	13,104,000	2,940,000	124,362,000	14,850,000	200,976,000
Del City	9,000,000	1,800,000	3,120,000	700,000	-	5,940,000	20,560,000
Midwest City	9,900,000	2,160,000	3,432,000	770,000	-	-	16,262,000
Moore	61,200,000	12,960,000	21,216,000	4,760,000	-	52,920,000	153,056,000
COWRA	117,000,000	24,660,000	40,560,000	9,100,000	-	50,400,000	241,720,000
Edmond	108,900,000	23,040,000	37,752,000	8,470,000	101,817,600	89,760,000	369,739,600
Seminole	23,400,000	-	8,112,000	1,820,000	44,184,000	-	77,516,000
Shawnee	23,400,000	-	8,112,000	1,820,000	-	-	33,332,000
Total	**$900,000,000**	**$180,000,000**	**$312,000,000**	**$70,000,000**	**$328,545,600**	**$729,198,000**	**$2,519,743,600**

Table G-10

Other Supply Alternative

Supply from Sardis and Distribution D3

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Sardis to Atoka (Table 8-6)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D3 (Table 8-2)	WTP - D3 (Table 8-17)	Totals
OKC	$370,800,000	$78,300,000	$143,376,000	$28,840,000	$0	$401,712,000	$1,023,028,000
Norman	138,600,000	29,160,000	$53,592,000	10,780,000	58,182,000	113,616,000	403,930,000
Chickasha	37,800,000	7,920,000	$14,616,000	2,940,000	124,362,000	14,850,000	202,488,000
Del City	9,000,000	1,800,000	$3,480,000	700,000	-	5,940,000	20,920,000
Midwest City	9,900,000	2,160,000	$3,828,000	770,000	-	-	16,658,000
Moore	61,200,000	12,960,000	$23,664,000	4,760,000	-	52,920,000	155,504,000
COWRA	117,000,000	24,660,000	$45,240,000	9,100,000	-	50,400,000	246,400,000
Edmond	108,900,000	23,040,000	$42,108,000	8,470,000	101,817,600	89,760,000	374,095,600
Seminole	23,400,000	-	$9,048,000	1,820,000	44,184,000	-	78,452,000
Shawnee	23,400,000	-	$9,048,000	1,820,000	-	-	34,268,000
Total	**$900,000,000**	**$180,000,000**	**$348,000,000**	**$70,000,000**	**$328,545,600**	**$729,198,000**	**$2,555,743,600**

Table G-11

Other Supply Alternative

Supply from Highway 3 and Distribution D3

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Highway 3 to Atoka (Table 8-8)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D3 (Table 8-2)	WTP - D3 (Table 8-17)	Totals
OKC	$370,800,000	$78,300,000	$168,096,000	$28,840,000	$0	$401,712,000	$1,047,748,000
Norman	138,600,000	29,160,000	$62,832,000	10,780,000	58,182,000	113,616,000	413,170,000
Chickasha	37,800,000	7,920,000	$17,136,000	2,940,000	124,362,000	14,850,000	205,008,000
Del City	9,000,000	1,800,000	$4,080,000	700,000	-	5,940,000	21,520,000
Midwest City	9,900,000	2,160,000	$4,488,000	770,000	-	-	17,318,000
Moore	61,200,000	12,960,000	$27,744,000	4,760,000	-	52,920,000	159,584,000
COWRA	117,000,000	24,660,000	$53,040,000	9,100,000	-	50,400,000	254,200,000
Edmond	108,900,000	23,040,000	$49,368,000	8,470,000	101,817,600	89,760,000	381,355,600
Seminole	23,400,000	-	$10,608,000	1,820,000	44,184,000	-	80,012,000
Shawnee	23,400,000	-	$10,608,000	1,820,000	-	-	35,828,000
Total	**$900,000,000**	**$180,000,000**	**$408,000,000**	**$70,000,000**	**$328,545,600**	**$729,198,000**	**$2,615,743,600**

Table G-12

Other Supply Alternative

Supply from Hugo and Distribution D3

	Transmission - Atoka to Seminole & Shawnee (Table 8-4)	Transmission - Seminole & Shawnee to Stanley Draper (Table 8-5)	Supply - Hugo to Atoka (Table 8-9)	Sardis Debt Service (Table 8-10)	Distribution Pipeline - D3 (Table 8-2)	WTP - D3 (Table 8-17)	Totals
OKC	$370,800,000	$78,300,000	$187,872,000	$28,840,000	$0	$401,712,000	$1,067,524,000
Norman	138,600,000	29,160,000	$70,224,000	10,780,000	58,182,000	113,616,000	420,562,000
Chickasha	37,800,000	7,920,000	$19,152,000	2,940,000	124,362,000	14,850,000	207,024,000
Del City	9,000,000	1,800,000	$4,560,000	700,000	-	5,940,000	22,000,000
Midwest City	9,900,000	2,160,000	$5,016,000	770,000	-	-	17,846,000
Moore	61,200,000	12,960,000	$31,008,000	4,760,000	-	52,920,000	162,848,000
COWRA	117,000,000	24,660,000	$59,280,000	9,100,000	-	50,400,000	260,440,000
Edmond	108,900,000	23,040,000	$55,176,000	8,470,000	101,817,600	89,760,000	387,163,600
Seminole	23,400,000	-	$11,856,000	1,820,000	44,184,000	-	81,260,000
Shawnee	23,400,000	-	$11,856,000	1,820,000	-	-	37,076,000
Total	**$900,000,000**	**$180,000,000**	**$456,000,000**	**$70,000,000**	**$328,545,600**	**$729,198,000**	**$2,663,743,600**

Appendix G-13
Recommended Alternative
Distribution D2
Annual Variable Operating Costs

Participants	Demand 2020	Annual Variable Costs 2020	Demand 2040	Annual Variable Costs 2040	Demand 2060	Annual Variable Costs 2060
OKC ($0.36/1,000 gal.)	23.73	$3,118,000	61.20	$8,041,000	108.69	$14,282,000
Norman ($0.36/1,000 gal.)	4.96	$652,000	13.63	$1,791,000	23.67	$3,110,000
Chickasha ($0.36/1,000 gal.)	5.60	$736,000	6.00	$788,000	6.40	$841,000
Del City ($0.36/1,000 gal.)	1.50	$197,000	1.50	$197,000	1.50	$197,000
Midwest City ($0.36/1,000 gal.)	-	$0	0.40	$53,000	1.70	$223,000
Moore ($0.36/1,000 gal.)	8.40	$1,104,000	9.50	$1,248,000	10.50	$1,380,000
COWRA ($0.36/1,000 gal.)	14.10	$1,853,000	20.00	$2,629,000	20.00	$2,629,000
Edmond ($0.36/1,000 gal.)	4.20	$552,000	10.70	$1,406,000	18.70	$2,457,000
Seminole ($0.37/1,000 gal.)	2.20	$297,000	3.10	$419,000	4.00	$540,000
Shawnee ($0.37/1,000 gal.)	3.20	$432,000	3.60	$486,000	4.00	$540,000
Total	67.89	$8,941,000	129.63	$17,058,000	199.17	$26,199,000

Appendix G-14
Recommended Alternative
Distribution D3
Annual Variable Operating Costs

Participants	Demand 2020	Annual Variable Costs 2020	Demand 2040	Annual Variable Costs 2040	Demand 2060	Annual Variable Costs 2060
OKC ($0.36/1,000 gal.)	23.73	$3,118,000	61.20	$8,041,000	108.69	$14,282,000
Norman ($0.22/1,000 gal.)	4.96	$398,000	13.63	$1,094,000	23.67	$1,901,000
Chickasha ($0.22/1,000 gal.)	5.60	$450,000	6.00	$482,000	6.40	$514,000
Del City ($0.22/1,000 gal.)	1.50	$120,000	1.50	$120,000	1.50	$120,000
Midwest City ($0.22/1,000 gal.)	-	$0	0.40	$32,000	1.70	$137,000
Moore ($0.36/1,000 gal.)	8.40	$1,104,000	9.50	$1,248,000	10.50	$1,380,000
COWRA ($0.36/1,000 gal.)	14.10	$1,853,000	20.00	$2,629,000	20.00	$2,629,000
Edmond ($0.36/1,000 gal.)	4.20	$552,000	10.70	$1,406,000	18.70	$2,457,000
Seminole ($0.37/1,000 gal.)	2.20	$297,000	3.10	$419,000	4.00	$540,000
Shawnee ($0.37/1,000 gal.)	3.20	$432,000	3.60	$486,000	4.00	$540,000
Total	67.89	$8,324,000	129.63	$15,957,000	199.17	$24,500,000

Appendix H

Unit Cost Results for Participants

Appendix H
Unit Cost Results for Participants

The annual variable operating costs and the annual debt service costs are presented per participant based on the data in **Appendix G**. In addition, the pumping operating costs are included per Section 8 information. The existing annual costs (operating and debt service) are added to the new costs in arriving at total annual costs. The result of the incorporation of this data is provided in **Tables H-1** through **H-143** for all combinations of Transmission, Supply and Distribution Themes per participant.

Appendix H-1
Supply from Moyers Crossing and Distribution D2

OKC - Annual and Unit Costs

OKC - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$606,484,000	$1,008,196,000	$1,008,196,000
Projected Annual Debt Service[a]	$48,907,000	$81,301,000	$32,394,000
Coverage Requirement (20%)	9,781,400	16,260,200	6,478,800
O&M Costs Pumping (Appendix F)	-	-	4,225,114
O&M Costs Allocated to Participant (Appendix G13)	3,118,000	8,041,000	14,282,000
Total New Costs	$61,806,400	$105,602,200	$57,379,914
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$123,000,844**	**$166,796,644**	**$118,574,358**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$123,000,844	$166,796,644	$118,574,358
Percent Increase in User Fee Revenue	38.30%	44.45%	-20.91%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$288.94	$301.79	$165.24
Monthly Charge per Connection - Projected	$24.08	$25.15	$13.77
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.14	$4.73	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-2

Supply from Moyers Crossing and Distribution D2

Seminole - Annual and Unit Costs

Seminole - Moyers Crossing/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$33,332,000	$77,516,000	$77,516,000
Projected Annual Debt Service[a]	$2,688,000	$6,251,000	$3,563,000
Coverage Requirement (20%)	537,600	1,250,200	712,600
O&M Costs Pumping (Appendix F)	500,501	686,070	969,307
O&M Costs Allocated to Participant (Appendix G13)	297,000	419,000	540,000
Total New Costs	$4,023,101	$8,606,270	$5,784,907
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,845,696**	**$9,428,865**	**$6,607,502**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,845,696	$9,428,865	$6,607,502
Percent Increase in User Fee Revenue	428.61%	663.69%	297.35%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,349.22	$1,949.24	$1,014.20
Monthly Charge per Connection - Projected	**$112.44**	**$162.44**	**$84.52**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.01**	**$7.61**	**$3.96**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-3

Supply from Moyers Crossing and Distribution D2

Shawnee - Annual and Unit Costs

Shawnee - Moyers Crossing/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$33,332,000	$33,332,000	$33,332,000
Projected Annual Debt Service[a]	$2,688,000	$2,688,000	$0
Coverage Requirement (20%)	537,600	537,600	-
O&M Costs Pumping (Appendix F)	676,039	723,265	866,304
O&M Costs Allocated to Participant (Appendix G13)	432,000	486,000	540,000
Total New Costs	$4,333,639	$4,434,865	$1,406,304
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,085,822**	**$10,187,048**	**$7,158,487**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,085,822	$10,187,048	$7,158,487
Percent Increase in User Fee Revenue	137.67%	115.11%	35.45%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$657.10	$594.74	$374.50
Monthly Charge per Connection - Projected	**$54.76**	**$49.56**	**$31.21**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.71**	**$3.38**	**$0.96**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-4

Supply from Moyers Crossing and Distribution D2

Edmond - Annual and Unit Costs

Edmond - Moyers Crossing/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$267,922,000	$267,922,000	$267,922,000
Projected Annual Debt Service[a]	$21,605,308	$21,605,308	$0
Coverage Requirement (20%)	4,321,062	4,321,062	-
O&M Costs Pumping (Appendix F)	887,301	2,149,704	4,049,972
O&M Costs Allocated to Participant (Appendix G13)	552,000	1,406,000	2,457,000
Total New Costs	$27,365,671	$29,482,074	$6,506,972
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$40,128,613**	**$42,245,016**	**$19,269,914**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$40,128,613	$42,245,016	$19,269,914
Percent Increase in User Fee Revenue	116.03%	59.18%	-49.18%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$590.28	$434.94	$138.86
Monthly Charge per Connection - Projected	**$49.19**	**$36.24**	**$11.57**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$17.85**	**$7.55**	**$0.95**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

Appendix H-5

Supply from Moyers Crossing and Distribution D2

Norman - Annual and Unit Costs

Norman - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$340,204,000	$398,386,000	$398,386,000
Projected Annual Debt Service[a]	$27,434,150	$32,125,963	$4,691,813
Coverage Requirement (20%)	5,486,830	6,425,193	938,363
O&M Costs Pumping (Appendix F)	1,149,089	3,039,139	5,730,687
O&M Costs Allocated to Participant (Appendix G13)	652,000	1,791,000	3,110,000
Total New Costs	**$34,722,069**	**$43,381,295**	**$14,470,863**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$43,338,613**	**$51,997,839**	**$23,087,407**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$43,338,613	$51,997,839	$23,087,407
Percent Increase in User Fee Revenue	151.58%	124.11%	-26.12%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$486.06	$432.99	$142.74
Monthly Charge per Connection - Projected	**$40.50**	**$36.08**	**$11.90**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$19.18**	**$8.72**	**$1.67**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-6

Supply from Moyers Crossing and Distribution D2

Moore - Annual and Unit Costs

Moore - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$212,559,200	$212,559,200	$212,559,200
Projected Annual Debt Service[a]	$17,140,836	$17,140,836	$0
Coverage Requirement (20%)	3,428,167	3,428,167	3,428,167
O&M Costs Pumping (Appendix F)	2,081,225	2,268,140	2,686,076
O&M Costs Allocated to Participant (Appendix G13)	1,104,000	1,248,000	1,380,000
Total New Costs	**$23,754,228**	**$24,085,143**	**$7,494,243**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$28,426,011**	**$28,756,926**	**$12,166,026**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$28,426,011	$28,756,926	$12,166,026
Percent Increase in User Fee Revenue	279.08%	243.65%	30.28%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$1,169.08	$1,059.81	$401.78
Monthly Charge per Connection - Projected	**$97.42**	**$88.32**	**$33.48**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$7.75**	**$6.95**	**$1.96**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-7

Supply from Moyers Crossing and Distribution D2

Chickashee - Annual and Unit Costs

Chickashee - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$227,481,600	$227,481,600	$227,481,600
Projected Annual Debt Service[a]	$18,344,183	$18,344,183	$0
Coverage Requirement (20%)	3,668,837	3,668,837	-
O&M Costs Pumping (Appendix F)	1,296,985	1,336,932	1,537,324
O&M Costs Allocated to Participant (Appendix G13)	736,000	788,000	841,000
Total New Costs	**$24,046,004**	**$24,137,951**	**$2,378,324**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$25,717,601**	**$25,809,548**	**$4,049,921**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$25,717,601	$25,809,548	$4,049,921
Percent Increase in User Fee Revenue	1068.97%	755.72%	-2.06%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,851.65	$1,355.47	$155.14
Monthly Charge per Connection - Projected	**$154.30**	**$112.96**	**$12.93**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$11.76**	**$11.02**	**$1.02**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-8

Supply from Moyers Crossing and Distribution D2

Midwest City - Annual and Unit Costs

Midwest City - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$24,422,000	$24,422,000	$24,422,000
Projected Annual Debt Service[a]	$1,969,397	$1,969,397	$0
Coverage Requirement (20%)	393,879	393,879	-
O&M Costs Pumping (Appendix F)	-	93,358	444,478
O&M Costs Allocated to Participant (Appendix G13)	-	53,000	223,000
Total New Costs	**$2,363,277**	**$2,509,635**	**$667,478**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$122.01	$90.50	$16.81
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$420.93	$389.42	$315.73
Monthly Charge per Connection - Projected	**$35.08**	**$32.45**	**$26.31**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.19**	**$1.08**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-9

Supply from Moyers Crossing and Distribution D2

Mustang - Annual and Unit Costs

Mustang - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$54,387,000	$54,387,000	$54,387,000
Projected Annual Debt Service[a]	4,385,784	4,385,784	$0
Coverage Requirement (20%)	877,157	877,157	-
O&M Costs Pumping (Appendix F)	726,747	990,885	1,068,846
O&M Costs Allocated to Participant (Appendix G13)	416,925	591,525	591,525
Total New Costs	**$6,406,612**	**$6,845,351**	**$1,660,371**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$10,211,621**	**$10,650,360**	**$5,465,381**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$10,211,621	$10,650,360	$5,465,381
Percent Increase in User Fee Revenue	312.37%	183.82%	-3.89%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,125.76	$774.82	$262.39
Monthly Charge per Connection - Projected	**$93.81**	**$64.57**	**$21.87**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.82**	**$6.48**	**$3.33**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-10

Supply from Moyers Crossing and Distribution D2

El Reno - Annual and Unit Costs

El Reno - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$54,387,000	$54,387,000	$54,387,000
Projected Annual Debt Service[a]	$4,385,784	$4,385,784	$0
Coverage Requirement (20%)	877,157	877,157	-
O&M Costs Pumping (Appendix F)	726,747	990,885	1,068,846
O&M Costs Allocated to Participant (Appendix G13)	416,925	591,525	591,525
Total New Costs	**$6,406,612**	**$6,845,351**	**$1,660,371**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$9,652,783**	**$10,091,522**	**$4,906,542**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$9,652,783	$10,091,522	$4,906,542
Percent Increase in User Fee Revenue	216.93%	144.56%	-12.24%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$942.42	$727.21	$260.97
Monthly Charge per Connection - Projected	**$78.53**	**$60.60**	**$21.75**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.34**	**$6.14**	**$2.99**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-11

Supply from Moyers Crossing and Distribution D2

Yukon - Annual and Unit Costs

Yukon - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$84,602,000	$84,602,000	$84,602,000
Projected Annual Debt Service[a]	$6,822,330	$6,822,330	$0
Coverage Requirement (20%)	1,364,466	1,364,466	-
O&M Costs Pumping (Appendix F)	1,130,495	1,541,377	1,662,650
O&M Costs Allocated to Participant (Appendix G13)	648,550	920,150	920,150
Total New Costs	**$9,965,841**	**$10,648,323**	**$2,582,800**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$932.90	$670.81	$109.50
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,222.58	$960.49	$399.18
Monthly Charge per Connection - Projected	**$101.88**	**$80.04**	**$33.26**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.61**	**$6.48**	**$1.57**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

Appendix H-12
Supply from Moyers Crossing and Distribution D2

Calumet - Annual and Unit Costs

Calumet - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$6,043,000	$6,043,000	$6,043,000
Projected Annual Debt Service[a]	$487,309	$487,309	$0
Coverage Requirement (20%)	97,462	97,462	-
O&M Costs Pumping (Appendix F)	80,750	110,098	118,761
O&M Costs Allocated to Participant (Appendix G13)	46,325	65,725	65,725
Total New Costs	**$711,846**	**$760,595**	**$184,486**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,779.61	$1,500.86	$287.34
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$2,097.61	$1,818.86	$605.34
Monthly Charge per Connection - Projected	**$174.80**	**$151.57**	**$50.45**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.53**	**$4.17**	**$1.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-13

Supply from Moyers Crossing and Distribution D2

Okarche - Annual and Unit Costs

Okarche - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$6,043,000	$6,043,000	$6,043,000
Projected Annual Debt Service[a]	$487,309	$487,309	$0
Coverage Requirement (20%)	97,462	97,462	-
O&M Costs Pumping (Appendix F)	80,750	110,098	118,761
O&M Costs Allocated to Participant (Appendix G13)	46,325	65,725	65,725
Total New Costs	**$711,846**	**$760,595**	**$184,486**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$926.88	$698.63	$119.54
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,430.64	$1,202.39	$623.30
Monthly Charge per Connection - Projected	**$119.22**	**$100.20**	**$51.94**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.53**	**$4.17**	**$1.01**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-13

Supply from Moyers Crossing and Distribution D2

Okarche - Annual and Unit Costs

Okarche - Moyers/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-5)	$6,043,000	$6,043,000	$6,043,000
Projected Annual Debt Service[a]	$487,309	$487,309	$0
Coverage Requirement (20%)	97,462	97,462	-
O&M Costs Pumping (Appendix F)	80,750	110,098	118,761
O&M Costs Allocated to Participant (Appendix G13)	46,325	65,725	65,725
Total New Costs	**$711,846**	**$760,595**	**$184,486**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$926.88	$698.63	$119.54
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,430.64	$1,202.39	$623.30
Monthly Charge per Connection - Projected	**$119.22**	**$100.20**	**$51.94**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.53**	**$4.17**	**$1.01**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-15

Supply from Moyers Crossing and Distribution D3

Seminole - Annual and Unit Costs

Seminole - Moyers Crossing/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$33,332,000	$77,516,000	$77,516,000
Projected Annual Debt Service[a]	$2,687,902	$6,250,913	$3,563,011
Coverage Requirement (20%)	537,580	1,250,183	712,602
O&M Costs Pumping (Appendix F)	470,658	618,952	846,401
O&M Costs Allocated to Participant (Appendix G14)	297,000	419,000	540,000
Total New Costs	$3,993,141	$8,539,047	$5,662,014
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,815,736**	**$9,361,643**	**$6,484,609**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,815,736	$9,361,643	$6,484,609
Percent Increase in User Fee Revenue	425.34%	658.25%	289.96%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,340.88	$1,935.35	$995.34
Monthly Charge per Connection - Projected	**$111.74**	**$161.28**	**$82.94**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$4.97**	**$7.55**	**$3.88**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-16

Supply from Moyers Crossing and Distribution D3

Shawnee - Annual and Unit Costs

Shawnee - Moyers Crossing/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$33,332,000	$33,332,000	$33,332,000
Projected Annual Debt Service[a]	$2,687,902	$2,687,902	$0
Coverage Requirement (20%)	537,580	537,580	-
O&M Costs Pumping (Appendix F)	669,540	686,845	789,535
O&M Costs Allocated to Participant (Appendix G14)	432,000	486,000	540,000
Total New Costs	$4,327,023	$4,398,328	$1,329,535
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,079,205**	**$10,150,510**	**$7,081,718**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,079,205	$10,150,510	$7,081,718
Percent Increase in User Fee Revenue	137.51%	114.34%	34.00%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$656.67	$592.61	$370.49
Monthly Charge per Connection - Projected	**$54.72**	**$49.38**	**$30.87**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.70**	**$3.35**	**$0.91**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-17

Supply from Moyers Crossing and Distribution D3

Edmond - Annual and Unit Costs

Edmond - Moyers Crossing/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$178,162,000	$369,739,600	$369,739,600
Projected Annual Debt Service[a]	$14,367,036	$29,815,909	$15,448,874
Coverage Requirement (20%)	2,873,407	5,963,182	3,089,775
O&M Costs Pumping (Appendix F)	878,772	2,041,457	3,691,233
O&M Costs Allocated to Participant (Appendix G14)	552,000	1,406,000	2,457,000
Total New Costs	$18,671,215	$39,226,548	$24,686,881
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$31,434,157**	**$51,989,490**	**$37,449,823**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$31,434,157	$51,989,490	$37,449,823
Percent Increase in User Fee Revenue	69.22%	95.89%	-1.24%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$462.39	$535.26	$269.86
Monthly Charge per Connection - Projected	**$38.53**	**$44.61**	**$22.49**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.18**	**$10.04**	**$3.62**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.8%.

Appendix H-18

Supply from Moyers Crossing and Distribution D3

Norman - Annual and Unit Costs

Norman - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$226,588,000	$398,386,000	$398,386,000
Projected Annual Debt Service[a]	$18,272,122	$32,125,963	$13,853,841
Coverage Requirement (20%)	3,654,424	6,425,193	2,770,768
O&M Costs Pumping (Appendix F)	1,213,091	3,145,285	5,519,291
O&M Costs Allocated to Participant (Appendix G14)	398,000	1,094,000	1,901,000
Total New Costs	**$23,537,638**	**$42,790,441**	**$24,044,900**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$32,154,182**	**$51,406,985**	**$32,661,444**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$32,154,182	$51,406,985	$32,661,444
Percent Increase in User Fee Revenue	86.66%	121.57%	4.52%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$360.62	$428.07	$201.93
Monthly Charge per Connection - Projected	**$30.05**	**$35.67**	**$16.83**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.00**	**$8.60**	**$2.78**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-19

Supply from Moyers Crossing and Distribution D3

Moore - Annual and Unit Costs

Moore - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$100,136,000	$100,136,000	$100,136,000
Projected Annual Debt Service[a]	$8,074,996	$8,074,996	$0
Coverage Requirement (20%)	1,614,999	1,614,999	1,614,999
O&M Costs Pumping (Appendix F)	1,836,380	1,901,851	2,171,475
O&M Costs Allocated to Participant (Appendix G14)	1,104,000	1,248,000	1,380,000
Total New Costs	**$12,630,376**	**$12,839,847**	**$5,166,474**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,302,159**	**$17,511,630**	**$9,838,257**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,302,159	$17,511,630	$9,838,257
Percent Increase in User Fee Revenue	130.73%	109.27%	5.35%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$711.59	$645.37	$324.91
Monthly Charge per Connection - Projected	**$59.30**	**$53.78**	**$27.08**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.12**	**$3.70**	**$1.35**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-20

Supply from Moyers Crossing and Distribution D3

Chickashee - Annual and Unit Costs

Chickashee - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$186,126,000	$200,976,000	$200,976,000
Projected Annual Debt Service[a]	$15,009,255	$16,206,763	$1,197,508
Coverage Requirement (20%)	3,001,851	3,241,353	239,502
O&M Costs Pumping (Appendix F)	1,340,594	1,346,275	1,493,346
O&M Costs Allocated to Participant (Appendix G14)	450,000	482,000	514,000
Total New Costs	**$19,801,700**	**$21,276,391**	**$3,444,356**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$21,473,297**	**$22,947,988**	**$5,115,953**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$21,473,297	$22,947,988	$5,115,953
Percent Increase in User Fee Revenue	876.05%	660.85%	23.73%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,546.06	$1,205.18	$195.98
Monthly Charge per Connection - Projected	**$128.84**	**$100.43**	**$16.33**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$9.69**	**$9.72**	**$1.47**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-21

Supply from Moyers Crossing and Distribution D3

Midwest City - Annual and Unit Costs

Midwest City - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$16,262,000	$17,612,000	$17,612,000
Projected Annual Debt Service[a]	$1,311,372	$1,420,237	$108,864
Coverage Requirement (20%)	262,274	284,047	21,773
O&M Costs Pumping (Appendix F)	-	93,858	412,870
O&M Costs Allocated to Participant (Appendix G14)	-	32,000	137,000
Total New Costs	**$1,573,647**	**$1,830,142**	**$680,507**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$81.24	$66.00	$17.14
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$380.16	$364.92	$316.06
Monthly Charge per Connection - Projected	**$31.68**	**$30.41**	**$26.34**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$12.54**	**$1.10**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-22

Supply from Moyers Crossing and Distribution D3

Mustang - Annual and Unit Costs

Mustang - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$43,047,000	$54,387,000	$54,387,000
Projected Annual Debt Service[a]	3,471,323	4,385,784	$914,461
Coverage Requirement (20%)	694,265	877,157	182,892
O&M Costs Pumping (Appendix F)	724,380	953,375	986,514
O&M Costs Allocated to Participant (Appendix G14)	416,925	591,525	591,525
Total New Costs	**$5,306,892**	**$6,807,840**	**$2,675,392**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,111,902**	**$10,612,849**	**$6,480,402**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,111,902	$10,612,849	$6,480,402
Percent Increase in User Fee Revenue	267.96%	182.82%	13.96%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,004.52	$772.09	$311.12
Monthly Charge per Connection - Projected	**$83.71**	**$64.34**	**$25.93**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.87**	**$6.46**	**$3.94**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-23

Supply from Moyers Crossing and Distribution D3

El Reno - Annual and Unit Costs

El Reno - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$43,047,000	$54,387,000	$54,387,000
Projected Annual Debt Service[a]	$3,471,323	$4,385,784	$914,461
Coverage Requirement (20%)	694,265	877,157	182,892
O&M Costs Pumping (Appendix F)	724,380	953,375	986,514
O&M Costs Allocated to Participant (Appendix G14)	416,925	591,525	591,525
Total New Costs	**$5,306,892**	**$6,807,840**	**$2,675,392**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,553,063**	**$10,054,011**	**$5,921,563**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,553,063	$10,054,011	$5,921,563
Percent Increase in User Fee Revenue	180.82%	143.65%	5.92%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$835.05	$724.51	$314.96
Monthly Charge per Connection - Projected	**$69.59**	**$60.38**	**$26.25**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.39**	**$6.12**	**$3.60**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-24

Supply from Moyers Crossing and Distribution D3

Yukon - Annual and Unit Costs

Yukon - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$66,962,000	$84,602,000	$84,602,000
Projected Annual Debt Service[a]	$5,399,835	$6,822,330	$1,422,495
Coverage Requirement (20%)	1,079,967	1,364,466	284,499
O&M Costs Pumping (Appendix F)	1,126,814	1,483,027	1,534,578
O&M Costs Allocated to Participant (Appendix G14)	648,550	920,150	920,150
Total New Costs	**$8,255,166**	**$10,589,973**	**$4,161,721**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$772.77	$667.14	$176.44
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,062.45	$956.82	$466.12
Monthly Charge per Connection - Projected	**$88.54**	**$79.73**	**$38.84**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.13**	**$6.45**	**$2.53**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

Appendix H-25
Supply from Moyers Crossing and Distribution D3

Calumet - Annual and Unit Costs

Calumet - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$4,783,000	$6,043,000	$6,043,000
Projected Annual Debt Service[a]	$385,703	$487,309	$101,607
Coverage Requirement (20%)	77,141	97,462	20,321
O&M Costs Pumping (Appendix F)	80,487	105,931	109,613
O&M Costs Allocated to Participant (Appendix G14)	46,325	65,725	65,725
Total New Costs	**$589,655**	**$756,427**	**$297,266**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,474.14	$1,492.64	$463.00
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,792.14	$1,810.64	$781.00
Monthly Charge per Connection - Projected	**$149.34**	**$150.89**	**$65.08**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.58**	**$4.14**	**$1.63**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-26

Supply from Moyers Crossing and Distribution D3

Okarche - Annual and Unit Costs

Okarche - Moyers/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-9)	$4,783,000	$6,043,000	$6,043,000
Projected Annual Debt Service[a]	$385,703	$487,309	$101,607
Coverage Requirement (20%)	77,141	97,462	20,321
O&M Costs Pumping (Appendix F)	80,487	105,931	109,613
O&M Costs Allocated to Participant (Appendix G14)	46,325	65,725	65,725
Total New Costs	**$589,655**	**$756,427**	**$297,266**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$767.78	$694.81	$192.62
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,271.54	$1,198.57	$696.38
Monthly Charge per Connection - Projected	**$105.96**	**$99.88**	**$58.03**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.58**	**$4.14**	**$1.63**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-27

Supply from Sardis and Distribution D1

OKC - Annual and Unit Costs

OKC - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$621,316,000	$1,023,028,000	$1,023,028,000
Projected Annual Debt Service[a]	$50,103,104	$82,497,276	$32,394,173
Coverage Requirement (20%)	10,020,621	16,499,455	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,410,448
O&M Costs Allocated to Participant (Table 10-3)	3,118,000	8,041,000	14,282,000
Total New Costs	$63,241,724	$107,037,732	$57,565,455
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$124,436,168**	**$168,232,175**	**$118,759,899**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$124,436,168	$168,232,175	$118,759,899
Percent Increase in User Fee Revenue	39.91%	45.69%	-20.78%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$292.31	$304.39	$165.50
Monthly Charge per Connection - Projected	$24.36	$25.37	$13.79
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.30	$4.79	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-28

Supply from Sardis and Distribution D1

Seminole - Annual and Unit Costs

Seminole - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$34,268,000	$78,452,000	$78,452,000
Projected Annual Debt Service[a]	$2,763,382	$6,326,392	$3,563,011
Coverage Requirement (20%)	552,676	1,265,278	712,602
O&M Costs Pumping (Appendix F)	509,575	706,177	1,007,308
O&M Costs Allocated to Participant (Table 10-3)	297,000	419,000	540,000
Total New Costs	$4,122,633	$8,716,848	$5,822,921
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,945,228**	**$9,539,443**	**$6,645,516**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,945,228	$9,539,443	$6,645,516
Percent Increase in User Fee Revenue	439.47%	672.65%	299.64%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,376.94	$1,972.10	$1,020.03
Monthly Charge per Connection - Projected	**$114.74**	**$164.34**	**$85.00**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.13**	**$7.70**	**$3.99**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-29

Supply from Sardis and Distribution D1

Shawnee - Annual and Unit Costs

Shawnee - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$34,268,000	$34,268,000	$34,268,000
Projected Annual Debt Service[a]	$2,763,382	$2,763,382	$0
Coverage Requirement (20%)	552,676	552,676	-
O&M Costs Pumping (Appendix F)	693,652	753,211	913,653
O&M Costs Allocated to Participant (Table 10-3)	432,000	486,000	540,000
Total New Costs	$4,441,710	$4,555,269	$1,453,653
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,193,892**	**$10,307,451**	**$7,205,836**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,193,892	$10,307,451	$7,205,836
Percent Increase in User Fee Revenue	140.21%	117.65%	36.35%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$664.14	$601.77	$376.98
Monthly Charge per Connection - Projected	**$55.34**	**$50.15**	**$31.42**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.80**	**$3.47**	**$1.00**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-30

Supply from Sardis and Distribution D1

Edmond - Annual and Unit Costs

Edmond - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$182,518,000	$272,278,000	$272,278,000
Projected Annual Debt Service[a]	$14,718,305	$21,956,577	$7,238,273
Coverage Requirement (20%)	2,943,661	4,391,315	1,447,655
O&M Costs Pumping (Appendix F)	904,624	2,219,106	4,227,623
O&M Costs Allocated to Participant (Table 10-3)	552,000	1,406,000	2,457,000
Total New Costs	$19,118,590	$29,972,999	$15,370,550
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$31,881,532**	**$42,735,941**	**$28,133,492**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$31,881,532	$42,735,941	$28,133,492
Percent Increase in User Fee Revenue	71.63%	61.03%	-25.80%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$468.97	$439.99	$202.73
Monthly Charge per Connection - Projected	**$39.08**	**$36.67**	**$16.89**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.47**	**$7.67**	**$2.25**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

Appendix H-31

Supply from Sardis and Distribution D1

Norman - Annual and Unit Costs

Norman - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$232,132,000	$365,837,200	$365,837,200
Projected Annual Debt Service[a]	$18,719,192	$29,501,219	$10,782,026
Coverage Requirement (20%)	3,743,838	5,900,244	2,156,405
O&M Costs Pumping (Appendix F)	1,068,751	2,834,500	5,402,198
O&M Costs Allocated to Participant (Table 10-3)	652,000	1,791,000	3,110,000
Total New Costs	**$24,183,782**	**$40,026,962**	**$21,450,630**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$32,800,326**	**$48,643,506**	**$30,067,174**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$32,800,326	$48,643,506	$30,067,174
Percent Increase in User Fee Revenue	90.41%	109.66%	-3.78%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$367.87	$405.06	$185.89
Monthly Charge per Connection - Projected	**$30.66**	**$33.75**	**$15.49**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.36**	**$8.05**	**$2.48**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-32

Supply from Sardis and Distribution D1

Moore - Annual and Unit Costs

Moore - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$102,584,000	$152,984,000	$152,984,000
Projected Annual Debt Service[a]	$8,272,404	$12,336,674	$4,064,271
Coverage Requirement (20%)	1,654,481	2,467,335	2,467,335
O&M Costs Pumping (Appendix F)	1,809,248	1,970,235	2,373,799
O&M Costs Allocated to Participant (Table 10-3)	1,104,000	1,248,000	1,380,000
Total New Costs	**$12,840,132**	**$18,022,244**	**$10,285,405**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,511,915**	**$22,694,027**	**$14,957,188**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,511,915	$22,694,027	$14,957,188
Percent Increase in User Fee Revenue	133.53%	171.20%	60.17%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$720.21	$836.37	$493.96
Monthly Charge per Connection - Projected	**$60.02**	**$69.70**	**$41.16**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.19**	**$5.20**	**$2.68**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-33

Supply from Sardis and Distribution D1

Chickashee - Annual and Unit Costs

Chickashee - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$144,076,800	$174,796,800	$174,796,800
Projected Annual Debt Service[a]	$11,618,395	$14,095,665	$2,477,270
Coverage Requirement (20%)	2,323,679	2,819,133	495,454
O&M Costs Pumping (Appendix F)	1,263,066	1,313,629	1,530,139
O&M Costs Allocated to Participant (Table 10-3)	736,000	788,000	841,000
Total New Costs	**$15,941,140**	**$19,016,427**	**$5,343,863**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$17,612,737**	**$20,688,024**	**$7,015,460**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$17,612,737	$20,688,024	$7,015,460
Percent Increase in User Fee Revenue	700.57%	585.92%	69.66%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,268.10	$1,086.49	$268.75
Monthly Charge per Connection - Projected	**$105.68**	**$90.54**	**$22.40**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$7.80**	**$8.68**	**$2.29**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-34

Supply from Sardis and Distribution D1

Midwest City - Annual and Unit Costs

Midwest City - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$16,658,000	$24,818,000	$24,818,000
Projected Annual Debt Service[a]	$1,343,306	$2,001,331	$658,025
Coverage Requirement (20%)	268,661	400,266	131,605
O&M Costs Pumping (Appendix F)	-	82,957	384,329
O&M Costs Allocated to Participant (Table 10-3)	-	53,000	223,000
Total New Costs	**$1,611,967**	**$2,537,554**	**$1,396,959**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$83.22	$91.51	$35.19
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$382.14	$390.43	$334.11
Monthly Charge per Connection - Projected	**$31.84**	**$32.54**	**$27.84**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.38**	**$2.25**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-35

Supply from Sardis and Distribution D1

Mustang - Annual and Unit Costs

Mustang - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$44,100,000	$54,900,000	$54,900,000
Projected Annual Debt Service[a]	3,556,237	4,427,152	$870,915
Coverage Requirement (20%)	711,247	885,430	174,183
O&M Costs Pumping (Appendix F)	759,651	1,048,134	1,132,226
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,444,061**	**$6,952,241**	**$2,768,850**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,249,070**	**$10,757,250**	**$6,573,859**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,249,070	$10,757,250	$6,573,859
Percent Increase in User Fee Revenue	273.50%	186.66%	15.61%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,019.64	$782.59	$315.60
Monthly Charge per Connection - Projected	**$84.97**	**$65.22**	**$26.30**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.99**	**$6.55**	**$4.00**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-36

Supply from Sardis and Distribution D1

El Reno - Annual and Unit Costs

El Reno - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$44,100,000	$54,900,000	$54,900,000
Projected Annual Debt Service[a]	$3,556,237	$4,427,152	$870,915
Coverage Requirement (20%)	711,247	885,430	174,183
O&M Costs Pumping (Appendix F)	759,651	1,048,134	1,132,226
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,444,061**	**$6,952,241**	**$2,768,850**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,690,231**	**$10,198,412**	**$6,015,020**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,690,231	$10,198,412	$6,015,020
Percent Increase in User Fee Revenue	185.32%	147.15%	7.59%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$848.44	$734.91	$319.93
Monthly Charge per Connection - Projected	**$70.70**	**$61.24**	**$26.66**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.50**	**$6.21**	**$3.66**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-37

Supply from Sardis and Distribution D1

Yukon - Annual and Unit Costs

Yukon - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$68,600,000	$85,400,000	$85,400,000
Projected Annual Debt Service[a]	$5,531,924	$6,886,681	$1,354,757
Coverage Requirement (20%)	1,106,385	1,377,336	270,951
O&M Costs Pumping (Appendix F)	1,181,680	1,630,430	1,761,241
O&M Costs Allocated to Participant (Table 10-3)	648,550	920,150	920,150
Total New Costs	**$8,468,539**	**$10,814,597**	**$4,307,099**
Projected Connections in Year 2020/2040/2060*	10,683	15,874	23,588
Incremental Cost per Connection	$792.74	$681.29	$182.60
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,082.42	$970.97	$472.28
Monthly Charge per Connection - Projected	**$90.20**	**$80.91**	**$39.36**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.31**	**$6.58**	**$2.62**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

Appendix H-38

Supply from Sardis and Distribution D1

Calumet - Annual and Unit Costs

Calumet - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$4,900,000	$6,100,000	$6,100,000
Projected Annual Debt Service[a]	$395,137	$491,906	$96,768
Coverage Requirement (20%)	79,027	98,381	19,354
O&M Costs Pumping (Appendix F)	84,406	116,459	125,803
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$604,896**	**$772,471**	**$307,650**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,512.24	$1,524.30	$479.17
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,830.24	$1,842.30	$797.17
Monthly Charge per Connection - Projected	**$152.52**	**$153.52**	**$66.43**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.70**	**$4.23**	**$1.69**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-39

Supply from Sardis and Distribution D1

Okarche - Annual and Unit Costs

Okarche - Sardis/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-2)	$4,900,000	$6,100,000	$6,100,000
Projected Annual Debt Service[a]	$395,137	$491,906	$96,768
Coverage Requirement (20%)	79,027	98,381	19,354
O&M Costs Pumping (Appendix F)	84,406	116,459	125,803
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$604,896**	**$772,471**	**$307,650**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$787.62	$709.54	$199.35
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,291.38	$1,213.30	$703.11
Monthly Charge per Connection - Projected	**$107.62**	**$101.11**	**$58.59**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.70**	**$4.23**	**$1.69**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-40

Supply from Sardis and Distribution D2

OKC - Annual and Unit Costs

OKC - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$621,316,000	$1,023,028,000	$1,023,028,000
Projected Annual Debt Service[a]	$50,103,104	$82,497,276	$32,394,173
Coverage Requirement (20%)	10,020,621	16,499,455	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,288,904
O&M Costs Allocated to Participant (Appendix G-13)	3,118,000	8,041,000	14,282,000
Total New Costs	$63,241,724	$107,037,732	$57,443,911
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$124,436,168**	**$168,232,175**	**$118,638,355**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$124,436,168	$168,232,175	$118,638,355
Percent Increase in User Fee Revenue	39.91%	45.69%	-20.86%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$292.31	$304.39	$165.33
Monthly Charge per Connection - Projected	$24.36	$25.37	$13.78
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.30	$4.79	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-41

Supply from Sardis and Distribution D2

Seminole - Annual and Unit Costs

Seminole - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$34,268,000	$78,452,000	$78,452,000
Projected Annual Debt Service[a]	$2,763,382	$6,326,392	$3,563,011
Coverage Requirement (20%)	552,676	1,265,278	712,602
O&M Costs Pumping (Appendix F)	498,724	689,590	982,387
O&M Costs Allocated to Participant (Appendix G-13)	297,000	419,000	540,000
Total New Costs	$4,111,782	$8,700,261	$5,798,000
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,934,377**	**$9,522,856**	**$6,620,595**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,934,377	$9,522,856	$6,620,595
Percent Increase in User Fee Revenue	438.28%	671.30%	298.14%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,373.92	$1,968.67	$1,016.21
Monthly Charge per Connection - Projected	**$114.49**	**$164.06**	**$84.68**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.12**	**$7.69**	**$3.97**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-42

Supply from Sardis and Distribution D2

Shawnee - Annual and Unit Costs

Shawnee - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$34,268,000	$34,268,000	$34,268,000
Projected Annual Debt Service[a]	$2,763,382	$2,763,382	$0
Coverage Requirement (20%)	552,676	552,676	-
O&M Costs Pumping (Appendix F)	673,455	727,353	879,383
O&M Costs Allocated to Participant (Appendix G-13)	432,000	486,000	540,000
Total New Costs	$4,421,513	$4,529,411	$1,419,383
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,173,695**	**$10,281,593**	**$7,171,566**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,173,695	$10,281,593	$7,171,566
Percent Increase in User Fee Revenue	139.74%	117.11%	35.70%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$662.82	$600.26	$375.19
Monthly Charge per Connection - Projected	**$55.24**	**$50.02**	**$31.27**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.79**	**$3.45**	**$0.97**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-43

Supply from Sardis and Distribution D2

Edmond - Annual and Unit Costs

Edmond - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$272,278,000	$272,278,000	$272,278,000
Projected Annual Debt Service[a]	$21,956,577	$21,956,577	$0
Coverage Requirement (20%)	4,391,315	4,391,315	-
O&M Costs Pumping (Appendix F)	883,909	2,161,856	4,111,117
O&M Costs Allocated to Participant (Appendix G-13)	552,000	1,406,000	2,457,000
Total New Costs	$27,783,802	$29,915,749	$6,568,117
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$40,546,744**	**$42,678,691**	**$19,331,059**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$40,546,744	$42,678,691	$19,331,059
Percent Increase in User Fee Revenue	118.28%	60.81%	-49.02%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$596.43	$439.40	$139.30
Monthly Charge per Connection - Projected	**$49.70**	**$36.62**	**$11.61**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$18.12**	**$7.66**	**$0.96**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

Appendix H-44

Supply from Sardis and Distribution D2

Norman - Annual and Unit Costs

Norman - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$345,748,000	$403,930,000	$403,930,000
Projected Annual Debt Service[a]	$27,881,220	$32,573,033	$4,691,813
Coverage Requirement (20%)	5,576,244	6,514,607	938,363
O&M Costs Pumping (Appendix F)	1,145,083	3,054,618	5,808,083
O&M Costs Allocated to Participant (Appendix G-13)	652,000	1,791,000	3,110,000
Total New Costs	**$35,254,547**	**$43,933,258**	**$14,548,259**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$43,871,091**	**$52,549,802**	**$23,164,803**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$43,871,091	$52,549,802	$23,164,803
Percent Increase in User Fee Revenue	154.67%	126.49%	-25.87%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$492.03	$437.59	$143.22
Monthly Charge per Connection - Projected	**$41.00**	**$36.47**	**$11.93**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$19.47**	**$8.83**	**$1.68**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-45

Supply from Sardis and Distribution D2

Moore - Annual and Unit Costs

Moore - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$215,007,200	$215,007,200	$215,007,200
Projected Annual Debt Service[a]	$17,338,243	$17,338,243	$0
Coverage Requirement (20%)	3,467,649	3,467,649	3,467,649
O&M Costs Pumping (Appendix F)	2,074,441	2,278,929	2,720,409
O&M Costs Allocated to Participant (Appendix G-13)	1,104,000	1,248,000	1,380,000
Total New Costs	**$23,984,333**	**$24,332,821**	**$7,568,058**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$28,656,116**	**$29,004,604**	**$12,239,841**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$28,656,116	$29,004,604	$12,239,841
Percent Increase in User Fee Revenue	282.15%	246.61%	31.07%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$1,178.54	$1,068.94	$404.22
Monthly Charge per Connection - Projected	**$98.21**	**$89.08**	**$33.69**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$7.82**	**$7.02**	**$1.97**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-46

Supply from Sardis and Distribution D2

Chickashee - Annual and Unit Costs

Chickashee - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$228,993,600	$228,993,600	$228,993,600
Projected Annual Debt Service[a]	$18,466,111	$18,466,111	$0
Coverage Requirement (20%)	3,693,222	3,693,222	-
O&M Costs Pumping (Appendix F)	1,292,462	1,343,745	1,558,251
O&M Costs Allocated to Participant (Appendix G-13)	736,000	788,000	841,000
Total New Costs	**$24,187,795**	**$24,291,078**	**$2,399,251**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$25,859,392**	**$25,962,675**	**$4,070,848**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$25,859,392	$25,962,675	$4,070,848
Percent Increase in User Fee Revenue	1075.41%	760.80%	-1.55%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,861.85	$1,363.51	$155.95
Monthly Charge per Connection - Projected	**$155.15**	**$113.63**	**$13.00**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$11.83**	**$11.09**	**$1.03**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-47

Supply from Sardis and Distribution D2

Midwest City - Annual and Unit Costs

Midwest City - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$24,818,000	$24,818,000	$24,818,000
Projected Annual Debt Service[a]	$2,001,331	$2,001,331	$0
Coverage Requirement (20%)	400,266	400,266	-
O&M Costs Pumping (Appendix F)	-	93,812	450,037
O&M Costs Allocated to Participant (Appendix G-13)	-	53,000	223,000
Total New Costs	**$2,401,597**	**$2,548,409**	**$673,037**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$123.99	$91.90	$16.95
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$422.91	$390.82	$315.87
Monthly Charge per Connection - Projected	**$35.24**	**$32.57**	**$26.32**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.45**	**$1.08**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-48

Supply from Sardis and Distribution D2

Mustang - Annual and Unit Costs

Mustang - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$55,440,000	$55,440,000	$55,440,000
Projected Annual Debt Service[a]	4,470,698	4,470,698	$0
Coverage Requirement (20%)	894,140	894,140	-
O&M Costs Pumping (Appendix F)	724,184	995,997	1,083,564
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,505,947**	**$6,952,359**	**$1,675,089**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$10,310,956**	**$10,757,368**	**$5,480,098**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$10,310,956	$10,757,368	$5,480,098
Percent Increase in User Fee Revenue	316.38%	186.67%	-3.63%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,136.71	$782.60	$263.09
Monthly Charge per Connection - Projected	**$94.73**	**$65.22**	**$21.92**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.90**	**$6.55**	**$3.34**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-49

Supply from Sardis and Distribution D2

El Reno - Annual and Unit Costs

El Reno - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$55,440,000	$55,440,000	$55,440,000
Projected Annual Debt Service[a]	$4,470,698	$4,470,698	$0
Coverage Requirement (20%)	894,140	894,140	-
O&M Costs Pumping (Appendix F)	724,184	995,997	1,083,564
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,505,947**	**$6,952,359**	**$1,675,089**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$9,752,118**	**$10,198,530**	**$4,921,260**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$9,752,118	$10,198,530	$4,921,260
Percent Increase in User Fee Revenue	220.19%	147.15%	-11.97%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$952.12	$734.92	$261.75
Monthly Charge per Connection - Projected	**$79.34**	**$61.24**	**$21.81**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.42**	**$6.21**	**$3.00**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-50

Supply from Sardis and Distribution D2

Yukon - Annual and Unit Costs

Yukon - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$86,240,000	$86,240,000	$86,240,000
Projected Annual Debt Service[a]	$6,822,330	$6,822,330	$0
Coverage Requirement (20%)	1,364,466	1,364,466	-
O&M Costs Pumping (Appendix F)	1,126,509	1,549,329	1,685,544
O&M Costs Allocated to Participant (Appendix G-13)	648,550	920,150	920,150
Total New Costs	**$9,961,855**	**$10,656,275**	**$2,605,694**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$932.53	$671.31	$110.47
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,222.21	$960.99	$400.15
Monthly Charge per Connection - Projected	**$101.85**	**$80.08**	**$33.35**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.60**	**$6.49**	**$1.59**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

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Supply from Sardis and Distribution D2

Calumet - Annual and Unit Costs

Calumet - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$6,160,000	$6,160,000	$6,160,000
Projected Annual Debt Service[a]	$496,744	$496,744	$0
Coverage Requirement (20%)	99,349	99,349	-
O&M Costs Pumping (Appendix F)	80,465	110,666	120,396
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$722,883**	**$772,484**	**$186,121**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,807.21	$1,524.33	$289.89
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$2,125.21	$1,842.33	$607.89
Monthly Charge per Connection - Projected	**$177.10**	**$153.53**	**$50.66**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.62**	**$4.23**	**$1.02**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-52

Supply from Sardis and Distribution D2

Okarche - Annual and Unit Costs

Okarche - Sardis/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-6)	$6,160,000	$6,160,000	$6,160,000
Projected Annual Debt Service[a]	$496,744	$496,744	$0
Coverage Requirement (20%)	99,349	99,349	-
O&M Costs Pumping (Appendix F)	80,465	110,666	120,396
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$722,883**	**$772,484**	**$186,121**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$941.25	$709.56	$120.60
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,445.01	$1,213.32	$624.36
Monthly Charge per Connection - Projected	**$120.42**	**$101.11**	**$52.03**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.62**	**$4.23**	**$1.02**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-53

Supply from Sardis and Distribution D3

OKC - Annual and Unit Costs

OKC - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$621,316,000	$1,023,028,000	$1,023,028,000
Projected Annual Debt Service[a]	$50,103,104	$82,497,276	$32,394,173
Coverage Requirement (20%)	10,020,621	16,499,455	6,478,835
O&M Costs Pumping (Appendix F)	-	-	3,904,271
O&M Costs Allocated to Participant (Appendix G-14)	3,118,000	8,041,000	14,282,000
Total New Costs	$63,241,724	$107,037,732	$57,059,278
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$124,436,168**	**$168,232,175**	**$118,253,722**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$124,436,168	$168,232,175	$118,253,722
Percent Increase in User Fee Revenue	39.91%	45.69%	-21.12%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$292.31	$304.39	$164.80
Monthly Charge per Connection - Projected	$24.36	$25.37	$13.73
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.30	$4.79	$1.44

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-54

Supply from Sardis and Distribution D3

Seminole - Annual and Unit Costs

Seminole - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$34,268,000	$78,452,000	$78,452,000
Projected Annual Debt Service[a]	$2,763,382	$6,326,392	$3,563,011
Coverage Requirement (20%)	552,676	1,265,278	712,602
O&M Costs Pumping (Appendix F)	468,532	620,051	857,386
O&M Costs Allocated to Participant (Appendix G-14)	297,000	419,000	540,000
Total New Costs	$4,081,590	$8,630,722	$5,672,999
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$4,904,185**	**$9,453,317**	**$6,495,594**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$4,904,185	$9,453,317	$6,495,594
Percent Increase in User Fee Revenue	434.99%	665.67%	290.62%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,365.51	$1,954.30	$997.02
Monthly Charge per Connection - Projected	**$113.79**	**$162.86**	**$83.09**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.08**	**$7.63**	**$3.89**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-55

Supply from Sardis and Distribution D3

Shawnee - Annual and Unit Costs

Shawnee - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$34,268,000	$34,268,000	$34,268,000
Projected Annual Debt Service[a]	$2,763,382	$2,763,382	$0
Coverage Requirement (20%)	552,676	552,676	-
O&M Costs Pumping (Appendix F)	666,449	688,121	800,519
O&M Costs Allocated to Participant (Appendix G-14)	432,000	486,000	540,000
Total New Costs	$4,414,507	$4,490,179	$1,340,519
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,166,689**	**$10,242,361**	**$7,092,702**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,166,689	$10,242,361	$7,092,702
Percent Increase in User Fee Revenue	139.57%	116.28%	34.21%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$662.37	$597.97	$371.06
Monthly Charge per Connection - Projected	**$55.20**	**$49.83**	**$30.92**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.78**	**$3.42**	**$0.92**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-56

Supply from Sardis and Distribution D3

Edmond - Annual and Unit Costs

Edmond - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$182,518,000	$374,095,600	$374,095,600
Projected Annual Debt Service[a]	$14,718,305	$30,167,178	$15,448,874
Coverage Requirement (20%)	2,943,661	6,033,436	3,089,775
O&M Costs Pumping (Appendix F)	874,714	2,045,249	3,742,587
O&M Costs Allocated to Participant (Appendix G-14)	552,000	1,406,000	2,457,000
Total New Costs	$19,088,680	$39,651,863	$24,738,235
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$31,851,622**	**$52,414,805**	**$37,501,177**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$31,851,622	$52,414,805	$37,501,177
Percent Increase in User Fee Revenue	71.47%	97.50%	-1.10%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$468.53	$539.64	$270.23
Monthly Charge per Connection - Projected	**$39.04**	**$44.97**	**$22.52**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.45**	**$10.15**	**$3.62**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

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Supply from Sardis and Distribution D3

Norman - Annual and Unit Costs

Norman - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$232,132,000	$403,930,000	$403,930,000
Projected Annual Debt Service[a]	$18,719,192	$32,573,033	$13,853,841
Coverage Requirement (20%)	3,743,838	6,514,607	2,770,768
O&M Costs Pumping (Appendix F)	1,208,300	3,150,116	5,584,293
O&M Costs Allocated to Participant (Appendix G-14)	398,000	1,094,000	1,901,000
Total New Costs	**$24,069,331**	**$43,331,756**	**$24,109,902**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$32,685,875**	**$51,948,300**	**$32,726,446**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$32,685,875	$51,948,300	$32,726,446
Percent Increase in User Fee Revenue	89.74%	123.90%	4.73%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$366.58	$432.58	$202.33
Monthly Charge per Connection - Projected	**$30.55**	**$36.05**	**$16.86**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.30**	**$8.71**	**$2.79**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

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Supply from Sardis and Distribution D3

Moore - Annual and Unit Costs

Moore - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$102,584,000	$102,584,000	$102,584,000
Projected Annual Debt Service[a]	$8,272,404	$8,272,404	$0
Coverage Requirement (20%)	1,654,481	1,654,481	1,654,481
O&M Costs Pumping (Appendix F)	1,828,266	1,905,217	2,200,310
O&M Costs Allocated to Participant (Appendix G-14)	1,104,000	1,248,000	1,380,000
Total New Costs	**$12,859,150**	**$13,080,101**	**$5,234,791**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,530,933**	**$17,751,884**	**$9,906,574**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,530,933	$17,751,884	$9,906,574
Percent Increase in User Fee Revenue	133.79%	112.14%	6.08%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$720.99	$654.23	$327.17
Monthly Charge per Connection - Projected	**$60.08**	**$54.52**	**$27.26**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.19**	**$3.77**	**$1.37**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

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Supply from Sardis and Distribution D3

Chickashee - Annual and Unit Costs

Chickashee - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$187,638,000	$202,488,000	$202,488,000
Projected Annual Debt Service[a]	$15,131,183	$16,328,691	$1,197,508
Coverage Requirement (20%)	3,026,237	3,265,738	239,502
O&M Costs Pumping (Appendix F)	1,335,184	1,348,401	1,510,922
O&M Costs Allocated to Participant (Appendix G-14)	450,000	482,000	514,000
Total New Costs	**$19,942,604**	**$21,424,831**	**$3,461,932**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$21,614,201**	**$23,096,428**	**$5,133,529**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$21,614,201	$23,096,428	$5,133,529
Percent Increase in User Fee Revenue	882.45%	665.77%	24.15%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,556.20	$1,212.98	$196.65
Monthly Charge per Connection - Projected	**$129.68**	**$101.08**	**$16.39**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$9.76**	**$9.78**	**$1.48**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-60

Supply from Sardis and Distribution D3

Midwest City - Annual and Unit Costs

Midwest City - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$16,658,000	$18,008,000	$18,008,000
Projected Annual Debt Service[a]	$1,343,306	$1,452,170	$108,864
Coverage Requirement (20%)	268,661	290,434	21,773
O&M Costs Pumping (Appendix F)	-	94,000	417,539
O&M Costs Allocated to Participant (Appendix G-14)	-	32,000	137,000
Total New Costs	**$1,611,967**	**$1,868,604**	**$685,176**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$83.22	$67.39	$17.26
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$382.14	$366.31	$316.18
Monthly Charge per Connection - Projected	**$31.84**	**$30.53**	**$26.35**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$12.80**	**$1.10**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

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Supply from Sardis and Distribution D3

Mustang - Annual and Unit Costs

Mustang - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$44,100,000	$55,440,000	$55,440,000
Projected Annual Debt Service[a]	3,556,237	4,470,698	$914,461
Coverage Requirement (20%)	711,247	894,140	182,892
O&M Costs Pumping (Appendix F)	721,316	954,970	998,875
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,405,725**	**$6,911,332**	**$2,687,753**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,210,734**	**$10,716,342**	**$6,492,762**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,210,734	$10,716,342	$6,492,762
Percent Increase in User Fee Revenue	271.95%	185.57%	14.18%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,015.42	$779.62	$311.71
Monthly Charge per Connection - Projected	**$84.62**	**$64.97**	**$25.98**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.95**	**$6.52**	**$3.95**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

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Supply from Sardis and Distribution D3

El Reno - Annual and Unit Costs

El Reno - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$44,100,000	$55,440,000	$55,440,000
Projected Annual Debt Service[a]	$3,556,237	$4,470,698	$914,461
Coverage Requirement (20%)	711,247	894,140	182,892
O&M Costs Pumping (Appendix F)	721,316	954,970	998,875
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,405,725**	**$6,911,332**	**$2,687,753**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,651,896**	**$10,157,503**	**$5,933,924**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,651,896	$10,157,503	$5,933,924
Percent Increase in User Fee Revenue	184.07%	146.15%	6.14%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$844.70	$731.96	$315.61
Monthly Charge per Connection - Projected	**$70.39**	**$61.00**	**$26.30**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.47**	**$6.18**	**$3.61**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

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Supply from Sardis and Distribution D3

Yukon - Annual and Unit Costs

Yukon - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$68,600,000	$86,240,000	$86,240,000
Projected Annual Debt Service[a]	$5,531,924	$6,954,419	$1,422,495
Coverage Requirement (20%)	1,106,385	1,390,884	284,499
O&M Costs Pumping (Appendix F)	1,122,047	1,485,509	1,553,805
O&M Costs Allocated to Participant (Appendix G-14)	648,550	920,150	920,150
Total New Costs	**$8,408,906**	**$10,750,961**	**$4,180,949**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$787.16	$677.28	$177.25
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,076.84	$966.96	$466.93
Monthly Charge per Connection - Projected	**$89.74**	**$80.58**	**$38.91**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.26**	**$6.54**	**$2.54**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

Appendix H-64

Supply from Sardis and Distribution D3

Calumet - Annual and Unit Costs

Calumet - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$4,900,000	$6,160,000	$6,160,000
Projected Annual Debt Service[a]	$395,137	$496,744	$101,607
Coverage Requirement (20%)	79,027	99,349	20,321
O&M Costs Pumping (Appendix F)	80,146	106,108	110,986
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$600,636**	**$767,926**	**$298,639**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,501.59	$1,515.33	$465.14
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,819.59	$1,833.33	$783.14
Monthly Charge per Connection - Projected	**$151.63**	**$152.78**	**$65.26**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.67**	**$4.21**	**$1.64**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-65

Supply from Sardis and Distribution D3

Okarche - Annual and Unit Costs

Okarche - Sardis/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-10)	$4,900,000	$6,160,000	$6,160,000
Projected Annual Debt Service[a]	$395,137	$496,744	$101,607
Coverage Requirement (20%)	79,027	99,349	20,321
O&M Costs Pumping (Appendix F)	80,146	106,108	110,986
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$600,636**	**$767,926**	**$298,639**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$782.08	$705.37	$193.51
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,285.84	$1,209.13	$697.27
Monthly Charge per Connection - Projected	**$107.15**	**$100.76**	**$58.11**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.67**	**$4.21**	**$1.64**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-66

Supply from Hwy 3 and Distribution D1

OKC - Annual and Unit Costs

OKC - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$646,036,000	$1,047,748,000	$1,047,748,000
Projected Annual Debt Servicea	$52,096,532	$84,490,704	$32,394,173
Coverage Requirement (20%)	10,419,306	16,898,141	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,522,597
O&M Costs Allocated to Participant (Table 10-3)	3,118,000	8,041,000	14,282,000
Total New Costs	$65,633,838	$109,429,845	$57,677,604
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$126,828,282**	**$170,624,289**	**$118,872,048**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Baseb	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$126,828,282	$170,624,289	$118,872,048
Percent Increase in User Fee Revenue	42.60%	47.77%	-20.71%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$297.93	$308.71	$165.66
Monthly Charge per Connection - Projected	$24.83	$25.73	$13.80
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.58	$4.90	$1.45

aDebt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

bAnnual customer growth assumption 1.3139%.

Appendix H-67

Supply from Hwy 3 and Distribution D1

Seminole - Annual and Unit Costs

Seminole - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$35,828,000	$80,012,000	$80,012,000
Projected Annual Debt Service[a]	$2,889,180	$6,452,191	$3,563,011
Coverage Requirement (20%)	577,836	1,290,438	712,602
O&M Costs Pumping (Appendix F)	519,381	718,696	1,030,439
O&M Costs Allocated to Participant (Table 10-3)	297,000	419,000	540,000
Total New Costs	$4,283,397	$8,880,325	$5,846,052
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,105,993**	**$9,702,921**	**$6,668,647**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,105,993	$9,702,921	$6,668,647
Percent Increase in User Fee Revenue	457.00%	685.89%	301.03%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,421.70	$2,005.90	$1,023.58
Monthly Charge per Connection - Projected	**$118.47**	**$167.16**	**$85.30**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.33**	**$7.85**	**$4.00**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-68
Supply from Hwy 3 and Distribution D1
Shawnee - Annual and Unit Costs

Shawnee - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$35,828,000	$35,828,000	$35,828,000
Projected Annual Debt Service[a]	$2,889,180	$2,889,180	$0
Coverage Requirement (20%)	577,836	577,836	-
O&M Costs Pumping (Appendix F)	707,916	767,750	938,536
O&M Costs Allocated to Participant (Table 10-3)	432,000	486,000	540,000
Total New Costs	$4,606,932	$4,720,766	$1,478,536
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,359,115**	**$10,472,949**	**$7,230,719**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,359,115	$10,472,949	$7,230,719
Percent Increase in User Fee Revenue	144.11%	121.15%	36.82%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$674.90	$611.43	$378.28
Monthly Charge per Connection - Projected	**$56.24**	**$50.95**	**$31.52**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.94**	**$3.59**	**$1.01**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

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Supply from Hwy 3 and Distribution D1

Edmond - Annual and Unit Costs

Edmond - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$189,778,000	$279,538,000	$279,538,000
Projected Annual Debt Service[a]	$15,303,753	$22,542,026	$7,238,273
Coverage Requirement (20%)	3,060,751	4,508,405	1,447,655
O&M Costs Pumping (Appendix F)	923,345	2,262,317	4,340,307
O&M Costs Allocated to Participant (Table 10-3)	552,000	1,406,000	2,457,000
Total New Costs	$19,839,849	$30,718,748	$15,483,234
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$32,602,791**	**$43,481,690**	**$28,246,176**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$32,602,791	$43,481,690	$28,246,176
Percent Increase in User Fee Revenue	75.52%	63.84%	-25.51%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$479.58	$447.67	$203.54
Monthly Charge per Connection - Projected	**$39.97**	**$37.31**	**$16.96**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.94**	**$7.87**	**$2.27**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

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Supply from Hwy 3 and Distribution D1

Norman - Annual and Unit Costs

Norman - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$241,372,000	$375,077,200	$375,077,200
Projected Annual Debt Service[a]	$19,464,309	$30,246,335	$10,782,026
Coverage Requirement (20%)	3,892,862	6,049,267	2,156,405
O&M Costs Pumping (Appendix F)	1,090,861	2,889,544	5,552,190
O&M Costs Allocated to Participant (Table 10-3)	652,000	1,791,000	3,110,000
Total New Costs	**$25,100,031**	**$40,976,146**	**$21,600,622**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$33,716,575**	**$49,592,690**	**$30,217,166**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$33,716,575	$49,592,690	$30,217,166
Percent Increase in User Fee Revenue	95.73%	113.75%	-3.30%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$378.14	$412.96	$186.82
Monthly Charge per Connection - Projected	**$31.51**	**$34.41**	**$15.57**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.86**	**$8.24**	**$2.50**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

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Supply from Hwy 3 and Distribution D1

Moore - Annual and Unit Costs

Moore - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$106,664,000	$157,064,000	$157,064,000
Projected Annual Debt Service[a]	$8,601,416	$12,665,687	$4,064,271
Coverage Requirement (20%)	1,720,283	2,533,137	2,533,137
O&M Costs Pumping (Appendix F)	1,846,691	2,008,600	2,437,071
O&M Costs Allocated to Participant (Table 10-3)	1,104,000	1,248,000	1,380,000
Total New Costs	**$13,272,390**	**$18,455,424**	**$10,414,479**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,944,173**	**$23,127,207**	**$15,086,262**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,944,173	$23,127,207	$15,086,262
Percent Increase in User Fee Revenue	139.30%	176.37%	61.55%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$737.99	$852.33	$498.23
Monthly Charge per Connection - Projected	**$61.50**	**$71.03**	**$41.52**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.33**	**$5.32**	**$2.72**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-72

Supply from Hwy 3 and Distribution D1

Chickashee - Annual and Unit Costs

Chickashee - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$146,596,800	$177,316,800	$177,316,800
Projected Annual Debt Service[a]	$11,821,609	$14,298,878	$2,477,270
Coverage Requirement (20%)	2,364,322	2,859,776	495,454
O&M Costs Pumping (Appendix F)	1,288,028	1,337,854	1,568,616
O&M Costs Allocated to Participant (Table 10-3)	736,000	788,000	841,000
Total New Costs	**$16,209,958**	**$19,284,508**	**$5,382,340**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$17,881,555**	**$20,956,105**	**$7,053,937**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$17,881,555	$20,956,105	$7,053,937
Percent Increase in User Fee Revenue	712.79%	594.81%	70.59%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,287.46	$1,100.57	$270.22
Monthly Charge per Connection - Projected	**$107.29**	**$91.71**	**$22.52**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$7.93**	**$8.81**	**$2.30**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

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Supply from Hwy 3 and Distribution D1

Midwest City - Annual and Unit Costs

Midwest City - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$17,318,000	$25,478,000	$25,478,000
Projected Annual Debt Service[a]	$1,396,529	$2,054,553	$658,025
Coverage Requirement (20%)	279,306	410,911	131,605
O&M Costs Pumping (Appendix F)	-	84,573	394,573
O&M Costs Allocated to Participant (Table 10-3)	-	53,000	223,000
Total New Costs	**$1,675,834**	**$2,603,037**	**$1,407,203**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$86.52	$93.87	$35.45
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$385.44	$392.79	$334.37
Monthly Charge per Connection - Projected	**$32.12**	**$32.73**	**$27.86**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.83**	**$2.27**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

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Supply from Hwy 3 and Distribution D1

Mustang - Annual and Unit Costs

Mustang - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$45,855,000	$56,655,000	$56,655,000
Projected Annual Debt Service[a]	3,697,761	4,568,676	$870,915
Coverage Requirement (20%)	739,552	913,735	174,183
O&M Costs Pumping (Appendix F)	773,793	1,066,311	1,159,247
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,628,030**	**$7,140,247**	**$2,795,870**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,433,040**	**$10,945,256**	**$6,600,879**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,433,040	$10,945,256	$6,600,879
Percent Increase in User Fee Revenue	280.93%	191.67%	16.08%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,039.93	$796.27	$316.90
Monthly Charge per Connection - Projected	**$86.66**	**$66.36**	**$26.41**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.15**	**$6.66**	**$4.02**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

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Supply from Hwy 3 and Distribution D1

El Reno - Annual and Unit Costs

El Reno - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$45,855,000	$56,655,000	$56,655,000
Projected Annual Debt Service[a]	$3,697,761	$4,568,676	$870,915
Coverage Requirement (20%)	739,552	913,735	174,183
O&M Costs Pumping (Appendix F)	773,793	1,066,311	1,159,247
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,628,030**	**$7,140,247**	**$2,795,870**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,874,201**	**$10,386,418**	**$6,042,041**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,874,201	$10,386,418	$6,042,041
Percent Increase in User Fee Revenue	191.36%	151.70%	8.07%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$866.40	$748.46	$321.37
Monthly Charge per Connection - Projected	**$72.20**	**$62.37**	**$26.78**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.66**	**$6.32**	**$3.68**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-76

Supply from Hwy 3 and Distribution D1

Yukon - Annual and Unit Costs

Yukon - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$71,330,000	$88,130,000	$88,130,000
Projected Annual Debt Service[a]	$5,752,072	$7,106,829	$1,354,757
Coverage Requirement (20%)	1,150,414	1,421,366	270,951
O&M Costs Pumping (Appendix F)	1,203,678	1,658,706	1,803,273
O&M Costs Allocated to Participant (Table 10-3)	648,550	920,150	920,150
Total New Costs	**$8,754,714**	**$11,107,050**	**$4,349,131**
Projected Connections in Year 2020/2040/2060*	10,683	15,874	23,588
Incremental Cost per Connection	$819.53	$699.71	$184.38
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,109.21	$989.39	$474.06
Monthly Charge per Connection - Projected	**$92.43**	**$82.45**	**$39.51**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.56**	**$6.76**	**$2.65**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

Appendix H-77

Supply from Hwy 3 and Distribution D1

Calumet - Annual and Unit Costs

Calumet - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$5,095,000	$6,295,000	$6,295,000
Projected Annual Debt Service[a]	$410,862	$520,211	$109,348
Coverage Requirement (20%)	82,172	104,042	21,870
O&M Costs Pumping (Appendix F)	85,977	118,479	128,805
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$625,337**	**$808,457**	**$325,748**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,563.34	$1,595.31	$507.36
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,881.34	$1,913.31	$825.36
Monthly Charge per Connection - Projected	**$156.78**	**$159.44**	**$68.78**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.86**	**$4.43**	**$1.78**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-78

Supply from Hwy 3 and Distribution D1

Okarche - Annual and Unit Costs

Okarche - Hwy 3/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-3)	$5,095,000	$6,295,000	$6,295,000
Projected Annual Debt Service[a]	$410,862	$507,631	$96,768
Coverage Requirement (20%)	82,172	101,526	19,354
O&M Costs Pumping (Appendix F)	85,977	118,479	128,805
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$625,337**	**$793,361**	**$310,652**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$814.24	$728.73	$201.29
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,318.00	$1,232.49	$705.05
Monthly Charge per Connection - Projected	**$109.83**	**$102.71**	**$58.75**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.86**	**$4.35**	**$1.70**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-79

Supply from Hwy 3 and Distribution D2

OKC - Annual and Unit Costs

OKC - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$646,036,000	$1,047,748,000	$1,047,748,000
Projected Annual Debt Service[a]	$52,096,532	$84,490,704	$32,394,173
Coverage Requirement (20%)	10,419,306	16,898,141	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,403,693
O&M Costs Allocated to Participant (Appendix G-13)	3,118,000	8,041,000	14,282,000
Total New Costs	$65,633,838	$109,429,845	$57,558,700
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$126,828,282**	**$170,624,289**	**$118,753,144**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$126,828,282	$170,624,289	$118,753,144
Percent Increase in User Fee Revenue	42.60%	47.77%	-20.79%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$297.93	$308.71	$165.49
Monthly Charge per Connection - Projected	$24.83	$25.73	$13.79
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.58	$4.90	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-80

Supply from Hwy 3 and Distribution D2

Seminole - Annual and Unit Costs

Seminole - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$35,828,000	$80,012,000	$80,012,000
Projected Annual Debt Service[a]	$2,889,180	$6,452,191	$3,563,011
Coverage Requirement (20%)	577,836	1,290,438	712,602
O&M Costs Pumping (Appendix F)	508,638	702,110	1,005,044
O&M Costs Allocated to Participant (Appendix G-13)	297,000	419,000	540,000
Total New Costs	$4,272,654	$8,863,739	$5,820,657
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,095,250**	**$9,686,335**	**$6,643,252**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,095,250	$9,686,335	$6,643,252
Percent Increase in User Fee Revenue	455.83%	684.54%	299.50%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,418.71	$2,002.47	$1,019.69
Monthly Charge per Connection - Projected	**$118.23**	**$166.87**	**$84.97**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.32**	**$7.83**	**$3.99**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H081

Supply from Hwy 3 and Distribution D2

Shawnee - Annual and Unit Costs

Shawnee - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$35,828,000	$35,828,000	$35,828,000
Projected Annual Debt Service[a]	$2,889,180	$2,889,180	$0
Coverage Requirement (20%)	577,836	577,836	-
O&M Costs Pumping (Appendix F)	687,874	741,892	903,747
O&M Costs Allocated to Participant (Appendix G-13)	432,000	486,000	540,000
Total New Costs	$4,586,890	$4,694,908	$1,443,747
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,339,073**	**$10,447,091**	**$7,195,930**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,339,073	$10,447,091	$7,195,930
Percent Increase in User Fee Revenue	143.63%	120.60%	36.16%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$673.60	$609.92	$376.46
Monthly Charge per Connection - Projected	**$56.13**	**$50.83**	**$31.37**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.93**	**$3.57**	**$0.99**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 0.55%.			

Appendix H-82

Supply from Hwy 3 and Distribution D2

Edmond - Annual and Unit Costs

Edmond - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$279,538,000	$279,538,000	$279,538,000
Projected Annual Debt Service[a]	$22,542,026	$22,542,026	$0
Coverage Requirement (20%)	4,508,405	4,508,405	-
O&M Costs Pumping (Appendix F)	902,835	2,205,069	4,223,421
O&M Costs Allocated to Participant (Appendix G-13)	552,000	1,406,000	2,457,000
Total New Costs	$28,505,266	$30,661,500	$6,680,421
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$41,268,208**	**$43,424,442**	**$19,443,363**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$41,268,208	$43,424,442	$19,443,363
Percent Increase in User Fee Revenue	122.17%	63.62%	-48.72%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$607.05	$447.08	$140.11
Monthly Charge per Connection - Projected	**$50.59**	**$37.26**	**$11.68**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$18.59**	**$7.85**	**$0.98**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.8%.			

Appendix H-83

Supply from Hwy 3 and Distribution D2

Norman - Annual and Unit Costs

Norman - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$354,988,000	$413,170,000	$413,170,000
Projected Annual Debt Service[a]	$28,626,336	$33,318,149	$4,691,813
Coverage Requirement (20%)	5,725,267	6,663,630	938,363
O&M Costs Pumping (Appendix F)	1,167,433	3,109,664	5,953,865
O&M Costs Allocated to Participant (Appendix G-13)	652,000	1,791,000	3,110,000
Total New Costs	**$36,171,036**	**$44,882,443**	**$14,694,041**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$44,787,580**	**$53,498,987**	**$23,310,585**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$44,787,580	$53,498,987	$23,310,585
Percent Increase in User Fee Revenue	159.99%	130.58%	-25.40%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$502.31	$445.49	$144.12
Monthly Charge per Connection - Projected	**$41.86**	**$37.12**	**$12.01**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$19.98**	**$9.02**	**$1.70**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-84

Supply from Hwy 3 and Distribution D2

Moore - Annual and Unit Costs

Moore - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$219,087,200	$219,087,200	$219,087,200
Projected Annual Debt Service[a]	$17,667,256	$17,667,256	$0
Coverage Requirement (20%)	3,533,451	3,533,451	3,533,451
O&M Costs Pumping (Appendix F)	2,112,292	2,317,296	2,785,077
O&M Costs Allocated to Participant (Appendix G-13)	1,104,000	1,248,000	1,380,000
Total New Costs	**$24,416,999**	**$24,766,003**	**$7,698,528**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$29,088,782**	**$29,437,786**	**$12,370,311**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$29,088,782	$29,437,786	$12,370,311
Percent Increase in User Fee Revenue	287.92%	251.78%	32.47%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$1,196.33	$1,084.90	$408.53
Monthly Charge per Connection - Projected	**$99.69**	**$90.41**	**$34.04**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$7.96**	**$7.14**	**$2.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-85

Supply from Hwy 3 and Distribution D2

Chickashee - Annual and Unit Costs

Chickashee - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$231,513,600	$231,513,600	$231,513,600
Projected Annual Debt Service[a]	$18,669,324	$18,669,324	$0
Coverage Requirement (20%)	3,733,865	3,733,865	-
O&M Costs Pumping (Appendix F)	1,317,696	1,367,977	1,597,668
O&M Costs Allocated to Participant (Appendix G-13)	736,000	788,000	841,000
Total New Costs	**$24,456,885**	**$24,559,166**	**$2,438,668**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$26,128,482**	**$26,230,763**	**$4,110,265**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$26,128,482	$26,230,763	$4,110,265
Percent Increase in User Fee Revenue	1087.64%	769.69%	-0.60%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,881.23	$1,377.59	$157.46
Monthly Charge per Connection - Projected	**$156.77**	**$114.80**	**$13.12**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$11.97**	**$11.21**	**$1.04**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-86

Supply from Hwy 3 and Distribution D2

Midwest City - Annual and Unit Costs

Midwest City - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$25,478,000	$25,478,000	$25,478,000
Projected Annual Debt Service[a]	$2,054,553	$2,054,553	$0
Coverage Requirement (20%)	410,911	410,911	-
O&M Costs Pumping (Appendix F)	-	95,427	460,507
O&M Costs Allocated to Participant (Appendix G-13)	-	53,000	223,000
Total New Costs	**$2,465,464**	**$2,613,891**	**$683,507**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$127.28	$94.26	$17.22
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$426.20	$393.18	$316.14
Monthly Charge per Connection - Projected	**$35.52**	**$32.77**	**$26.34**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$17.90**	**$1.10**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-87

Supply from Hwy 3 and Distribution D2

Mustang - Annual and Unit Costs

Mustang - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$57,195,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	4,612,221	4,612,221	$0
Coverage Requirement (20%)	922,444	922,444	-
O&M Costs Pumping (Appendix F)	738,480	1,014,175	1,112,423
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,690,071**	**$7,140,366**	**$1,703,948**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$10,495,080**	**$10,945,375**	**$5,508,957**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$10,495,080	$10,945,375	$5,508,957
Percent Increase in User Fee Revenue	323.81%	191.68%	-3.12%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,157.01	$796.28	$264.48
Monthly Charge per Connection - Projected	**$96.42**	**$66.36**	**$22.04**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$9.06**	**$6.66**	**$3.35**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-88

Supply from Hwy 3 and Distribution D2

El Reno - Annual and Unit Costs

El Reno - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$57,195,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	$4,612,221	$4,612,221	$0
Coverage Requirement (20%)	922,444	922,444	-
O&M Costs Pumping (Appendix F)	738,480	1,014,175	1,112,423
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,690,071**	**$7,140,366**	**$1,703,948**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$9,936,242**	**$10,386,537**	**$4,950,119**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$9,936,242	$10,386,537	$4,950,119
Percent Increase in User Fee Revenue	226.23%	151.70%	-11.46%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$970.09	$748.47	$263.29
Monthly Charge per Connection - Projected	**$80.84**	**$62.37**	**$21.94**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.58**	**$6.32**	**$3.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

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Supply from Hwy 3 and Distribution D2

Yukon - Annual and Unit Costs

Yukon - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$88,970,000	$88,970,000	$88,970,000
Projected Annual Debt Service[a]	$7,174,567	$7,174,567	$0
Coverage Requirement (20%)	1,434,913	1,434,913	-
O&M Costs Pumping (Appendix F)	1,148,747	1,577,605	1,730,436
O&M Costs Allocated to Participant (Appendix G-13)	648,550	920,150	920,150
Total New Costs	**$10,406,777**	**$11,107,236**	**$2,650,586**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$974.18	$699.72	$112.37
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,263.86	$989.40	$402.05
Monthly Charge per Connection - Projected	**$105.32**	**$82.45**	**$33.50**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.99**	**$6.76**	**$1.61**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 2%.			

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Supply from Hwy 3 and Distribution D2

Calumet - Annual and Unit Costs

Calumet - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$6,355,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$512,469	$512,469	$0
Coverage Requirement (20%)	102,494	102,494	-
O&M Costs Pumping (Appendix F)	82,053	112,686	123,603
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$743,341**	**$793,374**	**$189,328**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,858.35	$1,565.55	$294.88
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$2,176.35	$1,883.55	$612.88
Monthly Charge per Connection - Projected	**$181.36**	**$156.96**	**$51.07**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.78**	**$4.35**	**$1.04**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-91

Supply from Hwy 3 and Distribution D2

Okarche - Annual and Unit Costs

Okarche - Hwy 3/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-7)	$6,355,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$512,469	$512,469	$0
Coverage Requirement (20%)	102,494	102,494	-
O&M Costs Pumping (Appendix F)	82,053	112,686	123,603
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$743,341**	**$793,374**	**$189,328**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$967.89	$728.74	$122.68
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,471.65	$1,232.50	$626.44
Monthly Charge per Connection - Projected	**$122.64**	**$102.71**	**$52.20**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.78**	**$4.35**	**$1.04**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-92

Supply from Hwy 3 and Distribution D3

OKC - Annual and Unit Costs

OKC - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$646,036,000	$1,047,748,000	$1,047,748,000
Projected Annual Debt Service[a]	$52,096,532	$84,490,704	$32,394,173
Coverage Requirement (20%)	10,419,306	16,898,141	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,002,307
O&M Costs Allocated to Participant (Appendix G-14)	3,118,000	8,041,000	14,282,000
Total New Costs	$65,633,838	$109,429,845	$57,157,314
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$126,828,282**	**$170,624,289**	**$118,351,758**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$126,828,282	$170,624,289	$118,351,758
Percent Increase in User Fee Revenue	42.60%	47.77%	-21.05%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$297.93	$308.71	$164.93
Monthly Charge per Connection - Projected	$24.83	$25.73	$13.74
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.58	$4.90	$1.44

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

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Supply from Hwy 3 and Distribution D3

Seminole - Annual and Unit Costs

Seminole - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$35,828,000	$80,012,000	$80,012,000
Projected Annual Debt Service[a]	$2,889,180	$6,452,191	$3,563,011
Coverage Requirement (20%)	577,836	1,290,438	712,602
O&M Costs Pumping (Appendix F)	478,233	632,769	874,666
O&M Costs Allocated to Participant (Appendix G-14)	297,000	419,000	540,000
Total New Costs	$4,242,249	$8,794,398	$5,690,279
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,064,845**	**$9,616,994**	**$6,512,874**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,064,845	$9,616,994	$6,512,874
Percent Increase in User Fee Revenue	452.52%	678.93%	291.66%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,410.24	$1,988.14	$999.67
Monthly Charge per Connection - Projected	**$117.52**	**$165.68**	**$83.31**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.28**	**$7.77**	**$3.90**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

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Supply from Hwy 3 and Distribution D3

Shawnee - Annual and Unit Costs

Shawnee - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$35,828,000	$35,828,000	$35,828,000
Projected Annual Debt Service[a]	$2,889,180	$2,889,180	$0
Coverage Requirement (20%)	577,836	577,836	-
O&M Costs Pumping (Appendix F)	680,559	702,891	820,620
O&M Costs Allocated to Participant (Appendix G-14)	432,000	486,000	540,000
Total New Costs	$4,579,575	$4,655,907	$1,360,620
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,331,758**	**$10,408,090**	**$7,112,803**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,331,758	$10,408,090	$7,112,803
Percent Increase in User Fee Revenue	143.46%	119.78%	34.59%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$673.12	$607.64	$372.11
Monthly Charge per Connection - Projected	**$56.09**	**$50.64**	**$31.01**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.92**	**$3.54**	**$0.93**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-95

Supply from Hwy 3 and Distribution D3

Edmond - Annual and Unit Costs

Edmond - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$189,778,000	$381,355,600	$381,355,600
Projected Annual Debt Service[a]	$15,303,753	$30,752,627	$15,448,874
Coverage Requirement (20%)	3,060,751	6,150,525	3,089,775
O&M Costs Pumping (Appendix F)	893,234	2,089,147	3,836,559
O&M Costs Allocated to Participant (Appendix G-14)	552,000	1,406,000	2,457,000
Total New Costs	$19,809,738	$40,398,299	$24,832,207
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$32,572,680**	**$53,161,241**	**$37,595,149**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$32,572,680	$53,161,241	$37,595,149
Percent Increase in User Fee Revenue	75.35%	100.31%	-0.85%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$479.14	$547.33	$270.91
Monthly Charge per Connection - Projected	**$39.93**	**$45.61**	**$22.58**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.92**	**$10.34**	**$3.64**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.8%.

Appendix H-96

Supply from Hwy 3 and Distribution D3

Norman - Annual and Unit Costs

Norman - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$241,372,000	$413,170,000	$413,170,000
Projected Annual Debt Service[a]	$19,464,309	$33,318,149	$13,853,841
Coverage Requirement (20%)	3,892,862	6,663,630	2,770,768
O&M Costs Pumping (Appendix F)	1,230,171	3,206,035	5,703,694
O&M Costs Allocated to Participant (Appendix G-14)	398,000	1,094,000	1,901,000
Total New Costs	**$24,985,341**	**$44,281,814**	**$24,229,303**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$33,601,885**	**$52,898,358**	**$32,845,847**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$33,601,885	$52,898,358	$32,845,847
Percent Increase in User Fee Revenue	95.06%	128.00%	5.11%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$376.86	$440.49	$203.07
Monthly Charge per Connection - Projected	**$31.40**	**$36.71**	**$16.92**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.80**	**$8.90**	**$2.80**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

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Supply from Hwy 3 and Distribution D3

Moore - Annual and Unit Costs

Moore - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$106,664,000	$106,664,000	$106,664,000
Projected Annual Debt Service[a]	$8,601,416	$8,601,416	$0
Coverage Requirement (20%)	1,720,283	1,720,283	1,720,283
O&M Costs Pumping (Appendix F)	1,865,305	1,944,192	2,253,075
O&M Costs Allocated to Participant (Appendix G-14)	1,104,000	1,248,000	1,380,000
Total New Costs	**$13,291,004**	**$13,513,891**	**$5,353,358**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,962,787**	**$18,185,674**	**$10,025,141**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,962,787	$18,185,674	$10,025,141
Percent Increase in User Fee Revenue	139.54%	117.32%	7.35%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$738.76	$670.22	$331.08
Monthly Charge per Connection - Projected	**$61.56**	**$55.85**	**$27.59**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.33**	**$3.90**	**$1.40**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

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Supply from Hwy 3 and Distribution D3

Chickashee - Annual and Unit Costs

Chickashee - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$190,158,000	$205,008,000	$205,008,000
Projected Annual Debt Service[a]	$15,334,397	$16,531,905	$1,197,508
Coverage Requirement (20%)	3,066,879	3,306,381	239,502
O&M Costs Pumping (Appendix F)	1,359,877	1,373,017	1,543,357
O&M Costs Allocated to Participant (Appendix G-14)	450,000	482,000	514,000
Total New Costs	**$20,211,153**	**$21,693,303**	**$3,494,367**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$21,882,750**	**$23,364,900**	**$5,165,964**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$21,882,750	$23,364,900	$5,165,964
Percent Increase in User Fee Revenue	894.66%	674.67%	24.94%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,575.54	$1,227.08	$197.90
Monthly Charge per Connection - Projected	**$131.29**	**$102.26**	**$16.49**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$9.89**	**$9.91**	**$1.50**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-99

Supply from Hwy 3 and Distribution D3

Midwest City - Annual and Unit Costs

Midwest City - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$17,318,000	$18,668,000	$18,668,000
Projected Annual Debt Service[a]	$1,396,529	$1,505,393	$108,864
Coverage Requirement (20%)	279,306	301,079	21,773
O&M Costs Pumping (Appendix F)	-	95,641	426,114
O&M Costs Allocated to Participant (Appendix G-14)	-	32,000	137,000
Total New Costs	**$1,675,834**	**$1,934,113**	**$693,751**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$86.52	$69.75	$17.48
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$385.44	$368.67	$316.40
Monthly Charge per Connection - Projected	**$32.12**	**$30.72**	**$26.37**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$13.25**	**$1.12**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-100

Supply from Hwy 3 and Distribution D3

Mustang - Annual and Unit Costs

Mustang - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$45,855,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	3,697,761	4,612,221	$914,461
Coverage Requirement (20%)	739,552	922,444	182,892
O&M Costs Pumping (Appendix F)	735,305	973,436	1,021,686
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,589,542**	**$7,099,627**	**$2,710,564**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,394,551**	**$10,904,636**	**$6,515,573**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,394,551	$10,904,636	$6,515,573
Percent Increase in User Fee Revenue	279.37%	190.59%	14.58%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,035.68	$793.32	$312.80
Monthly Charge per Connection - Projected	**$86.31**	**$66.11**	**$26.07**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.11**	**$6.64**	**$3.97**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-101

Supply from Hwy 3 and Distribution D3

El Reno - Annual and Unit Costs

El Reno - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$45,855,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	$3,697,761	$4,612,221	$914,461
Coverage Requirement (20%)	739,552	922,444	182,892
O&M Costs Pumping (Appendix F)	735,305	973,436	1,021,686
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,589,542**	**$7,099,627**	**$2,710,564**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,835,713**	**$10,345,798**	**$5,956,735**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,835,713	$10,345,798	$5,956,735
Percent Increase in User Fee Revenue	190.10%	150.72%	6.55%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$862.64	$745.53	$316.83
Monthly Charge per Connection - Projected	**$71.89**	**$62.13**	**$26.40**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.63**	**$6.30**	**$3.63**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-102

Supply from Hwy 3 and Distribution D3

Yukon - Annual and Unit Costs

Yukon - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$71,330,000	$88,970,000	$88,970,000
Projected Annual Debt Service[a]	$5,752,072	$7,174,567	$1,422,495
Coverage Requirement (20%)	1,150,414	1,434,913	284,499
O&M Costs Pumping (Appendix F)	1,143,807	1,514,234	1,589,289
O&M Costs Allocated to Participant (Appendix G-14)	648,550	920,150	920,150
Total New Costs	**$8,694,843**	**$11,043,864**	**$4,216,433**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$813.93	$695.73	$178.76
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,103.61	$985.41	$468.44
Monthly Charge per Connection - Projected	**$91.97**	**$82.12**	**$39.04**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.51**	**$6.72**	**$2.57**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-103

Supply from Hwy 3 and Distribution D3

Calumet - Annual and Unit Costs

Calumet - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$5,095,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$410,862	$512,469	$101,607
Coverage Requirement (20%)	82,172	102,494	20,321
O&M Costs Pumping (Appendix F)	81,701	108,160	113,521
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$621,060**	**$788,847**	**$301,174**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,552.65	$1,556.61	$469.09
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,870.65	$1,874.61	$787.09
Monthly Charge per Connection - Projected	**$155.89**	**$156.22**	**$65.59**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.83**	**$4.32**	**$1.65**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-104

Supply from Hwy 3 and Distribution D3

Okarche - Annual and Unit Costs

Okarche - Hwy 3/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-11)	$5,095,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$410,862	$512,469	$101,607
Coverage Requirement (20%)	82,172	102,494	20,321
O&M Costs Pumping (Appendix F)	81,701	108,160	113,521
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$621,060**	**$788,847**	**$301,174**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$808.67	$724.59	$195.15
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,312.43	$1,228.35	$698.91
Monthly Charge per Connection - Projected	**$109.37**	**$102.36**	**$58.24**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.83**	**$4.32**	**$1.65**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.76%.

Appendix H-105

Supply from Hugo and Distribution D1

OKC - Annual and Unit Costs

OKC - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$665,812,000	$1,067,524,000	$1,067,524,000
Projected Annual Debt Service[a]	$53,691,274	$86,085,447	$32,394,173
Coverage Requirement (20%)	10,738,255	17,217,089	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,546,270
O&M Costs Allocated to Participant (Table 10-3)	3,118,000	8,041,000	14,282,000
Total New Costs	$67,547,529	$111,343,536	$57,701,277
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$128,741,972**	**$172,537,980**	**$118,895,721**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$128,741,972	$172,537,980	$118,895,721
Percent Increase in User Fee Revenue	44.76%	49.42%	-20.69%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$302.42	$312.18	$165.69
Monthly Charge per Connection - Projected	$25.20	$26.01	$13.81
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.80	$4.98	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-106

Supply from Hugo and Distribution D1

Seminole - Annual and Unit Costs

Seminole - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$37,076,000	$81,260,000	$81,260,000
Projected Annual Debt Service[a]	$2,989,819	$6,552,830	$3,563,011
Coverage Requirement (20%)	597,964	1,310,566	712,602
O&M Costs Pumping (Appendix F)	519,896	720,736	1,033,400
O&M Costs Allocated to Participant (Table 10-3)	297,000	419,000	540,000
Total New Costs	$4,404,679	$9,003,132	$5,849,013
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,227,275**	**$9,825,727**	**$6,671,608**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,227,275	$9,825,727	$6,671,608
Percent Increase in User Fee Revenue	470.24%	695.83%	301.21%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,455.47	$2,031.29	$1,024.04
Monthly Charge per Connection - Projected	**$121.29**	**$169.27**	**$85.34**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.49**	**$7.96**	**$4.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-107

Supply from Hugo and Distribution D1

Shawnee - Annual and Unit Costs

Shawnee - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$37,076,000	$37,076,000	$37,076,000
Projected Annual Debt Service[a]	$2,989,819	$2,989,819	$0
Coverage Requirement (20%)	597,964	597,964	-
O&M Costs Pumping (Appendix F)	708,664	770,119	941,501
O&M Costs Allocated to Participant (Table 10-3)	432,000	486,000	540,000
Total New Costs	$4,728,447	$4,843,902	$1,481,501
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,480,630**	**$10,596,085**	**$7,233,684**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,480,630	$10,596,085	$7,233,684
Percent Increase in User Fee Revenue	146.97%	123.75%	36.88%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$682.82	$618.62	$378.44
Monthly Charge per Connection - Projected	**$56.90**	**$51.55**	**$31.54**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$4.05**	**$3.69**	**$1.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-108

Supply from Hugo and Distribution D1

Edmond - Annual and Unit Costs

Edmond - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$195,586,000	$285,346,000	$285,346,000
Projected Annual Debt Service[a]	$15,772,112	$23,010,385	$7,238,273
Coverage Requirement (20%)	3,154,422	4,602,077	1,447,655
O&M Costs Pumping (Appendix F)	924,328	2,269,360	4,357,815
O&M Costs Allocated to Participant (Table 10-3)	552,000	1,406,000	2,457,000
Total New Costs	$20,402,863	$31,287,822	$15,500,742
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$33,165,805**	**$44,050,764**	**$28,263,684**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$33,165,805	$44,050,764	$28,263,684
Percent Increase in User Fee Revenue	78.55%	65.98%	-25.46%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$487.86	$453.53	$203.67
Monthly Charge per Connection - Projected	**$40.66**	**$37.79**	**$16.97**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$13.31**	**$8.01**	**$2.27**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.8%.

Appendix H-109

Supply from Hugo and Distribution D1

Norman - Annual and Unit Costs

Norman - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$248,764,000	$382,469,200	$382,469,200
Projected Annual Debt Service[a]	$20,060,402	$30,842,428	$10,782,026
Coverage Requirement (20%)	4,012,080	6,168,486	2,156,405
O&M Costs Pumping (Appendix F)	1,092,021	2,898,515	5,572,123
O&M Costs Allocated to Participant (Table 10-3)	652,000	1,791,000	3,110,000
Total New Costs	**$25,816,503**	**$41,700,428**	**$21,620,555**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$34,433,047**	**$50,316,972**	**$30,237,099**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$34,433,047	$50,316,972	$30,237,099
Percent Increase in User Fee Revenue	99.89%	116.87%	-3.24%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$386.18	$418.99	$186.94
Monthly Charge per Connection - Projected	**$32.18**	**$34.92**	**$15.58**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$14.26**	**$8.38**	**$2.50**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-110

Supply from Hugo and Distribution D1

Moore - Annual and Unit Costs

Moore - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$109,928,000	$160,328,000	$160,328,000
Projected Annual Debt Service[a]	$8,864,626	$12,928,897	$4,064,271
Coverage Requirement (20%)	1,772,925	2,585,779	2,585,779
O&M Costs Pumping (Appendix F)	1,848,656	2,014,853	2,446,901
O&M Costs Allocated to Participant (Table 10-3)	1,104,000	1,248,000	1,380,000
Total New Costs	**$13,590,207**	**$18,777,529**	**$10,476,951**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$18,261,990**	**$23,449,312**	**$15,148,734**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$18,261,990	$23,449,312	$15,148,734
Percent Increase in User Fee Revenue	143.53%	180.22%	62.22%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$751.06	$864.20	$500.29
Monthly Charge per Connection - Projected	**$62.59**	**$72.02**	**$41.69**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.43**	**$5.42**	**$2.73**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-111

Supply from Hugo and Distribution D1

Chickashee - Annual and Unit Costs

Chickashee - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$148,612,800	$179,332,800	$179,332,800
Projected Annual Debt Service[a]	$11,984,180	$14,461,449	$2,477,270
Coverage Requirement (20%)	2,396,836	2,892,290	495,454
O&M Costs Pumping (Appendix F)	1,289,338	1,341,803	1,574,697
O&M Costs Allocated to Participant (Table 10-3)	736,000	788,000	841,000
Total New Costs	**$16,406,353**	**$19,483,542**	**$5,388,421**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$18,077,950**	**$21,155,139**	**$7,060,018**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$18,077,950	$21,155,139	$7,060,018
Percent Increase in User Fee Revenue	721.72%	601.40%	70.74%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,301.60	$1,111.03	$270.45
Monthly Charge per Connection - Projected	**$108.47**	**$92.59**	**$22.54**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$8.03**	**$8.90**	**$2.31**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-112

Supply from Hugo and Distribution D1

Midwest City - Annual and Unit Costs

Midwest City - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$17,846,000	$26,006,000	$26,006,000
Projected Annual Debt Service[a]	$1,439,107	$2,097,131	$658,025
Coverage Requirement (20%)	287,821	419,426	131,605
O&M Costs Pumping (Appendix F)	-	84,836	396,165
O&M Costs Allocated to Participant (Table 10-3)	-	53,000	223,000
Total New Costs	**$1,726,928**	**$2,654,394**	**$1,408,795**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$89.15	$95.73	$35.49
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$388.07	$394.65	$334.41
Monthly Charge per Connection - Projected	**$32.34**	**$32.89**	**$27.87**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$18.18**	**$2.27**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-113

Supply from Hugo and Distribution D1

Mustang - Annual and Unit Costs

Mustang - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$47,259,000	$58,059,000	$58,059,000
Projected Annual Debt Service[a]	3,810,980	4,681,895	$870,915
Coverage Requirement (20%)	762,196	936,379	174,183
O&M Costs Pumping (Appendix F)	774,535	1,069,273	1,163,563
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,764,636**	**$7,279,072**	**$2,800,186**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,569,645**	**$11,084,081**	**$6,605,196**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,569,645	$11,084,081	$6,605,196
Percent Increase in User Fee Revenue	286.44%	195.37%	16.16%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,054.99	$806.37	$317.11
Monthly Charge per Connection - Projected	**$87.92**	**$67.20**	**$26.43**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.26**	**$6.75**	**$4.02**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-114

Supply from Hugo and Distribution D1

El Reno - Annual and Unit Costs

El Reno - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$47,259,000	$58,059,000	$58,059,000
Projected Annual Debt Service[a]	$3,810,980	$4,681,895	$870,915
Coverage Requirement (20%)	762,196	936,379	174,183
O&M Costs Pumping (Appendix F)	774,535	1,069,273	1,163,563
O&M Costs Allocated to Participant (Table 10-3)	416,925	591,525	591,525
Total New Costs	**$5,764,636**	**$7,279,072**	**$2,800,186**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$9,010,806**	**$10,525,243**	**$6,046,357**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$9,010,806	$10,525,243	$6,046,357
Percent Increase in User Fee Revenue	195.85%	155.07%	8.15%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$879.74	$758.46	$321.59
Monthly Charge per Connection - Projected	**$73.31**	**$63.21**	**$26.80**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.78**	**$6.41**	**$3.68**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

Appendix H-115

Supply from Hugo and Distribution D1

Yukon - Annual and Unit Costs

Yukon - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$73,514,000	$90,314,000	$90,314,000
Projected Annual Debt Service[a]	$5,928,190	$7,282,947	$1,354,757
Coverage Requirement (20%)	1,185,638	1,456,589	270,951
O&M Costs Pumping (Appendix F)	1,204,832	1,663,314	1,809,987
O&M Costs Allocated to Participant (Table 10-3)	648,550	920,150	920,150
Total New Costs	**$8,967,211**	**$11,323,001**	**$4,355,845**
Projected Connections in Year 2020/2040/2060*	10,683	15,874	23,588
Incremental Cost per Connection	$839.42	$713.31	$184.67
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,129.10	$1,002.99	$474.35
Monthly Charge per Connection - Projected	**$94.09**	**$83.58**	**$39.53**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.74**	**$6.89**	**$2.65**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-116

Supply from Hugo and Distribution D1

Calumet - Annual and Unit Costs

Calumet - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$5,251,000	$6,451,000	$6,451,000
Projected Annual Debt Service[a]	$423,442	$520,211	$96,768
Coverage Requirement (20%)	84,688	104,042	19,354
O&M Costs Pumping (Appendix F)	86,059	118,808	129,285
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$640,515**	**$808,786**	**$311,132**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,601.29	$1,595.96	$484.60
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,919.29	$1,913.96	$802.60
Monthly Charge per Connection - Projected	**$159.94**	**$159.50**	**$66.88**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.98**	**$4.43**	**$1.70**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

Appendix H-117

Supply from Hugo and Distribution D1

Okarche - Annual and Unit Costs

Okarche - Hugo/D1	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-4)	$5,251,000	$6,451,000	$6,451,000
Projected Annual Debt Service[a]	$423,442	$520,211	$96,768
Coverage Requirement (20%)	84,688	104,042	19,354
O&M Costs Pumping (Appendix F)	86,059	118,808	129,285
O&M Costs Allocated to Participant (Table 10-3)	46,325	65,725	65,725
Total New Costs	**$640,515**	**$808,786**	**$311,132**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$834.00	$742.90	$201.60
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,337.76	$1,246.66	$705.36
Monthly Charge per Connection - Projected	**$111.48**	**$103.89**	**$58.78**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.98**	**$4.43**	**$1.70**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.76%.

Appendix H-118

Supply from Hugo and Distribution D2

OKC - Annual and Unit Costs

OKC - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$665,812,000	$1,067,524,000	$1,067,524,000
Projected Annual Debt Service[a]	$53,691,274	$86,085,447	$32,394,173
Coverage Requirement (20%)	10,738,255	17,217,089	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,421,050
O&M Costs Allocated to Participant (Appendix G-13)	3,118,000	8,041,000	14,282,000
Total New Costs	$67,547,529	$111,343,536	$57,576,057
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$128,741,972**	**$172,537,980**	**$118,770,501**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$128,741,972	$172,537,980	$118,770,501
Percent Increase in User Fee Revenue	44.76%	49.42%	-20.77%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$302.42	$312.18	$165.52
Monthly Charge per Connection - Projected	$25.20	$26.01	$13.79
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.80	$4.98	$1.45

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-119

Supply from Hugo and Distribution D2

Seminole - Annual and Unit Costs

Seminole - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$37,076,000	$81,260,000	$81,260,000
Projected Annual Debt Service[a]	$2,989,819	$6,552,830	$3,563,011
Coverage Requirement (20%)	597,964	1,310,566	712,602
O&M Costs Pumping (Appendix F)	509,156	704,149	1,007,770
O&M Costs Allocated to Participant (Appendix G-13)	297,000	419,000	540,000
Total New Costs	$4,393,939	$8,986,545	$5,823,383
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,216,535**	**$9,809,140**	**$6,645,978**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,216,535	$9,809,140	$6,645,978
Percent Increase in User Fee Revenue	469.06%	694.49%	299.66%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,452.48	$2,027.86	$1,020.10
Monthly Charge per Connection - Projected	**$121.04**	**$168.99**	**$85.01**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.47**	**$7.94**	**$3.99**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

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Supply from Hugo and Distribution D2

Shawnee - Annual and Unit Costs

Shawnee - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$37,076,000	$37,076,000	$37,076,000
Projected Annual Debt Service[a]	$2,989,819	$2,989,819	$0
Coverage Requirement (20%)	597,964	597,964	-
O&M Costs Pumping (Appendix F)	688,628	744,260	906,478
O&M Costs Allocated to Participant (Appendix G-13)	432,000	486,000	540,000
Total New Costs	$4,708,411	$4,818,043	$1,446,478
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,460,594**	**$10,570,226**	**$7,198,661**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,460,594	$10,570,226	$7,198,661
Percent Increase in User Fee Revenue	146.50%	123.20%	36.21%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$681.52	$617.11	$376.61
Monthly Charge per Connection - Projected	**$56.79**	**$51.43**	**$31.38**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$4.03**	**$3.67**	**$0.99**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

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Supply from Hugo and Distribution D2

Edmond - Annual and Unit Costs

Edmond - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$285,346,000	$285,346,000	$285,346,000
Projected Annual Debt Service[a]	$23,010,385	$23,010,385	$0
Coverage Requirement (20%)	4,602,077	4,602,077	-
O&M Costs Pumping (Appendix F)	903,824	2,212,107	4,237,786
O&M Costs Allocated to Participant (Appendix G-13)	552,000	1,406,000	2,457,000
Total New Costs	$29,068,286	$31,230,569	$6,694,786
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$41,831,228**	**$43,993,511**	**$19,457,728**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$41,831,228	$43,993,511	$19,457,728
Percent Increase in User Fee Revenue	125.20%	65.77%	-48.69%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$615.33	$452.94	$140.21
Monthly Charge per Connection - Projected	**$51.28**	**$37.74**	**$11.68**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$18.96**	**$8.00**	**$0.98**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.8%.

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Supply from Hugo and Distribution D2

Norman - Annual and Unit Costs

Norman - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$362,380,000	$420,562,000	$420,562,000
Projected Annual Debt Service[a]	$29,222,429	$33,914,242	$4,691,813
Coverage Requirement (20%)	5,844,486	6,782,848	938,363
O&M Costs Pumping (Appendix F)	1,168,601	3,118,629	5,970,025
O&M Costs Allocated to Participant (Appendix G-13)	652,000	1,791,000	3,110,000
Total New Costs	**$36,887,516**	**$45,606,720**	**$14,710,201**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$45,504,060**	**$54,223,264**	**$23,326,745**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$45,504,060	$54,223,264	$23,326,745
Percent Increase in User Fee Revenue	164.15%	133.71%	-25.35%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$510.34	$451.52	$144.22
Monthly Charge per Connection - Projected	**$42.53**	**$37.63**	**$12.02**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$20.38**	**$9.17**	**$1.70**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

Appendix H-123

Supply from Hugo and Distribution D2

Moore - Annual and Unit Costs

Moore - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$222,351,200	$222,351,200	$222,351,200
Projected Annual Debt Service[a]	$17,930,466	$17,930,466	$0
Coverage Requirement (20%)	3,586,093	3,586,093	3,586,093
O&M Costs Pumping (Appendix F)	2,114,271	2,323,544	2,792,246
O&M Costs Allocated to Participant (Appendix G-13)	1,104,000	1,248,000	1,380,000
Total New Costs	**$24,734,830**	**$25,088,103**	**$7,758,339**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$29,406,613**	**$29,759,886**	**$12,430,122**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$29,406,613	$29,759,886	$12,430,122
Percent Increase in User Fee Revenue	292.15%	255.63%	33.11%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$1,209.41	$1,096.77	$410.51
Monthly Charge per Connection - Projected	**$100.78**	**$91.40**	**$34.21**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$8.07**	**$7.24**	**$2.02**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-124

Supply from Hugo and Distribution D2

Chickashee - Annual and Unit Costs

Chickashee - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$233,529,600	$233,529,600	$233,529,600
Projected Annual Debt Service[a]	$18,831,895	$18,831,895	$0
Coverage Requirement (20%)	3,766,379	3,766,379	-
O&M Costs Pumping (Appendix F)	1,319,015	1,371,923	1,602,037
O&M Costs Allocated to Participant (Appendix G-13)	736,000	788,000	841,000
Total New Costs	**$24,653,289**	**$24,758,197**	**$2,443,037**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$26,324,886**	**$26,429,794**	**$4,114,634**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$26,324,886	$26,429,794	$4,114,634
Percent Increase in User Fee Revenue	1096.57%	776.29%	-0.49%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,895.37	$1,388.04	$157.62
Monthly Charge per Connection - Projected	**$157.95**	**$115.67**	**$13.14**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$12.06**	**$11.31**	**$1.05**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

Appendix H-125

Supply from Hugo and Distribution D2

Midwest City - Annual and Unit Costs

Midwest City - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$26,006,000	$26,006,000	$26,006,000
Projected Annual Debt Service[a]	$2,097,131	$2,097,131	$0
Coverage Requirement (20%)	419,426	419,426	-
O&M Costs Pumping (Appendix F)	-	95,690	461,667
O&M Costs Allocated to Participant (Appendix G-13)	-	53,000	223,000
Total New Costs	**$2,516,558**	**$2,665,248**	**$684,667**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$129.92	$96.12	$17.25
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$428.84	$395.04	$316.17
Monthly Charge per Connection - Projected	**$35.74**	**$32.92**	**$26.35**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$18.26**	**$1.10**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-126

Supply from Hugo and Distribution D2

Mustang - Annual and Unit Costs

Mustang - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$58,599,000	$58,599,000	$58,599,000
Projected Annual Debt Service[a]	4,725,440	4,725,440	$0
Coverage Requirement (20%)	945,088	945,088	-
O&M Costs Pumping (Appendix F)	739,227	1,017,135	1,115,137
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,826,681**	**$7,279,189**	**$1,706,662**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$10,631,690**	**$11,084,198**	**$5,511,671**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$10,631,690	$11,084,198	$5,511,671
Percent Increase in User Fee Revenue	329.33%	195.38%	-3.07%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,172.07	$806.38	$264.61
Monthly Charge per Connection - Projected	**$97.67**	**$67.20**	**$22.05**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$9.18**	**$6.75**	**$3.35**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

Appendix H-127

Supply from Hugo and Distribution D2

El Reno - Annual and Unit Costs

El Reno - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$58,599,000	$58,599,000	$58,599,000
Projected Annual Debt Service[a]	$4,725,440	$4,725,440	$0
Coverage Requirement (20%)	945,088	945,088	-
O&M Costs Pumping (Appendix F)	739,227	1,017,135	1,115,137
O&M Costs Allocated to Participant (Appendix G-13)	416,925	591,525	591,525
Total New Costs	**$6,826,681**	**$7,279,189**	**$1,706,662**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$10,072,852**	**$10,525,360**	**$4,952,833**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$10,072,852	$10,525,360	$4,952,833
Percent Increase in User Fee Revenue	230.72%	155.07%	-11.41%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$983.43	$758.47	$263.43
Monthly Charge per Connection - Projected	**$81.95**	**$63.21**	**$21.95**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.70**	**$6.41**	**$3.01**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

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Supply from Hugo and Distribution D2

Yukon - Annual and Unit Costs

Yukon - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$91,154,000	$91,154,000	$91,154,000
Projected Annual Debt Service[a]	$7,350,685	$7,350,685	$0
Coverage Requirement (20%)	1,470,137	1,470,137	-
O&M Costs Pumping (Appendix F)	1,149,909	1,582,210	1,734,657
O&M Costs Allocated to Participant (Appendix G-13)	648,550	920,150	920,150
Total New Costs	**$10,619,281**	**$11,323,183**	**$2,654,807**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$994.07	$713.33	$112.55
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,283.75	$1,003.01	$402.23
Monthly Charge per Connection - Projected	**$106.98**	**$83.58**	**$33.52**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$9.17**	**$6.89**	**$1.62**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

Appendix H-129

Supply from Hugo and Distribution D2

Calumet - Annual and Unit Costs

Calumet - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$6,511,000	$6,511,000	$6,511,000
Projected Annual Debt Service[a]	$525,049	$525,049	$0
Coverage Requirement (20%)	105,010	105,010	-
O&M Costs Pumping (Appendix F)	82,136	113,015	123,904
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$758,520**	**$808,799**	**$189,629**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,896.30	$1,595.98	$295.35
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$2,214.30	$1,913.98	$613.35
Monthly Charge per Connection - Projected	**$184.53**	**$159.50**	**$51.11**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.90**	**$4.43**	**$1.04**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

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Supply from Hugo and Distribution D2

Okarche - Annual and Unit Costs

Okarche - Hugo/D2	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-8)	$6,511,000	$6,511,000	$6,511,000
Projected Annual Debt Service[a]	$525,049	$525,049	$0
Coverage Requirement (20%)	105,010	105,010	-
O&M Costs Pumping (Appendix F)	82,136	113,015	123,904
O&M Costs Allocated to Participant (Appendix G-13)	46,325	65,725	65,725
Total New Costs	**$758,520**	**$808,799**	**$189,629**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$987.66	$742.91	$122.87
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,491.42	$1,246.67	$626.63
Monthly Charge per Connection - Projected	**$124.28**	**$103.89**	**$52.22**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$5.90**	**$4.43**	**$1.04**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.76%.			

Appendix H-131

Supply from Hugo and Distribution D3

OKC - Annual and Unit Costs

OKC - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$646,036,000	$1,047,748,000	$1,047,748,000
Projected Annual Debt Service[a]	$52,096,532	$84,490,704	$32,394,173
Coverage Requirement (20%)	10,419,306	16,898,141	6,478,835
O&M Costs Pumping (Appendix F)	-	-	4,002,307
O&M Costs Allocated to Participant (Appendix G-14)	3,118,000	8,041,000	14,282,000
Total New Costs	$65,633,838	$109,429,845	$57,157,314
Existing Participant Costs			
O&M	$50,186,635	$50,186,635	$50,186,635
Annual Debt Service	11,007,809	11,007,809	11,007,809
Total Existing Costs	$61,194,444	$61,194,444	$61,194,444
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	$61,194,444	$61,194,444	$61,194,444
Total - Existing Plus New Revenue Requirement	**$126,828,282**	**$170,624,289**	**$118,351,758**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$88,937,468	$115,469,007	$149,915,349
User Fee Revenue Required	$126,828,282	$170,624,289	$118,351,758
Percent Increase in User Fee Revenue	42.60%	47.77%	-21.05%
Annual Charge per Connection - Existing (8,000 gal./month)	$208.92	$208.92	$208.92
Monthly Charge per Connection - Existing	$17.41	$17.41	$17.41
Annual Charge per Connection - Projected	$297.93	$308.71	$164.93
Monthly Charge per Connection - Projected	$24.83	$25.73	$13.74
Annual Gallons (in 1,000's)	8,661,710	22,337,155	39,673,341
New Costs per 1,000 Gallons	$7.58	$4.90	$1.44

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.3139%.

Appendix H-132

Supply from Hugo and Distribution D3

Seminole - Annual and Unit Costs

Seminole - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$35,828,000	$80,012,000	$80,012,000
Projected Annual Debt Service[a]	$2,889,180	$6,452,191	$3,563,011
Coverage Requirement (20%)	577,836	1,290,438	712,602
O&M Costs Pumping (Appendix F)	478,233	632,769	874,666
O&M Costs Allocated to Participant (Appendix G-14)	297,000	419,000	540,000
Total New Costs	$4,242,249	$8,794,398	$5,690,279
Existing Participant Costs			
O&M	$375,109	$375,109	$375,109
Annual Debt Service	670,754	670,754	670,754
Total Existing Costs	$1,045,863	$1,045,863	$1,045,863
Less: Non-Operating Revenues	(223,268)	(223,268)	(223,268)
Net Operating Revenue Requirement	$822,595	$822,595	$822,595
Total - Existing Plus New Revenue Requirement	**$5,064,845**	**$9,616,994**	**$6,512,874**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$916,687	$1,234,645	$1,662,887
User Fee Revenue Required	$5,064,845	$9,616,994	$6,512,874
Percent Increase in User Fee Revenue	452.52%	678.93%	291.66%
Annual Charge per Connection - Existing	$255.24	$255.24	$255.24
Monthly Charge per Connection - Existing	$21.27	$21.27	$21.27
Annual Charge per Connection - Projected	$1,410.24	$1,988.14	$999.67
Monthly Charge per Connection - Projected	**$117.52**	**$165.68**	**$83.31**
Annual Gallons (in 1,000's)	803,000	1,131,500	1,460,000
New Costs per 1,000 Gallons	**$5.28**	**$7.77**	**$3.90**
[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.			
[b]Annual customer growth assumption 1.5%.			

Appendix H-133

Supply from Hugo and Distribution D3

Shawnee - Annual and Unit Costs

Shawnee - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$35,828,000	$35,828,000	$35,828,000
Projected Annual Debt Service[a]	$2,889,180	$2,889,180	$0
Coverage Requirement (20%)	577,836	577,836	-
O&M Costs Pumping (Appendix F)	680,559	702,891	820,620
O&M Costs Allocated to Participant (Appendix G-14)	432,000	486,000	540,000
Total New Costs	$4,579,575	$4,655,907	$1,360,620
Existing Participant Costs			
O&M	$6,040,098	$6,040,098	$6,040,098
Annual Debt Service	476,642	476,642	476,642
Total Existing Costs	$6,516,740	$6,516,740	$6,516,740
Less: Non-Operating Revenues	(764,557)	(764,557)	(764,557)
Net Operating Revenue Requirement	$5,752,183	$5,752,183	$5,752,183
Total - Existing Plus New Revenue Requirement	**$10,331,758**	**$10,408,090**	**$7,112,803**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$4,243,698	$4,735,719	$5,284,787
User Fee Revenue Required	$10,331,758	$10,408,090	$7,112,803
Percent Increase in User Fee Revenue	143.46%	119.78%	34.59%
Annual Charge per Connection - Existing	$276.48	$276.48	$276.48
Monthly Charge per Connection - Existing	$23.04	$23.04	$23.04
Annual Charge per Connection - Projected	$673.12	$607.64	$372.11
Monthly Charge per Connection - Projected	**$56.09**	**$50.64**	**$31.01**
Annual Gallons (in 1,000's)	1,168,000	1,314,000	1,460,000
New Costs per 1,000 Gallons	**$3.92**	**$3.54**	**$0.93**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

Appendix H-134

Supply from Hugo and Distribution D3

Edmond - Annual and Unit Costs

Edmond - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$189,778,000	$381,355,600	$381,355,600
Projected Annual Debt Service[a]	$15,303,753	$30,752,627	$15,448,874
Coverage Requirement (20%)	3,060,751	6,150,525	3,089,775
O&M Costs Pumping (Appendix F)	893,234	2,089,147	3,836,559
O&M Costs Allocated to Participant (Appendix G-14)	552,000	1,406,000	2,457,000
Total New Costs	$19,809,738	$40,398,299	$24,832,207
Existing Participant Costs			
O&M	$8,933,058	$8,933,058	$8,933,058
Annual Debt Service	6,383,128	6,383,128	6,383,128
Total Existing Costs	$15,316,186	$15,316,186	$15,316,186
Less: Non-Operating Revenues	(2,553,244)	(2,553,244)	(2,553,244)
Net Operating Revenue Requirement	$12,762,942	$12,762,942	$12,762,942
Total - Existing Plus New Revenue Requirement	**$32,572,680**	**$53,161,241**	**$37,595,149**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$18,575,379	$26,539,531	$37,918,296
User Fee Revenue Required	$32,572,680	$53,161,241	$37,595,149
Percent Increase in User Fee Revenue	75.35%	100.31%	-0.85%
Annual Charge per Connection - Existing	$273.24	$273.24	$273.24
Monthly Charge per Connection - Existing	$22.77	$22.77	$22.77
Annual Charge per Connection - Projected	$479.14	$547.33	$270.91
Monthly Charge per Connection - Projected	**$39.93**	**$45.61**	**$22.58**
Annual Gallons (in 1,000's)	1,533,000	3,905,500	6,825,500
New Costs per 1,000 Gallons	**$12.92**	**$10.34**	**$3.64**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.8%.

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Supply from Hugo and Distribution D3

Norman - Annual and Unit Costs

Norman - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$241,372,000	$413,170,000	$413,170,000
Projected Annual Debt Service[a]	$19,464,309	$33,318,149	$13,853,841
Coverage Requirement (20%)	3,892,862	6,663,630	2,770,768
O&M Costs Pumping (Appendix F)	1,230,171	3,206,035	5,703,694
O&M Costs Allocated to Participant (Appendix G-14)	398,000	1,094,000	1,901,000
Total New Costs	**$24,985,341**	**$44,281,814**	**$24,229,303**
Existing Participant Costs			
O&M	$8,841,052	$8,841,052	$8,841,052
Annual Debt Service	858,275	858,275	858,275
Total Existing Costs	**$9,699,327**	**$9,699,327**	**$9,699,327**
Less: Non-Operating Revenues	(1,082,783)	(1,082,783)	(1,082,783)
Net Operating Revenue Requirement	**$8,616,544**	**$8,616,544**	**$8,616,544**
Total - Existing Plus New Revenue Requirement	**$33,601,885**	**$52,898,358**	**$32,845,847**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$17,226,373	$23,201,427	$31,248,958
User Fee Revenue Required	$33,601,885	$52,898,358	$32,845,847
Percent Increase in User Fee Revenue	95.06%	128.00%	5.11%
Annual Charge per Connection - Existing	$193.20	$193.20	$193.20
Monthly Charge per Connection - Existing	$16.10	$16.10	$16.10
Annual Charge per Connection - Projected	$376.86	$440.49	$203.07
Monthly Charge per Connection - Projected	**$31.40**	**$36.71**	**$16.92**
Annual Gallons (in 1,000's)	1,810,400	4,974,950	8,639,550
New Costs per 1,000 Gallons	**$13.80**	**$8.90**	**$2.80**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.5%.

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Supply from Hugo and Distribution D3

Moore - Annual and Unit Costs

Moore - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$106,664,000	$106,664,000	$106,664,000
Projected Annual Debt Service[a]	$8,601,416	$8,601,416	$0
Coverage Requirement (20%)	1,720,283	1,720,283	1,720,283
O&M Costs Pumping (Appendix F)	1,865,305	1,944,192	2,253,075
O&M Costs Allocated to Participant (Appendix G-14)	1,104,000	1,248,000	1,380,000
Total New Costs	**$13,291,004**	**$13,513,891**	**$5,353,358**
Existing Participant Costs			
O&M	$3,770,778	$3,770,778	$3,770,778
Annual Debt Service	901,005	901,005	901,005
Total Existing Costs	**$4,671,783**	**$4,671,783**	**$4,671,783**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$4,671,783**	**$4,671,783**	**$4,671,783**
Total - Existing Plus New Revenue Requirement	**$17,962,787**	**$18,185,674**	**$10,025,141**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$7,498,723	$8,368,138	$9,338,353
User Fee Revenue Required	$17,962,787	$18,185,674	$10,025,141
Percent Increase in User Fee Revenue	139.54%	117.32%	7.35%
Annual Charge per Connection - Existing	$308.40	$308.40	$308.40
Monthly Charge per Connection - Existing	$25.70	$25.70	$25.70
Annual Charge per Connection - Projected	$738.76	$670.22	$331.08
Monthly Charge per Connection - Projected	**$61.56**	**$55.85**	**$27.59**
Annual Gallons (in 1,000's)	3,066,000	3,467,500	3,832,500
New Costs per 1,000 Gallons	**$4.33**	**$3.90**	**$1.40**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 0.55%.

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Supply from Hugo and Distribution D3

Chickashee - Annual and Unit Costs

Chickashee - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$190,158,000	$205,008,000	$205,008,000
Projected Annual Debt Service[a]	$15,334,397	$16,531,905	$1,197,508
Coverage Requirement (20%)	3,066,879	3,306,381	239,502
O&M Costs Pumping (Appendix F)	1,359,877	1,373,017	1,543,357
O&M Costs Allocated to Participant (Appendix G-14)	450,000	482,000	514,000
Total New Costs	**$20,211,153**	**$21,693,303**	**$3,494,367**
Existing Participant Costs			
O&M	$1,671,597	$1,671,597	$1,671,597
Annual Debt Service	-	-	-
Total Existing Costs	**$1,671,597**	**$1,671,597**	**$1,671,597**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$1,671,597**	**$1,671,597**	**$1,671,597**
Total - Existing Plus New Revenue Requirement	**$21,882,750**	**$23,364,900**	**$5,165,964**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,200,026	$3,016,109	$4,134,912
User Fee Revenue Required	$21,882,750	$23,364,900	$5,165,964
Percent Increase in User Fee Revenue	894.66%	674.67%	24.94%
Annual Charge per Connection - Existing	$158.40	$158.40	$158.40
Monthly Charge per Connection - Existing	$13.20	$13.20	$13.20
Annual Charge per Connection - Projected	$1,575.54	$1,227.08	$197.90
Monthly Charge per Connection - Projected	**$131.29**	**$102.26**	**$16.49**
Annual Gallons (in 1,000's)	2,044,000	2,190,000	2,336,000
New Costs per 1,000 Gallons	**$9.89**	**$9.91**	**$1.50**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.59%.

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Supply from Hugo and Distribution D3

Midwest City - Annual and Unit Costs

Midwest City - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$17,318,000	$18,668,000	$18,668,000
Projected Annual Debt Service[a]	$1,396,529	$1,505,393	$108,864
Coverage Requirement (20%)	279,306	301,079	21,773
O&M Costs Pumping (Appendix F)	-	95,641	426,114
O&M Costs Allocated to Participant (Appendix G-14)	-	32,000	137,000
Total New Costs	**$1,675,834**	**$1,934,113**	**$693,751**
Projected Connections in Year 2020/2040/2060[b]	19,370	27,729	39,696
Incremental Cost per Connection	$86.52	$69.75	$17.48
Annual Charge per Connection - Existing	$298.92	$298.92	$298.92
Monthly Charge per Connection - Existing	$24.91	$24.91	$24.91
Annual Charge per Connection - Projected	$385.44	$368.67	$316.40
Monthly Charge per Connection - Projected	**$32.12**	**$30.72**	**$26.37**
Annual Gallons (in 1,000's)	-	146,000	620,500
New Costs per 1,000 Gallons	**$0.00**	**$13.25**	**$1.12**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

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Supply from Hugo and Distribution D3

Mustang - Annual and Unit Costs

Mustang - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$45,855,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	3,697,761	4,612,221	$914,461
Coverage Requirement (20%)	739,552	922,444	182,892
O&M Costs Pumping (Appendix F)	735,305	973,436	1,021,686
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,589,542**	**$7,099,627**	**$2,710,564**
Existing Participant Costs			
O&M	$1,402,146	$1,402,146	$1,402,146
Annual Debt Service	2,402,863	2,402,863	2,402,863
Total Existing Costs	**$3,805,009**	**$3,805,009**	**$3,805,009**
Less: Non-Operating Revenues	-	-	-
Net Operating Revenue Requirement	**$3,805,009**	**$3,805,009**	**$3,805,009**
Total - Existing Plus New Revenue Requirement	**$9,394,551**	**$10,904,636**	**$6,515,573**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$2,476,351	$3,752,554	$5,686,458
User Fee Revenue Required	$9,394,551	$10,904,636	$6,515,573
Percent Increase in User Fee Revenue	279.37%	190.59%	14.58%
Annual Charge per Connection - Existing	$273.00	$273.00	$273.00
Monthly Charge per Connection - Existing	$22.75	$22.75	$22.75
Annual Charge per Connection - Projected	$1,035.68	$793.32	$312.80
Monthly Charge per Connection - Projected	**$86.31**	**$66.11**	**$26.07**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$8.11**	**$6.64**	**$3.97**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2.1%.

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Supply from Hugo and Distribution D3

El Reno - Annual and Unit Costs

El Reno - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$45,855,000	$57,195,000	$57,195,000
Projected Annual Debt Service[a]	$3,697,761	$4,612,221	$914,461
Coverage Requirement (20%)	739,552	922,444	182,892
O&M Costs Pumping (Appendix F)	735,305	973,436	1,021,686
O&M Costs Allocated to Participant (Appendix G-14)	416,925	591,525	591,525
Total New Costs	**$5,589,542**	**$7,099,627**	**$2,710,564**
Existing Participant Costs			
O&M	$1,697,000	$1,697,000	$1,697,000
Annual Debt Service	1,630,171	1,630,171	1,630,171
Total Existing Costs	**$3,327,171**	**$3,327,171**	**$3,327,171**
Less: Non-Operating Revenues	(81,000)	(81,000)	(81,000)
Net Operating Revenue Requirement	**$3,246,171**	**$3,246,171**	**$3,246,171**
Total - Existing Plus New Revenue Requirement	**$8,835,713**	**$10,345,798**	**$5,956,735**
Existing User Fee Revenues - Increased for 2020/2040/2060 Customer Base[b]	$3,045,735	$4,126,480	$5,590,717
User Fee Revenue Required	$8,835,713	$10,345,798	$5,956,735
Percent Increase in User Fee Revenue	190.10%	150.72%	6.55%
Annual Charge per Connection - Existing	$297.36	$297.36	$297.36
Monthly Charge per Connection - Existing	**$24.78**	**$24.78**	**$24.78**
Annual Charge per Connection - Projected	$862.64	$745.53	$316.83
Monthly Charge per Connection - Projected	**$71.89**	**$62.13**	**$26.40**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.63**	**$6.30**	**$3.63**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.53%.

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Supply from Hugo and Distribution D3

Yukon - Annual and Unit Costs

Yukon - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$71,330,000	$88,970,000	$88,970,000
Projected Annual Debt Service[a]	$5,752,072	$7,174,567	$1,422,495
Coverage Requirement (20%)	1,150,414	1,434,913	284,499
O&M Costs Pumping (Appendix F)	1,143,807	1,514,234	1,589,289
O&M Costs Allocated to Participant (Appendix G-14)	648,550	920,150	920,150
Total New Costs	**$8,694,843**	**$11,043,864**	**$4,216,433**
Projected Connections in Year 2020/2040/2060[b]	10,683	15,874	23,588
Incremental Cost per Connection	$813.93	$695.73	$178.76
Annual Charge per Connection - Existing	$289.68	$289.68	$289.68
Monthly Charge per Connection - Existing	**$24.14**	**$24.14**	**$24.14**
Annual Charge per Connection - Projected	$1,103.61	$985.41	$468.44
Monthly Charge per Connection - Projected	**$91.97**	**$82.12**	**$39.04**
Annual Gallons (in 1,000's)	1,157,963	1,642,876	1,642,876
New Costs per 1,000 Gallons	**$7.51**	**$6.72**	**$2.57**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 2%.

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Supply from Hugo and Distribution D3

Calumet - Annual and Unit Costs

Calumet - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$5,095,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$410,862	$512,469	$101,607
Coverage Requirement (20%)	82,172	102,494	20,321
O&M Costs Pumping (Appendix F)	81,701	108,160	113,521
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$621,060**	**$788,847**	**$301,174**
Projected Connections in Year 2020/2040/2060[b]	400	507	642
Incremental Cost per Connection	$1,552.65	$1,556.61	$469.09
Annual Charge per Connection - Existing	$318.00	$318.00	$318.00
Monthly Charge per Connection - Existing	**$26.50**	**$26.50**	**$26.50**
Annual Charge per Connection - Projected	$1,870.65	$1,874.61	$787.09
Monthly Charge per Connection - Projected	**$155.89**	**$156.22**	**$65.59**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.83**	**$4.32**	**$1.65**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.19%.

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Supply from Hugo and Distribution D3

Okarche - Annual and Unit Costs

Okarche - Hugo/D3	**Treated Water - Immediate Projects Only (Year 2020)**	**Treated Water - - Immediate & Deferred Projects (Year 2040)**	**Treated Water - Immediate & Deferred Projects (Year 2060)**
Capital Costs Allocated to Participant (Appendix G-12)	$5,095,000	$6,355,000	$6,355,000
Projected Annual Debt Service[a]	$410,862	$512,469	$101,607
Coverage Requirement (20%)	82,172	102,494	20,321
O&M Costs Pumping (Appendix F)	81,701	108,160	113,521
O&M Costs Allocated to Participant (Appendix G-14)	46,325	65,725	65,725
Total New Costs	**$621,060**	**$788,847**	**$301,174**
Projected Connections in Year 2020/2040/2060[b]	768	1,089	1,543
Incremental Cost per Connection	$808.67	$724.59	$195.15
Annual Charge per Connection - Existing	$503.76	$503.76	$503.76
Monthly Charge per Connection - Existing	**$41.98**	**$41.98**	**$41.98**
Annual Charge per Connection - Projected	$1,312.43	$1,228.35	$698.91
Monthly Charge per Connection - Projected	**$109.37**	**$102.36**	**$58.24**
Annual Gallons (in 1,000's)	128,663	182,542	182,542
New Costs per 1,000 Gallons	**$4.83**	**$4.32**	**$1.65**

[a]Debt service payment based on 30 year repayment, 6% interest, 1% issuance costs and 10% debt service reserve.

[b]Annual customer growth assumption 1.76%.

Appendix I

List of Assumptions

Appendix I
List of Assumptions

List of Assumptions on Hydraulics:

- Hazen Williams C-factor (planning): C=120 (no allowance for minor losses)
- Maximum/minimum operating pressure at pump discharge/suction: 150 psi/15 psi
- Maximum operating velocity (transmission): 6 to 7 feet per second (6 fps target for distribution)
- Wire to water pumping efficiency: 65% (for power cost analysis and facility power requirements)
- Source flows: 2070 annual average day basis
- Distribution flows: 2060 annual maximum day basis (specific to each participant)
- Flow summary (Source)
  - Existing Atoka Pipeline capacity: 90 mgd
  - Existing McGee Creek capacity: 50 mgd
  - New Parallel Atoka Pipeline capacity required: 195 mgd
  - New McGee Creek parallel and other source to Atoka capacity required: 155 mgd

List of Assumptions on Costing:

- Pipe installation rate (300 linear feet per day on average)
- Cost Contingency (Construction): 25%
- Implementation Adder: 20% (added to Construction with contingency)
- No allowance for rock construction
- No construction period cost escalation included
- Source pipe material used for estimate: welded steel with mortar lining (material quote from American Spiral Weld), tape wrap coating, D/T assumption of 240, sand bedding zone material

- Distribution pipe material used for estimate: restrained joint ductile iron pipe for all sizes through 48 inch and welded steel pipe in larger diameters

- Construction component cost inclusions (not contingency):

  - 1 percent building permit

  - 9 percent sales tax

  - 1 percent insurance

  - 2 percent GC bonds

  - 9 percent GC field GC

  - 10 percent GC Margin

  - Construction materials are tax exempt

List of Assumptions on Systems Model

- The model assumes a specific path for delivery of water after terminal storage in OKC. That path for each theme (D1, D2 and D3) is the same used for capital cost estimates for those themes

- In every reach between two model nodes, only one elevation difference is computed. Model assumes, for energy costs, an elevation head equal to the difference in elevation between the pumping location and the highest elevation point in the path to a delivery node.

- Model assumes that city's with ownership and access to a central Oklahoma reservoir will supply their local surface water needs out of those reservoirs first, and then use regional water from the project. The use of local surface water makes room for terminal storage for project water.

- For all reservoirs, and operating curve is assume on a monthly basis. The operating curves vary for reservoirs but generally try to keep terminal storage reservoirs relatively full so that project water is pumped from Southeast Oklahoma accordingly.

- For a given city, the model assumes use of local storage water first, then moves upstream to the nearest reservoir in central Oklahoma available to that city, then calls for water from Southeast Oklahoma

- Model assumes a cost allocation identical to the financial analysis allocation formula, based on the percent utilization of a shared facility

- Model assumes a seasonal demand curve for all cities

- Model assumes a peak day demand factor for all cities, equal to the peak day demand factor used for the financial analysis
- Model assumes the local runoff into the reservoirs for a hydrology period equal to the hydrology period used in the water availability analysis described in Chapter three.
- Model assumes some level of storage in the Highway 3 source location dictated by the levels of water in Hugo Lake. This was described in Section 3 as well.
- Model assumes a Hazen Williams C-factor (planning) of 120 for friction losses in energy requirement calculations.

List of Assumptions on Financing:

- Interest Rate – 6%
- Terms – 30 years
- Cost of Issuance – 1%
- Debt Service Reserve – 10%
- Debt Service Coverage – 20%

List of Assumptions on Customer Growth:

- OKC – 1.3139%
- Seminole – 1.5%
- Shawnee – 0.55%
- Midwest City – 1.81%
- Edmond – 1.8%
- Norman – 1.5%
- Moore – 0.55%
- Chickasha – 1.59%
- Mustang – 2.1%
- El Reno – 1.53%
- Yukon – 2%
- Calumet – 1.19%
- Okarche - 1.76%

For List of Assumptions on Availability Analysis, see Section 5.3.2.