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Task Order YW06

Cameron Pipeline
Preliminary Engineering Report

U.S. Army Corps of Engineers
Kansas City District

Northwest Missouri Regional Water Supply Transmission System Study Phase V

May 2013

US Army Corps of Engineers
Kansas City District

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Missouri Department of Natural Resources

CDM Smith

Northwest Missouri Regional Water Supply
Transmission System Study
Phase V

Cameron Pipeline
Preliminary Engineering Report

May 2013

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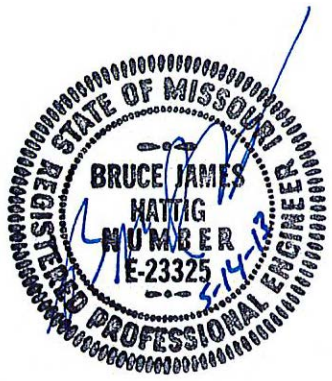

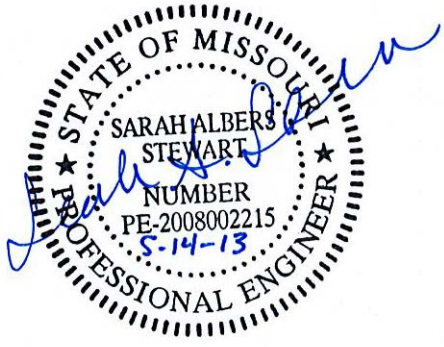

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Acronyms

ACWWC	Atchison County Wholesale Water Commission
BHp	brake horsepower
CDM Smith	CDM Federal Programs Corporation
EPS	Extended Period Simulation
gal/min	gallons per minute
Gentry2	Gentry County Public Water Supply District No. 2
GNWWC	Great Northeast Wholesale Water Commission
gpd	gallons per day
HGL	hydraulic grade line
HP	horsepower
KCMO	Kansas City, Missouri
kgal	thousand gallons
kWh	kilowatt-hours
MDNR	Missouri Department of Natural Resources
MGD	million gallons per day
MHp	motor horsepower
O&M	operation and maintenance
OPCC	opinion of probable construction costs
psi	pounds per square inch
PVC	polyvinyl chloride
PER	preliminary engineering report
TM	technical memorandum
USACE	U.S. Army Corps of Engineers
WTP	water treatment plant

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Executive Summary

Water is a key driver in the success and stability of population trends. In northwest Missouri, many communities depend on access to the Missouri River and its alluvial aquifers or reservoirs for their water supply. Communities without access to these sources purchase water from wholesale suppliers or utilize inconsistent groundwater sources and a few large lakes for supply. This Preliminary Engineering Report (PER) was developed to determine an alternative water supply for the Cities of Cameron, Maysville, Stewartsville, and King City, and Gentry County Public Water Supply District No. 2 (Gentry 2).

This PER was created under the U.S. Army Corps of Engineers (USACE) and the Missouri Department of Natural Resources (MDNR) Water Resources Center Planning Assistance to States Cost Share Agreement. Under this agreement, CDM Federal Programs Corporation (CDM Smith) and Bartlett & West, Inc. provided engineering and technical support services to the USACE Kansas City District for Phase V of the Northwest Missouri Regional Water Supply Study. This PER evaluates the feasibility of extending water transmission lines to serve several members of the Great Northwest Wholesale Water Commission (GNWWC) and presents cost opinions for two supply alternatives and three transmission alternatives.

Special acknowledgement for GNWWC should also be given for:

- The individual utilities willingness to be a part of this study, most especially the Cities of Cameron, Maysville, Stewartsville, and King City, and Gentry 2.
- GNWWC's interest in pursuing a regional solution to water supply needs in the northwest area over the past decade.
- The willingness to add members to the GNWWC regardless of location and size.

This study is one of several studies evaluating how best to address the water supply needs in northwest Missouri.

Project Description

Two water supplier alternatives, Kansas City, Missouri (KCMO) and Missouri-American, were evaluated to determine which wholesale supplier would provide the least cost source of potable water supply. The City of Liberty was contacted as a possible source of supply, but decided not to participate at this time. The City of Plattsburg is allowed an allocation up to 10 million gallons per day (MGD) out of Smithville Lake and currently operates a 1.3 MGD water treatment plant (WTP). The GNWWC elected not to consider the City of Plattsburg due to the cost and expense of constructing and maintaining an expansion to the Plattsburg WTP.

Three different water demand scenarios were evaluated for pipeline sizing, cost opinions, and the cost of water purchase. These scenarios all utilized 2050 maximum day water demands to size the transmission systems and 2012 average day water demands to compare estimated water costs.

- Base Scenario – Maximum Day Water Demand (Maximum Day Demand) for Maysville and Half of Maximum Day Demand to Stewartsville and Cameron.
- Alternate Scenario 1 – Maximum Day Demands for Stewartsville, Cameron, and Maysville.
- Alternate Scenario 2 – Maximum Day Demand for Stewartsville, Cameron, King City, Gentry 2, and Maysville.

Findings

Missouri-American is the least cost provider even without the connection fee included from KCMO. Based on this cost analysis Missouri-American is the recommended primary water source for the Cameron pipeline. Therefore, only Missouri-American was modeled for the three scenarios. Table ES-1 presents a summary of comparative information.

Table ES-1 Water Supply Comparison

Description	Pipeline Length (Miles)	OPCC	Annual Debt Service Payment*	Est. Annual Expenses
KCMO Supplier	61	$32,340,000	$2,200,000	$3.81M
Missouri-American Supplier	39	$20,750,000	$1,400,000	$2.82M

*Based on 20 years at 3-percent interest assuming Missouri State Revolving Fund is the lending agency.

Table ES-2 summarizes the estimated revenue requirements, water sales, and cost per thousand gallon based on the 2012 water day demand data. The difference in cost per 1,000 gallon relates to the cost of the transmission system and the amount of water sold. The three scenarios have three different costs as they have different pipe sizes and lengths. Additionally, the fixed transmission system's debt service cost causes a correlation where increased water sales results in a decreased cost per 1,000 gallons.

The preliminary estimate of the wholesale rates applicable are composed of debt service on construction of facilities, operations and maintenance (O&M) expenses of the facilities, and water cost purchased for resale. Total expenses to purchase potable water and transmit water through the transmission system were based on the cost of constructing the transmission system, O&M costs, and renewal and replacement expenses.

Table ES-2 Summary of Wholesale Rate Requirements

Description	Base Scenario	Alternate Scenario 1	Alternate Scenario 2
Estimated Water Sales (kgal)	340,000	654,000	705,000
Estimated Annual Water Purchase (kgal)	374,000	719,000	776,000
Estimated Annual Water Purchase Cost	$906,000	$1,656,000	$1,786,000
Estimated Annual Debt Service	$1,400,000	$2,000,000	$2,600,000
Estimated O&M Expense	$325,000	$362,000	$415,000
Estimated Annual Renewal and Replacement	$193,000	$264,000	$344,000
Total Estimated Annual Revenue Requirement	$2,820,000	$4,280,000	$5,140,000
Estimated Cost per kgal	$8.40	$6.60	$7.30
Estimated Customer Monthly Wholesale Cost (5,000 gallon)	$42.00	$33.00	$36.50

kgal = thousand gallons

Section 1
Introduction

Water is a key driver in the success and stability of population trends. In northwest Missouri, many communities depend on access to the Missouri River and its alluvial aquifers or reservoirs for their water supply. Communities without access to these sources purchase water from wholesale suppliers or utilize inconsistent groundwater sources and a few large lakes for supply. This Preliminary Engineering Report (PER) was developed to determine an alternative water supply for the Cities of Cameron, Maysville, Stewartsville, and King City, and Gentry County Public Water Supply District No. 2 (Gentry 2).

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- GNWWC's interest in pursuing a regional solution to water supply needs in the northwest area over the past decade.
- The willingness to add members to the GNWWC regardless of location and size.

This study is one of several studies evaluating how best to address the water supply needs in northwest Missouri.

1.1 Project Description

The project team determined the long-term water demands for Cameron, King City, Gentry 2, Maysville, and Stewartsville and assessed three scenarios for connecting these utilities to the Cameron pipeline water transmission system.

- Base Scenario – Maximum Day Demand to Maysville and Half a Maximum Day Demand to Stewartsville and Cameron.
- Alternate Scenario 1 – Maximum Day Demands to Stewartsville, Cameron, and Maysville.
- Alternate Scenario 2 – Maximum Day Demands to Stewartsville, Cameron, King City, Gentry 2, and Maysville.

Two water supplier alternatives, Kansas City, Missouri (KCMO) and Missouri-American, were evaluated to determine which wholesale supplier would provide the least cost source of potable water supply. This included a comparison of water rates and non-economic factors to recommend a water supplier for the GNWWC. The City of Liberty was contacted as a possible source of supply, but the city was uninterested in being considered at this time. The City of Plattsburg is allowed an allocation up to 10 million gallons per day (MGD) out of Smithville Lake and currently operates a 1.3 MGD water treatment plant (WTP). The GNWWC elected not to consider the City of Plattsburg due to the cost and expense of constructing and maintaining an expansion to the Plattsburg WTP.

Three different scenarios were evaluated for pipeline sizing, cost opinions, and the cost of water purchase as presented above. Hydraulic models were developed for Cameron pipeline alignments and created to develop recommended pipeline sizing, pump station location and size, and storage location and size for these scenarios. This PER also presents cost opinions and cost of water service for the three scenarios.

1.2 Project Background

A group of interested parties and stakeholders from Northwest Missouri established a Water Partnership Planning Group (Water Partnership) consisting of representatives from each of the 12 counties in Northwest Missouri. The 12 counties included: Andrew, Atchison, Buchanan, Caldwell, Clinton, Davies, DeKalb, Gentry, Harrison, Holt, Nodaway, and Worth. The goal of the Water Partnership was to explore options for a regional plan that provides a long-term, affordable, high-quality water supply.

During the 2007 Phase I Study, 83 public water systems in the 12 county area were evaluated with regards to their water supply capacity (including source capacity and treatment capacity), ability to withstand drought, and adequacy of water treatment facilities (including excess capacity, age of treatment facilities, and compliance with drinking water standards). Only 40 of the 83 systems had their own water supply sources. Other potential water supply sources for the 12 county area were identified and evaluated. These sources included aquifers, potential reservoir sites, off stream diversions, and other suppliers (KCMO, Rathburn Reservoir in Iowa, and Missouri-American Water Company of St. Joseph, Missouri). The water supply demands were identified, including the existing unserved population, anticipated population growth, and other needs including commercial and industrial projections. The initial studies identified seven of the current water systems that could serve as hubs in a more comprehensive, long-range plan. These systems have the capacity to continue meeting the needs of their current service area while providing additional water to a regional system. The Water Partnership and an appointed engineering/technical subcommittee were assigned responsibility for identifying and evaluating alternative solutions to address the water supply needs for the 12 county area. The subcommittee identified and evaluated several alternatives, and provided the Water Partnership with a recommended water supply transmission system plan. The recommendation was adopted by the Water Partnership as the best alternative to evaluate for implementation in Phase II of the study.

The Phase II Study, completed March 6, 2009, provided the preliminary planning report with cost estimates for the regional water supply transmission system and a framework for implementing the regional water supply system outlined in Phase I.

The Water Partnership eventually formed the GNWWC that had 24 member utilities as of the beginning of 2011. The GNWWC, along with the USACE and MDNR, also produced a Phase III study in 2010. This study provided a methodology for water supply facilities to compare cost, a discussion of

how current and future regulatory issues may impact groundwater and surface water supplies, and an analysis of the availability, reliability, and quality of current groundwater and surface water supplies.

Phase IV, completed in 2011, produced a Feasibility Study Update and Stage 1 Pipeline PER. The GNWWC Strategic Planning Sub-Committee, along with MDNR and USACE assistance, identified the initial Stage 1 Pipeline alignment. At that time, there were four potential water suppliers identified as alternatives for evaluation: Missouri-American, City of Savannah, City of Plattsburg, and the Atchison County Wholesale Water Commission (ACWWC). At that time, Missouri-American was selected as the least cost water supplier for the first phase of the GNWWC water transmission system.

The focus of Phase V shifted from Phase IV due to an inability to identify utilities on the Stage 1 alignment willing to commit to beginning the endeavor of formalizing and starting on a design of the proposed pipeline alignment. The objectives of Phase V study are as follows:

- Provide a Cameron PER to evaluate two potential sources of water supply (Missouri-American and KCMO) to serve five of the water utilities in the Commission (Cameron, Stewartsville, Maysville, Gentry 2, and King City).
- Provide a Middle Fork WTP and Reservoir Condition Assessment. This was completed and submitted. Middle Fork was found capable of sustaining a portion of the GNWWC demands in the northwest region of the service area.
- Provide GIS data collected for the Commission in order to develop Base Maps and a letter documenting the source of the collection efforts. This was submitted as a separate deliverable.
- Provide a Savannah WTP Assessment Technical Memorandum (TM) to determine the cost effectiveness for the possible purchase of water from the City of Savannah or purchase of the City of Savannah WTP to serve a portion of the GNWWC demands. This was completed and at this time, the City of Savannah is not interested in further negotiations in serving the GNWWC unless under a direct water purchase contract. For the GNWWC, Missouri-American as the source of supply is less costly than Savannah.

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Section 2

Water Demand Projections

Water demand information for the participating utilities presented in Table 2-1 is from the MDNR and previous studies. The MDNR water demand calculations are in Appendix A.

Table 2-1 Water Demand Information for Participating Utilities

Utility	2012 Average Water Demand [2] (gpd)	2012 Maximum Water Demand [3] (gpd)	2050 Projected Average Water Demand [4] (gpd)	2050 Projected Maximum Day Water Demand [3] (gpd)
Cameron [1]	1,660,000	3,320,000	2,545,000	5,090,000
Stewartsville	49,000	98,000	82,000	164,000
Maysville	79,000	158,000	119,000	238,000
King City	100,000	200,000	102,000	204,000
Gentry 2 [5]	44,000	88,000	39,000	78,000

gpd = gallons per day

1 Based on MDNR e-mail dated December 19, 2012, the 2012 demand quantities were used for Cameron and their current customers usage

2 Calculated from MDNR 2010 City Water Demand Straight-line Projections

3 Maximum Day = 2.0 x Average Day Demand

4 From MDNR Average Day Water Demand Calculations "Cities Pop & Water Demand 2050" and "County Pop & Water Demand 2050" from the medium growth alternative.

5 Based on Northwest Missouri Water Commission Water Study of 2010 estimation of Gentry 2 serving 9-percent of Gentry County Population and MDNR County Water Demand Medium Growth Projections for 2010 and Projected (2050) Water Demand.

Table 2-2 presents the total 2050 demands for the three supply scenarios based on the demands summarized in Table 2-1.

- Base Scenario – Maximum Day Demands to Maysville and Half a Maximum Day Demand to Stewartsville and Cameron.
- Alternate Scenario 1 – Maximum Day Demands to Stewartsville, Cameron, and Maysville.
- Alternate Scenario 2 – Maximum Day Demands to Stewartsville, Cameron, King City, Gentry 2, and Maysville.

Table 2-2 Modeling Scenarios

Scenario	Proposed Utilities Served		2050 Maximum Day Water Demand Projection (gallons per day)
	Maximum Day Supplied	Half Maximum Day Supplied	
Base Scenario	Maysville	Stewartsville and Cameron	2,870,000
Alternate Scenario 1	Maysville, Stewartsville, and Cameron	n/a	5,490,000
Alternate Scenario 2	Stewartsville, Cameron, King City, Maysville, and Gentry 2	n/a	5,770,000

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Section 3

Conceptual Design Criteria

EPANET 2.0 modeling software was used to perform a conceptual static hydraulic analysis on the overall system for each scenario. The input parameters used to create the EPANET 2.0 model and the output data are included in Appendix B. Points were assigned for each utility to represent where they would receive water to create the overall system model. The delivery points for each location had been determined in previous reports.

Further modeling is recommended as part of preliminary design activities and should include:

- Extended Period Simulation (EPS) – An EPS simulation is recommended to evaluate transmission system operation of pumps, and storage tank level fluctuations.
- Water Quality – Since a single supply source is used to serve the master meters over long distances, water age should be evaluated to assess the water quality reaching the customers.

3.1 Design Criteria and Pipeline Sizing

The hydraulic criteria used to develop the model are presented in Table 3-1. These criteria were chosen to minimize energy costs while optimizing storage and pumping facilities. A maximum pressure was selected to minimize the need for energy dissipation at delivery points. Most GNWWC members should be able to accept incoming water at this selected pressure without the need for throttling or higher pressure class pipelines. Some utilities may need to install booster pump stations to meet pressure requirements.

Table 3-1 Modeling Development Criteria

Model Constraint	Value
Allowable Friction Headloss Range	5.3 - 15.8 feet per mile
Target Pressure Range	40 - 150 psi
Allowable Pressure Range	35 - 200 psi
Maximum Transmission Velocity	3.5 feet per second
Transmission Storage Tank Volume	10% Transmission Flow
Plant Storage Tank Volume	15% of Transmission Flow
Maximum Horsepower per Pump	300 HP
Hazen-Williams Roughness Coefficient	140

psi = pounds per square inch
HP = horsepower

Due to proposed regulations from MDNR, it is likely that a statute requiring every water transmission system to run at a minimum pressure of 35 psi will be implemented. In order to meet this anticipated MDNR statute, the allowable minimum pressure in the model was set at 35 psi. It was assumed that the pipeline material is polyvinyl chloride (PVC) for all pipes. A pipe roughness of 140 for the Hazen-William's head loss equation was used for all the pipe sizes throughout the model.

3.2 Pumping Facilities

The pump stations were sized to provide flow for peak daily demands in a 24-hour delivery period. Individual pumps were sized for 300 horsepower (HP) to allow low voltage (480 volt or less) equipment while keeping conductor sizes within a reasonable and economical range. A pump station is necessary at the Missouri-American WTP to serve the transmission system.

The methodology used to size the pump stations was performed in a step process:

1. The system head was based on headloss through the pipe and the change in elevation from the pump station to the overflow of the water tower.

2. The brake horsepower (BHp) was determined by multiplying the flow by the head and then divided by efficiency. The BHp is the HP required to pump the water.

3. The motor horsepower (MHp) was determined by dividing the BHp by efficiency. The MHp accounts for inefficiencies in power transfer and system losses.

4. The quantity of pumps was determined by dividing the total HP by 300 (to limit the pump size) and rounding up to the nearest pump number. An additional pump was added for redundancy.

3.3 Water Storage Facilities

The purpose of the water storage facilities is to provide a minimum required pressure of 35 psi throughout the regional water system and a maximum required pressure of 200 psi. Storage facilities were sized in the transmission system for pump station equalization and based on a percentage of the total demand.

Each GNWWC member will be responsible for the individual storage needs. Some storage capacity is available on the transmission system, but it is assumed that each GNWWC member will provide emergency storage and storage for fire flows. Recirculation systems may be needed to maintain disinfectant residuals for each storage tank. Details of the types, sizes, and locations of the proposed water storage facilities are described later in the report.

Section 4

Water Supply Alternatives

This section presents the comparison of two feasible water supply alternatives and a recommended water supply source for the Cameron Pipeline. The two water source options compared were KCMO and Missouri-American. Figure 4-1 shows the base alignment for KCMO. Figure 4-2 shows the base alignment for Missouri-American. The system costs were determined using the same methodology used in the *Stage 1 Report.*

Total costs to purchase and transmit potable water through the transmission system were based on:

- Opinion of probable construction costs (OPCCs) and related annual debt service payments.
- Estimated costs to purchase water.
- Transmission system operation and maintenance (O&M) costs.
- Annual renewal and replacement expenses.

The CDM Smith team contacted the City of Liberty to determine if they would be interested in supplying water to the GNWWC. Based on the communication included in Appendix C – Attachment 1, the City was not interested in being considered at the time this PER was prepared. The City of Plattsburg is allowed an allocation up to 10 MGD out of Smithville Lake and currently operates a 1.3 MGD WTP. The GNWWC elected not to consider the City of Plattsburg due to the cost and expense of constructing and maintaining an expansion to the Plattsburg WTP.

Figures 4-1 and 4-2 present preliminary alignments used for this analysis, and the pipe lengths and sizes for comparison.

4.1 Opinion of Probable Construction Cost

The OPCCs contain allowances for construction contingencies. Contingencies typically vary with the level of effort of the work involved. The American Association of Cost Engineers has developed levels of accuracy for a OPCCs as shown below in Table 4-1.

Table 4-1 Construction Cost Estimating Contingencies

	Study Phase	Design Phase				Bid
		10-20%	30%	60%	90%	
Construction Contingencies[1]	25%	25%	20%	15%	10%[2]	5%[2]

[1] From Association for the Advancement of Cost Engineering (AACE)
[2] From USEPA construction grant and load program. Change order allocation.

As projects become better defined, there are fewer "unknowns" so the contingency value decreases. In general, planning estimate level reports (such as this study) include budget estimates of costs. For example, a study might not identify actual sites for items such as new treatment facilities or alignments for new pipelines. Therefore, physical characteristics such as slope of the land, depth to groundwater, and conflicting utilities are unknown and cannot be included in the cost estimates. For

this report, a contingency factor of 20-percent is used to account for these types of unknowns and is multiplied to the subtotal with general conditions and overhead and profit. The addition of the construction contingency along with any required escalation provides the OPCC.

Table 4-2 lists the OPCCs and estimated annual debt service payments for the two water supply alternatives. The details of the OPCCs are included in Appendix C – Attachment 2.

Table 4-2 OPCCs and Estimated Annual Debt Service Payments for Water Supply Alternatives

Description	OPCC	Annual Debt Service Payment*	Total Debt Service Payment*
KCMO Supplier	$32,340,000	$2,200,000	$44,000,000
Missouri-American Supplier	$20,750,000	$1,400,000	$28,000,000

*Based on 20 years at 3-percent interest assuming Missouri State Revolving Fund is the lending agency.

The KCMO preliminary alignment as shown on Figure 4-1 has approximately 61 miles of pipeline. Other components of the KCMO transmission system are two water storage tanks, two pump stations, and a flow control structure. The Missouri-American preliminary alignment as shown on Figure 4-2 has approximately 39 miles of pipeline. Other components of the Missouri-American transmission system are two water storage tanks, one pump station, and a flow control structure. The description of the components for the KCMO and Missouri-American preliminary alignments are listed in Table 4-3.

Table 4-3 Water Transmission System Components

Description	KCMO Transmission System Quantity	Missouri-American Transmission System Quantity
Pipe		
4-inch diameter	18,000 feet	n/a
6-inch diameter	48,000 feet	48,000 feet
16-inch diameter	255,000 feet	157,000 feet
Water Storage Tank		
300,000 Gallon Elevated Storage Tank	2	1
500,000 Gallon Ground Storage Tank	n/a	1
Pump Station (2.87 MGD)	2	1
200 HP Pumps	2	n/a
250 HP Pumps	2	n/a
450 HP Pumps	n/a	3
Flow Control Structure	1	1

Note: Transmission system details are based on Bartlett & West OPCCs provided in Appendix C – Attachment 2.

4.2 Water Purchase Cost

KCMO's average cost for water is $1.96 per 100 cubic feet or $2.62 per thousand gallons (Appendix C - Attachment 2). KCMO is currently completing a cost of service rate study, which includes water rate increases (Appendix C – Attachment 2). KCMO typically also charges a connection fee, however while the amount of this connection fee was requested, it has not been provided at this time.

Missouri-American's average cost for water is $2.42 per thousand gallons (kgal). Missouri-American does not charge a connection fee.

4.3 Transmission System O&M Costs

The transmission system O&M costs consist of four components: staffing, energy (electricity), storage tank repainting, and pipeline maintenance and repair. The four components are discussed below:

- Staffing costs, for both KCMO and Missouri-American transmission systems, assume a staffing level of one part-time administrative staff and one full-time field employee. Estimated staffing costs include benefits and employer payroll contributions totaling $120,000.
- Electrical costs for both alignments assume pumping operations are active approximately 25-percent of the total hours available in a year. The KCMO transmission system would require two pump stations with an estimated annual energy cost of $180,000 per year assuming a rate cost of $0.12 per kilowatt-hour (kWh). The Missouri-American transmission system would require one pump station $180,000 per year.
- Storage tank recoating is another significant maintenance cost on the conceptual transmission system. It was assumed that the coating the transmission systems used would require a full blast and recoat every 15 years. Recent recoating costs for similar size tanks indicate the present value cost of recoating is approximately $150,000 per tank. Annualizing these costs, the cost to recoat both of the transmission system's storage tanks is budgeted at approximately $20,000 per year.
- The final component of the estimated O&M costs is pipeline maintenance and repair. For this component, it is assumed that one break will occur once per each 20 miles of pipeline each year. The present value repair cost, represents the additional labor cost, equipment cost, and parts, and is estimated at $3,000 per repair. Based on the length of the pipelines, multiplying these two factors calculates an estimated cost of upkeep for the KCMO transmission system at approximately $12,000 per year and the Missouri-American transmission system at approximately $6,000 per year.

Combining these four factors provides the estimated annual O&M costs for the two transmission system options, excluding depreciation. The annual cost for O&M for the KCMO transmission system is $331,000 per year. The Missouri-American transmission system O&M annual cost is $325,000. It is assumed that cash investments set aside for depreciation will gain interest at a rate equal to inflation, which should compensate for price inflation during the lifespan of the facilities.

4.4 Transmission Renewal and Replacement Expenses

Transmission system replacement expenses are essential to managing a water system and are an important component in determining rates. Based on the methodology used in the *Stage 1 Report*, full replacement of each component at the end of its lifespan at the inflated initial construction cost was assumed, minus 40-percent for one-time project incidentals. The expenses, such as easement acquisition and some design costs are not paid again during a replacement project. Projected lifespan is assumed at 20 years for pump stations, 40 years for water storage facilities, and 60 years for the pipeline. It is assumed that cash investments set aside for depreciation will gain interest at a rate equal to inflation, which should compensate for price inflation during the lifespan of the facilities. The estimated expenses for each transmission system, using these assumptions and the data from the OPCCs (Appendix C - Attachment 2), are presented in Table 4-4.

Table 4-4 Renewal and Replacement Expense Comparison

	KCMO Transmission System	Missouri-American Transmission System
Transmission Lines	$228,000	$144,000
Water Storage Tanks	$24,000	$17,000
Pump Station	$48,000	$32,000
Total	**$300,000**	**$193,000**

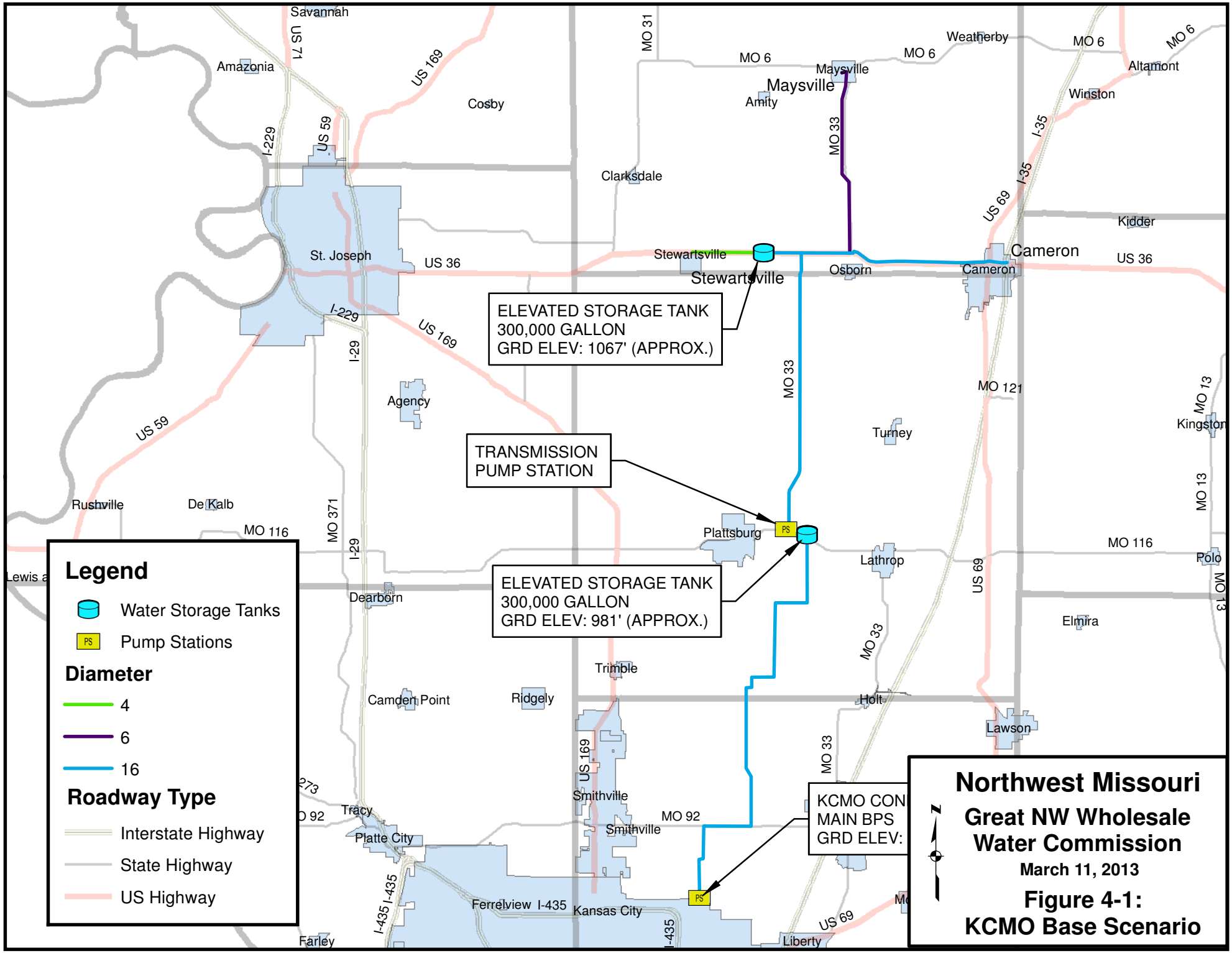
4.5 Water Cost Comparison

Using the information presented in the previous sections, the costs of water from the two different water suppliers were calculated. Table 4-5 summarizes the water cost comparison. Appendix C – Attachment 4 presents the detailed calculations.

Table 4-5 Water Cost Comparison

Description	KCMO Supplier	Missouri-American Supplier
Annual Water Purchased/Produced Volume, kgal	374,000	374,000
Annual Water Sales Volume, kgal	340,000	340,000
Water Purchase Cost	$981,000	$906,000
Annual Transmission System Debt Service	$2,200,000	$1,400,000
Transmission System Annual Costs		
Est. Ann. Renewal and Replacement	$300,000	$193,000
Est. O&M	$331,000	$325,000
Annual Expenses	$3,812,000	$2,824,000
Cost per kgal Sold	$11.30	$8.40

Missouri-American is the least cost provider even without the connection fee included from KCMO. Based on this cost analysis Missouri-American is the recommended primary water source for the Cameron pipeline. The GNWWC chose Missouri-American as the water provider to use in the transmission scenarios, based on the lower cost per kgal presented in this section.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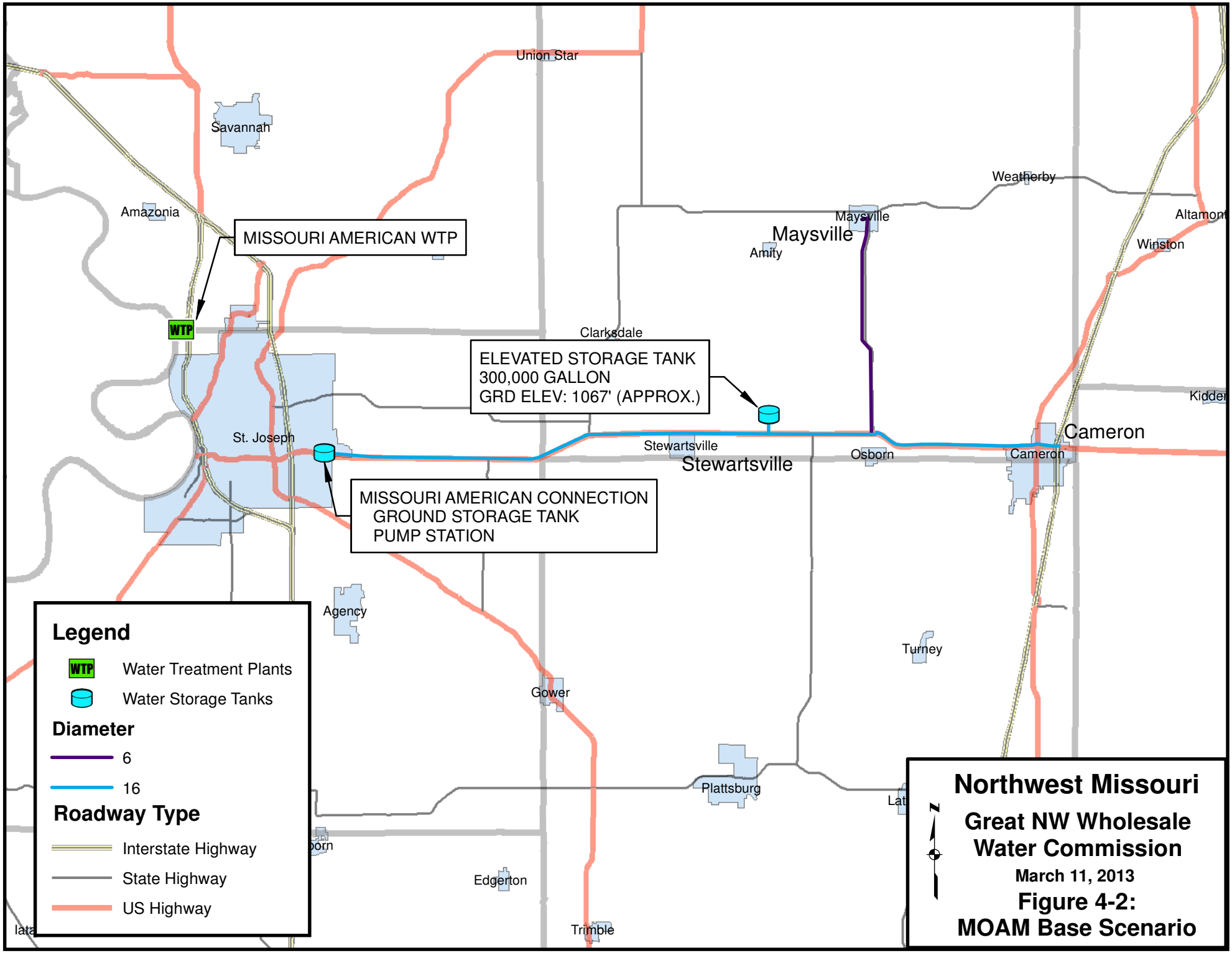
Lathrop
US 69
ELEVATED STORAGE TANK
300,000 GALLON
GRD ELEV: 981' (APPROX.)
Dearborn
Elmira
MO 33
Trimble
Camden Point
Ridgely
Holt
Lawson
MO 33
US 169
Smithville
KCMO CON
MAIN BPS
GRD ELEV:
273
Tracy
O 92
MO 92
Smithville
Platte City
I-435
I-435
Ferrelview I-435
Kansas City
PS
US 69
Farley
I-435
Liberty
Legend
Water Storage Tanks
PS
Pump Stations
Diameter
4
6
16
Roadway Type
Interstate Highway
State Highway
US Highway
Northwest Missouri
Great NW Wholesale
Water Commission
March 11, 2013
Figure 4-1:
KCMO Base Scenario


Union Star
Savannah
Amazonia
MISSOURI AMERICAN WTP
WTP
Clarksdale
ELEVATED STORAGE TANK
300,000 GALLON
GRD ELEV: 1067' (APPROX.)
St. Joseph
MISSOURI AMERICAN CONNECTION
GROUND STORAGE TANK
PUMP STATION
Stewartsville
Stewartsville
Osborn
Maysville
Maysville
Amity
Weatherby
Altamont
Winston
Kidder
Cameron
Cameron
Agency
Turney
Gower
Plattsburg
Edgerton
Trimble
Legend
WTP Water Treatment Plants
Water Storage Tanks
Diameter
6
16
Roadway Type
Interstate Highway
State Highway
US Highway
Northwest Missouri
Great NW Wholesale
Water Commission
March 11, 2013
Figure 4-2:
MOAM Base Scenario

Section 5

Transmission System Alternatives

5.1 Transmission System Description

Based on the GNWWC selection of Missouri-American as the source of water supply to the Cameron Pipeline, modeling of the following three service scenarios was conducted:

- Base Scenario – Maximum Day Demand to Maysville and Half a Maximum Day Demand to Stewartsville and Cameron.
- Alternate Scenario 1 – Maximum Day Demands to Stewartsville, Cameron, and Maysville.
- Alternate Scenario 2 – Maximum Day Demands to Stewartsville, Cameron, King City, Gentry 2, and Maysville.

The Base Scenario transmission system provides a back-up water supply for Cameron and Stewartsville, and the full demand for Maysville. Cameron would only receive half of their water supply in this scenario. Therefore, the system only requires a 16-inch diameter pipe. The transmission line is near capacity when considering their future demand so it would be difficult to expand the system from the original design. Figure 4-2 presents the Base Scenario transmission system.

This system is designed around a centralized storage tank located east of Stewartsville. The tank design does support instantaneous peak day demand. The purpose of the elevated storage tank is to stabilize the flow from the WTP. Water distribution to the three communities occurs by gravity after pumping it from the Missouri-American WTP to the elevated storage tank.

The Alternate Scenario 1 transmission system provides the full demand for Cameron, Maysville, and Stewartsville. The increased flow rate requires a 24-inch pipeline from the Missouri-American WTP to Cameron. Figure 5-1 presents the Alternate Scenario 1 transmission system.

The Alternate Scenario 2 transmission system expands the service area to include King City and Gentry 2. The Missouri-American WTP would be the main supply for all five communities. This alternative would require an elevated storage tank in the same location as the other two scenarios. However, in this scenario it is not possible to distribute the water by gravity to King City and Gentry 2. Additional infrastructure is required to maintain the minimum pressure of 35 psi when it reaches King City. A second pump station and elevated storage tank west of Maysville is required to meet the State's proposed minimum pressure requirements. Figure 5-2 presents the Alternate Scenario 2 transmission system.

The criteria described in Section 3 were used to model pipeline size, pumping facility, and storage requirements for the three service scenarios. The hydraulic modeling results are presented in Appendix B. Table 5-1 summarizes the pipeline sizing and lengths for the three scenarios.

Table 5-1 Missouri-American Pipeline Sizes and Lengths

Pipeline size	Base Pipe Length	Alternate 1 Pipe Length	Alternate 2 Pipe Length
4-inch	-	-	67,000
6-inch	48,000	48,000	-
8-inch	-	-	155,000
16-inch	157,000	-	-
24-inch	-	157,000	157,000
Total Feet	**205,000**	**205,000**	**379,000**
Total Miles	**39**	**39**	**72**

All three scenarios require the construction of a ground storage tank equipped with a pump station at the Missouri-American Water WTP. Based on the criteria provided in this report the pump station will be the same size in all three scenarios. The pump station is designed to deliver the maximum day demand to a centralized elevated storage tank located east of Stewartsville. Alternate 2 is the only one that requires additional infrastructure. An additional pump station and elevated storage tank is required to deliver the water supply to King City and Gentry 2, Gentry County. The second pump station would be located west of Maysville and it would pump to an elevated storage tank at a nearby location. Table 5-2 lists the Missouri-American pump station information for the various scenarios.

Table 5-2 Missouri-American Pumping Facility Details

Description	Flow (gal/min)	Flow (MGD)	Total HP	Number of Pumps
Base Pump Station	1,993	2.87	450	3
Alternate 1 Pump Station	3,812	5.49	550	3
Alternate 2 Main Pump Station	4,007	5.77	600	3
Alternate 2 Secondary Pump Station	196	0.28	50	2

gal/min = gallons per minute

The storage tanks in the system are summarized in Table 5-3.

Table 5-3 Missouri-American Transmission System Model Tank Assumptions

Location	Height (feet)	HGL	Volume (kgal)	Tank Type
Near Stewartsville	130	1194	300 to 600	Elevated
Near King City	130	1216	50	Elevated
Missouri-American	--		500 to 900	Ground

HGL = hydraulic grade line

5.2 Opinion of Probable Construction Cost

The assumptions used for developing the OPCC are outlined in Appendix D of this report. An OPCC was developed so that the GNWWC could make an informed decision about the most feasible project. The costs for engineering are included in the construction costs presented below. Table 5-4 outlines the total cost summaries for each scenario. A detailed cost summary including specific OPCC tables is in Appendix E. A 20-percent contingency was also applied to the OPCCs as described in Section 4.1 of this report.

Table 5-4 Opinion of Probable Costs Summary

Description	Base Scenario	Alternate Scenario 1	Alternate Scenario 2
Pipeline	$14,320,000	$20,800,000	$26,610,000
Water Storage Facilities	$1,240,000	$1,710,000	$2,330,000
Pump Stations	$1,040,000	$1,040,000	$1,450,000
Subtotal	**$16,600,000**	**$23,550,000**	**$30,390,000**
Legal and Financial (5%)	$830,000	$1,180,000	$1,520,000
Contingency and Inflation (20%)	$3,320,000	$4,710,000	$6,080,000
Total	**$20,750,000**	**$29,440,000**	**$37,990,000**

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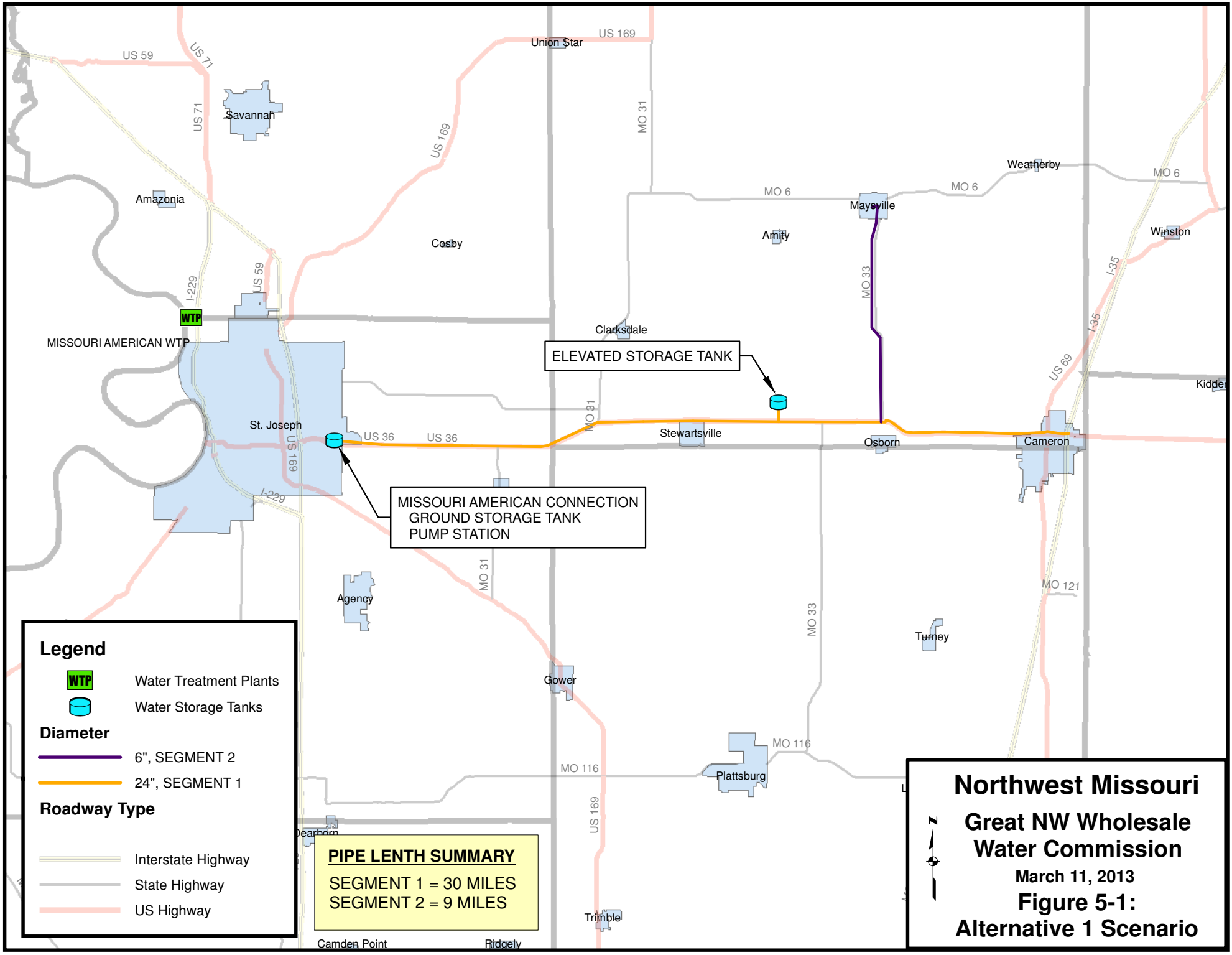
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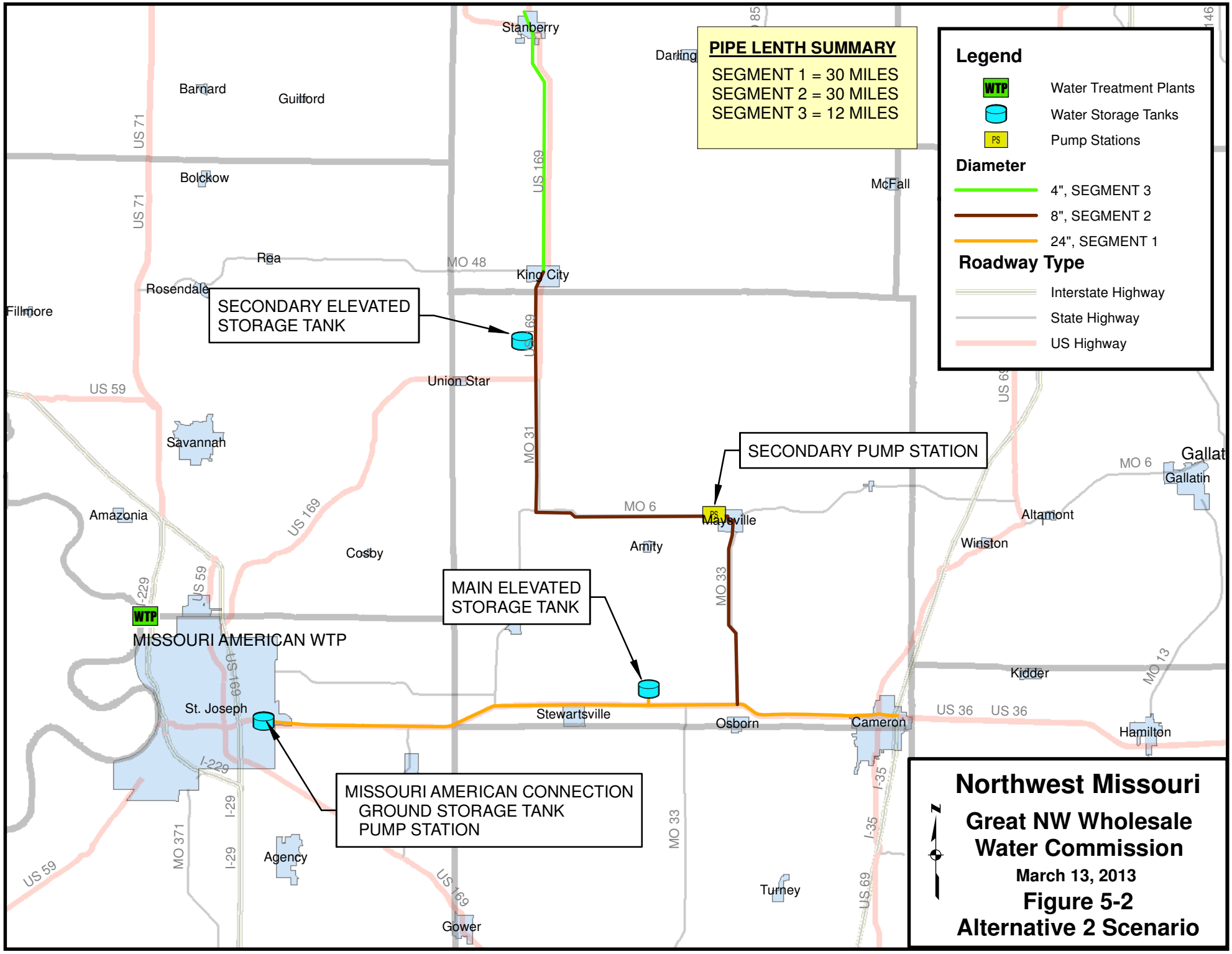
US 71
Savannah
Union Star
US 169
MO 31
Amazonia
Cosby
MO 6
Weatherby
Mayeville
Amity
Winston
I-229
WTP
MISSOURI AMERICAN WTP
Clarksdale
ELEVATED STORAGE TANK
MO 33
I-35
US 69
Kidder
St. Joseph
US 36
Stewartsville
Osborn
Cameron
MISSOURI AMERICAN CONNECTION
GROUND STORAGE TANK
PUMP STATION
Agency
MO 121
Turney
Gower
MO 116
Plattsburg
Trimble
Dearborn
Camden Point
Ridgely
Legend
Water Treatment Plants
Water Storage Tanks
Diameter
6", SEGMENT 2
24", SEGMENT 1
Roadway Type
Interstate Highway
State Highway
US Highway
PIPE LENTH SUMMARY
SEGMENT 1 = 30 MILES
SEGMENT 2 = 9 MILES
Northwest Missouri
Great NW Wholesale Water Commission
March 11, 2013
Figure 5-1:
Alternative 1 Scenario


PIPE LENTH SUMMARY
SEGMENT 1 = 30 MILES
SEGMENT 2 = 30 MILES
SEGMENT 3 = 12 MILES
Legend
WTP
Water Treatment Plants
Water Storage Tanks
PS
Pump Stations
Diameter
4", SEGMENT 3
8", SEGMENT 2
24", SEGMENT 1
Roadway Type
Interstate Highway
State Highway
US Highway
SECONDARY ELEVATED STORAGE TANK
SECONDARY PUMP STATION
MAIN ELEVATED STORAGE TANK
MISSOURI AMERICAN CONNECTION GROUND STORAGE TANK PUMP STATION
MISSOURI AMERICAN WTP
Stanberry
Darling
Barnard
Guilford
Bolckow
McFall
Rea
Rosendale
Fillmore
King City
Union Star
Savannah
Amazonia
Cosby
Mayeville
Amity
Winston
Altamont
Gallatin
Kidder
Hamilton
St. Joseph
Stewartsville
Osborn
Cameron
Agency
Turney
Gower
US 71
US 169
US 59
MO 48
MO 31
MO 6
MO 33
MO 13
US 36
I-229
I-29
I-35
MO 371
US 69
Northwest Missouri
Great NW Wholesale Water Commission
March 13, 2013
Figure 5-2
Alternative 2 Scenario

Section 6

Annual O&M and Annual Renewal and Replacement Costs

Total expenses to purchase potable water and transmit water through the transmission system were based on the O&M costs. This section presents the annual O&M cost assumptions for the three transmission system options (Base Scenario, Alternate Scenario 1, and Alternate Scenario 2). Additionally, this section presents the estimated annual renewal and replacement expenses for the transmission systems.

6.1 Transmission System O&M Costs

O&M costs for the transmission system were based on the same methodology used in the *Stage 1 Report.* The costs were based on four components: staffing, energy (electricity) costs, storage tank repainting, and pipeline maintenance and repair as described in Subsection 4.3. Costs for these four categories have been estimated and the total of these costs are represented as the estimated annual O&M cost for the transmission system in Table 6-1. Appendix E contains the detailed calculations for the O&M costs.

Table 6-1 Transmission System O&M Costs for Transmission Alternatives

Description	Base Scenario	Alternate Scenario 1	Alternate Scenario 2
Staffing	$120,000	$120,000	$120,000
Energy (electricity) costs	$179,000	$216,000	$253,000
Storage Repainting Cost	$20,000	$20,000	$30,000
Pipeline Maintenance cost	$6,000	$6,000	$12,000
Total Cost	**$325,000**	**$362,000**	**$415,000**

6.2 Transmission Renewal and Replacement Expenses

Transmission system replacement expenses are essential to managing a water system and are an important component in determining rates. Based on the methodology used in the *Stage 1 Report*, this PER uses the following assumption: full replacement of each component at the end of its lifespan at the inflated initial construction cost, minus 40-percent for one-time project incidentals. The expenses, such as easement acquisition and some design costs are not paid again during a replacement project. Projected lifespan is assumed at 20 years for pump stations, 40 years for water storage facilities, and 60 years for the pipeline. It is assumed that cash investments set aside for depreciation will gain interest at a rate equal to inflation, which should compensate for price inflation during the lifespan of the facilities.

The estimated annualized replacement expenses assumptions for the Base Scenario alignment (Figure 4-2), Alternate Scenario 1 alignment (Figure 5-1), Alternate Scenario 2 alignment (Figure 5-2), are listed on Table 6-2. Frequently investments can be chosen which exceed the rate of price inflation.

Utilizing this methodology can reduce the amount of cash needed to fund depreciation. Appendix E contains the detailed calculations for the Renewal and Replacement expenses.

Table 6-2 Annual Renewal and Replacement Expenses for Transmission Alternatives

Description	Base Scenario Annual Cost	Alternate Scenario 1 Annual Cost	Alternate Scenario 2 Annual Cost
Pump Station Replacement	$32,000	$32,000	$44,000
Elevated Storage Tank Replacement	$13,000	$18,000	$27,000
Ground Level Storage Tank Replacement	$4,000	$6,000	$6,000
Pipeline Replacement	$144,000	$208,000	$267,000
Total Replacement Expenses	**$193,000**	**$264,000**	**$344,000**

Section 7

Summary of Wholesale Rate Requirements

This section of the report presents the results of financial analyzes required to provide a preliminary estimate of the wholesale rates applicable to this project. Rate requirements are composed of debt service on construction of facilities, O&M expenses of the facilities, and water cost purchased for resale. The three scenarios have three different costs as they have different pipe sizes and lengths. Additionally, the fixed transmission system's debt service cost causes a correlation where increased water sales results in a decreased cost per 1,000 gallons. Table 7-1 presents the summary of wholesale water rates for the Base Scenario and Alternate 1 and Alternate 2. The water sales numbers are based on the current average day water sales. Water purchase amounts allows for 10-percent unaccounted for water in excess of the water sales volume. Unaccounted for water is typically water purchased but not sold to a customer. Examples of sources of unaccounted water are pipeline breaks, flushing, meter inaccuracies, and the fire flows.

Table 7-1 Summary of Wholesale Rate Requirements

Description	Base Scenario	Alternate Scenario 1	Alternate Scenario 2
Estimated Water Sales (kgal)	340,000	654,000	705,000
Estimated Annual Water Purchase (kgal)	374,000	719,000	776,000
Estimated Annual Water Purchase Cost	$906,000	$1,656,000	$1,780,000
Estimated Annual Debt Service	$1,400,000	$2,000,000	$2,600,000
Estimated O&M Expense	$325,000	$362,000	$415,000
Estimated Annual Renewal and Replacement	$193,000	$264,000	$344,000
Total Estimated Annual Revenue Requirement	$2,820,000	$4,280,000	$5,140,000
Estimated Cost per kgal	$8.40	$6.60	$7.30
Estimated Customer Monthly Wholesale Cost (5,000 gallon)	$42.00	$33.00	$36.50

The difference in cost per 1,000 gallons in each of the scenarios is due to the correlation between the fixed capital costs and the amount of water sold, because an increase in water sales decreases the cost per 1,000 gallons due to the fixed annual capital cost.

The necessity and amount of capital and operating reserves and bond issuance costs cannot be established at this time. The bond underwriter will determine the need for reserves to provide investor security based on the actual project phasing plan to be implemented. Typically, if these reserves are deemed necessary, they can be accumulated over a time by the entity. Bond issuance cost is directly related to the size of the bond issues. Without a phasing plan, bond issuance sizes cannot be determined along with bond issuance costs.

For purpose of these financial analyses, the following assumptions are used:

- Annual water usage was calculated using the MDNR daily use water demand average, assuming all wholesale customers are under contract for service.

- No phasing of the issuance of revenue bonds has been assumed. All revenue bonds are assumed to have been issued at a 3-percent interest rate, 20-year term, similar to the current requirements of the Missouri State Revolving Fund loan program with equal annual debt service payments.
- All funding of any operating and capital reserves, which may be necessary for revenue bond issuance has been completed. Reserves may not be necessary should insurance be ultimately obtained.
- Estimated debt service amounts do not reflect impact of any issuance costs nor any capitalized interest during construction.
- Water purchases are from Missouri-American.
- Estimated annual renewal and replacement cost is based on straight-line depreciation projections for various facility types.

To refine the "Summary of Wholesale Rate Requirements" presented in Table 7-1, certain key activities must be initiated and completed in order to have an accurate representation of the project's long term financial requirements. The list below denotes key activities:

- Legal commitment by community members to participate in the project during design, construction, and operation of the project facilities through take or pay agreements.
- Development and execution of agreements between the system and wholesale customers to establish rate stability and strengthen the financial viability of the system.
- Selection of the funding agency to support the project either through the state or federal government or through a private lending/bonding agency.

To provide an idea of how grant funds could impact the overall cost of the project, should a 50-percent grant/ 50-percent loan be applied to the base scenario, the unit cost per 1,000 gallons would be $6.30.

7.1 Factors that Impact the Cost of Water

The cost estimate presented in this section is a snapshot as to what the cost of water would be under a specific situation. There are a variety of factors that impact this number, both positively and negatively. Examples of those factors are:

- Possibly the most important factor is the volume of water sold to each of the connecting members. In general the more water sold, the less the water will cost on a per 1,000 gallon basis.
- Inflation impacting the cost of water and the O&M costs for the system
- Changes to the overall alignment
- The range in water demands between the maximum water withdrawal and the average flows. In general, the narrower the range the less the system will cost reducing the overall construction costs and resulting debt service.
- The addition or removal of members to purchase water from the GNWWC.

Section 8
Conclusions

The recommended potable water supply alternative for the GNWWC is to negotiate a water purchase contract with Missouri-American. However, it is still feasible for the GNWWC to evaluate additional or smaller water purchase contracts from others.

There is still significant work to be conducted in order for this project to be feasible as outlined as part of the "Next Steps." A proposed project schedule for the GNWWC to follow towards construction completion of this project is presented in Figure 8-1.

8.1 Recommended "Next Steps"

The following summarizes the recommended "next steps" to be implemented for this project before moving into final design and construction:

- Steps identified in Section 7 of this report.
- Environmental clearances need to be completed in compliance with the Missouri Water and Wastewater Review Committee Guidelines.
- Public meetings need to be held to comply with the Missouri Water and Wastewater Review Committee Guidelines.
- Conduct survey of proposed pipeline alignment.
- Contact other utilities along the proposed pipeline route to determine if there is any interest in connecting to the proposed transmission line.
- Negotiate a water purchase contract with Missouri-American contingent on obtaining funding and receiving water sales agreements with the GNWWC membership. Discuss finished water quality and hardness impacts during negotiations.
- Obtain project funding through the Missouri Water and Wastewater Review Committee, via Missouri State Revolving Fund or U.S. Department of Agriculture Rural Development Program, or through private lenders.
- Establish a contractual mechanism as to how to administer water sales to the customers and select a method of equitable payment for the GNWWC members.
- Acquire property rights for pump stations, storage tanks, and pipeline.

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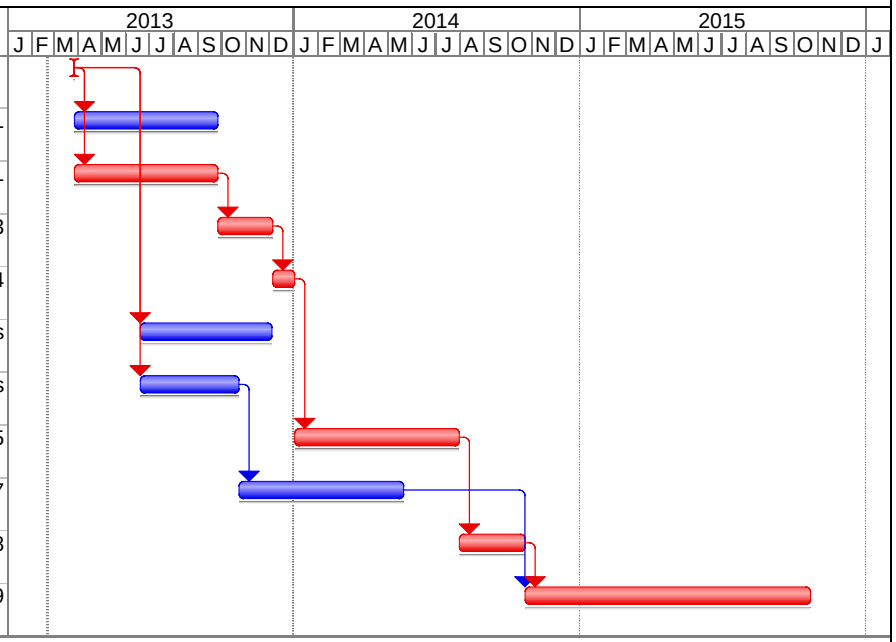
Figure 8-1 Cameron Pipeline Schedule

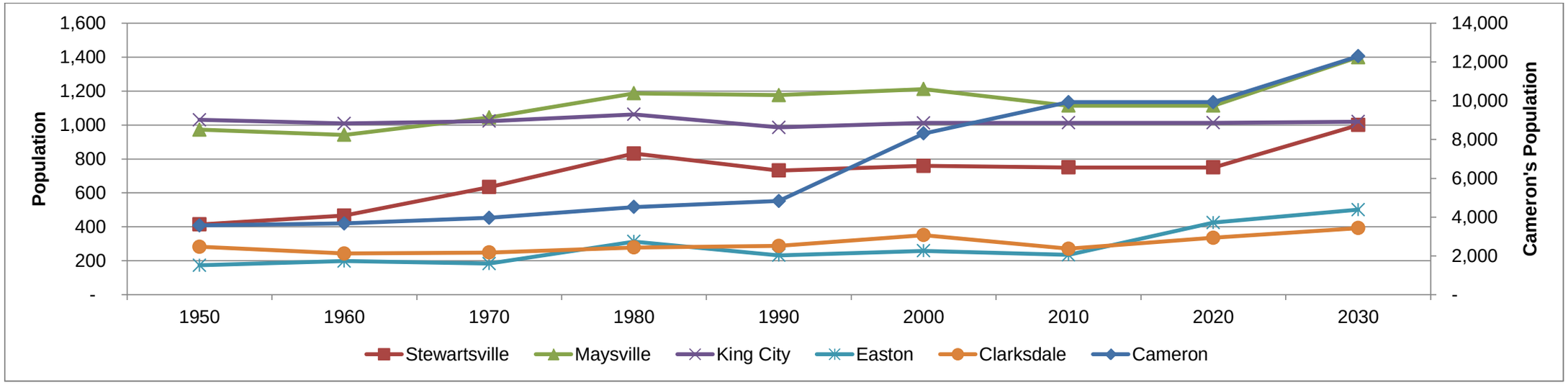
ID	Task Name	Start	Finish	Predecessors
1	Complete PER	Wed 3/27/13	Wed 3/27/13	
2	Secure Funding	Thu 3/28/13	Thu 9/26/13	1
3	Supply and Sales Contract Negotiation	Thu 3/28/13	Thu 9/26/13	1
4	Revise Preliminary Design for Contracts	Fri 9/27/13	Thu 12/5/13	3
5	GNWWC Review	Fri 12/6/13	Thu 1/2/14	4
6	Environmental Clearances	Thu 6/20/13	Wed 12/4/13	1FS+60 days
7	Survey	Thu 6/20/13	Wed 10/23/13	1FS+60 days
8	Final Design	Fri 1/3/14	Thu 7/31/14	5
9	Land Acquisition	Thu 10/24/13	Wed 5/21/14	7
10	MDNR Review	Fri 8/1/14	Thu 10/23/14	8
11	Bidding and Construction	Fri 10/24/14	Thu 10/22/15	10,9



Appendix A

MDNR Calculations

Appendix A



Cities Pop & Water Demand 2050 Tab Summary		
Water Demand Projections (Gallons per day)		
City Water Demand	**2010**	**2050**
Cameron	1,340,955	2,022,513
Stewartsville	47,250	81,556
Maysville	76,866	119,136
King City	100,287	101,676
Easton	15,210	40,302
Clarksdale	17,615	32,452

County Pop & Water Demand 2050 Tab Summary		
Water Demand Projections (Gallons per day)		
Medium Growth	**2010**	**2050**
Clinton	1,348,295	2,229,823
DeKalb	902,440	1,306,084
Gentry	491,874	437,561
Buchanan	7,938,889	14,622,901
Caldwell	782,192	1,436,570

2012 Projections[1]	
Stewartsville	48,965
Maysville	78,980
King City	100,322
Gentry 2	44,024

[1] 2012 Projections interpolated as straight line annual changes between 2050 and 2010.

Gentry 2 water demands were based on Northwest Missouri Water Commission Water Study of 2010 estimation of Gentry 2 serving 9-percent of Gentry County Population and MDNR County Water Demand Medium Growth Projections for Current (2010) and Projected (2050) Water Demand.

Pugh, Terry

From: Stewart, Sarah
Sent: Wednesday, December 19, 2012 1:00 PM
To: Pugh, Terry
Cc: Bruce Hattig (Bruce.hattig@bartwest.com); Ricky Teed
Subject: FW: GNW Revised SOW - Final Version
Attachments: 12-3-12 SOW Cameron Pipeline.doc; Cameron_2012_v2 (4).pptx; Copy of Cameron Population Projections 2000-2050 revised 11 26 2012.xlsx

Terry,

Please revise based on MDNR's comments below. We need to get the new tables to Suzie as soon as possible so that she can contact KCMO.

Thanks!
Sarah

From: McIntosh, Steve [mailto:steve.mcintosh@dnr.mo.gov]
Sent: Wednesday, December 19, 2012 10:04 AM
To: Stewart, Sarah
Cc: Vitello, Diane; Upendram, Sreedhar
Subject: FW: GNW Revised SOW - Final Version

Sarah:
We noticed that you were including the 15 % growth in alternative # 2. Please note that when you revised your scope of work to use the 2050 growth factor you deleted the 15 % growth factor.

12-3 version
Alternate Scenario2 - Maximum Day Demands to Stewartsville, Cameron, King City, Gentry 2 and Maysville. This scenario will also include a 2050 growth factor on the demands. This modeling scenario will be done for only one supplier.

11-27 version
Alternate Scenario2 - Maximum Day Demands to Stewartsville, Cameron, King City, Gentry 2 and Maysville. This scenario will also include a 15-percent growth factor on the demands. This modeling scenario will be done for only one supplier.

Also for Cameron we suggest adding in their current customers for all scenarios: 2012 demand for Cameron plus their current customers should be 1.66 MGD.

Medium Growth	2050	Max day
Clinton PWSD#3	0.441	0.882
Caldwell PWSD#2	0.081	0.162

A 5.77 MGD number for 2050 max day and 2.886 DGD should be correct for 2050 average day. All of these numbers including the PWSDs and counties are in the spreadsheet completed by Sreedhar.

Steve
573.751.7823

From: Stewart, Sarah [mailto:StewartSA@cdmsmith.com]
Sent: Monday, December 03, 2012 8:51 AM
To: McIntosh, Steve; Gard, Scott W NWK; Bruce Hattig; Beezhold, Michael T.; Mosher, Jackie
Subject: GNW Revised SOW - Final Version

All,

Here is the final revised SOW. Scott, please note that I added a sentence at the end of the SOW to document your request for a "list of steps to move forward."

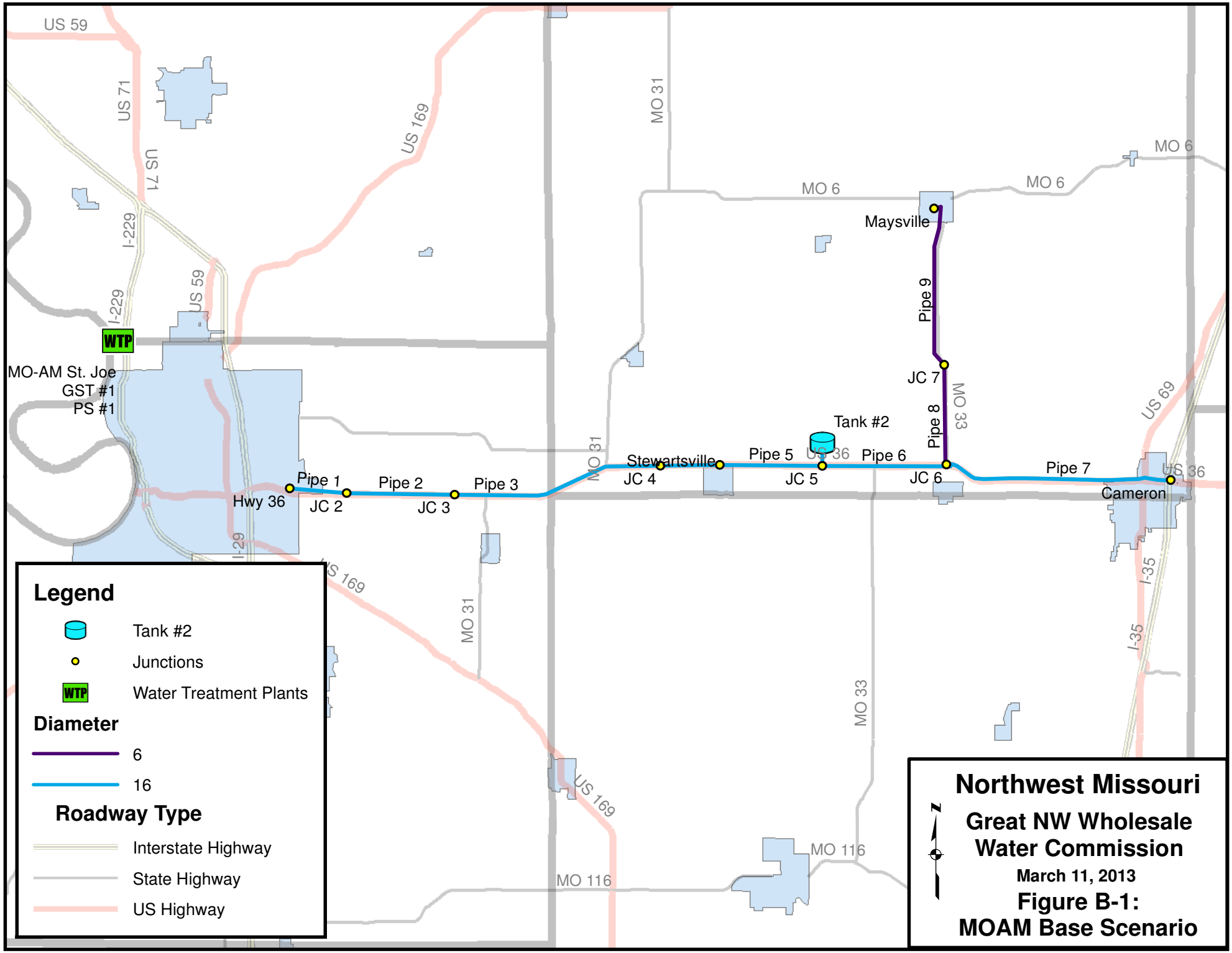
Scott, budget revisions to follow.

Thanks!
Sarah

Sarah A. Stewart, P.E. | Project Manager | CDM Smith | Texas Firm No. F-3043 |3050 Post Oak Blvd. Ste. 300, Houston, TX 77056| ph. 713-423-7300 | e-mail: stewartsa@cdmsmith.com

Appendix B

Hydraulic Modeling Results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US 71
US 169
MO 31
MO 6
I-229
WTP
MO-AM St. Joe
GST #1
PS #1
Maysville
Pipe 9
JC 7
Pipe 8
MO 33
Tank #2
Stewartsville
JC 4
Pipe 5
JC 5
Pipe 6
JC 6
Pipe 7
Cameron
US 69
US 36
Pipe 1
JC 2
Pipe 2
JC 3
Pipe 3
Hwy 36
I-29
I-35
MO 116
Legend
Tank #2
Junctions
WTP
Water Treatment Plants
Diameter
6
16
Roadway Type
Interstate Highway
State Highway
US Highway
N
Northwest Missouri
Great NW Wholesale
Water Commission
March 11, 2013
Figure B-1:
MOAM Base Scenario

```
*********************************************************************
*                            E P A N E T                            *
*                     Hydraulic and Water Quality                   *
*                     Analysis for Pipe Networks                    *
*                           Version 2.0                             *
*********************************************************************
```

Input File: Phase V-2nd Modification_Base_revised.net

Missouri American Water Supply

Link - Node Table:

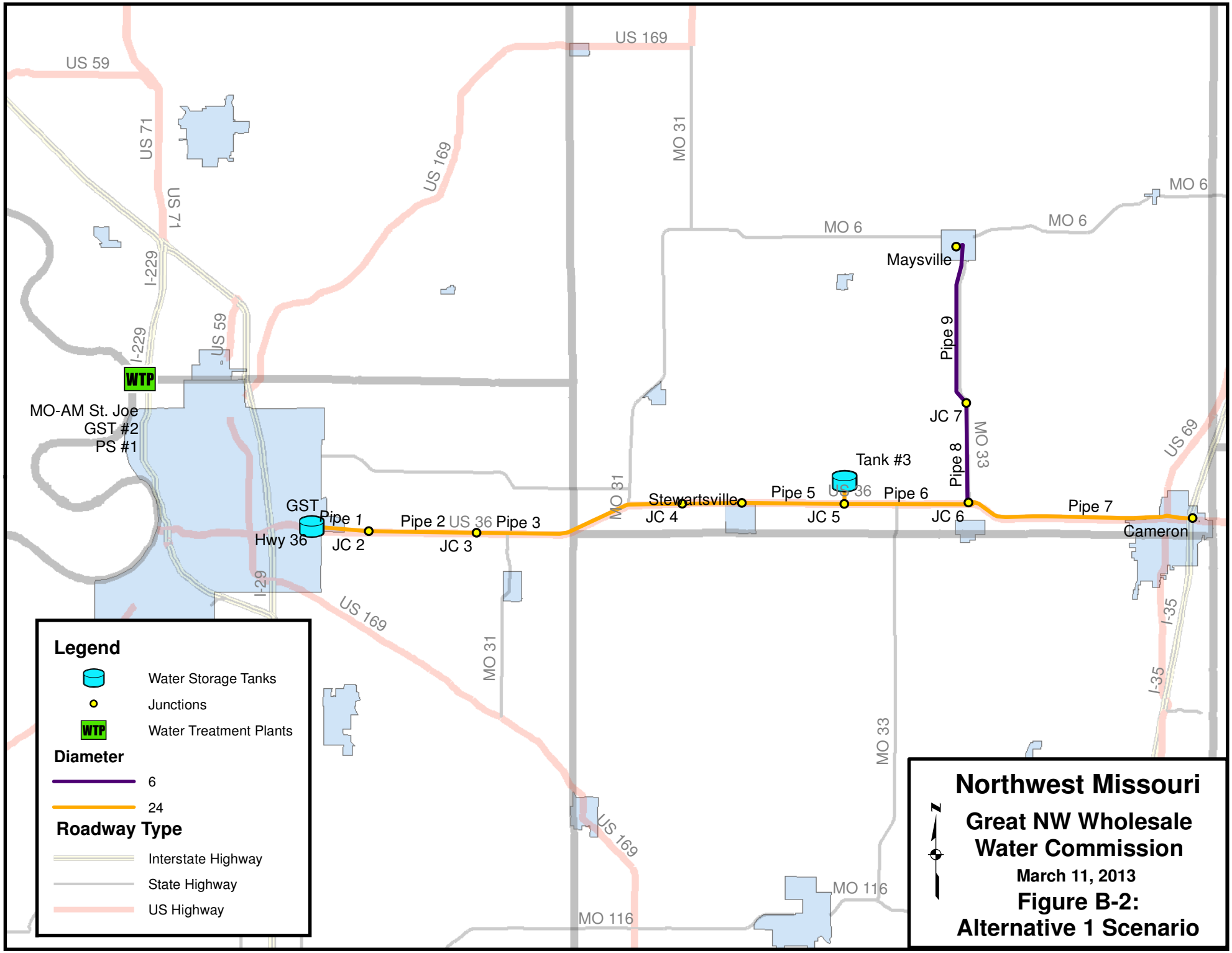
Link ID	Start Node	End Node	Length ft	Diameter in
2	JC2	JC3	18807	16
3	JC3	JC4	37981	16
4	JC4	Stewartville	9351	16
5	Stewartville	JC5	17857	16
6	JC5	JC6	21648	16
7	JC6	Cameron	39897	16
8	JC6	JC7	17411	6
9	JC7	Maysville	29593	6
10	EST2	JC5	30	16
1	Hwy36	JC2	11134	16

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
Hwy36	0.00	1193.89	51.08	0.00	
JC2	0.00	1193.89	153.34	0.00	
JC3	0.00	1193.89	154.64	0.00	
JC4	0.00	1193.89	75.35	0.00	
Stewartville	57.00	1193.89	79.68	0.00	
JC5	0.00	1193.94	55.00	0.00	
JC6	0.00	1154.06	62.42	0.00	
Cameron	1767.00	1091.75	72.25	0.00	
JC7	0.00	1114.04	42.05	0.00	
Maysville	165.00	1046.03	36.41	0.00	
EST2	-1989.00	1194.00	55.03	0.00	Tank

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	0.00	0.00	0.00	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
5	-57.00	0.09	0.00	Open
6	1932.00	3.08	1.84	Open
7	1767.00	2.82	1.56	Open
8	165.00	1.87	2.30	Open
9	165.00	1.87	2.30	Open
10	1989.00	3.17	1.94	Open
1	0.00	0.00	0.00	Open


US 59
US 169
US 71
MO 31
MO 6
I-229
US 59
WTP
MO-AM St. Joe
GST #2
PS #1
Maysville
Pipe 9
JC 7
Pipe 8
MO 33
Tank #3
US 69
GST
Pipe 1
Pipe 2
US 36
Pipe 3
Stewartsville
Pipe 5
Pipe 6
Pipe 7
Hwy 36
JC 2
JC 3
JC 4
JC 5
JC 6
Cameron
I-29
I-35
MO 116
Legend
Water Storage Tanks
Junctions
Water Treatment Plants
Diameter
6
24
Roadway Type
Interstate Highway
State Highway
US Highway
N
Northwest Missouri
Great NW Wholesale Water Commission
March 11, 2013
Figure B-2:
Alternative 1 Scenario

```
*********************************************************************
*                            E P A N E T                            *
*                     Hydraulic and Water Quality                   *
*                     Analysis for Pipe Networks                    *
*                           Version 2.0                             *
*********************************************************************
```

Input File: Phase V-2nd Modification_Alt1_revised.net

Missouri American Water Supply

Link - Node Table:

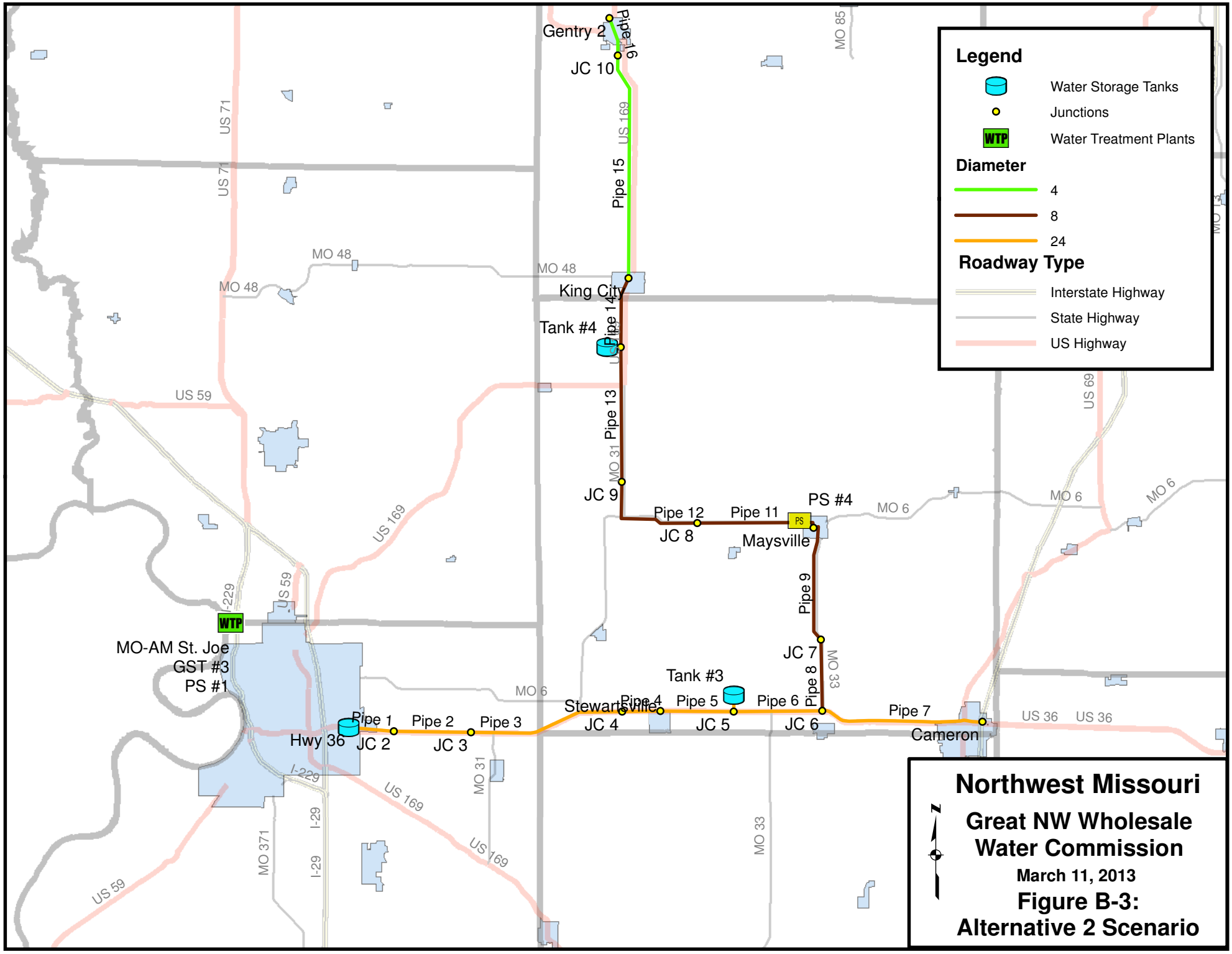
Link ID	Start Node	End Node	Length ft	Diameter in
2	JC2	JC3	18807	24
3	JC3	JC4	37981	24
4	JC4	Stewartville	9351	24
5	Stewartville	JC5	17857	24
6	JC5	JC6	21648	24
7	JC6	Cameron	39897	24
8	JC6	JC7	17411	6
9	JC7	Maysville	29593	6
10	EST3	JC5	30	24
1	Hwy36	JC2	11134	24

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
Hwy36	0.00	1193.95	73.21	0.00	
JC2	0.00	1193.95	153.37	0.00	
JC3	0.00	1193.95	154.67	0.00	
JC4	0.00	1193.95	75.37	0.00	
Stewartville	114.00	1193.95	79.71	0.00	
JC5	0.00	1193.97	55.02	0.00	
JC6	0.00	1175.54	71.73	0.00	
Cameron	3535.00	1144.31	95.03	0.00	
JC7	0.00	1135.52	51.35	0.00	
Maysville	165.00	1067.51	45.72	0.00	
EST3	-3814.00	1194.00	55.03	0.00	Tank

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	0.00	0.00	0.00	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
5	-114.00	0.08	0.00	Open
6	3700.00	2.62	0.85	Open
7	3535.00	2.51	0.78	Open
8	165.00	1.87	2.30	Open
9	165.00	1.87	2.30	Open
10	3814.00	2.70	0.90	Open
1	0.00	0.00	0.00	Open


Legend
Water Storage Tanks
Junctions
WTP
Water Treatment Plants
Diameter
4
8
24
Roadway Type
Interstate Highway
State Highway
US Highway
Gentry 2
JC 10
Pipe 16
Pipe 15
King City
Tank #4
Pipe 14
Pipe 13
JC 9
Pipe 12
Pipe 11
PS #4
JC 8
Maysville
Pipe 9
JC 7
Pipe 8
Tank #3
Pipe 4
Pipe 5
Pipe 6
Pipe 7
Stewartsville
JC 4
JC 5
JC 6
Cameron
WTP
MO-AM St. Joe
GST #3
PS #1
Pipe 1
Pipe 2
Pipe 3
Hwy 36
JC 2
JC 3
US 71
MO 48
US 59
US 169
I-229
I-29
MO 371
MO 31
MO 33
MO 6
MO 85
US 69
US 36
Northwest Missouri
Great NW Wholesale Water Commission
March 11, 2013
Figure B-3:
Alternative 2 Scenario

```
*********************************************************************
*                          E P A N E T                              *
*                   Hydraulic and Water Quality                     *
*                   Analysis for Pipe Networks                      *
*                         Version 2.0                               *
*********************************************************************
```

Input File: Phase V-2nd Modification_Alt2_revised.net

Missouri American Water Supply

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in	
2	JC2	JC3	18807	24	
3	JC3	JC4	37981	24	
4	JC4	Stewartville	9351	24	
5	Stewartville	JC5	17857	24	
6	JC5	JC6	21648	24	
7	JC6	Cameron	39897	24	
8	JC6	JC7	17411	8	
9	JC7	Maysville	29593	8	
10	EST3	JC5	30	24	
11	Valve	JC8	29549	8	
12	JC8	JC9	27971	8	
13	JC9	EST4	32914	8	
14	EST4	KingCity	17254	8	
15	KingCity	JC10	55320	4	
16	JC10	Gentry2	9501	4	
1	Hwy36	JC2	11134	24	
Valve	Maysville	Valve	#N/A	8	Valve

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
Hwy36	0.00	1193.95	73.20	0.00
JC2	0.00	1193.95	153.36	0.00
JC3	0.00	1193.95	154.66	0.00
JC4	0.00	1193.95	75.37	0.00
Stewartville	114.00	1193.95	79.70	0.00
JC5	0.00	1193.97	55.02	0.00
JC6	0.00	1173.68	70.92	0.00
Cameron	3535.00	1142.46	94.22	0.00
JC7	0.00	1131.67	49.69	0.00
Maysville	361.00	1060.27	42.58	0.00
JC8	0.00	1216.00	72.36	0.00
JC9	0.00	1216.00	68.46	0.00
KingCity	142.00	1202.57	50.94	0.00
JC10	0.00	1086.79	88.30	0.00

Node Results: (continued)

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
Gentry2	54.00	1066.90	55.42	0.00	
Valve	0.00	1216.00	110.06	0.00	
EST3	-4010.00	1194.00	55.03	0.00	Tank
EST4	-196.00	1216.00	55.03	0.00	Tank

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	0.00	0.00	0.00	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
5	-114.00	0.08	0.00	Open
6	3896.00	2.76	0.94	Open
7	3535.00	2.51	0.78	Open
8	361.00	2.30	2.41	Open
9	361.00	2.30	2.41	Open
10	4010.00	2.84	0.99	Open
11	0.00	0.00	0.00	Open
12	0.00	0.00	0.00	Open
13	0.00	0.00	0.00	Open
14	196.00	1.25	0.78	Open
15	54.00	1.38	2.09	Open
16	54.00	1.38	2.09	Open
1	0.00	0.00	0.00	Open
Valve	0.00	0.00	0.00	Closed Valve

Appendix C

Water Supply Alternative Support Documents

Attachment 1
Correspondence

Pugh, Terry

From: Bruce Hattig [bruce.hattig@bartwest.com]
Sent: Tuesday, January 29, 2013 9:36 AM
To: Stewart, Sarah; Pugh, Terry; Ricky Teed
Cc: McIntosh, Steve
Subject: Liberty's consent

Terry and Ricky,
Attached is an email string indicating:

- Liberty's message not to consider providing service to the Commission.
- Charlie Stevens' consent to include this message in our report.

I am not sure where this will go into the report, but please be sure to add it……

Bruce Hattig, P.E.

BARTLETT & WEST
SERVICE. THE BARTLETT & WEST WAY.

228 NW Executive Way
Lee's Summit, MO 64063
General Office: 816-525-3562
Direct Dial: 816-282-6362
Cell: 816-898-4118
Email: bruce.hattig@bartwest.com
www.bartwest.com

From: CSTEVENS@ci.liberty.mo.us [mailto:CSTEVENS@ci.liberty.mo.us]
Sent: Tuesday, January 29, 2013 9:19 AM
To: Bruce Hattig
Subject: Re: follow up to 1-24-13 phone call

Bruce,

Please feel free to include my message in the report for the Commissioner's.

Thank you,
In Service,
Charles G. Stevens
Director of Utilities
City of Liberty, MO.

From: Bruce Hattig <bruce.hattig@bartwest.com>
To: "cstevens@ci.liberty.mo.us" <cstevens@ci.liberty.mo.us>
Date: 01/29/2013 09:16 AM
Subject: follow up to 1-24-13 phone call

Charlie,

Thanks again for getting back to me so quickly with your message, "The Liberty Utilities Department does not want to consider providing wholesale service to the Great NW Wholesale Water Commission, at this time." I've communicated your message to the Commission's leadership and to the two governmental agencies sponsoring the project. MDNR, who is one of the sponsors, has asked that we document your message in our report. I've explained to MDNR that I did not have your consent to include your message in a report.

Please respond to this email with a message that we *can* or *cannot* include your message in the report as indicated in the quotes above. A preliminary version of the report will likely be in the public record by February 13th.

Regards,

Bruce Hattig, P.E.
BARTLETT & WEST
SERVICE. THE BARTLETT & WEST WAY.
228 NW Executive Way
Lee's Summit, MO 64063
General Office: 816-525-3562
Direct Dial: 816-282-6362
Cell: 816-898-4118
Email: bruce.hattig@bartwest.com
www.bartwest.com

Attachment 2
OPCCs

Date: 26 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

BASE DESIGN

Missouri American Opinion of Probable Construction Cost (OPCC)

Kansas City Construction Cost Index (KC CCI) Valı

February 2013 =	10670.62
December 2010 =	10410.12
March 2009 =	9667.81
December 2001 =	6477.21

OPCC Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
6	48,000	$ 27.71	$ 1,340,000
16	157,000	$ 82.65	$ 12,980,000
		Total	**$ 14,320,000**

OPCC Water Storage Tanks/Stand Pipes

Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
2	130	300	$ 860,000
GST-1	--	500	$ 380,000
		Total	**$ 1,240,000**

OPCC Pump Stations/Flow Control

Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total Required HP	HP per Pump	Number of Pumps	Extension[1]
1	1,993	2.87	390	450	300	3	$ 950,000
Flow Control Structure	--	--	--	--	--	--	$ 90,000
						Total	**$ 1,040,000**

1) Notes: Unit prices include design, construction administration, resident inspection, material, installation, land, and incidentals.

2) Notes: Pipe lengths were rounded to the nearest 1,000, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Total Construction Cost

Transmission Lines	$ 14,320,000
Water Storage Tanks	$ 1,240,000
Pump Stations	$ 1,040,000
Total	$ 16,600,000

MO American Total Cost Summary

Construction, Land & Engineering	$ 16,600,000
Legal & Financial (5%)	$ 830,000
Contingency & Inflation (20%)	$ 3,320,000
Total	$ 20,750,000

BARTLETT & WEST

Date: 18 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

Kansas City Missouri Opinion of Probable Cost (OPCC)

Kansas City Construction Cost Index (KC CCI) Value

February 2013 =	10670.62
December 2010 =	10410.12
March 2009 =	9667.81
December 2001 =	6477.21

OPCC Pipeline[2]			
Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
4	18000	$ 15.87	$ 290,000
6	48,000	$ 27.71	$ 1,340,000
16	255,000	$ 82.67	$ 21,090,000
		Total	$ 22,720,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 1,000, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Elevated Water Storage Tanks/Stand Pipes			
Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
1	100	300	$ 780,000
1	100	300	$ 780,000
		Total	$ 1,560,000

OPCC Pump Stations/Flow Control						
Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	Number of Pumps	Extension[1]
2	1,993	2.87	312	250	2	$ 800,000
3	1,993	2.87	247	200	2	$ 690,000
Flow Control Structure	--	--	--	--	--	$ 90,000
					Total	$ 1,580,000

BARTLETT & WEST

Date: 18 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

Kansas City Missouri Opinion of Probable Cost (OPCC)

OPCC Total Construction Cost	
Transmission Lines	$ 22,720,000
Elevated Water Storage Tanks	$ 1,560,000
Pump Stations	$ 1,580,000
Total	$ 25,860,000

KCMO Total Cost Summary	
Construction, Land & Engineering	$ 25,860,000
Legal & Financial (5%)	$ 1,300,000
Contingency & Inflation (20%)	$ 5,180,000
Total	$ 32,340,000

BARTLETT & WEST

Attachment 3
KCMO Water Costs

Pugh, Terry

From: Stewart, Sarah
Sent: Thursday, February 21, 2013 6:38 PM
To: Pugh, Terry
Subject: FW: Response to GNWWC Questions
Attachments: Figure 1 - Base Scenario.pdf; Worksheet 1 - Water Demand.pdf; Connection Point.pdf; KCMO Water Rates.pdf

Terry,

Would you please make sure all of this gets captured on Projectwise?

Thanks!
Sarah

From: Carpenter, Suzenne
Sent: Thursday, February 21, 2013 7:40 AM
To: Stewart, Sarah; Bruce Hattig (bruce.hattig@bartwest.com)
Subject: FW: Response to GNWWC Questions

Sarah and Bruce,
Please see below from KCMO.
Thanks,
Suzie

Suzie Carpenter | Project Manager | CDM Smith | 9200 Ward Parkway Suite 500 Kansas City MO 64114 |
Office: 816-412-3108 | Cell: 816-698- 6546 | carpenters2@cdmsmith.com | cdmsmith.com

---

From: Andy Shively [mailto:Andy.Shively@kcmo.org]
Sent: Wednesday, February 20, 2013 8:04 PM
To: Carpenter, Suzenne
Cc: Sean Hennessy; Kelly Finn; Roger Lehr
Subject: Response to GNWWC Questions

Let me know if you need anything else.

Andy

1. Is KCMO interested in providing wholesale water to the Commission? **Yes.**
2. If yes, please provide the following:
   A. Capital or Connection Charge. **To be negotiated.**

   B. Location for the proposed Connection: **west side of I-35 at Highway 69 on the Clay County Transmission Main at Station 101+20 (See attached Connection Point.pdf)**

   C. Capacity and size of the pipeline supplying the connection: **24-inch, 10.1 MGD capacity.**

   D. Available flow capacity**: KCMO has a number of improvements currently underway (study, design, or construction phases) for the North Booster system. These improvements include the following:**

1. **North Eastern 24-inch Transmission Main, NE 96th Street to NE 106th Street. Additional pipeline capacity to 20-inch NE Cookingham Road.**
2. **Elevated storage tank at Highway 291 & I-435. Additional 2.0 MG emergency and equalization storage for North Booster System.**
3. **Shoal Creek Pump Station and Reservoir at Hwy 152 and Shoal Creek Parkway. Additional booster pumping and ground level reservoir similar to Arrowhead Booster Pump Station.**
4. **Arrowhead Transmission Main Phases 3 and 4: Additional transmission main capacity from the Water Treatment Plant to the Arrowhead Pump Station for the North Booster system.**

Black & Veatch is updating the North System model for planned future improvements and projected water demands in 5-year intervals through the year 2035. This modeling effort should be complete within approximately 3 months. We intend to include the proposed GNWWC demands in this modeling effort to ensure the schedule for our North Booster system improvements would be sufficient to meet the GNWWC demands as required.

E. Available hydraulic grade line elevation**. Accurate hydraulic grade line information for GNWWC demands with the future improvements would be supplied with the modeling efforts described above. A typical HGL for the North Booster System in the vicinity of the Clay County Transmission Main at NE Cookingham Road is 1145.**

F. Wholesale purchase rate today as well as planned rate increases into the future.

The current wholesale water service rates are the following:

Commodity Charge: $1.89 per 100 cubic feet (Restricted) or
$1.95 per 100 cubic feet (Unrestricted).

Repump Charge: $0.18 per 100 cubic feet

The proposed wholesale water service rates as of May 1, 2013 (subject to Council approval) are the following:

Commodity Charge: $1.99 per 100 cubic feet (Restricted) or
$2.05 per 100 cubic feet (Unrestricted).

Repump Charge: $0.18 per 100 cubic feet (no change in Repump Charge)

In addition, there is a monthly service charge, based on meter size. Complete current rate information is attached. We anticipate future rate increases to be limited to inflation.

Attachment 4
Water Cost Comparison Calculations

Sheet 2: Cameron Assessment MO AM Base Distribution Cost

Sheet 3: Cameron Assessment Water Purchase Cost Calculation by Scenario

Sheet 4: Cameron Assessment Water Supplier Cost Comparison Calculations

Sheet 5: Cameron Assessment KCMO Base Distribution Cost

Sheet 6: Cameron Assessment KCMO Water Purchase Cost Calculations

Sheet 7: Cameron Assessment Water System Scenario Demands Calculations

Sheet 8: Cameron Assessment 2050 Water Demands Calculations

CDM Smith

PROJECT: Phase V Cameron Assessment | COMPUTED BY : TAP | CHECKED BY: SAS
JOB NO.: 51115-85333 | DATE : 2/27/2013 | REVIEWED BY: AMC
CLIENT: USACE KC District | REVISION NO.: | PAGE NO. :

Description:

Sheet 2: Cameron Assessment MO AM Distribution Cost

Distribution Replacement Costs

OPCC Break Down - Provided by Bartlett & West				Annualized Replacement Costs			
	Base	**Alt 1**	**Alt 2**	**Base**	**Alt 1**	**Alt 2**	**Proposed Life**
Transmission Lines	$ 14,320,000	$ 20,800,000	$ 26,610,000	$ 144,000	$ 208,000	$ 267,000	60
Elevated Water Storage Tanks	$ 860,000	$ 1,190,000	$ 1,770,000	$ 13,000	$ 18,000	$ 27,000	40
Ground Water Storage Tank	$ 380,000	$ 520,000	$ 560,000	$ 4,000	$ 6,000	$ 6,000	
Pump Station	$ 950,000	$ 950,000	$ 1,300,000	$ 29,000	$ 29,000	$ 39,000	20
Flow Control Structure	$ 90,000	$ 90,000	$ 150,000	$ 3,000	$ 3,000	$ 5,000	
Total	**$ 16,600,000**	**$ 23,550,000**	**$ 30,390,000**	**$ 193,000**	**$ 264,000**	**$ 344,000**	

Pump Stations: Base and Alt 1 have one pump station, and Alt 2 has 2 pump stations

Replacement Cost = 2013 OPCC Value * (1-0.4) [Proposed Life Span; 40% of initial OPCC is assumed as a one time expense]

Proposed lifespan (Ref. 4): 20 years for pump stations, 40 years for storage facilities, 60 years for pipelines

Elevated Water Storage Tanks: Base and Alt 1 have one tank, and Alt 2 has 2 tanks

O&M Costs

O&M Cost Summary per year	Base	Alt 1	Alt 2
Staffing	$ 120,000	$ 120,000	$ 120,000
Electrical	$ 179,000	$ 216,000	$ 253,000
Storage Tanks	$ 20,000	$ 20,000	$ 30,000
Piping	$ 6,000	$ 6,000	$ 12,000
Total O&M	$ 325,000	$ 362,000	$ 415,000

Staffing Assumptions:

$120,000

1 part time ADMIN and 1 full time field service employees, Employee cost is $40,000 for part-time per year and $80,000 for full time per year

Electrical Assume PS operates 50% of the time

	HP	KW	KW*HR	Cost / KWH	Annual Cost	KWH rounded
Base	450	340	1489200	0.12	$ 179,000	1,489,000
Alt 1	550	410	1795800	0.12	$ 216,000	1,796,000
Alt 2	650	480	2102400	0.12	$ 253,000	2,102,000

Base Scenario: Required 450 HP, 3 active 300 HP pumps per pump station (OPCC report from B&West)

Alt 1 Scenario: Required 550 HP, 3 active 300 HPpumps per pump station (OPCC report from B&West)

Alt 2 Scenario: Required 650 HP, 3 active 300 HP pumps and Required 2 active 50 HP pumps per pump station (OPCC report from B&West)

Storage Tanks $10,000 per tank | Base/Alt 1 | Alt/2

No. of Tanks 2 3 (OPCC report from B&West)

Base and Alt 1 Scenario have 1 ground and 1 elevated tank

Alt 2 Scenario has 1 ground and 2 elevated tank

Assumed $150K every 15 years for repainting and maintenance

Pipelines:

	Base	Alt 1	Alt 2
Total Pipeline Mileage	39	39	72
Total Breaks Per Year	2	2	4
Total Line O&M	$6,000	$ 6,000	$ 12,000

Assume 1 break every 20 miles and $3000 to fix each break

OPCC

	Base	Alt 1	Alt 2
Construction Land & Engineering	$ 16,600,000	$ 23,550,000	$ 30,390,000
Legal & Financial	$ 830,000	$ 1,180,000	$ 1,520,000
Contingency & Inflation	$ 3,320,000	$ 4,710,000	$ 6,080,000
Total OPCC	**$ 20,750,000**	**$ 29,440,000**	**$ 37,990,000**

Base Scenario

Pipeline size	Pipe length	$/ft	Cost
6"	48,000	$27.71	$ 1,340,000
16"	157,000	$82.65	$ 12,980,000
			$ -
			$ -
			$ -
Feet	205,000		$ 14,320,000
mile	**39**		

Alternative 1

Pipeline size	Pipe length	$/ft	Cost
6"	48,000	$27.71	$ 1,340,000
24"	157,000	$123.91	$ 19,460,000
			$ -
			$ -
			$ -
Feet	**205,000**		$ 20,800,000
mile	**39**		

Alternative 2

Pipeline size	Pipe length	$/ft	Cost
4"	67,000	$15.87	$ 1,070,000
6"		$27.71	$ -
8"	155,000	$39.17	$ 6,080,000
24"	157,000	$123.91	$ 19,460,000
			$ -
Feet	**379,000**		$ 26,610,000
mile	**72**		

Pipeline Source (OPCC report from B&West)

Annual GNWWC Distribution System Debt Service

50%Grant/50% Loan

	Annual	Total Payment
20 years at 3%	$ 700,000	$ 14,000,000

Annual GNWWC Distribution System Debt Service

	Base		Alt 1		Alt 2	
	Annual	Total Payment	Annual	Total Payment	Annual	Total Payment
20 years at 3%	$ 1,400,000	$ 28,000,000	$ 2,000,000	$ 40,000,000	$ 2,600,000	$ 52,000,000

CDM Smith	PROJECT: Phase V Cameron Assessment	COMPUTED BY : TAP	CHECKED BY: SAS
	JOB NO.: 51115-85333	DATE : 2/27/2013	REVIEWED BY: AMC
	CLIENT: USACE KC District	REVISION NO.:	PAGE NO. :

Description:

Sheet 3: Cameron Assessment Water Purchase Cost Calculations by Scenario

2013 Water Purchase Costs

		Column 1	*Column 2*	*Column 3*	*Column 4*
	Annual Water Purchase Volumes	Base Scenario	Alternate 1	Alternate 2	
		kgal/ Month	kgal/ Month	kgal/ Month	
Line 1	Annual water	374,000	719,000	776,000	
Line 2	monthly water	31,167	59,917	64,667	

Base Scenario

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 3	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 4	For the first	100	$4.9217	$500	
Line 5	For the next	1900	$3.8222	$7,300	
Line 6	For the next	3000	$3.1847	$9,600	
Line 7	For everything over 5MG/Month	26,167	$2.1721	$56,800	
Line 8	Total Monthly Cost to Purchase Water from Missouri-American			$75,500	
Line 9	Total Annual Water Cost			$906,000	$2.42

Alternate 1

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 10	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 11	For the first	100	$4.9217	$500	
Line 12	For the next	1900	$3.8222	$7,300	
Line 13	For the next	3000	$3.1847	$9,600	
Line 14	For everything over 5MG/Month	54,917	$2.1721	$119,300	
Line 15	Total Monthly Cost to Purchase Water from Missouri-American			$138,000	
Line 16	Total Annual Water Cost			$1,656,000	$2.30

Alternate 2

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 17	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 18	For the first	100	$4.9217	$500	
Line 19	For the next	1900	$3.8222	$7,300	
Line 20	For the next	3000	$3.1847	$9,600	
Line 21	For everything over 5MG/Month	59,667	$2.1721	$129,600	
Line 22	Total Monthly Cost to Purchase Water from Missouri-American			$148,300	
Line 23	Total Annual Water Cost			$1,779,600	$2.29

* Reference 1 source of rates and monthly minimum charge

Line - Column	Link Source
Line 2 - Column 1	Sheet 1: Cameron Assessment Final Table Calculations

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PROJECT: Phase V Cameron Assessment
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Description:

Sheet 4: Cameron Assessment Water Supplier Cost Comparison Calculations

		Column 1	*Column 2*	
		KCMO Supplier	**MO AM Supplier**	
Line 1	**Annual Water Purchased/Produced Volume, kgal** [(1)]	374,000	374,000	
Line 2	**Annual Water Sales Volume, kgal** [(2)]	340,000	340,000	
Line 3	**Water Purchase Cost** [(3)]	$981,000	$ 906,000	
Line 4	**Annual GNWWC Distribution System Debt Service**	$2,200,000	$1,400,000	
	GNWWC Distribution System Annual Costs			
Line 5	*Est. Ann. Renewal and Replacement*	$300,000	$193,000	*2.422459893*
Line 6	*Est. O&M*	$331,000	$325,000	
Line 7	**Annual Expenses**	**$3,812,000**	**$2,824,000**	
Line 8	**Cost per kgal Sold**	**$11.30**	**$8.40**	

Line - Column	Link Source
Line 2 - Column 1 & 2	Sheet 7: Cameron Assessment Water System Scenario Demands
Line 3 - Column 1	Sheet 3: Cameron Assessment MO AM Water Purchase Cost
Line 3 - Column 2	Sheet 6: Cameron Assessment KCMO Water Purchase Cost
Line 4, 5 & 6 - Column 1	Sheet 2: Cameron Assessment MO AM Distribution Cost
Line 4, 5 & 6 - Column 2	Sheet 5: Cameron Assessment KCMO Base Distribution Cost

CDM Smith

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Sheet 5: Cameron Assessment KCMO Base Distribution Cost

Distribution Replacement Costs

OPCC Break Down - Provided by Bartlett & West

Transmission Lines	$22,720,000
Elevated Water Storage Tank	$1,560,000
Pump Stations	$1,490,000
Flow Control Structure	$90,000
Total	$25,860,000

(Assumed Values)

Annualized Replacement Costs	Proposed Life Span (yrs.)	
$228,000	60	
$24,000	40	
$45,000	20	2 pump stations
$3,000	20	
$300,000		

Replacement Cost = 2013 OPCC Value * (1-0.4) [Proposed Life Span; 40% of initial OPCC is assumed as a one time expense]
Proposed lifespan (Ref. 4): 20 years for pump stations, 40 years for storage facilities, 60 years for pipelines

O&M Costs

Summary:

O&M Cost Summary per year	
Staffing	$120,000
Electrical	$179,000
Storage Tanks	$20,000
Piping	$12,000
Total O&M	$331,000

Staffing Assumptions: 1 part time ADMIN and 1 full time field service employees, Employee cost is $40,000 for part-time per year and $80,000 for full time per year
$120,000

Electrical

Assume PS operates 25% of the time				
HP	KW	KW*HR	Cost / KWH	Annual Cost
450	340	1,489,200	0.12	$179,000

KWH rounded: 1,489,000

Base Scenario: Required 450 HP, 2 active 250 HP pumps for one pump station and 2 active 200 HP Pumps for the other pump station (OPCC report from B&West)

Storage Tanks: Assumed $150K every 15 years for repainting and maintenance
$10,000 per tank
No. of Tanks 2 (OPCC report from B&West)
(2 elevated tanks)

Pipelines: Assume 1 break every 20 miles and $3000 to fix each break

Total Pipeline Mileage	61	miles
Total Breaks Per Year	4	
Total Line O&M	$12,000	

(OPCC report from B&West)

OPCC

Construction Land & Engineering	$25,860,000
Legal & Financial	$1,300,000
Contingency & Inflation	$5,180,000
Total OPCC	$32,340,000

$2,200,000	$ 44,000,000	20 years at 3%	
$2,000,000	$ 66,000,000	33 years at 4.75%	

Pipeline size	Pipe length	$/ft	Cost
4"	18,000	$15.87	$ 290,000
6"	48,000	$27.71	$ 1,340,000
8"			$ -
12"			$ -
16"	255,000	$82.67	$ 21,090,000
Feet	**321,000**		$ 22,720,000
mile	**61**		

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Sheet 6: Cameron Assessment KCMO Water Purchase Cost Calculations

2013 Water Purchase Costs

		Column 1	*Column 2*	*Column 3*	*Column 4*
	Annual Water Purchase Volumes	Base Scenario			
		kgal	gal	cubic foot	100 cubic foot
Line 1	Annual water	374,000	374,000,000	50,000,000	500,000
Line 2	Monthly water	31,167	31,166,667	4,166,667	41,667

7.48 gallons equals 1 cubic foot

Base Scenario

		1,000 cubic foot/ Month	Water Purchase Rates* ($/k cubic foot)	Cost per Month for Water Purchase ($)	Average Cost per 100 cubic foot	Average Cost per kgal
Line 3	Monthly Minimum Charge (1)	-	$409.00	$409		
Line 4	Wholesale	41,667	$1.9500	$81,300		
Line 5	Total Monthly Cost to Purchase Water from KCMO			$81,709		
Line 6	Total Annual Water Cost			$980,508	$1.96	$2.62

*Cost per table provided by Ann Casey in e-mail dated January 18, 2013 ($1.95/100 cubic foot)
(1) 12" meter size was chosen for the monthly charge.

Line - Column	Link Source
Line 1 - Column 1	Sheet 1: Cameron Assessment Final Table Calculations

CDM Smith

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Sheet 7: Cameron Assessment Water System Scenario Demands Calculations

		Column 1		*Column 2*	*Column 3*
		Base		**Alternate 1**	**Alternate 2**
Line 1	**50 % of 2050 Max day use**	1,435,000		2,745,000	2,885,000
Line 2	**50 % of 2012 Average Gallons per day**	465,000		895,000	965,000
Line 3	**2012 Average Gallons per year**	339,450,000		653,350,000	704,450,000
Line 4	**2012 Average Thousand gallons per year rounded up to nearest thousandth**	340,000		654,000	705,000
Line 6	**50 % of 2012 Max Day Use Thousand Gallons per year**	523,775		1,001,925	1,053,025

Line - Column	**Link Source**
Line 1 & 2 - Column 1, 2 & 3	Sheet 8: Cameron Assessment Water Demands

CDM Smith	PROJECT: Phase V Cameron Assessment	COMPUTED BY : TAP	CHECKED BY: SAS
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Description:

Sheet 8: Cameron Assessment 2050 Water Demands Calculations

Maximum Demands per Scenario

		Column 1	*Column 2*	*Column 3*	*Column 4*
	Scenario	**2010 Max. Day**	**Half 2010 Max. Day**	**Total 2012 Avg. Demand per Scenario (Gallons per day)**	**Total Max 2050 Demand per Scenario (Gallons per day)**
Line 1	**Base**	Maysville	Stewartsville and Cameron	930,000	2,870,000
Line 2	**Alternate 1**	Maysville, Stewartsville and Cameron	n/a	1,790,000	5,490,000
Line 3	**Alternate 2**	Stewartsville, Cameron, King City, Gentry 2 and Maysville	n/a	1,930,000	5,770,000

Water Demand Projections (Gallons per day)

	Utility	**2012 Avg. Water Demand [2]**	**2012 Max. Water Demand [3]**	**Projected 2050 Avg. Water Demand [5]**	**Projected 2050 Max. Day Water Demand [3]**
Line 4	**Cameron[1]**	1,660,000	3,320,000	2,545,000	5,090,000
Line 5	**Stewartsville**	49,000	98,000	82,000	164,000
Line 6	**Maysville**	79,000	158,000	119,000	238,000
Line 7	**King City**	100,000	200,000	102,000	204,000
Line 8	**Gentry 2 [4]**	44,000	88,000	39,000	78,000

1 Based on MDNR e-mail dated 19DEC2012 the 2012 demand quantities were used for Cameron and their current customers usage

2 Interpolated from MDNR 2010 and 2012 City Water Demand Straight line Projections

3 Maximum Day = 2.0 x Average Day Demand

4 Based on Northwest Missouri Water Commission Water Study of 2010 estimation of Gentry 2 serving 9% of Gentry County Population and MDNR County Water Demand Medium Growth Projections for Current (2010) and Projected (2050) Water Demand

5 From MDNR Avg. Day Water Demand Calculations "Cities Pop & Water Demand 2050" and "County Pop & Water Demand 2050" from the medium growth alternative.

Appendix D

Reference Calculations

Appendix D – Reference Calculations for Supply Alternative Comparison

The reference calculations for each alternative analyzed in this report was derived from the Phase II report. The Phase II report was completed in March 2009 so to adjust for increases in construction costs the Engineering News Record's (ENR) Kansas City Construction Cost Index (KC CCI) was used to reflect the market costs in the project area (see Table D.1).

Table D.1 – KC CCI Values	
Month, Year	KC CCI Value
March, 2009	9,667.81
February, 2013	10,670.62

Pipeline

The pipeline cost was developed to include design, material, installation, and land. Various pipe costs were plotted on a graph to determine an equation for all pipe diameters. Equation D.1 was generated after the estimated pipe costs were developed.

$$Cost = 7 * (Pipe\ Diameter)^{0.9} - 10 \qquad \textit{Equation D.1}$$

Once this equation was generated then the estimated pipe cost for each associated pipe diameter was generated. Table D.2 demonstrates the inflation of pipe prices from March 2009 to February 2013.

Table D.2 – Pipe Prices		
Pipe Diameter (inches)	March 2009(1) Unit Price ($/L.F.)	February 2013(2) Unit Price ($/L.F.)
4	$ 14.38	15.87
6	25.11	27.71
8	35.49	39.71
10	45.60	50.33
12	55.52	61.28
14	65.27	72.04
16	74.88	82.67
18	84.37	93.12
20	93.76	103.48
24	112.26	123.91
30	139.45	153.92
36	166.10	183.33

(1) KC CCI Value = 9667.81

(2) KC CCI Value = 10670.62

Elevated Storage

The elevated storage cost comprises of three main factors 1) fixed factor, 2) height factor, and 3) volume factor. Assumptions for the cost of the three factors in 2009 include are:

- Fixed Factor = $150,000
- Height Factor = $2,500 / foot height
- Volume Factor = $1,000 / 1,000 Gallons Stored

Equation D.2 incorporates all the key factors when considering an elevated storage tank.

$$Cost = (Fixed\ Factor) + (Height\ Factor * Height) + (Volume\ Factor * Volume) \quad \textbf{\textit{Equation D.2}}$$

Table D.3 identifies individual tanks used for the OPCC. Tank ID 1 corresponds to the original OPCC when Kansas City Missouri Water Supply was being compared to the Missouri American Water Supply. When the hydraulic model was developed the main water tower had to be raised an additional 30 feet to meet the 35 psi minimum water pressure throughout the distribution system (see Tank ID 2 & 3). Tank ID represents the required height and capacity to serve King City and Gentry No. 2.

Table D.3 – Elevated Storage Tanks

Tank ID	Height (feet)	Volume (x1,000 gal)	Extension[(1)]
1	100	300	$780,000
2	130	300	$860,000
3	130	600	$1,190,000
4	130	50	$580,000

(1) Cost adjusted upward to represent February 2013 KC CCI

Ground Storage Tank

The ground storage tank cost is based on two current bid costs and two budgetary numbers, therefore no escalation factor is used with these estimates. The assumed height of a ground storage tank is 33'. The ground storage cost comprises of two main factors 1) fixed factor and 2) volume factor.

- Fixed Factor = $160,000
- Volume Factor = $0.44 / Gallon Stored

Equation D.3 incorporates the key factors when considering an elevated storage tank

$$Cost = (Fixed\ Factor) + (Cost\ per\ Gallon * Volume) \quad \textbf{\textit{Equation D.3}}$$

Table D.4 identifies the current cost for a ground storage tank located at the Missouri-American WTP.

Table D.4 – Ground Storage Tanks

Tank ID	Volume (x1,000 gal)	Extension
GST-1	500	$380,000
GST-2	800	$520,000
GST-3	900	$560,000

Pump Station

The pump station cost comprises of three main factors 1) fixed factor, 2) space factor, and 3) horsepower factor. Assumptions for the cost of the three factors in 2009 include are:

- Fixed Factor = $140,000
- Space Factor = $40,000 / Pump
- Horsepower Factor = $2,000 / Hp

Equation D.4 incorporates all the key factors when considering a pump station.

$$Cost = (Fixed\ Factor) + (Sapce\ Factor * \#\ of\ Pumps) + (Hp\ Factor * Hp) \qquad \textbf{\textit{Equation D.4}}$$

Table D.5 identifies pump stations used for the OPCC. Pump Station ID 1 corresponds to any alternative that uses the Missouri American Water Supply. Pump Station 2 &3 were developed when considering the Kansas City Missouri Water Supply option. Pump Station 4 is required on Alternative 2 for the Missouri-American water supply analysis.

Table D.5 – Pump Stations

Pump Station ID	# of Pumps	Horsepower	Extension[(1)]
1	3	300	$950,000
2	2	250	$800,000
3	2	200	$690,000
4	2	50	$350,000

(1) Cost adjusted upward to represent February 2013 KC CCI

Appendix E

Calculations and Cost Opinions

A **Calculation Form (Excel)**

Client:	USACE KC District	**Job #**	51115-85333	**Calc. By:**	TAP
Project:	Phase V Cameron Assessment	**Checked By:**	Sarah A. Stewart	**Date:**	02/26/13
Detail:	Cost Comparison	**Date:**	02/27/13	**Calc. No.:**	--
		Reviewed By:	Ann M. Casey	**Revision#:**	1
		Date:	02/26/13	**Date:**	

Calculation Brief Title: Determine the water use rates based on cost per kgal water from three scenarios for the Stage 1 Pipeline.

1.0 Purpose/Objective

Determine the water use rates based on cost per kgal water from three scenarios for the Stage 1 Pipeline.

2.0 Procedure

1 Determine water demand based on *Ref. 3*
2 Determine current water capacity versus water demand *Ref. 2 and Ref. 3*
3 Summarize water rate from Missouri-American (*Ref. 1*)
4 Summarize OPCC data from Bartlett & West (*Ref. 2*)
5 Determine O&M, Debt Service, Replacement Costs, and Staffing Costs (*Ref. 2*)

3.0 References/Data Sources

1 2012 Water Rates from Missouri American date April 1, 2012.
2 OPCCs provided by Bartlett & West on 02-20-2013 for each Scenario including contingency, land acquisition, engineering & legal
3 *MDNR Avg. Day Water Demand Calculations "Cities Pop & Water Demand 2050" and "County Pop & Water Demand 2050" from the medium growth alternative.*

4.0 Assumptions and Limitations

1 Final numbers rounded up (to nearest thousand for gallons and nearest dollar for monetary calcuations)

5.0 Calculations

Calculations provided on following sheets:	**SHEET TITLE**	**DESCRIPTION**
	Sheet 1: Cameron Assessment Final Table Calculations	Summary Cost Table
	Sheet 2: Cameron Assessment MO AM Distribution Cost	Calculation of MO AM distribution costs
	Sheet 3: Cameron Assessment Water Purchase Cost Calculations by Scenario	Calculation of average MO AM Bulk water rate based on all Scenarios
	Sheet 4: Cameron Assessment Water Supplier Cost Comparison Calculations	Calculation comparing purchase cost of water between KCMO and MO AM
	Sheet 5: Cameron Assessment KCMO Base Distribution Cost	Calculation of KCMO distribution costs based on Base Scenario
	Sheet 6: Cameron Assessment KCMO Water Purchase Cost Calculations	Calculation of average KCMO Bulk water rate based on Base Scenario
	Sheet 7: Cameron Assessment Water System Scenario Demands Calculations	Calculations with water demands breakout by Scenario for calculations
	Sheet 8: Cameron Assessment Water Demands Calculations	Base calculations to determine water demand projects for utilities and for Scenarios
	Sheet 9: Cameron Assessment Electricity Cost Calculations	Calculations to determine cost of electricity per kWh

6.0 Acronyms

D -	Distribution System
EA -	Each
gpm	Gallons per minute
HP	Horsepower
HR	Hour
KC CCI	Kansas City Construction Cost Index
KCMO	Kansas City, Missouri
kgal -	Thousand Gallons
KW	Kilowatt
KWH	Kilowatt Hour
LS -	Lump Sum
MGD -	Million Gallons per Day
MO AM	Missouri American Water
O&M -	Operation and Maintenance

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Description: **Sheet 1: Cameron Assessment Final Table Calculations**

		Column 1	Column 2	Column 3	Column 4
		Base Scenario	**Alternate 1**	**Alternate 2**	**Base Scenario (50% Grant/ 50% Loan Cost)**
Line 1	**Annual Water Purchased, kgal** [(1)]	374,000	719,000	776,000	374,000
Line 2	**Annual Water Sales Volume, kgal** [(2)]	340,000	654,000	705,000	340,000
Line 3	**Missouri American Water Purchase Cost** [(3)]	$ 906,000	$ 1,656,000	$ 1,780,000	$ 906,000
Line 4	**Annual GNWWC Distribution System Debt Service**	$ 1,400,000	$ 2,000,000	$ 2,600,000	$ 700,000
	GNWWC Distribution System Annual Costs				
Line 5	*Est. Ann. Renewal and Replacement*	$ 193,000	$ 264,000	$ 344,000	$ 193,000
Line 6	*Est. O&M*	$ 325,000	$ 362,000	$ 415,000	$ 325,000
Line 7	**Annual Expenses**	**$ 2,824,000**	**$ 4,282,000**	**$ 5,139,000**	**$ 2,124,000**
Line 8	**Cost per kgal Sold**	**$ 8.40**	**$ 6.60**	**$ 7.30**	**$ 6.30**
	Customer Monthly Wholesale Cost (5,000 gallon)	**$ 42.00**	**$ 33.00**	**$ 36.50**	

kgal - thousand gallons

(1) 2010 Max. Day Water demands plus *10% increase for water loss in the distribution system.*

(2) 2010 Max. Day Water demands

(3) Water purchase costs from Missouri-American published rates as of April 1 2012.

Line - Column	**Link Source**
Line 2 - Column 1, 2, & 3	Sheet 7: Cameron Assessment Water System Scenario Demands
Line 3 - Column 1, 2 & 3	Sheet 3: Cameron Assessment MO AM Water Purchase Cost
Line 4, 5 & 6 - Column 1, 2 & 3	Sheet 2: Cameron Assessment MO AM Distribution Cost

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Description:

Sheet 2: Cameron Assessment MO AM Distribution Cost

Distribution Replacement Costs

OPCC Break Down - Provided by Bartlett & West				Annualized Replacement Costs			
	Base	**Alt 1**	**Alt 2**	**Base**	**Alt 1**	**Alt 2**	**Proposed Life**
Transmission Lines	$ 14,320,000	$ 20,800,000	$ 26,610,000	$ 144,000	$ 208,000	$ 267,000	60
Elevated Water Storage Tanks	$ 860,000	$ 1,190,000	$ 1,770,000	$ 13,000	$ 18,000	$ 27,000	40
Ground Water Storage Tank	$ 380,000	$ 520,000	$ 560,000	$ 4,000	$ 6,000	$ 6,000	
Pump Station	$ 950,000	$ 950,000	$ 1,300,000	$ 29,000	$ 29,000	$ 39,000	20
Flow Control Structure	$ 90,000	$ 90,000	$ 150,000	$ 3,000	$ 3,000	$ 5,000	
Total	**$ 16,600,000**	**$ 23,550,000**	**$ 30,390,000**	**$ 193,000**	**$ 264,000**	**$ 344,000**	

Pump Stations: Base and Alt 1 have one pump station, and Alt 2 has 2 pump stations

Replacement Cost = 2013 OPCC Value * (1-0.4) [Proposed Life Span; 40% of initial OPCC is assumed as a one time expense]

Proposed lifespan (Ref. 4): 20 years for pump stations, 40 years for storage facilities, 60 years for pipelines

Elevated Water Storage Tanks: Base and Alt 1 have one tank, and Alt 2 has 2 tanks

O&M Costs

O&M Cost Summary per year	Base	Alt 1	Alt 2
Staffing	$ 120,000	$ 120,000	$ 120,000
Electrical	$ 179,000	$ 216,000	$ 253,000
Storage Tanks	$ 20,000	$ 20,000	$ 30,000
Piping	$ 6,000	$ 6,000	$ 12,000
Total O&M	$ 325,000	$ 362,000	$ 415,000

Staffing Assumptions:

$120,000

1 part time ADMIN and 1 full time field service employees, Employee cost is $40,000 for part-time per year and $80,000 for full time per year

Electrical Assume PS operates 50% of the time

	HP	KW	KW*HR	Cost / KWH	Annual Cost	KWH rounded
Base	450	340	1489200	0.12	$ 179,000	1,489,000
Alt 1	550	410	1795800	0.12	$ 216,000	1,796,000
Alt 2	650	480	2102400	0.12	$ 253,000	2,102,000

Base Scenario: Required 450 HP, 3 active 300 HP pumps per pump station (OPCC report from B&West)

Alt 1 Scenario: Required 550 HP, 3 active 300 HPpumps per pump station (OPCC report from B&West)

Alt 2 Scenario: Required 650 HP, 3 active 300 HP pumps and Required 2 active 50 HP pumps per pump station (OPCC report from B&West)

Storage Tanks $10,000 per tank | Base/Alt 1 | Alt/2

No. of Tanks 2 3 (OPCC report from B&West)

Base and Alt 1 Scenario have 1 ground and 1 elevated tank

Alt 2 Scenario has 1 ground and 2 elevated tank

Assumed $150K every 15 years for repainting and maintenance

Pipelines:

	Base	Alt 1	Alt 2
Total Pipeline Mileage	39	39	72
Total Breaks Per Year	2	2	4
Total Line O&M	$6,000	$ 6,000	$ 12,000

Assume 1 break every 20 miles and $3000 to fix each break

OPCC

	Base	Alt 1	Alt 2
Construction Land & Engineering	$ 16,600,000	$ 23,550,000	$ 30,390,000
Legal & Financial	$ 830,000	$ 1,180,000	$ 1,520,000
Contingency & Inflation	$ 3,320,000	$ 4,710,000	$ 6,080,000
Total OPCC	**$ 20,750,000**	**$ 29,440,000**	**$ 37,990,000**

Base Scenario

Pipeline size	Pipe length	$/ft	Cost
6"	48,000	$27.71	$ 1,340,000
16"	157,000	$82.65	$ 12,980,000
			$ -
			$ -
			$ -
Feet	205,000		$ 14,320,000
mile	**39**		

Alternative 1

Pipeline size	Pipe length	$/ft	Cost
6"	48,000	$27.71	$ 1,340,000
24"	157,000	$123.91	$ 19,460,000
			$ -
			$ -
			$ -
Feet	**205,000**		$ 20,800,000
mile	**39**		

Alternative 2

Pipeline size	Pipe length	$/ft	Cost
4"	67,000	$15.87	$ 1,070,000
6"		$27.71	$ -
8"	155,000	$39.17	$ 6,080,000
24"	157,000	$123.91	$ 19,460,000
			$ -
Feet	**379,000**		$ 26,610,000
mile	**72**		

Pipeline Source (OPCC report from B&West)

Annual GNWWC Distribution System Debt Service

50%Grant/50% Loan

	Annual	Total Payment
20 years at 3%	$ 700,000	$ 14,000,000

Annual GNWWC Distribution System Debt Service

	Base		Alt 1		Alt 2	
	Annual	Total Payment	Annual	Total Payment	Annual	Total Payment
20 years at 3%	$ 1,400,000	$ 28,000,000	$ 2,000,000	$ 40,000,000	$ 2,600,000	$ 52,000,000

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Sheet 3: Cameron Assessment Water Purchase Cost Calculations by Scenario

2013 Water Purchase Costs

		Column 1	*Column 2*	*Column 3*	*Column 4*
	Annual Water Purchase Volumes	Base Scenario	Alternate 1	Alternate 2	
		kgal/ Month	kgal/ Month	kgal/ Month	
Line 1	Annual water	374,000	719,000	776,000	
Line 2	monthly water	31,167	59,917	64,667	

Base Scenario

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 3	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 4	For the first	100	$4.9217	$500	
Line 5	For the next	1900	$3.8222	$7,300	
Line 6	For the next	3000	$3.1847	$9,600	
Line 7	For everything over 5MG/Month	26,167	$2.1721	$56,800	
Line 8	Total Monthly Cost to Purchase Water from Missouri-American			$75,500	
Line 9	Total Annual Water Cost			$906,000	$2.42

Alternate 1

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 10	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 11	For the first	100	$4.9217	$500	
Line 12	For the next	1900	$3.8222	$7,300	
Line 13	For the next	3000	$3.1847	$9,600	
Line 14	For everything over 5MG/Month	54,917	$2.1721	$119,300	
Line 15	Total Monthly Cost to Purchase Water from Missouri-American			$138,000	
Line 16	Total Annual Water Cost			$1,656,000	$2.30

Alternate 2

		1,000 Gallons/ Month	Water Purchase Rates*	Cost per Month for Water Purchase ($)	Average Cost per kgal
Line 17	Monthly Minimum Charge *	--	$1,293.43	$1,300	
Line 18	For the first	100	$4.9217	$500	
Line 19	For the next	1900	$3.8222	$7,300	
Line 20	For the next	3000	$3.1847	$9,600	
Line 21	For everything over 5MG/Month	59,667	$2.1721	$129,600	
Line 22	Total Monthly Cost to Purchase Water from Missouri-American			$148,300	
Line 23	Total Annual Water Cost			$1,779,600	$2.29

* Reference 1 source of rates and monthly minimum charge

Line - Column	Link Source
Line 2 - Column 1	Sheet 1: Cameron Assessment Final Table Calculations

CDM Smith

PROJECT: Phase V Cameron Assessment
JOB NO.: 51115-85333
CLIENT: USACE KC District

COMPUTED BY : TAP
DATE : 2/27/2013
REVISION NO.:

CHECKED BY: SAS
REVIEWED BY: AMC
PAGE NO. :

Description:

Sheet 7: Cameron Assessment Water System Scenario Demands Calculations

		Column 1		*Column 2*	*Column 3*
		Base		**Alternate 1**	**Alternate 2**
Line 1	**50 % of 2050 Max day use**	1,435,000		2,745,000	2,885,000
Line 2	**50 % of 2012 Average Gallons per day**	465,000		895,000	965,000
Line 3	**2012 Average Gallons per year**	339,450,000		653,350,000	704,450,000
Line 4	**2012 Average Thousand gallons per year rounded up to nearest thousandth**	340,000		654,000	705,000
Line 6	**50 % of 2012 Max Day Use Thousand Gallons per year**	523,775		1,001,925	1,053,025

Line - Column	**Link Source**
Line 1 & 2 - Column 1, 2 & 3	Sheet 8: Cameron Assessment Water Demands

CDM Smith	PROJECT: Phase V Cameron Assessment	COMPUTED BY : TAP	CHECKED BY: SAS
	JOB NO.: 51115-85333	DATE : 2/27/2013	REVIEWED BY: AMC
	CLIENT: USACE KC District	REVISION NO.:	PAGE NO. :

Description:

Sheet 8: Cameron Assessment 2050 Water Demands Calculations

Maximum Demands per Scenario

		Column 1	*Column 2*	*Column 3*	*Column 4*
	Scenario	**2010 Max. Day**	**Half 2010 Max. Day**	**Total 2012 Avg. Demand per Scenario (Gallons per day)**	**Total Max 2050 Demand per Scenario (Gallons per day)**
Line 1	**Base**	Maysville	Stewartsville and Cameron	930,000	2,870,000
Line 2	**Alternate 1**	Maysville, Stewartsville and Cameron	n/a	1,790,000	5,490,000
Line 3	**Alternate 2**	Stewartsville, Cameron, King City, Gentry 2 and Maysville	n/a	1,930,000	5,770,000

Water Demand Projections (Gallons per day)

	Utility	**2012 Avg. Water Demand [2]**	**2012 Max. Water Demand [3]**	**Projected 2050 Avg. Water Demand [5]**	**Projected 2050 Max. Day Water Demand [3]**
Line 4	**Cameron[1]**	1,660,000	3,320,000	2,545,000	5,090,000
Line 5	**Stewartsville**	49,000	98,000	82,000	164,000
Line 6	**Maysville**	79,000	158,000	119,000	238,000
Line 7	**King City**	100,000	200,000	102,000	204,000
Line 8	**Gentry 2 [4]**	44,000	88,000	39,000	78,000

1 Based on MDNR e-mail dated 19DEC2012 the 2012 demand quantities were used for Cameron and their current customers usage

2 Interpolated from MDNR 2010 and 2012 City Water Demand Straight line Projections

3 Maximum Day = 2.0 x Average Day Demand

4 Based on Northwest Missouri Water Commission Water Study of 2010 estimation of Gentry 2 serving 9% of Gentry County Population and MDNR County Water Demand Medium Growth Projections for Current (2010) and Projected (2050) Water Demand

5 From MDNR Avg. Day Water Demand Calculations "Cities Pop & Water Demand 2050" and "County Pop & Water Demand 2050" from the medium growth alternative.

Date: 26 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

BASE DESIGN

Missouri American Opinion of Probable Construction Cost (OPCC)

Kansas City Construction Cost Index (KC CCI) Valı

February 2013 =	10670.62
December 2010 =	10410.12
March 2009 =	9667.81
December 2001 =	6477.21

OPCC Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
6	48,000	$ 27.71	$ 1,340,000
16	157,000	$ 82.65	$ 12,980,000
		Total	**$ 14,320,000**

OPCC Water Storage Tanks/Stand Pipes

Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
2	130	300	$ 860,000
GST-1	--	500	$ 380,000
		Total	**$ 1,240,000**

OPCC Pump Stations/Flow Control

Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total Required HP	HP per Pump	Number of Pumps	Extension[1]
1	1,993	2.87	390	450	300	3	$ 950,000
Flow Control Structure	--	--	--	--	--	--	$ 90,000
						Total	**$ 1,040,000**

1) Notes: Unit prices include design, construction administration, resident inspection, material, installation, land, and incidentals.

2) Notes: Pipe lengths were rounded to the nearest 1,000, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Total Construction Cost

Transmission Lines	$ 14,320,000
Water Storage Tanks	$ 1,240,000
Pump Stations	$ 1,040,000
Total	$ 16,600,000

MO American Total Cost Summary

Construction, Land & Engineering	$ 16,600,000
Legal & Financial (5%)	$ 830,000
Contingency & Inflation (20%)	$ 3,320,000
Total	$ 20,750,000

BARTLETT & WEST

Date: 26 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

ALTERNATE 1 DESIGN

Missouri American Opinion of Probable Construction Cost (OPCC)

Kansas City Construction Cost Index (KC CCI) Valu	
February 2013 =	10670.62
December 2010 =	10410.12
March 2009 =	9667.81
December 2001 =	6477.21

OPCC Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
4	0	$ 15.87	$ -
6	48,000	$ 27.71	$ 1,340,000
24	157,000	$ 123.91	$ 19,460,000
		Total	**$ 20,800,000**

OPCC Water Storage Tanks/Stand Pipes

Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
3	130	600	$ 1,190,000
GST-2	--	800	$ 520,000
		Total	**$ 1,710,000**

OPCC Pump Stations/Flow Control

Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	HP per Pump	Number of Pumps	Extension[1]
1	3,812	5.49	270	550	300	3	$ 950,000
Flow Control Structure	--	--	--	--	--	--	$ 90,000
						Total	**$ 1,040,000**

1) Notes: Unit prices include design, construction administration, resident inspection, material, installation, land, and incidentals.

2) Notes: Pipe lengths were rounded to the nearest 1,000, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Total Construction Cost

Transmission Lines	$ 20,800,000
Water Storage Tanks	$ 1,710,000
Pump Stations	$ 1,040,000
Total	$ 23,550,000

MO American Total Cost Summary

Construction, Land & Engineering	$ 23,550,000
Legal & Financial (5%)	$ 1,180,000
Contingency & Inflation (20%)	$ 4,710,000
Total	$ 29,440,000

BARTLETT & WEST

Date: 26 February 2013
By: Ricky Teed
Checked: Bruce Hattig
Re: 16164.013 Great NW Phase V Cameron Assessment

ALTERNATE 2 DESIGN

Missouri American Opinion of Probable Construction Cost (OPCC)

Kansas City Construction Cost Index (KC CCI) Value

February 2013 =	10670.62
December 2010 =	10410.12
March 2009 =	9667.81
December 2001 =	6477.21

OPCC Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
4	67,000	$ 15.87	$ 1,070,000
8	155,000	$ 39.17	$ 6,080,000
24	157,000	$ 123.91	$ 19,460,000
		Total	**$ 26,610,000**

OPCC Water Storage Tanks/Stand Pipes

Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
3	130	600	$ 1,190,000
4	130	50	$ 580,000
GST-3	--	900	$ 560,000
		Total	**$ 2,330,000**

OPCC Pump Stations/Flow Control

Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total Required HP	HP per Pump	Number of Pumps	Extension[1]
1	4,007	5.77	280	600	300	3	$ 950,000
Flow Control Structure 1	--	--	--	--	--	--	$ 90,000
4	196	0.28	360	50	50	2	$ 350,000
Flow Control Structure 2	--	--	--	--	--	--	$ 60,000
						Total	**$ 1,450,000**

1) Notes: Unit prices include design, construction administration, resident inspection, material, installation, land, and incidentals.

2) Notes: Pipe lengths were rounded to the nearest 1,000, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Total Construction Cost

Transmission Lines	$ 26,610,000
Water Storage Tanks	$ 2,330,000
Pump Stations	$ 1,450,000
Total	$ 30,390,000

MO American Total Cost Summary

Construction, Land & Engineering	$ 30,390,000
Legal & Financial (5%)	$ 1,520,000
Contingency & Inflation (20%)	$ 6,080,000
Total	$ 37,990,000

BARTLETT & WEST