

# REQUEST AUTHORIZATION FOR MAYOR AND FINANCE OFFICER TO SIGN PROFESSIONAL SERVICES AGREEMENT OR AMENDMENT

Date: 08212015

**Project Name & Number:** Water Utility System Master Plan Update/Model Recalibration, Project No. 13-2141 **CIP #:** 50817

**Project Description:** Professional Engineering services necessary for Master Plan update and water model recalibration. Master Plan updates and model calibration are part of an ongoing maintenance program for the system. As part of the City's recent Utility Master Plan it was recommended that the City annually, or at a minimum every two (2) years, update and recalibrate the City's water distribution model and wastewater collection model. A recalibration of the models has not occurred since 2008.

**Consultant:** Black & Veatch Corporation

**Original Contract Amount:** \$1,365,586.00

**Original Contract Date:**

**Original Completion Date:**

**Addendum No:**

**Amendment Description:**

**Current Contract Amount:** \_\_\_\_\_

**Current Completion Date:** \_\_\_\_\_

**Change Requested:** \_\_\_\_\_

**New Contract Amount:** \_\_\_\_\_ \$0.00

**New Completion Date:** \_\_\_\_\_

**Funding Source This Request:**

Amount	Dept.	Line Item	Fund	Comments
\$750,000.00	933	4223	602	
\$615,586.00	934	4223	602	
\$1,365,586.00	<b>Total</b>			

**Agreement Review & Approvals**

*Sharon A. Totus* \_\_\_\_\_ 9/9/15  
Project Manager Date

*Don Tom* \_\_\_\_\_ 9-9-15  
Division Manager Date

*Amber J. Jett* \_\_\_\_\_ 8/27/15  
Compliance Specialist Date

*T. W. [Signature]* \_\_\_\_\_ 9-8-15  
Department Director Date

\_\_\_\_\_  
City Attorney Date

**ROUTING INSTRUCTIONS**

Route two originals of the Agreement for review and signatures.  
Finance Office - Retain one original  
Project Manager - Retain second original for delivery to Consultant  
cc: Public Works  
Engineering  
Project Manager

**FINANCE OFFICE USE ONLY**

(Note to Finance: Please write date of Agreement in appropriate space in the Agreement document)

Date	Initials	Approved
9/10/15	JTS	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
Appropriation		<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Cash Flow		<input type="checkbox"/> Y <input checked="" type="checkbox"/> N

**Agreement Between City of Rapid City and Black and Veatch Corporation for  
Master Planning Professional Services for the Water Utility System Master Plan  
Update/Model Recalibration, Project No. 13-2141 / CIP No. 50817.**

AGREEMENT made \_\_\_\_\_, 20\_\_\_\_, between the City of Rapid City, SD (City) and Black & Veatch Corporation, (Engineer), located at 4600 South Syracuse Street, Suite 800, Denver, CO 80237. City intends to obtain services for design and bidding for the Water Utility System Master Plan Update/Model Recalibration, Project No. 13-2141, CIP No. 50817. The scope of services is as described within this document and as further described in Exhibits A and B (attached).

The City and the Engineer agree as follows:

The Engineer shall provide professional engineering services for the City in all phases of the Project and as further defined in Exhibits A and B (attached), serve as the City's professional engineering representative for the Project, and give professional engineering consultation and advice to the City while performing its services.

**Section 1—Basic Services of Engineer**

**1.1 General**

- 1.1.1 The Engineer shall perform professional services described in this agreement, which include customary engineering services. Engineer intends to serve as the City's professional representative for those services as defined in this agreement and to provide advice and consultation to the City as a professional. Any opinions of probable project cost, approvals, and other decisions provided by Engineer for the City are rendered on the basis of experience and qualifications and represent Engineer's professional judgment.
- 1.1.2 All work shall be performed by or under the direct supervision of a professional Engineer licensed to practice in South Dakota.
- 1.1.3 All documents including Drawings and Specifications provided or furnished by Engineer pursuant to this Agreement are instruments of service in respect of the Project and Engineer shall retain an ownership therein. Reuse of any documents pertaining to this project by the City on extensions of this project or on any other project shall be at the City's risk. The City agrees to defend, indemnify, and hold harmless Engineer from all claims, damages, and expenses including attorney's fees arising out of such reuse of the documents by the City or by others acting through the City.



- 1.1.4 The contract will be based on an hourly rate and reimbursable fee schedule with a maximum not-to-exceed amount.

**1.2 Scope of Work**

The Engineer shall:

- 1.2.1 Consult with the City, other agencies, groups, consultants, and/or individuals to clarify and define requirements for the Project and review available data.
- 1.2.2 Perform the tasks described in the Scope of Services. (See Exhibit A and B.)
- 1.2.3 Conduct a location survey of the Project to the extent deemed necessary to provide adequate site information.
- 1.2.4 Prepare a report presenting the results of the study as outlined in the scope of services.

**Section 2—Information Provided by City**

The City will provide any information in its possession for the project at no cost to the Engineer.

**Section 3—Notice to Proceed**

The City will issue a written notification to the Engineer to proceed with the work. The Engineer shall not start work prior to receipt of the written notice. The Engineer shall not be paid for any work performed prior to receiving the Notice to Proceed.

**Section 4—Mutual Covenants**

**4.1 General**

- 4.1.1 The Engineer shall not sublet or assign any part of the work under this Agreement without written authority from the City.
- 4.1.2 The City and the Engineer each binds itself and partners, successors, executors, administrators, assigns, and legal representatives to the other party to this agreement and to the partners, successors, executors, administrators, assigns, and legal representatives of such other party, regarding all covenants, agreements, and obligations of this agreement.
- 4.1.3 Nothing in this agreement shall give any rights or benefits to anyone other than the City and the Engineer.



- 4.1.4 This agreement constitutes the entire agreement between the City and the Engineer and supersedes all prior written or oral understandings. This agreement may only be amended, supplemented, modified, or canceled by a duly executed written instrument.
- 4.1.5 The Engineer shall make such revisions in plans which may already have been completed, approved, and accepted by the City, as are necessary to correct Engineer's errors or omissions in the plans, when requested to do so by the City, without extra compensation therefore.
- 4.1.6 If the City requests that previously satisfactorily completed and accepted plans or parts thereof be revised, the Engineer shall make the revisions requested by the City. This work shall be paid for as extra work.
- 4.1.7 If the City changes the location from the one furnished to the Engineer, or changes the basic design requiring a new survey for the portions so changed, the redesign will be paid for as extra work.
- 4.1.8 The City may at any time by written order make changes within the general scope of this Agreement in the work and services to be performed by the Engineer. Any changes which materially increase or reduce the cost of or the time required for the performance of the Agreement shall be deemed a change in the scope of work for which an adjustment shall be made in the Agreement price or of the time for performance, or both, and the Agreement shall be modified in writing accordingly. Additional work necessary due to the extension of project limits shall be paid for as extra work.
- 4.1.9 Extra work, as authorized by the City, will be paid for separately and be in addition to the consideration of this Section.
- 4.1.10 For those projects involving conceptual or process development services, activities often cannot be fully defined during the initial planning. As the project does progress, facts and conditions uncovered may reveal a change in direction that may alter the scope of services. Engineer will promptly inform the City in writing of such situations so that changes in this agreement can be renegotiated.
- 4.1.11 This Agreement may be terminated (a) by the City with or without cause upon seven days' written notice to the Engineer and (b) by the Engineer for cause upon seven days' written notice to the City. If the City terminates the agreement without cause, the Engineer will be



paid for all services rendered and all reimbursable expenses incurred prior to the date of termination.

If termination is due to the failure of the Engineer to fulfill its agreement obligations, the City may take over the work and complete it. In such case, the Engineer shall be liable to the City for any additional cost to the extent directly resulting from Engineer's action.

- 4.1.12 The City or its duly authorized representatives may examine any books, documents, papers, and records of the Engineer involving transactions related to this agreement for three years after final payment. All examinations will be performed at reasonable times, with proper notice. Engineer's documentation will be in a format consistent with general accounting procedures.
- 4.1.13 The City shall designate a representative authorized to act on the City's behalf with respect to the Project. The City or such authorized representative shall render decisions in a timely manner pertaining to documents submitted by the Engineer in order to avoid unreasonable delay in the orderly and sequential progress of the Engineer's services.
- 4.1.14 Costs and schedule commitments shall be subject to renegotiation for delays caused by the City's failure to provide specified facilities or information or for delays caused by other parties, excluding sub-contractors and sub-consultants, unpredictable occurrences including without limitation, fires, floods, riots, strikes, unavailability of labor or materials, delays or defaults by suppliers of materials or services, process shutdowns, acts of God, or the public enemy, or acts of regulations of any governmental agency or any other conditions or circumstances beyond the control of the City or Engineer. Temporary delays of services caused by any of the above which results in additional costs beyond those outlined may require renegotiation of this agreement.
- 4.1.15 The City will give prompt written notice to the Engineer if the City becomes aware of any fault or defect in the Project or nonconformance with the Project Documents.
- 4.1.16 Unless otherwise provided in this Agreement, the Engineer and the Engineer's consultants shall have no responsibility for the discovery, presence, handling, removal or disposal of, or exposure of persons to hazardous materials in any form at the project site, including but not limited to asbestos products, polychlorinated biphenyl (PCB), or other toxic substances.



- 4.1.17 In the event asbestos or toxic materials are encountered at the jobsite, or should it become known in any way that such materials may be present at the jobsite or any adjacent areas that may affect the performance of Engineer's services, Engineer may, at their option and without liability for consequential or any other damages, suspend performance of services on the project until the City retains appropriate specialist CONSULTANT(S) or contractor(s) to identify, abate, and/or remove the asbestos or hazardous or toxic materials.
- 4.1.18 This agreement, unless explicitly indicated in writing, shall not be construed as giving Engineer the responsibility or authority to direct or supervise construction means, methods, techniques, sequences, or procedures of construction selected by any contractors or subcontractors or the safety precautions and programs incident to the work of any contractors or subcontractors.
- 4.1.19 Neither the City nor the Engineer, nor its Consultants, shall hold the other liable for any claim based upon, arising out of, or in any way involving the discharge, dispersal, release or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids, or gases, waste materials, or other irritants, contaminants, or pollutants.
- 4.1.20 Neither the City nor the Engineer, nor its Consultants, shall hold the other liable for any claim based upon, arising out of, or any way involving the specification or recommendation of asbestos, in any form, or any claims based upon use of a product containing asbestos.
- 4.1.21 Engineer hereby represents and warrants that it does not fail or refuse to collect or remit South Dakota or City sales or use tax for transactions which are taxable under the laws of the State of South Dakota.

#### 4.2 City of Rapid City NonDiscrimination Policy Statement

In compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, the Age Discrimination act of 1975, the Americans with Disabilities Act of 1990, and other nondiscrimination authorities it is the policy of the City of Rapid City, 300 Sixth Street, Rapid City, SD 57701-5035, to provide benefits, services, and employment to all persons without regard to race, color, national origin, sex, disabilities/handicaps, age, or income status. No distinction is made among any persons in eligibility for the reception of benefits and services provided by or through the auspices of the City of Rapid City.

Engineer will permit access to any and all records pertaining to hiring and employment and to other pertinent data and records for the purpose of enabling the Commission, its agencies or representatives, to ascertain compliance with the above provisions.



This section shall be binding on all subcontractors or suppliers.

## **Section 5—Payments to the Engineer**

### **5.1 Schedule of Pay Rates**

The City will pay the Engineer for services rendered or authorized extra work according to the Engineer's hourly and reimbursable rate schedule described in Exhibit C.

### **5.2 Fee**

The maximum amount of the fee for the services as detailed in Section 1.2 shall not exceed \$1,365,586.00 unless the scope of the project is changed as outlined in Section 4. If expenses exceed the maximum amount, the Engineer shall complete the design as agreed upon here without any additional compensation. Sub task dollar amounts may be reallocated to other tasks as long as the total fee is not exceeded. Prime consultant may not mark up sub-consultant or sub-contractor services.

### **5.3 Progress Payments**

Monthly progress payments shall be processed by the City upon receipt of the claim as computed by the Engineer based on work completed during the month per the hourly rates and allowable reimbursable as established in Section 5.1 and approved by the City.

Net payment to the Engineer shall be due within forty-five (45) days of receipt by the City.

## **Section 6—Completion of Services**

The Engineer shall complete services on or before **December 31<sup>st</sup>, 2018** based on an award date of **September 8<sup>th</sup>, 2015**.

## **Section 7—Insurance Requirements**

### **7.1 Insurance Required**

The Engineer shall secure the insurance specified below. The insurance shall be issued by insurance company(s) acceptable to the City and may be in a policy or policies of insurance, primary or excess. Certificates of all required insurance including any policy endorsements shall be provided to the City prior to or upon the execution of this Agreement.



## 7.2 Cancellation

The Engineer will provide the City with at least 30 days' written notice of an insurer's intent to cancel or not renew any of the insurance coverage. The Contractor agrees to hold the City harmless from any liability, including additional premium due because of the Contractor's failure to maintain the coverage limits required.

## 7.3 City Acceptance of Proof

The City's approval or acceptance of certificates of insurance does not constitute City assumption of responsibility for the validity of any insurance policies nor does the City represent that the coverages and limits described in this agreement are adequate to protect the Engineer, its consultants or subcontractors interests, and assumes no liability therefore. The Engineer will hold the City harmless from any liability, including additional premium due, because of the Engineer's failure to maintain the coverage limits required.

## 7.4 Specific Requirements

7.4.1 Workers' compensation insurance with statutory limits required by South Dakota law. Coverage B-Employer's Liability coverage of not less than \$500,000 each accident, \$500,000 disease-policy limit, and \$500,000 disease-each employee.

7.4.2 Commercial general liability insurance providing occurrence form contractual, personal injury, bodily injury and property damage liability coverage with limits of not less than \$1,000,000 per occurrence, \$2,000,000 general aggregate, and \$2,000,000 aggregate products and completed operations. If the occurrence form is not available, claims-made coverage shall be maintained for three years after completion of the terms of this agreement. The policy shall name the City and its representatives as an additional insured.

7.4.3 Automobile liability insurance covering all owned, nonowned, and hired automobiles, trucks, and trailers. The coverage shall be at least as broad as that found in the standard comprehensive automobile liability policy with limits of not less than \$1,000,000 combined single limit each occurrence. The required limit may include excess liability (umbrella) coverage.

7.4.4 Professional liability insurance providing claims-made coverage for claims arising from the negligent acts, errors or omissions of the Engineer or its consultants, of not less than \$1,000,000 each occurrence and not less than \$1,000,000 annual aggregate.





Coverage shall be maintained for at least three years after final completion of the services.

**Section 8—Hold Harmless**

The Engineer hereby agrees to hold the City harmless from any and all claims or liability including attorneys' fees arising out of the professional services furnished under this Agreement, and for bodily injury or property damage arising out of services furnished under this Agreement, providing that such claims or liability are the result of a negligent act, error or omission of the Engineer and/or its employees/agents arising out of the professional services described in the Agreement.

**Section 9—Independent Business**

The parties agree that the Engineer operates an independent business and is contracting to do work according to his own methods, without being subject to the control of the City, except as to the product or the result of the work. The relationship between the City and the Engineer shall be that as between an independent contractor and the City and not as an employer-employee relationship. The payment to the Engineer is inclusive of any use, excise, income or any other tax arising out of this agreement.

**Section 10-Indemnification**

If this project involves construction and Engineer does not provide consulting services during construction including, but not limited to, onsite monitoring, site visits, site observation, shop drawing review and/or design clarifications, City agrees to indemnify and hold harmless Engineer from any liability arising from the construction activities undertaken for this project, except to the extent such liability is caused by Engineer's negligence.

**Section 11-Controlling Law and Venue**

This Agreement shall be subject to, interpreted and enforced according to the laws of the State of South Dakota, without regard to any conflicts of law provisions. Parties agree to submit to the exclusive venue and jurisdiction of the State of South Dakota, 7<sup>th</sup> Judicial Circuit, Pennington County.

**Section 12-Severability**

Any unenforceable provision herein shall be amended to the extent necessary to make it enforceable; if not possible, it shall be deleted and all other provisions shall remain in full force and effect.



**Section 13—Funds Appropriation**

If funds are not budgeted or appropriated for any fiscal year for services provided by the terms of this agreement, this agreement shall impose no obligation on the City for payment. This agreement is null and void except as to annual payments herein agreed upon for which funds have been budgeted or appropriated, and no right of action or damage shall accrue to the benefit of the Engineer, its successors or assignees, for any further payments. For future phases of this or any project, project components not identified within this contract shall not constitute an obligation by the City until funding for that component has been appropriated.

IN WITNESS WHEREOF, the parties hereto have made and executed this Agreement as of the day and year first above written.

**City of Rapid City:**

**Engineer:**

\_\_\_\_\_  
MAYOR

*Paul Bowman*  
\_\_\_\_\_  
BLACK & VEATCH CORPORATION

DATE: \_\_\_\_\_

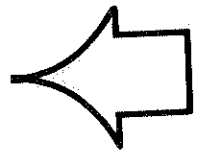
DATE: 8/26/2015

ATTEST:

\_\_\_\_\_  
FINANCE OFFICER

**Reviewed By:**

*Stacey J. Titus*  
\_\_\_\_\_  
STACEY TITUS, PROJECT MANAGER



DATE: 9/9/15

CITY'S DESIGNATED PROJECT REPRESENTATIVE

ENGINEERING FIRM'S DESIGNATED PROJECT REPRESENTATIVE

NAME Stacey Titus, P.E.  
PHONE: 605-394-4154  
EMAIL: [Stacey.titus@rcgov.org](mailto:Stacey.titus@rcgov.org)

NAME: Shawn LaBonde  
PHONE: 720-834-4267  
EMAIL: [labondesd@bv.com](mailto:labondesd@bv.com)



# EXHIBIT A

## SCOPE OF SERVICES

### PROJECT OVERVIEW

The City's existing water distribution system can supply approximately 56 million gallons per day (mgd) of potable water to customers. Current annual average daily demand is approximately 11-12 mgd. The existing water supply and distribution system consists of two water treatment plants (WTPs), eight ground water wells, 18 water storage tanks (includes two clearwells at WTPs), 14 pump stations, and more than 439 miles of 4-inch to 30-inch water mains. The City currently serves potable water to 18 pressure zones, and has adopted seven service levels in which the pressure zones reside.

The City's current 2008 Utility System Master Plan projects water system requirements to the year 2030. Regular Master Plan updates along with recalibration/update of the water distribution system hydraulic model are part of an ongoing maintenance program for the system to support planning for future growth, water system operations, and ongoing development occurring in the City's service area. An update and recalibration of the water system hydraulic model was last completed during the 2008 Utility System Master Plan preparation.

The objective of this project is to update the City's Water System Master Plan (Master Plan) and recalibrate/update the distribution system hydraulic model thereby allowing the City to:

- Systematically provide for growth of water utility infrastructure over a 100-year planning period, and determine short-term (10-year) to long-term (100-year) infrastructure needs.
- Identify future capital improvement projects to address improvement, replacement, and growth/development requirements providing reliable, high quality service to customers.
- Develop and document current water supply philosophies.
- Provide a visual representation of proposed improvements to demonstrate smart growth expansion and existing system improvements as well as eventual replacement of the existing infrastructure assets.
- Provide the development community with an improved guide and tool for holistic and cohesive utility planning and design.
- Support water system planning, design, budgeting, operations, water quality, and financial (rate study) needs.
- Train/mentor City staff on use of the distribution system hydraulic model.

The Scope of Services described in this exhibit covers services for preparing an updated Master Plan and associated recalibration/update of the water distribution system hydraulic model. An outline of phases and tasks used to accomplish the objectives of this project is as follows:

### PHASE A - PROJECT INITIATION, RECURRING MEETINGS, AND MANAGEMENT

101 – Prepare and Finalize Project Execution Plan

103 –Data/Information Request

105 – Review and Incorporation of Previous Reports

- 107 – GIS and Hydraulic Model Update Procedures
- 109 – Distribution System Operations Review.
- 111 – Workshop #1 – Project Initiation, GIS/Model Update Approach, Operations Review, and Infrastructure Design Criteria Manual (IDCM) Review
- 113 – Recurring Meetings
- 115 – Project Management and Administration

**PHASE B – GIS DATA AND HYDRAULIC MODEL RECALIBRATION/UPDATE**

- 121 – Part 1 GIS Water System Feature Update
- 122 – NGVD29 to NAVD88 Vertical Datum/Elevation Conversion
- 123 – Part 1 GIS Data Extraction and Hydraulic Model Update
- 124 – Develop Model Maintenance Procedures
- 125 – Part 2 GIS Water System Feature Update
- 126 – Part 2 GIS Data Extraction and Hydraulic Model Update
- 131 – Historical Population, Water Use, Per Capita Use Rates (Metered Sales), 24-Hour Demand Patterns, and Design Peaking Factors
- 133 – Future Service Area Population and Water Demand Projections
- 135 – Workshop #2 – Hydraulic Model Update and Future Demand Projections
- 139 – Metered Sales Evaluation and Allocation to Hydraulic Model
- 141 – Maximum Day 24-Hour Extended Period Simulation (EPS) Model Calibration Data Development and Input
- 143 – Maximum Day 24-Hour EPS Hydraulic Model Calibration
- 147 – Workshop #4 – Model Calibration, Existing System Deficiencies, and Alternative Surface/Groundwater Supply First Schematic Development

**PHASE C - HYDRAULIC MODELING ANALYSES AND IMPROVEMENTS PLANNING**

- 150 – Define Surface and Groundwater Supply Alternatives (Includes Workshop #3 (Surface Water First and Groundwater First Supply Alternatives) and Workshop #5 (Water Supply Alternatives Results & Public Works Director Briefing))
- 151 – Medium-Term Hydraulic Modeling Analyses and Improvements Planning
- 155 – Workshop #6 – Recommended Water Supply Strategy and Medium-Term Improvements
- 157 – Long-Term Hydraulic Analyses and Improvements Planning
- 159 – Workshop #7 – Long-Term Hydraulic Analyses and Improvements
- 161 – Short-Term Hydraulic Analyses and Improvements Planning
- 163 – Short and Medium-Term Water Age Analyses
- 165 – Workshop #8 – Short-Term Hydraulic and Water Age Analyses

**PHASE D – EXISTING SYSTEM HYDRAULIC ANALYSES FOR SYSTEM RELIABILITY/REDUNDANCY, FIRE FLOW EVALUATIONS, SYSTEM PRESSURES, AND PRESSURE ZONE BOUNDARIES**

- 171 – System Reliability/Redundancy Analyses
- 173 – Fire Flow Analyses
- 175 – Pressure Zone Boundaries and System Pressures
- 177 – Workshop #9 – System Reliability, Fire Flow Analyses, and Pressure Zone Boundary Evaluation
- 181 – Final Medium, Long, and Short-Term Analyses and Recommended Supply Strategy

**PHASE E - WATER FACILITY ASSESSMENTS AND REPLACEMENT CAPITAL IMPROVEMENT PLAN (CIP) DEVELOPMENT**

- 201 – Review Water Facility Information and Compile Inventory Listing
- 205 – Establish Criticality Ranking For Water Facilities
- 207 – Establish Useful Life Values for Water Facilities
- 209 – Workshop #10 – Water Facility Inventory, Criticality, and Useful Life Values
- 211 – Conduct Facility Site Tours and Determine Remaining Useful Life De-rating Score
- 213 – Develop Facility Replacement Costs
- 215 – Develop Facility Replacement CIP
- 216 – Water Facility Assessment and Replacement CIP Technical Memorandum (TM)
- 217 – Workshop #11 – Water Facility Replacement CIP

**PHASE F – PIPELINE REPLACEMENT PLANNING AND CIP DEVELOPMENT**

- 231 – Compile Pipe Installation Years, Materials, and Main Break History
- 233 – Pipe Attribute Data
- 235 – GIS Based Pipe Inventory Analysis and Development of Risk Criteria
- 237 – Risk of Failure and Replacement Priority Ranking Evaluation
- 239 – Pipe Replacement Budget Strategy Evaluation
- 240 – Pipeline Replacement Priority and Budget Strategy Evaluation TM
- 241 – Workshop #12 – Pipeline Replacement Priorities and Budget Strategies
- 243 – Develop Pipeline Replacement CIP

**PHASE G – GPS FIELD SURVEY FOR GIS SURFACE FEATURE DEFINITION**

- 251 – Pressure Zone Review, Selection, and Inventory Development
- 253 – GPS Field Survey of Water Assets
- 254 – GPS Survey of Service Lines
- 255 – Document Results of GPS Field Survey and Service Line GPS Survey. Develop Plan for Surveying Balance of System
- 257 – Workshop #13 – GPS Field Survey Workflows and Results

**PHASE H - DEFINITION OF POLICIES, PROCESSES, AND PROCEDURES**

- 271 – Master Plan Updates, Amendments, and Revisions
- 273 – Model Maintenance and Update Procedures
- 275 – Water System Surface and Service Line Feature GPS Definition
- 277 – Project Development Submittal Requirements for Evaluation and GIS/Model Integration
- 279 – Design Criteria Review and Amendments
- 281 – Review of Potential Valve Closure Management Approaches and Systems
- 283 – Review of Potential Water System Base Map Accessibility Approaches and Systems
- 285 – Review of IT Hardware Requirements for Hydraulic Modeling and GIS Functions in Public Works and Utility Maintenance

**PHASE I - CAPITAL IMPROVEMENT PLAN AND MASTER PLAN REPORT**

- 301 – Recommended Capital Improvement Plan
- 303 – Draft Master Plan Report
- 305 – Workshop #14 – CIP and Draft Master Plan Review

307 – Final CIP and Master Plan Report (Includes Workshop #15 (Draft Final Master Plan Review))

**PHASE J – TRAINING AND CONTINUING SERVICES SUPPORT**

331 – Training

333 – Continuing On-Call Modeling Support Services

**CITY REVIEW FRAMEWORK**

Throughout the scope of services described herein, Engineer will submit interim deliverables to the City for review and comment on the technical progress of the work activity. Engineer’s project schedule incorporates critical path review time by the City as well as council timeframe. The following table defines the project’s document review time frame for the City:

Project Deliverable Review Time Frame Guidelines		
Draft Document or TM Length (Pages)	City Review by Public Works Only	City Review by Public Works and Other Departments (Fire, Planning, etc.)
5 Pages or Less	5 Working Days	10 Working Days
6-25 Pages	10 Working Days	15 Working Days
Greater Than 25 Pages	15 Working Days	15 Working Days

**PHASE A - PROJECT INITIATION, MEETINGS, AND MANAGEMENT**

**Task 101 – Prepare and Finalize Project Execution Plan**

Using the draft project execution plan (PEP) developed in the proposal for the Water Utility System Master Plan Update & Model Recalibration, finalize and submit the PEP to the City. The final PEP establishes the project’s baseline staffing plan, scope of services, schedule, quality control plan, and budget to which actual project activity is tracked during progression of the work. Submit the PEP prior to Workshop #1

**Task 103 –Data Information Request**

Prepare and submit a list of data and information to be provided by the City for use during the study including but not limited to operations data from SCADA, GIS data, hydraulic model, land use planning information, water use rates and patterns, existing level of service and water quality goals, and facility information, and related studies and reports.

**Task 105 – Review and Incorporation of Previous Reports**

As part of an early review meeting conducted concurrently with a Task 231.1 review meeting, review a list of water system studies and reports completed previously for the City, and identify important components of each study that are relevant to the current project. Consolidate review information by pressure zone. Identify higher and lower priority studies to integrate into the current project. Note previous work that has been superseded and/or is outdated. Obtain copies of the required reports from the City.

Review previous water system studies and reports. Prepare summary memoranda that documents the purpose and recommendations for each report, consolidates the review information by pressure zone, and summarizes relevant components to be integrated into this project's effort.

Document reviews in summary TMs.

- Submit draft TMs to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in City Review Framework Table.
- Conduct a review meeting with City via conference call to review comments.
- Revise TMs with changes agreed to with the City for use in subsequent master planning tasks.

The following documents are included in this review and consolidation effort:

1. "Planning Report for Skyline, Terracita, Southwest, Carriage Hills, and Future Southwest Rapid City Water Service Zones" Project No. W03-953.M1, by CETEC Engineering Services, Inc. dated April 25, 2006.
2. "North Deadwood Avenue Water System Expansion Study", by Ferber Engineering Company, Inc. (2003).
3. "North Rapid High Level and North Deadwood Avenue Water System Expansion Study", by Ferber Engineering Company, Inc. (2005).
4. "Northridge Water Storage Reservoir City of Rapid City Project No. W09-1792 CIP No 50754", by Banner Associates (2013).
5. "Memorial Park and Farlow Avenue Water Main Reconstruction" City of Rapid City Project No. SS08-1710 & SS08-1711, by Ferber Engineering Company, Inc. (2009)
6. "Preliminary Report for Water System Expansion East Rapid City" City of Rapid City Project No. W03-1288, by FMG. Inc.,(2006).
7. "East Mall Drive Connection" City of Rapid City Project No. ST03-1334, by Ferber Engineering Company, Inc. (2004?).
8. "East Anamosa Street Extension Study" City of Rapid City Project No. ST98-660 by HDR Engineering and Alliance Architects and Engineers, (2000).
9. "Alma Street, Gladys Streets, and Lennon Lane Area Water Main Extension", City of Rapid City Project No. 12-2039/CIP No. 50912, by Dream Design International, Inc (2013).
10. "Technical Memorandum-Potential Considerations of HDPE Pipe Municipal Applications" City of Rapid City Project No. \_\_\_\_\_, by Banner Associates and Black & Veatch, (2013).
11. "Northeast Area Analysis" City of Rapid City Project No. \_\_\_\_\_ by HDR Engineering and Alliance Architects and Engineers, (2002).

12. "Mall Drive Utility Reconstruction-Haines Avenue to North Street", City of Rapid City Project No. ST08-1753/CIP #50646, by Ferber Engineering Company, Inc. (2010).
13. "Preliminary Design Report-West Chicago Street Reconstruction", City of Rapid City Project No. ST02-1071, by CETEC Engineering Services, Inc. (2001)
14. "Good Samaritan Society St. Martin's Village Rapid City" City of Rapid City Project No. W03-1288, by FMG. Inc., (2007).
15. "Analysis of Chapel Lane Water Company Supply, Storage and Distribution System and Feasibility of Acquisition", Chapel Lane Water Company Project., by CETEC Engineering Services, Inc. (2001).
16. "Final Engineering Design Report and Facilities Plan Analysis of Colonial Pine Hills Sanitary District Water System Rapid City, South Dakota", Colonial Pine Hills Sanitary District Water System Project., by CETEC Engineering Services, Inc. (2001).
17. "Planning Study-Pressure Zone Separation W. Main Street to Canyon Lake Drive and From Sheridan Lake Road to Dakota Drive" City of Rapid City Project No. W10-1894/CIP #50399, by FMG. Inc., (2012).
18. "Silver Street Area Utility Improvements-Preliminary Design Report" City of Rapid City Project No. SSW07-1656/CIP #50418, by Ferber Engineering Company, Inc. (2010).
19. "Omaha Street Utilities-12<sup>th</sup> Street to East Boulevard", City of Rapid City Project No. SSW02-1106., by CETEC Engineering Services, Inc. (2002).
20. "Preliminary Design Report Tower Road Reconstruction" , City of Rapid City Project No. ST 01-973., by CETEC Engineering Services, Inc. (2001).
21. "Canyon Lake Drive Reconstruction Design Report" City of Rapid City Project No. WTP10-878/CIP #50004, by Ferber Engineering Company, Inc. (2010).
22. "Skyline Drive Restoration Conceptual Design Report" City of Rapid City Project No. \_\_\_\_, by Stanley Consultants, FMG. Inc., and Wyss Associates, Inc. (2009).
23. "Final Water Supply Study Rapid City Regional Airport Rapid City, South Dakota" City of Rapid City Project No. \_\_\_\_, by Kadrmas Lee & Jackson and AE2S. (2009).
24. "Red Rock High Pressure Zone" Preliminary Study by Dream Design International, Inc. (2001)
25. "Elk Vale Low Level Reservoir and Elk Vale High Level Reservoir Preliminary Engineering Report" City of Rapid City Project No. W07-1638, by Kadrmas Lee & Jackson and AE2S. (2009).
26. "Visitor Information Center Utilities Extensions Preliminary Design Report", City Project No. SSW95-591, by FMG Engineering (1996).



27. "Lacrosse & Centre Street Reconstruction Preliminary Study and Report for Water and Sewer Utilities", City Project No. ST98-774, by CETEC Engineering (1998).
28. "East Anamosa Street Extension North LaCrosse Street to East North Street Preliminary Engineering Report", City Project STO4-1397 & EM 1648(1), by Kadrmas Lee & Jackson (2007).
29. "Holiday Inn, North Street and Farlow Avenue Water Main Reconstruction Report Revisions from 65% to Final", City Project W07-1631/CIP 50465, by Ferber Engineering Company (2008).
30. "Catron Boulevard Reconstruction Utility Relocation and Modification Preliminary Design Report", City Project SSW09-1819 / CIP 50396 (2010).
31. "Dakota Drive – West Main Street Utilities Reconstruction Final Design Report", City Project No. W10-1894 / CIP 50399, by FMG Engineering (2012).
32. "Memorial Park and Civic Center Irrigation Improvements Study Report", by FMG Engineering (2012).
33. "Homestead-Meadow Ridge Transmission Main Extension Project Design Report", City Project No. 2012-2011/CIP 50898, by Sperlich Consulting (2012)
34. "Investigation of Irrigation Water Source for Soccer Complex Summary Report", City Project No. 13-2098/CIP 50963, by CETEC Engineering (2013).
35. "West Chicago and Staton Place Reconstruction and Drainage Improvements Design Report", City Project No. 12-1187/CIP 50364, by Ferber Engineering Company (2013).
36. "Omaha Street / West Boulevard Intersection Reconstruction – Utilities", City Project No. 14-2097/CIP 50955, by Ferber Engineering Company (2013).
37. "Harmony Land & West St. Cloud Street Reconstruction Projects Final Design Report", City Project No. 12-2047/CIP 50712 and 15-2113/CIP 50939, by Fisk Land Surveying & Consulting Engineers and Britton Engineering & Land Surveying (2013).
38. "Grandview Drive and Nevada Drive Robbinsdale Area Utility and Street Reconstruction Project Design Report", City Project No. 13-2102/CIP 50421.3-4, by Sperlich Consulting (2014).
39. "North Rapid Pump Station Project Final Design Report", City Project No. 13-2080/CIP 50812.
40. "Country Road Water Transmission Main Final Design Report", City Project No. 14-2173/ CIP50460.
41. "East Rapid City Water System Expansion Final Design Report", City Project No. 13-2107/CIP 50964.
42. "Seeger Drive Reconstruction Final Design Report", City Project 15-2268/CIP 50277.

43. “Ellsworth Air Force Base Meter Facility Relocation Project Design Report, Water Model Analysis, and TM on Flow Capacity and Redundancy”, by FMG, Inc.

In addition to the list of 43 items above, the City may identify additional studies and reports for review and integration into this project’s work effort. This scope of services provides for review of additional documents beyond the 43 items listed above. For purposes of establishing a level of effort to review additional documents, an additional 6 documents is included. The actual number of documents reviewed may be more or less than 6.

Conduct an initial review of the 2008 Water Utility System Master Plan Report and develop an initial listing of chapters and sections that will be (1) superceded/replaced by work prepared on this project; (2) unchanged from the 2008 and remain valid following completion of this project; and (3) modified by work prepared on this project, but remain in use following completion of this project. Use this review and initial listing in subsequent tasks (271-Master Plan Updates, Amendments, and Revisions; 303 – Draft Master Plan Report) to establish processes for future updates as well as to identify the portions of the 2008 Water Utility System Master Plan Report that will continue to be utilized for information by the City in conjunction with the 2013 Water Utility System Master Plan.

#### **107 - GIS and Hydraulic Model Update Procedures**

The City’s existing GIS database and hydraulic model will be utilized extensively during development of the Master Plan and subsequently to support City engineering and utility operations. There are several possible methods to update and maintain these systems while improving efficiency and functionality. This task confirms the steps that will be used to update the GIS data and hydraulic model. Once confirmed with the City, subsequent tasks will implement these steps to demonstrate the process, and, if necessary, revise procedures for final documentation and future use by the City.

- Obtain current versions of the City’s GIS data and hydraulic model to become familiar with system organization, attributes, functionality, and types of uses currently employed by the City.
- Part 1 GIS Data Update. Develop outline summary of procedures, responsibilities, and schedules to update GIS connectivity and attribute data, and perform a NGVD29 to NAVD88 vertical datum conversion in GIS.
- Part 1 GIS Data Extraction and Hydraulic Model Update. Develop outline summary of procedures, responsibilities, and schedules for Part 1 of the hydraulic model update including (1) extracting all GIS pipe and node data and transferring the data to the hydraulic model, (2) performing a NGVD29 to NAVD88 vertical datum conversion on all model nodes not transferred from GIS, and (3) performing nodal demand allocation following model update Part 1. Development of a “1-to1” model (model elements have a 1-to-1 relationship with GIS features) is planned.
- Model Maintenance Strategy and Procedures. Develop outline summary of procedures, responsibilities, and schedules to maintain the City’s INFOWATER model relying on the

INFOWATER GIS Gateway and other customized tools. Include procedures to update model demands using metered sales.

- Part 2 GIS Data Update. Develop outline summary of procedures, responsibilities, and schedules for Part 2 of the GIS update. Add/update currently backlogged and approved construction projects and development projects into GIS. Conversion from NGVD29 to NAVD88 may be necessary and will be completed if necessary.
- Part 2 GIS Data Extraction and Model Update. Develop outline summary of procedures, responsibilities, and schedules for Part 2 Model Update that will implement and test the model maintenance procedures during transfer of new data developed as part of the Part 2 GIS Data Update.

#### **Task 109 - Distribution System Operations Review.**

Develop typical distribution system maximum day operating conditions using existing historical SCADA data to understand existing distribution system operations. Review hourly operations typical to meet maximum hour demands. A review of distribution system operations will include WTP, well, and booster pump station operating rates; tank levels; and 24-hour demand factors (INFOWATER Patterns).

#### **Task 111 – Workshop #1 - Project Initiation, GIS/Model Update Approach, Operations Review, and Review of Infrastructure Design Criteria Manual (IDCM).**

Conduct workshop to review and confirm the final project execution plan, procedures to complete the GIS and hydraulic model update (Parts 1 and 2), and distribution system operation review. Conduct an initial overview of the IDCM to identify components that will be reviewed during Phase H activities.

Following Workshop #1, conduct a tour of the major distribution system facilities with City operations and engineering staff.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

#### **113- Recurring Meetings**

Conduct meetings on a recurring basis described as follows:

- 113.1** Twice monthly project management call to discuss an overview of project status, issues requiring resolution or revised approach, and action items with City project management. Prepare meeting minutes and submit in draft form within 3 working days after the meeting. City will review and provide comments within 3 working days. Finalize minutes within 2 days after receiving City comments.

#### **115 – Project Management and Administration**

Provide management and administration of the project including progress reporting, schedule and budget adjustment, and invoicing.

Prepare and submit a monthly narrative progress report summarizing progress and status of each task along with discussion of project issues requiring resolution and attention.

Prepare and submit monthly invoices.

Prepare and submit a monthly review of the project schedule. Schedule review will compare actual progress and completion to a project baseline schedule. If progress falls behind schedule to a point where recovery is unlikely or not feasible, work with City to develop a recovery plan or to develop a re-forecasted schedule.

Prepare and submit a monthly review of the project budget. Budget review will consist of an earned value analysis that compares baseline forecasted expenditures, spent (invoiced) value, and earned value calculated from an estimate of completion for each task.

Develop and follow a project QA/QC plan for project deliverables. Conduct quality assurance/quality control reviews on all project deliverables in two phases including (1) formatting/grammar QA/QC prior to submittal to the City, and (2) technical QA/QC concurrent with review by the City. Conduct reviews with professionals of appropriate level and subject matter expertise. Submit a draft QA/QC plan to the City for review and comment. Document QA/QC plan compliance by submitting the current plan with each monthly progress report.

**DELIVERABLES FOR PHASE A**

Task	Deliverables
101	• Final project execution plan. (ten hard copies; one pdf format electronic copy)
103	• Data and information request list for City to compile and provide to consultant.
105	• Initial review meeting conducted concurrently with Task 231.1 review meeting • Summary technical memorandum (TM) for each of 25 previous studies/reports already identified plus additional documents identified during the project up to an allowance established in Task 105. One pdf format electronic copy, and one MS Word format electronic copy. • Review Meeting to review TMs conducted via conference call.
107	• Outline summary of procedures, responsibilities, and schedules to update GIS and Hydraulic Model procedures. One pdf format electronic copy, and one MS Word format electronic copy. For review and discussion at Workshop #1.
109	• Water distribution system operations summary. One pdf format electronic copy, and one MS Word format electronic copy. For review and discussion at Workshop #1
111	• Workshop #1 agenda, review materials, and meeting minutes. • Tour of major distribution system facilities
113.1	• Maintain and update project action item and decision logs; Progress call meeting minutes
115	• Monthly narrative progress report, invoice, schedule review, QA/QC plan compliance, and budget status

## **PHASE B – GIS DATA AND HYDRAULIC MODEL RECALIBRATION/UPDATE**

### **Task 121 – Part 1 GIS Water System Feature Update**

Identify GIS water system feature (pipes, fittings, system valves, hydrants, etc.) updates required for the hydraulic model update.

Prior to beginning this task, the City will enter/update distribution system feature information in GIS. The basis for work to be completed by the City in relation to the Part 1 GIS feature update is a series of City database reports (Construction Report, Design Report, Warranty Report, Development Report) that identify projects and developments in various stages of completion. The Part 1 GIS feature update will include all projects from the database reports where facilities/pipelines were operational prior to August 20, 2014. This includes 2 projects from the Construction Report, 0 projects from the Design Report, 39 projects from the Warranty Report, and 5 projects from the Development Report.

Following completion of input/update of project features by the City, Engineer will evaluate and identify connectivity errors and incorrect or missing attribute data. Complete an update of the GIS water system features necessary for subsequent hydraulic model development, and return GIS data to the City.

Work with the City to finalize an approach for transferring the City's GIS data to the Engineer. Engineer will obtain a checked-out replica version of the City's water system enterprise geodatabase, complete the necessary revisions, and return the replica geodatabase back to the City. The City will then have the option of (1) review and reconcile the changes prior to posting changes to the City's enterprise geodatabase; or (2) post changes to the enterprise geodatabase without review and reconciliation.

### **Task 122 – NGVD29 to NAVD88 Vertical Datum/Elevation Conversion**

Following the Part 1 GIS water system feature update, perform a NGVD29 to NAVD88 vertical datum conversion allowing elevations for water system GIS nodes to be assigned elevations on the NAVD88 datum. This datum conversion allows GIS data transferred to the hydraulic model to be on the NAVD88 coordinate system. Horizontal datum currently in use by the City is South Dakota State Plane South Zone NAD 83 (2011).

To assure accuracy and precision during this conversion process, confirm methodology with City survey staff prior to proceeding with conversion.

In step 1 of this datum/elevation conversion, assign elevation data to GIS water system nodes using the City's existing 2008 2-foot contour mapping (the 2008 contour mapping is based on the NGVD29 datum). In step 2 of this datum/elevation conversion, convert all GIS water system node elevations from NGVD29 datum to NAVD88 datum using the USGS VERTCON computer software or similar. Return updated GIS data with NAVD88 based node elevations to the City.

### **Task 123 – Part 1 GIS Data Extraction and Hydraulic Model Update**

Update INFOWATER hydraulic model pipes and nodes by extracting the City's water system GIS data and transferring the data to the model via the INFOWATER GIS Gateway. Complete the data transfer following completion of the Part 1 GIS Water System Feature Update task.

Complete additional tasks as part of this Part 1 model update including:

- Delete facilities (pumps and tanks) abandoned or taken out of service from the model.
- Convert elevations for nodes not transferred to the model from GIS to NAVD88 vertical datum using the USGS VERTCON computer software. Provide an output listing of NAVD88 elevations for reservoir overflows and other hydraulically critical system components.
- Determine pipe roughness data (C value) based on pipe material and age.
- Review and update connections to existing pumps, tanks, etc. already in the hydraulic model as needed.
- Add new distribution facilities not in GIS (pumps, tanks, etc.) to the model.
- Review PRV settings and update in the model as needed.
- Review all valves with regards to flow direction.
- Update pump curves from 3-point to multiple point curves.
- Identify closed isolation valves at pressure zone boundaries (closed valves rather than closes pipes will be used at zone boundaries).

### **Task 124 – Develop Model Maintenance Procedures**

Develop procedures to update the hydraulic model from GIS data. The model maintenance procedures will rely on but not be limited to the INFOWATER GIS Gateway tools. Include development of procedures to incorporate completed development projects and City projects into GIS and hydraulic model. Include development of instructions to update demands in the model based on new customer metered sales data. Include approach to maintain the integrity of master hydraulic model files under use by multiple users simultaneously. Procedures to transfer operating data (pump operations, etc.) from SCADA and other sources is not included as part of this task.

Document model maintenance procedures in a TM.

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in City Review Framework Table.
- Conduct a review of the TM at Workshop #2.
- Revise TM with changes agreed to with the City for further use in subsequent Part 2 GIS and hydraulic model update tasks.

### **Task 125 – Part 2 GIS Water System Feature Update**

Add/update GIS attribute data (pipes, valves, hydrants, etc.) into the City's GIS system from projects and developments that were operational after August 20, 2014 or projects that are not yet constructed but in various stages of development. The basis for work to be completed in relation to the Part 2 GIS feature update is a series of City database reports (Construction Report, Design Report, Warranty Report, Development Report) that identify projects and developments in various

stages of completion. The Part 2 GIS feature update will include all projects from the database reports where facilities/pipelines were not yet operational as of August 20, 2014. This includes 16 projects from the Construction Report, 20 projects from the Design Report, 4 projects from the Warranty Report, and 33 projects from the Development Report.

Following input of GIS attribute data, perform connectivity checks and attribute data review on the entered GIS data to confirm functionality and accuracy.

#### **Task 126 - Part 2 GIS Data Extraction and Hydraulic Model Update**

Extract GIS data and transfer it to the hydraulic model via the INFOWATER GIS Gateway and other tools. Utilize this model update step to test and revise, if necessary, the model maintenance procedures defined in a previous task. Update the Model Maintenance Procedures TM as required and submit a final version of the TM.

#### **Task 131 – Historical Population, Water Use, Per Capita Use Rates (Metered Sales), 24-hour Demand Patterns, and Design Peaking Factors**

Review historical population data provided by the City.

Evaluate historical average day, maximum day, and maximum hour (if available) water use for years 2008 through 2014. Obtain and evaluate annual metered sales data by customer class and wholesale customer data for years 2008 through 2014. Update the following Tables from the 2008 Utility System Master Plan with 2008-2014 historical data:

- Table 3.1, Past (and Projected) Retail Water Counts
- Table 3.2, Past (and Projected) Retail per Meter Usage Rates
- Table 3.3, Past (and Projected) Retail Water Metered Sales
- Table 3.4, Past (and Projected) Annual Wholesale and Raw Water Sales
- Table 3.5, Past (and Projected) Total Water Demands

Update design demand factors. Obtain three days of maximum day hourly SCADA data and use data to develop maximum day 24-hour demand patterns system-wide and in the individual pressure zones and/or service areas. Compare the individual pressure zone hourly demand patterns to the 2008 Utility System Master Plan Table 6.5 design MD/AD and MH/AD demand factors.

Spring/Fall or winter day demand factors. Obtain two days of spring/fall or winter day hourly SCADA data to develop 24-hour demand patterns system-wide and in the individual pressure zone and/or service area. These demand factors will be used to perform spring/fall or winter day water age analyses.

Document information from this task into a TM (Historical Water Use Data (Task 131) and Future Demand Projections (Task 133)).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City. City will provide written review comments within the time frame defined in City Review Framework Table.
- Conduct a review of the TM at Workshop #2.

- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

### **Task 133 – Future Service Population and Water Demand Projections**

Planning horizons and design years selected for this master plan include the following:

- Short-term, 10 year (2025)
- Medium-term, 30 year (2045; with a new modified Tier 1 growth boundary)
- Long-term, 100 year (2115; with the established Tier 2 growth boundary and area of development within the Tier 2 boundary indicated)

Future City population estimates for the three design years will be provided by the City.

Future 10-year and 30-year “small area” population estimates will be based on Traffic Analysis Zone (TAZ) population projections provided by the City. The future 100-year small area population estimates will be based on land use data for the Metropolitan Planning Organization (MPO) area and compared with the City’s 2115 population estimate (provided by the City).

Coordinate with the City to compile a list of existing and potential future wholesale/bulk water sale customers for inclusion into future demand projections. The City will contact and meet with existing and potential future customers as necessary to obtain existing and future demand projections for use in this master planning effort. Engineer will provide input to the City regarding the type of data and information to request during the meetings, compile and summarize information obtained in the meetings, and recommend follow-up communication and meetings if necessary.

In support of this task, the City will provide the following:

- 2045 and 2115 service area population projections
- TAZ data for 2045 (household population, employment data, etc.)
- 2115 land use data with percentage of area developed in each use area to allow distribution of demand and population within each land use area.
- Compiled listing of existing and potential future wholesale/bulk water customers along with anticipated demand for each.

Use updated design demand factors from previous task to determine future maximum day and maximum hour demands for use in modeling and master plan development. Develop future alternative demand scenarios to evaluate the sensitivity of the future demand assumptions, such as future per customer (per capita) water use, widening use of low flow plumbing fixtures, heightened water conservation awareness, higher cost rate structure, etc. Projected demands will be updated in Tables 3.1 through 3.5 noted in previous task.

Document information from this task into a TM (Historical Water Use Data (Task 131) and Future Demand Projections (Task 133)).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.



- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #2.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

**Task 135 – Workshop #2 - Hydraulic Model Update and Future Demand Projections**

Conduct workshop to review the updated hydraulic model and future demand projections. Review proposed approach and schedule for completing subsequent tasks.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**Task 139 – Metered Sales Evaluation and Allocation to Hydraulic Model**

Obtain and evaluate the most recent 12 months of individual customer metered sales data. Evaluate metered sales by pressure zone and use class. Allocate individual customer annual average metered sales to the hydraulic model using the INFOWATER Allocator tool.

**Task 141 – Maximum Day 24-hour Extended Period Simulation (EPS) Model Calibration Data Development and Input**

Based on review of three days of maximum day operational (SCADA) data, select one day’s data to perform the 24-hour EPS model calibration analysis. For the selected maximum day calibration data, use SCADA data to develop the following hourly model inputs.

- Well operating rates
- WTP operating rates
- Pump operating rates
- Tank initial water levels
- Control valve hourly operating rates (as required)
- Service area (combined pressure zones) and pressure zone demand patterns (from Task 120)

**Task 143 – Maximum Day 24-Hour EPS Hydraulic Model Calibration**

Perform the maximum day calibration scenario/analysis for 24 hours. Develop figures and tables depicting recorded (SCADA) versus modeled pump station flows, groundwater well flows, system pressures, tank levels, etc. Compare recorded (SCADA) data to modeled flows, pressures, tank levels, etc. to confirm model calibration with actual conditions. Make adjustments to the model to achieve improved agreement between recorded (SCADA) and modeled flows, pressures, and tank levels.

Document hydraulic model calibration process (Tasks 139, 141, and 143) and results in a summary TM (Hydraulic Model Calibration).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.

- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #4.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

**Task 147 – Workshop #4 - Model Calibration and Surface/Groundwater Supply First Schematic Development**

Conduct workshop to review results from the maximum day model calibration. Also review conceptual/schematic water supply alternatives for surface water first and groundwater first supply strategies developed in Tasks 150.2 and 150.3.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**DELIVERABLES FOR PHASE B**

Task	Deliverables
121	<ul style="list-style-type: none"> <li>• Revised GIS data that incorporates revisions from geometric network check, connectivity rules check, attribute data update, and flagged hydrant leads</li> </ul>
122	<ul style="list-style-type: none"> <li>• Updated Part 1 GIS data with water system node elevations based on NAVD88 datum</li> </ul>
123	<ul style="list-style-type: none"> <li>• Output listing of NAVD88 elevations for reservoir overflows and other hydraulically critical system components</li> </ul>
124	<ul style="list-style-type: none"> <li>• TM (Model Maintenance Procedures). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #2</li> </ul>
125	<ul style="list-style-type: none"> <li>• Updated Part 2 GIS database with water system node elevation based on NAVD88 datum</li> </ul>
126	<ul style="list-style-type: none"> <li>• Updated Part 2 INFOWATER Hydraulic Model</li> <li>• Update TM (Model Maintenance Procedures)</li> </ul>
131 / 133	<ul style="list-style-type: none"> <li>• TM (Historical Water Use Data and Future Demand Projections). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #2</li> </ul>
135	<ul style="list-style-type: none"> <li>• Workshop #2 agenda, review material, and meeting minutes</li> </ul>
143	<ul style="list-style-type: none"> <li>• TM (Hydraulic Model Calibration). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #4</li> <li>• Calibrated INFOWATER hydraulic model</li> </ul>
147	<ul style="list-style-type: none"> <li>• Workshop #4 agenda, review material, and meeting minutes.</li> </ul>

**PHASE C – HYDRAULIC MODELING ANALYSES AND IMPROVEMENTS PLANNING**

The medium and long-term analyses performed using the hydraulic model will include evaluation and refinement of the surface and groundwater supply alternatives as well as development of operational, growth based, and localized pressure zone improvements. The short-term hydraulic

analyses will focus on staging of improvements for the recommended surface and groundwater supply strategy as well as localized pressure zone improvements.

Final medium, long, and short-term analyses using the hydraulic model will be used to identify and select the final system-wide and localized improvements for the recommended surface and groundwater supply strategy.

The following design years establish the medium, long, and short-term planning periods:

- Medium-Term, 30 year (2045; with a new modified Tier 1 growth boundary)
- Long-Term, 100 year (2115; with the established Tier 2 growth boundary and area of development within the Tier 2 boundary indicated)
- Short-Term, 10 year (2025)

### **Task 150 – Define Surface and Ground Water Supply Alternatives**

In 2014 the City adopted the Water Advisory Task Force recommendations which include the following:

- An update to the City’s Water System Master Plan should be initiated and should include the establishment of the 2045 design capacity for the Mt. View Water Treatment Facility.
- The operation of the City of Rapid City water system shall strive to insure optimal use of all City surface and groundwater sources.
- The core values for operating the City’s water system shall entail utilization of surface water sources to the greatest extent, when available, and supplementation of surface water sources with groundwater sources as necessary.

This task’s objective is to define three water supply alternatives that allow evaluation and comparison of infrastructure costs and operational functionality for various surface water and groundwater utilization approaches as part of the medium-term (30 year) hydraulic analyses tasks. Tasks 150 and 151 are inter-related and will be completed concurrently.

**150.1** During the 2008 Utility System Master Plan, the Source Water Evaluation and Facility Plan (2006), and the Phase 2B Water Treatment Plant Improvements Project, significant effort was expended to determine the number, capacity, and location of surface WTPs to serve Rapid City into the future. The following action plan was adopted:

- Construct an 8 mgd dual source source water (surface water and groundwater) Jackson Springs WTP to treat water supplied by the Jackson Springs Infiltration Gallery using a process that includes full conventional pretreatment (mechanical rapid mixing, aluminum sulfate coagulation, flocculation, plate assisted sedimentation), membrane filtration, sodium hydroxide based stabilization of finished water, free chlorine primary and residual disinfection with sodium hypochlorite, and fluoridation.
- Construct a new WTP at the existing Mountain View WTP site to replace the existing facilities. New treatment processes at the new Mountain View WTP facilities were

to match those at the Jackson Springs WTP. The capacity of the new Mountain View WTP was planned for 32 mgd initial capacity expandable to 48 mgd.. Its existing capacity is 24 mgd.

Conduct a review of the documents listed above related to specific items requiring additional and/or updated consideration including:

- Previous studies determined that all future WTP capacity should be located on the west side of Rapid City which is closest to the source of supply. This decision was based largely on protecting source water quality prior to treatment, but is counter to potential long-term future growth that may occur primarily in the eastern portions of the Rapid City service area. For this study review and re-evaluate consideration for locating a future WTP in the eastern portion of the Rapid City service area.
- Review of the water treatment process selection for the new Mountain View WTP is not planned as part of this study's effort. Recommendations made during the 2006-2008 studies will be carried forward into this study without modification.
- Review the City's existing Surface Water Utilization Tool (SWUT) which defines various ground water/surface water utilization strategies based on comparison of current to historic precipitation, current to historic and minimum water stored in Pactola Reservoir, and excess stream flow in Rapid Creek. Utilize the SWUT as necessary to assist in the definition of three water supply alternatives as described below.

**150.2 Surface Water First Supply Strategy.** Surface water sources will be utilized first to the maximum extent possible to meet maximum day demands. Demands in excess of surface water availability will be supplemented by groundwater sources. Define the maximum capacity that can be supplied by surface water sources based on current surface water rights and storage rights. Define the supplemental groundwater supply capacity required for this scenario.

For this study review and evaluate considerations for locating a new surface WTP east of the Hogback (i.e. east of Cambell Street) either in lieu of a new WTP at the Mountain View WTP site, or in combination with a new WTP at the Mountain View WTP.

Conceptually develop the configuration and capacity of components related to a surface water first supply strategy that includes a Mountain View WTP and an East Side WTP including:

- Raw water conveyance infrastructure
- Finished water storage, distribution, and pumping infrastructure (completed as part of Task 151 – Medium-Term Hydraulic Modeling Analyses and Improvements Planning)
- WTP facilities
- Operational approach related to base load versus peaking plant operation

- Logistics of transferring water rights to an East Side WP
- Water quality and regulatory considerations for an East Side WTP

Development of four alternatives for surface water treatment and supply are anticipated:

- New west side Mountain View WTP only (24 mgd initial capacity expandable to 48 mgd). This is the currently adopted plan. Both initial and expanded capacity will be re-evaluated and confirmed as part of this project.
- New East Side WTP only (24 mgd initial capacity expandable to 48 mgd). Both initial and expanded capacity will be re-evaluated and confirmed as part of this project.
- New East Site WTP (capacity to be determined) with a future smaller WTP at the Mountain View site (capacity to be determined)
- New smaller WTP at the Mountain View site initially (capacity to be determined) with a future East Site WTP (capacity to be determined)

For each surface WTP alternative identified above, develop raw water infrastructure and WTP facility costs using parametric unit cost estimating methods for the selected treatment capacities. Costs for the required finished water infrastructure will be developed as part of Task 151 (Medium-Term Hydraulic Modeling Analyses and Improvements Planning).

Review and evaluate a viable minimum operating capacity for the surface water WTP alternatives to provide input into evaluation of tasks related to development of alternatives for a Balanced Supply Strategy and a Groundwater First Supply Strategy. Water treatment unit process selection for the new WTPs is not planned as part of this study's effort. Recommendations made during the 2006-2008 studies will be carried forward into this study without modifications.

**150.3 Groundwater First Supply Strategy.** During an extended drought when surface water availability is restricted or during an operational emergency when surface water is not available, groundwater is required to meet water demands. Define a reduced surface water supply drought capacity, and the extent of groundwater utilization required to supplement reduced surface water supply. Additionally, define the maximum demand that can be met with a groundwater only source of supply during an operational emergency.

Conceptually develop the configuration and capacity of components related to a groundwater first supply strategy that includes:

- Required groundwater supply wells and general location within the Rapid City services area.
- Operation of WTP facilities at either zero capacity contribution (operational emergency) or at minimal capacity contribution (surface water drought restrictions).
- Finished water storage, distribution, and pumping infrastructure (completed as part of Task 151 - Medium-Term Hydraulic Modeling Analyses and Improvements Planning)

For the defined groundwater first supply strategy, consolidate raw water infrastructure and WTP facility costs from previous tasks with additional costs developed for groundwater sources defined in this task using parametric unit cost estimating methods. Costs for the required finished water infrastructure will be developed as part of Task 151 (Medium-Term Hydraulic Modeling Analyses and Improvements Planning).

Coordinate with USGS technical staff regarding the most probable locations of new groundwater supply wells within the Rapid City service area.

#### **150.4 Workshop #3 - Surface Water First and Groundwater First Supply Alternatives**

Review supply alternatives defined above to develop agreement and consensus on the definition of alternatives to be evaluated in Task 150.5 (Balanced Surface Water/Groundwater Supply Strategy) and continuing medium-term hydraulic analyses. It is the intent of this Workshop to define one preferred surface water WTP configuration (number of WTPs, location of WTPs, etc.) to carry forward into Task 150.5.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

#### **150.5 Balanced Surface Water/Groundwater Supply Strategy.** Allowing for optimal use of all surface and groundwater sources, this alternative utilizes both surface water and groundwater to meet maximum day demands. Using results from Task 150.2 (Surface Water First Supply Strategy) and 150.3 (Groundwater First Supply Strategy), define a balanced strategy that utilizes both surface water and groundwater to jointly supply maximum day demands.

Conceptually develop the configuration and capacity of components related to a balanced supply strategy that includes:

- Required groundwater supply wells and general location within the Rapid City services area. The general location of groundwater supply wells will be the same as that developed in Task 150.3 (Groundwater First Supply Strategy), but with adjusted capacities to reflect a larger contribution from surface water.
- Required WTP facilities. The number and location of WTP facilities will be the preferred surface water supply alternative developed in Task 150.2 (Surface Water First Supply Strategy) and selected in Task 150.4 (Workshop #3), but with adjusted capacities to reflect a larger contribution from groundwater.
- Finished water storage, distribution, and pumping infrastructure (completed as part of Task 151 – Medium-Term Hydraulic Modeling Analyses and Improvements Planning).

For the defined balanced supply strategy, consolidate and revise costs for raw water infrastructure, WTP facilities, groundwater supply wells, and finished water infrastructure developed in previous tasks to represent costs for the balanced strategy.

**150.6** Document the water supply alternative development effort in a summary TM (Water Supply Alternatives Evaluation).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #5.
- Revise TM with changes agreed to with the City for use in subsequent tasks and for inclusion into the Master Plan Report.

**150.7 Workshop #5: Water Supply Alternative Evaluation Results (Public Works Director Briefing)**

Review the balanced supply strategy medium-term hydraulic analyses completed in Task 151.3 and the summary TM prepared in Task 150.6 (Water Supply Alternatives Evaluation) to develop agreement and consensus on a recommended water supply strategy for further development in the subsequent detailed medium-term, long-term, and short-term hydraulic analyses. Finalize a recommended water supply strategy during this meeting to allow progression of the planning effort into the detailed medium-term, long-term, and short-term hydraulic analyses.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**Task 151 – Medium-Term Hydraulic Modeling Analyses and Improvements Planning**

Detailed medium term analyses performed using the hydraulic model include evaluation and refinement of the surface and groundwater supply alternatives defined in Task 150 and development of operational, growth based, and individual pressure zone improvements .

**151.1** Medium-term Pipe, Valve, Pump, and Tank Model Facilities. Develop future medium-term model facilities and input components to the hydraulic model.

**151.2** Medium-term Demand Allocation. Allocate the TAZ based medium-term (2045) average day demands to the hydraulic model.

**151.3** Conceptual Hydraulic Analyses to Evaluate Alternative Surface and Groundwater Supply Strategies. Perform medium-term (2045) hydraulic analyses to evaluate alternative surface and groundwater supply strategies (see Task 150 for related work activity).

Six hydraulic scenarios/analyses will be performed including:

- Surface water first supply strategy (4 scenarios considering alternative WTP facility locations)
- Groundwater first supply strategy (1 scenario)
- Balanced supply strategy (1 scenario)

City will provide input and insight into the potential location for new facilities such as reservoirs and pump stations.

Document medium-term hydraulic analyses performed in a summary TM (Water Supply Alternatives Evaluation) prepared under Task 150.6.

**151.4 East Side WTP Preliminary Site Evaluation and Selection.** In Tasks 150.2 (Surface Water First Supply Strategy), 150.3 (Groundwater First Supply Strategy), 150.5 (Balanced Surface Water/Groundwater Supply Strategy), and 151.3 (Conceptual Hydraulic Analyses to Evaluate Alternative Surface and Groundwater Supply Strategies), evaluations are conducted to evaluate the location of surface water treatment capacity at either the existing Mtn View WTP site or at a new location east of the Hogback (East Side WTP).

If these evaluations determine that an East Side WTP should be included in future CIP plans (either constructed before a Mtn. View WTP upgrade or constructed prior to the 2045 medium-term design period), then this task will complete a preliminary East Side WTP site evaluation and selection. The site selected as part of this task will then be incorporated into the detailed medium-term hydraulic analyses (Task 151.5), long-term hydraulic analyses, (Task 157), and short-term hydraulic analyses (Task 161).

If these evaluations determine that an East Side WTP is not recommended during the short-term (2025) or medium-term (2045) design periods, this task will not be necessary and will not be completed.

- A.** Work with the City to identify potential sites for a new East Side WTP east of the Hogback (i.e. east of Campbell Street). Utilize county assessor mapping and county GIS database information to review property ownership records and property boundaries. Compare WTP elevation requirements to available property elevations, and confirm that potential sites are large enough to accommodate a new WTP of the capacity required to meet 2045 demands.
- B.** Conduct site visits of the potential WTP locations with the City. Based on the site visits, select three final candidate sites for further evaluation and comparison.
- C.** Develop Site Evaluation Criteria. Work with the City to establish criteria to compare and rank three potential site locations. Establish criteria and weighting to apply in the project's Decision Model used as part of the evaluation process. Develop a first-cut list of criteria and sub-criteria for the site evaluation criteria. Document the listing in a summary TM, and submit to the City for review. Review the criteria with the City and finalize based on discussion. Criteria components could include:

- (1) Raw Water Supply (Availability, redundancy, consistency, treatability, microbial quality, and other contaminant potential);



- (2) Raw Water Conveyance (Conveyance capacity and distance, pumping requirements, land acquisition requirements, and operational complexity);
- (3) Environmental and Public Acceptance (Critical wildlife habitats, archeologically sensitive lands, historically sensitive lands (Significant agricultural lands, residential area proximity, visual impacts, traffic pattern impacts);
- (4) Site Specific Factors (Available area for facilities, raw water storage area, residuals handling area, construction area, hazardous materials risk, geological and geotechnical subsurface risks, permitting requirements, land acquisition requirements property acquisition, utilities availability, vehicle access, and security);
- (5) Finished Water Transmission (Conveyance capacity and distance, pumping requirements, land acquisition requirements, operational complexity).

- D. Conduct Alternative Site Screening Evaluation. Conduct a screening evaluation of the three sites identified in previous tasks. A Decision Model (Criterion Decision Plus – CDP) will be utilized for the screening evaluation. Conduct the qualitative screening evaluation during Workshop #16. Alternatives will be presented and the pros and cons of each site will be discussed along with potential obstacles and issues. Using individual scoring from project team members, real-time revisions to the CDP Decision Model will be made during the workshop based on consensus input from the group. Sensitivity analyses will be conducted to test the merit and validity of the resulting scoring process. Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.
- E. Site Evaluation Summary and Recommendation. Document the alternative site evaluation process and the results in a summary TM (East Side WTP Site Evaluation Summary and Recommendations).
  - Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
  - City will provide written review comments within the time frame defined in the City Review Framework Table.
  - Conduct a review of the TM via conference call.
  - Revise TM with changes agreed to with the City for use in subsequent tasks and for inclusion into the Master Plan Report.

**151.5 Detailed Medium-Term Hydraulic Analyses and Improvements With Recommended Supply Alternative.** Perform medium-term (2045) hydraulic analyses and develop operational,

growth based, and individual pressure zone improvement recommendations for the recommended surface and groundwater supply strategy:

- WTP supply capacity and location
- Groundwater pumping supply capacity and location
- Storage tank volume and location
- Distribution pump station capacity and location
- Distribution piping and control valves

Three medium-term hydraulic scenarios/analyses will be performed. This task will not commence until after Workshop #5 is complete and concurrence on a recommended alternative is obtained from the City.

Document medium-term hydraulic analyses performed in a summary TM (Detailed Medium-Term Hydraulic Analyses and Improvements).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table..
- Conduct a review of the TM at Workshop #6.
- Revise TM with changes agreed to with the City for use in subsequent tasks and for inclusion into the Master Plan Report.

#### **Task 155 – Workshop #6 - Recommended Water Supply Strategy and Medium-term Improvements**

Conduct workshop to review results from the medium-term (2045) hydraulic analyses (Task 151) and water supply alternative evaluations (Task 150). Present a final recommended water supply strategy during this workshop to City staff and Public Works Director. Discuss approach for the long-term analyses to be performed in subsequent tasks.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

#### **Task 157 – Long-Term Hydraulic Modeling Analyses and Improvements Planning**

The long-term analyses performed using the hydraulic model will include evaluation and refinement of the surface and groundwater supply alternatives as well as development of operational, growth based, and individual pressure zone improvements.

**157.1** Long-term Pipe, Valve, Pump, and Tank Model Facilities. Develop future long-term model facilities and input components into the hydraulic model.

**157.2** Long-term Demand Allocation. Allocate Metropolitan Planning Organization based long-term average day demands to the hydraulic model.

**157.3 Long-term Hydraulic Analyses and Improvements.** Perform long-term hydraulic analyses and develop operational and growth based improvement recommendations for:

- WTP supply capacity and location
- Groundwater pumping supply capacity and location
- Storage tank volume and location
- Distribution pump station capacity and location
- Distribution piping and control valves

Three (3) long-term hydraulic scenarios/analyses will be performed.

City will provide input and insight into the potential location for new facilities such as reservoirs and pump stations. City will also provide information related to major street plans to establish potential utility corridors for long-term planning.

Document long-term hydraulic analyses performed in a summary TM (Long-Term Hydraulic Analyses and Improvements).

- Submit draft TM to City and internal QA/QC team for review and comment. City will provide written review comments within 10 days after submittal of the TM.
- Conduct a review of the TM at Workshop #7.
- Revise TM with changes agreed to with the City for use in subsequent tasks and for inclusion into the Master Plan Report.

#### **Task 159 – Workshop #7 - Long-term Hydraulic Analyses and Improvements**

Conduct workshop to review results from the long-term hydraulic analyses and recommended improvements. Discuss approach for the short-term analyses to be performed in subsequent tasks.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

#### **Task 161 – Short-Term Hydraulic Analyses and Improvement Planning**

The short-term hydraulic analyses will focus on staging of improvements for the recommended surface and groundwater supply strategy as well as localized (individual pressure zone) improvements.

**161.1 Short-term Pipe, Valve, Pump, and Tank Model Facilities.** Identify and develop future short-term model facilities and “Facility Sets” in the hydraulic model. Short-term model facilities will have been previously input during the medium and long-term hydraulic analyses, and this task is limited to identifying which of these facilities will be required in the short-term (staging of improvements).

**161.2 Short-term Demand Allocation.** Allocate TAZ based short-term (2025) average day demands to the hydraulic model.

**161.3 Short-term Hydraulic Analyses.** Perform short-term hydraulic analyses to develop operational and growth based improvement recommendations. Additional localized (pressure zone) improvements will be considered.

Three (3) short-term hydraulic scenarios/analyses will be performed.

Document short-term hydraulic analyses performed in Task 161.3 and water age analyses performed in Task 163 in a summary TM (Short-Term Hydraulic Analyses and Water Age Analyses).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #8.
- Revise TM with changes agreed to with the City. Submit a draft-final version.

**Task 163 – Short and Medium-term Water Age Analyses**

Perform water age analyses for the short and medium-term demand scenarios to assure that the sizing of future improvements will not have adverse impacts on water age/quality. An overview of distribution system water quality data will be performed and discussions with City staff will be conducted to determine seasonal water quality issues and concerns. Based on the findings of this review, water age analyses will be performed for the winter, spring/fall, or summer day demand conditions. Three (3) water age analyses will be performed. Summarize results in the TM prepared as part of Task 161.3.

**Task 165 – Workshop #8, Short-term Hydraulic and Water Age Analyses**

Conduct workshop to review results the short-term (2025) hydraulic analyses, water age analyses, and staging of recommended improvements into a CIP.

Prepare and distribute workshop agenda at least 5 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**PHASE C DELIVERABLES**

Task	Deliverables
150.4	• Workshop #3 agenda, review materials, and meeting minutes
150.6	• TM (Water Supply Alternatives Evaluation). One pdf format electronic copy, and one MS Word format electronic copy. • Review at Workshop #5.
150.7	• Workshop #5 agenda, review materials, and meeting minutes
151.35.B	• Site visits of potential East Side WTP locations and selection of 3 final candidates
151.35.C	• TM (East Side WTP Site Evaluation Criteria). One pdf format electronic copy, and one MS Word format electronic copy.

151.35.D	<ul style="list-style-type: none"> <li>• Workshop #16 agenda, review materials, and meeting minutes</li> </ul>
151.35.E	<ul style="list-style-type: none"> <li>• TM (East Side WTP Site Evaluation Summary and Recommendations). One pdf format electronic copy, and one MS Word format electronic copy.</li> </ul>
151.4	<ul style="list-style-type: none"> <li>• TM (Detailed Medium-Term Hydraulic Analyses and Improvements). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #6</li> </ul>
155	<ul style="list-style-type: none"> <li>• Workshop #6 agenda, review materials, and meeting minutes</li> </ul>
157	<ul style="list-style-type: none"> <li>• TM (Long-Term Hydraulic Analyses and Improvements). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #7</li> </ul>
159	<ul style="list-style-type: none"> <li>• Workshop #7 agenda, review, materials, and meeting minutes</li> </ul>
161.3	<ul style="list-style-type: none"> <li>• TM (Short-Term Hydraulic Analyses/Improvements and Water Age Analyses). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #8</li> </ul>
165	<ul style="list-style-type: none"> <li>• Workshop #8 agenda, review materials, and meeting minutes</li> </ul>

## **PHASE D – EXISTING SYSTEM HYDRAULIC ANALYSES FOR SYSTEM RELIABILITY/REDUNDANCY, FIRE FLOW EVALUATIONS, SYSTEM PRESSURES, AND PRESSURE ZONE BOUNDARIES**

### **Task 171 – System Reliability/Redundancy Analyses**

Perform analyses and evaluations as described below:

**171.1** Pressure Zone Reliability/Redundancy Evaluations. Perform qualitative reliability/redundancy evaluations for each distribution system pressure zone. Identify the number of supply points to the zone, amount of “floating” and pumped storage available to serve the zone, and existing and potential intertie improvements to supply the zone.

**171.2** Identify Critical Facility Outage Potential. Identify critical facility outages that may disrupt service to pressure zones for use in redundancy evaluation. As an example, the 2008 USMP identified 2 transmission mains and one pump station which carried 10% or more of maximum hour demands. Prioritize potential facility outages with input from the City including:

- Water Treatment Plants
- Wells
- Transmission and distribution mains
- Pump Stations
- Pressure reducing and pressure sustaining valves

**171.3** Identify Potential Critical Water Service Customers. Review and identify critical water service customers for use in redundancy evaluation. As an example, the 2008 USMP also identified 5 facilities with critical (uninterruptable) water supply needs (jail/juvenile services, hospital, nursing homes).

**171.4** Hydraulic Analyses to Improve Redundant Service Capabilities. Utilize the updated, calibrated hydraulic model to determine whether adequate redundant hydraulic capacity exists to provide acceptable service during outages of major distribution system facilities. Develop, model, and recommend existing system improvements to improve redundant service capabilities to an acceptable level. Where it is financially and/or physically impractical to provide a secondary/emergency supply to a zone, consider “hardening” alternatives for existing facilities (backup power, additional pumping capacity, increased storage, etc.). Six (6) system reliability/redundancy analyses are included in this task.

**171.5** Document the system reliability/redundancy analyses performed in a summary TM (System Reliability/Redundancy Analyses and Prioritized Improvement Recommendations).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at a Monthly Progress Meeting in Rapid City.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

### **Task 173 – Fire Flow Analyses**

Perform three types of fire flow analyses as described below:

**173.1** System-wide Hydrant Capacities. Fire flow capacities at a residual pressure of 20 psi will be performed for each hydrant in the City for the maximum day demand using steady state analysis. Utilize INFOWATER fire flow settings and constraints to (1) limit minimum system pressures throughout the system during fire flow (Critical Node Search Range – Entire Network), and (2) limit maximum velocity throughout the system (Domain Pipes). Develop a system-side fire flow figure depicting individual fire hydrant capacities. Consider if the maximum velocity constraint is applied to distribution system pipes or to fire hydrant leads.

Two system-wide fire flow scenario/analysis (all hydrants) are included in this task. The first will model operation in conformance with the City’s Infrastructure Design Criteria Manual for meeting fire flows under maximum day demand conditions with no pumps in the distribution system operational. The second will model fire flows under maximum day demand conditions with pumps operational as they would normally operate during a maximum day demand period. The modeling scenarios will determine hydrant capacity and controlling condition (20 psi at hydrant, 20 psi system pressure, or 12 fps pipe velocity).

Review results of this task in the context of the City’s IDCM criteria for meeting fire flows under maximum day demand condition with no distribution system pumps operating. Recommend revisions to the IDCM criteria if warranted for review and consideration by the City.

**173.2 Multiple Hydrant Fire Flow Analyses.** Schools, hospitals, and commercial, industrial, public buildings typically require higher fire fighting capacities requiring the use of multiple fire hydrants to deliver fire flow. Identify and review facilities with potentially large fire flow requirements. Select six locations/facilities to perform multi-hydrant fire flow analyses. Prior to proceeding with these analyses, coordinate with the City on the actual method to be used for this effort considering flows, criteria, and hydrant identification. Six (6) hydraulic scenarios/analyses are included in this task.

**173.3 Fire Hydrants and/or areas with low fire flows due to 20 psi pressure or with Potential to Cause Zero/Negative Pressures at High Ground Elevations.** The City has determined that fire engine booster pumping can potentially cause distribution system pressures at high ground elevations to drop to zero or below (vacuum) although suction (residual) pressures at the hydrant are maintained above 20 psi. Review the system-wide fire flow analyses to determine potential fire hydrant locations which could cause zero or negative pressures. Perform fire flow analyses at these hydrant locations to determine the minimum pressures allowed during a fire event. Six (6) fire flow analyses are included in this task. Evaluate improvements for hydrants and/or areas with deficient fire-fighting capacity due to (1) low system pressure or (2) high pipe velocity per operating criteria standards developed in Task 279. Also consider the need to mark specific fire hydrants in the field to alert Fire Department responders to special fire fighting requirements at these hydrants.

**173.4 Recommend Improvements to Fire Flow Service.** Utilize the updated, calibrated hydraulic model to conduct fire flow analyses as described. Develop, model, and recommend improvements to the existing system to improve fire flow service capabilities. For example, use a pressure sustaining valve to supply flow into a lower zone experiencing a fire to keep residual pressures above the required 20 psi.

**173.5 Document the fire flow analyses performed in a summary TM (Fire Flow Analyses and Improvement Recommendations).**

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at a Review Meeting in Rapid City and with Fire Department officials.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

### **Task 175 – Pressure Zone Boundaries and System Pressures**

Review pressures within individual pressure zones for the existing system using the updated, calibrated hydraulic model. Evaluate pressure zone boundary modifications to address low and high pressure concerns. Utilize recently updated City pressure zone boundary map as needed. Up to 3 hydraulic analyses will be performed to evaluate pressure zone boundary changes and recommend boundary changes for implementation.

Document the pressure zone boundary and system pressure analyses performed in a summary TM (Pressure Zone Boundary and System Pressure Analyses and Improvement Recommendations).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #9.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report

**Task 177 - Workshop #9 - System Reliability, Fire Flow Analyses, and Pressure Zone Boundary Evaluation**

Conduct workshop to review results from evaluations related to existing system reliability, fire flow analyses, and pressure zone boundaries.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**Task 181 - Final Medium, Long, and Short-term Analyses and Recommended Supply Strategy**

Perform final medium, long, and short-term analyses to finalize the recommended operational and growth based improvements. The final medium, long, and short-term analyses will incorporate findings and recommendations from the system reliability, fire flow, and pressure zone boundary analyses.

The hydraulic analyses performed under this task will finalize the recommended surface and ground water supply operating strategies for the three design years. Three (3) hydraulic scenarios/analyses will be performed.

**PHASE D DELIVERABLES**

Task	Deliverables
171.5	<ul style="list-style-type: none"> <li>• TM (System Reliability/Redundancy Analyses and Improvement Recommendations). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review TM at Monthly Progress Meeting</li> </ul>
173.5	<ul style="list-style-type: none"> <li>• TM (Fire Flow Analyses and Improvement Recommendations). One pdf format electronic copy, and one MS Word format electronic copy</li> <li>• Review TM at Monthly Progress Meeting</li> </ul>
175	<ul style="list-style-type: none"> <li>• TM (Pressure Zone Boundary and System Pressure Analyses and Improvement Recommendations). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review TM at Workshop #9</li> </ul>
177	<ul style="list-style-type: none"> <li>• Workshop #9 agenda, review materials, and meeting minutes</li> </ul>



## **PHASE E – WATER FACILITY ASSESSMENTS AND REPLACEMENT CIP DEVELOPMENT**

The purpose of this phase is to establish a recommended capital improvement plan (cost and timing) for replacement of existing water system facilities. The assessment is intended to be a “desktop” evaluation that includes site tours of existing facilities; establishment of facility criticality; development of facility useful life and remaining useful life; development of replacement costs; and staging of replacements into a recommended capital improvement plan.

### **Task 201 – Review Water Facility Information and Compile Inventory Listing**

Review existing facility information from the 2008 Utility System Master Plan (including source water facility plans) to gain familiarity with existing water system facilities, operational practices of the City, and previous condition assessment work completed as part of the 2008 Utility System Master Plan.

Compile a inventory listing of water system facilities including WTPs at a unit process level (pretreatment, coagulation/flocculation/sedimentation, filtration, disinfection, chemical feed systems, structural/architectural systems, mechanical building systems, electrical power systems, instrumentation and control systems), groundwater wells/pumps, water storage tanks, pump stations, and primary flow control valve stations (pressure reducing/sustaining valves, flow regulation valves, etc.). The City will provide the year of installation for each water facility listed in the inventory in an excel spreadsheet format, and the year of any significant renovation or expansion work.

The City will provide any supplemental condition assessment information that is currently available and deemed relevant for the Phase E effort such as assessment information on the Signal Hill, Arrowhead, Robbinsdale, and High Level (Palo Verde) Reservoirs.

### **Task 205 – Establish Criticality Ranking For Water Facilities**

With City input, review each facility and establish a criticality ranking based on the facility’s consequence of failure. Consider factors such as public health and safety, the effect an outage (planned or unplanned) would have on water supply operations, potential for water quality regulatory violations, negative political or public relations exposure, etc.. Assign a criticality rank of high, medium, or low to each facility in the inventory listing. Establish/confirm criticality rank multipliers for use in calculating “stretched” useful life values (high criticality = 1.0; medium criticality = 1.15; low criticality = 1.3).

Prepare and submit a water facility inventory listing with criticality ranking indicated for each facility.

### **Task 207 – Establish Useful Life Values For Water Facilities**

Establish a “standard” useful life for each facility in the inventory listing using industry available standards for useful life values. Consider multiple sources of useful life information including:

- Municipal Accounting Manual Useful Life Table (South Dakota Department of Legislative Audit)

- International Infrastructure Management Manual (New Zealand Asset Management Support)
- Local Government and Municipal Knowledge Base (Australia and New Zealand local government encyclopedia)

Establish a “stretched” useful life value for each facility in the inventory listing which is defined as the product of the facility’s “standard” useful life and criticality rank multiplier. The purpose of the “stretched” useful life is to provide a pathway for extending the service of facilities that do not significantly compromise operations if they experience an outage.

Calculate both “standard” and “stretched” remaining useful life values for facilities in the inventory listing by subtracting the current facility age from the “standard” and “stretched” useful life values.

**Task 209 – Workshop #10 – Water Facility Inventory, Criticality, and Useful Life Values**

Conduct workshop to review inventory listing, criticality ranks, and useful life values of the water facilities. Prior to this workshop, obtain from the City relevant maintenance and inspection records for water facilities. During the workshop, review these records with City staff to identify high priority areas prior to conducting site tours in a subsequent task.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**Task 211 – Conduct Facility Site Tours and Determine Remaining Useful Life De-rating Score**

Working with the City, conduct site tours of each facility in the inventory listing to qualitatively assess existing facility conditions and identify immediate deficiencies and repair/replacement needs. Site tours are not intended to conduct an intensive asset condition assessment of all components and systems at a facility. Instead, the tours are intended to identify any existing conditions that would impact or de-rate the remaining useful life thereby accelerating in the replacement capital improvement plan. Where applicable, utilize condition assessment information compiled during the 2008 Utility System Master Plan to assist with current condition assessment.

Working with the City during the site tours, consider the condition, function, and utilization of facility components to assign scores as follows:

Existing Condition Score

- 1 – Chance of failure is minimal. Negligible wear. No problems beyond normal maintenance.
- 2 – Chance of failure is minimal. All wear within design tolerance. No problem beyond normal maintenance.
- 3 – Chance of failure is low but present. Wear approaching allowable limits. Problem that will require future attention.
- 4 – Chance of failure is real. Wear beyond allowable limits. Problem identified requiring immediate attention.
- 5 – Failed. Substantial deterioration. Dangerous or broken down.

Existing Function Score

- 1 – Easily performing required function. Facilities up-to-date. Meets regulatory and health/safety requirements.
- 2 – Adequately performing required function. Acceptable related to obsolescence. Meets regulatory and health/safety requirements.
- 3 – Performing function but possibly not effectively. Facilities dated but meeting need. Minor regulatory or health/safety infraction. Modifications may meet short-term needs.
- 4 – At lowest level of acceptability in performing required function. Out-of-date and obsolete (facilities just tolerable). Regulatory or health/safety requirement necessitates planned renewal.
- 5 – Not performing function. Obsolete. Does not meet regulatory or health/safety requirement.

Utilization Score

- 1 – Easily meeting existing and future planned load. Repeatedly utilized in operations. No damage.
- 2 – Adequately meeting existing and future planned load. Frequently utilized in operations. Aesthetic damage only.
- 3 – Usually meets existing load but occasional failure with financial or public relations consequence. Moderate utilization but reduced economic benefit. Moderate damage but cost effective repair does not return full functionality.
- 4 – Frequently fails to meet existing load and unlikely to meet future load. Infrequent utilization resulting in poor economic benefit. Damage necessitates planned renewal and would not be cost effective to repair.
- 5 – Unable to meet existing or future loads. Not utilized. Damage to point of failure.

Following facility site tours, apply the following de-rating factors to each facility’s calculated “standard” and “stretched” remaining useful life:

<u>Worst Condition / Function / Utilization Score</u>	<u>Useful Remaining Life De-rating Factor</u>
1	1.0 (No de-rating)
2	0.80
3	0.40
4	0.15
5	0.0

**Task 213 – Develop Facility Replacement Costs**

Using parametric cost estimating tools and methods and region specific cost data, develop facility replacement costs for each facility in the inventory listing. Cost estimating will be completed as a Class 5 Estimate based on the Association for the Advancement of Cost Engineering. Class 5 estimates carry a contingency range of -30% to +50%.

Obtain from the City, any historical project construction cost information as well as cost estimate development from the previous 2008 Utility System Master Plan to integrate into the parametric cost model.

Develop total project costs for replacement of each facility including:

- Estimated construction cost and construction contingency.
- Traditional contractor markups for overhead and profit; O&M manuals, startup, and training; payment and performance bonds.
- Taxes for non-tax exempt portions of construction.
- Escalation to mid-point of construction
- Engineering allowance for study, predesign, detailed design, bidding, services, engineering services during construction, resident field representation during construction, and post-construction services.
- City legal and administrative allowances.
- Other allowances such as material testing and field surveying services.
- Total project contingency.

**Task 215 – Develop Facility Replacement CIP**

Based each facility’s remaining useful life and total project cost estimates, establish the facility replacement CIP for inclusion into the 2015 Water Utility System Master Plan.

**Task 216 – Water Facility Assessment and Replacement CIP TM**

Document the facility assessment, criticality ranking, useful life basis, remaining useful life methodology, replacement costs, and replacement CIP in a summary TM (Water Facility Assessment and Replacement CIP).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #11.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report

**Task 217 – Workshop #11 – Water Facility Replacement CIP**

Conduct workshop to review the recommended water facility replacement CIP.

Prepare and distribute workshop agenda at least 5 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**PHASE E DELIVERABLES**

Task	Deliverables
201 / 205 / 207	• Water Facility Inventory, Criticality Ranking, and Useful Life For Each
209	• Workshop #10 agenda, review materials, and meeting minutes
211	• Water Facility Inventory, Criticality Ranking, Useful Life Basis, and Remaining Useful Life • Facility Site Tours

216	<ul style="list-style-type: none"> <li>• TM (Water Facility Assessment and Replacement CIP). One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #11</li> </ul>
217	<ul style="list-style-type: none"> <li>• Workshop #11 agenda, review materials, meeting minutes</li> </ul>

## **PHASE F – PIPELINE REPLACEMENT PLANNING AND CIP DEVELOPMENT**

The intent of this phase is to establish and implement a pipeline replacement CIP program based on a logical prioritization of pipe replacement needs and a basis for annual pipeline replacement budgets.

### **Task 231 – Compile Pipe Installation Year, Material, and Main Break History**

Collect and process existing distribution system piping data necessary to develop a pipeline replacement CIP. Complete three data collection and processing tasks:

**231.1** Pipe Installation Year and Material. Conduct a review meeting with the City to review reports, design drawings, and other relevant information in an effort to assign approximate installation year and material to pipes. During this meeting, develop distribution system maps with pipes colored by installation year and material designation.

**231.2** Transfer installation year and material data to GIS. This information may also be used in developing pipe Roughness (C value) values based on pipe material and age for the hydraulic model.

**231.3** Pipe Main Break History. Obtain and review the City's water main break/repair data, and develop an approach to assign main break data to pipes in GIS. The City will provide main break/repair history in an excel format spreadsheet format that matches the main break incident to a physical address. Utilize GIS based address matching of main break data to identify the pipe experiencing the failure.

**231.4** Establish GIS Pipe Attribute Fields. Work with the City to develop a procedure and new GIS pipe attribute fields to store historical main break data that will be updated as new main breaks occur. This GIS stored main break data can be used in the future to refine the pipeline replacement CIP and to determine the effectiveness of the CIP in reducing main break frequency. Coordinate with City to consider the role and use of City Works CMMS for compiling main break data and integration with GIS for compiling main break data.

### **Task 233 – Pipe Attribute Data**

Compile pipe attribute data (to the extent made available by the City) necessary for the pipeline replacement planning effort in a GIS compatible format. Relevant attribute data includes pipe age, pipe material, break/leak repair history, service pressure, and soil corrosion potential.

### **Task 235 – GIS Based Pipe Inventory Analysis and Development of Risk Criteria.**

**235.1** Prepare an initial analysis of pipe attribute data impacting pipe replacement needs. Summarize findings in figures and tables depicting existing system information as made

available from the City including location/occurrence of pipe by: age, material, pressure, breaks/leaks per mile by age per year, breaks/leaks per mile by material per year, installation in corrosive soil, etc.

- 235.2** Develop risk of failure (ROF) criteria and respective scoring methodology to use in developing replacement prioritization. ROF criteria include two categories – likelihood of failure (LOF) and consequence of failure (COF).

Conduct a review meeting with the City to review potential risk criteria and scoring methodology to be utilized during the replacement planning effort.

- 235.3** Work with City to finalize LOF criteria for use in the pipeline replacement planning effort. Initial items include:

- Age – Pipes are assigned progressively higher scores as their age increases.
- Material – Cast iron, ductile iron, steel, PVC, concrete, asbestos, HDPE materials are assigned scores based on potential for accelerated failure.
- Breaks/leak history – Pipe segments with elevated breaks/leaks per mile are assigned higher scores.
- Service pressure – As service pressures exceed defined thresholds, higher scores are assigned.
- Soil corrosion potential – Pipe segments located in corrosive soils are assigned higher scores.

- 235.4** Work with the City to finalize COF criteria for use in the pipeline replacement planning effort. Initial items include:

- Critical distribution system main – Water mains supplying critical water facilities such as WTPs, pump stations, groundwater wells, and reservoirs are assigned a higher score.
- Critical water supply service – Water mains providing service to critical facilities such hospitals, emergency response facilities, large retail centers, large schools, and emergency shelters are assigned a higher score.
- Related project coordination – This allows bringing a water main replacement forward in time if, for example, a street widening project or interceptor sewer project would allow convenient, simultaneous water main replacement under the same project. Utilize existing information from the City (5 year CIP Plan, Future Project List, etc.) where appropriate to identify related projects.
- Manager/Director input – This allows bringing a water main replacement forward in time in conjunction with overall development needs, emergency services, future plans, and other considerations that are best known to the City.

### **Task 237 – Risk of Failure and Replacement Priority Ranking Evaluation**

Combine LOF and COF scores to develop ROF scores for individual pipe segments. Using the ROF scores, compile a prioritized pipeline replacement ranking in the GIS based iCIP computer program. Prepare maps, figures, and tables to graphically depict the location and varying levels of pipe ROF scores as well as to summarize total miles of pipe and total pipe replacement costs contained in various ROF category groups.

### **Task 239 – Pipe Replacement Budget Strategy Evaluation**

Using pipe survival curve methodology or other similar methodology, develop alternative budget framework strategies for long-term, annual pipeline replacement program required to manage aging pipeline infrastructure. Consider various pipe survival curve assumptions (pessimistic versus optimistic versus Rapid City specific) in the development of budget framework strategies.

### **240 – Pipeline Replacement Priority and Budget Strategy Evaluation TM**

Document the pipeline replacement planning and budget strategy evaluation in a summary TM.

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #12.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

### **Task 241 – Workshop #12 – Pipeline Replacement Priorities and Budget Strategies**

Conduct workshop to review the priority ranking of pipeline replacements in iCIP, and budget framework strategies for long-term, annual pipeline replacement program.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

### **Task 243 – Develop Pipeline Replacement CIP**

Based on the prioritized replacement ranking and selected budget framework strategy, group high priority pipe segments into discreet replacement projects. Compile listing of replacement projects to establish a near-term (2015-2025) pipeline replacement CIP for inclusion into the 2015 Water Utility System Master Plan. The pipeline replacement CIP for years after 2025 will be established in 5-year periods to demonstrate 5-year funding requirements for the long-term replacement program.

- Submit short-term CIP to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the CIP at Workshop #12.
- Revise CIP with changes agreed to with the City for inclusion into the Master Plan Report.

## PHASE F DELIVERABLES

Task	Deliverables
231.1	• Review Meeting: Assign installation year and pipe materials for distribution system
231.2	• Pipe install year and material integrated with Part 1 GIS Update (Task 38)
235.2	• Review Meeting: Establish risk of failure criteria and scoring methodology
235.4	• Final likelihood and consequence of failure criteria listing
240	• TM (Pipeline Replacement Priority and Budget Strategy Evaluation). One pdf format electronic copy, and one MS Word format electronic copy. • Review at Workshop #12
241	• Workshop #12 agenda, review materials, and meeting minutes
243	• Pipeline Replacement CIP

## PHASE G – GPS FIELD SURVEY FOR GIS SURFACE FEATURE DEFINITION

### TASK 251 – Pressure Zone Review, Selection, and Inventory Development

The purpose of this task is to select two pressure zone service areas that will undergo a pilot GPS field survey of the water system surface features. The two service areas will be selected to demonstrate a wide range of conditions so that this pilot survey effort can establish adequate procedures for eventual survey of the City's remaining pressure zones during subsequent projects.

**251.1** Review Revised Pressure Zone Boundaries. There are 5 service areas and 15-20 pressure zones in the Rapid City water distribution system. Services areas are tied to common reservoirs and/or constant pressure booster stations, but are separated by intermediate pressure zones to control pressures within acceptable high and low limits. Pressure zone boundaries change slightly as new projects are completed. The depiction of these boundaries is currently being updated by the City in GIS to reflect actual field conditions. The location and operation status of the zone isolation and flow control valves are also currently being verified by the City. Review revised pressure zone boundaries with City provided information to gain an understanding of current zone boundaries and distribution system infrastructure included in each zone.

**251.2** Initial Review and Selection of Pressure Zones for GPS Field Survey. Conduct an informal meeting with the City to make an initial selection of two pressure zones to be included in the GPS field survey effort. An initial selection for development of the scope of services includes the Pinedale High High Zone (representing a zone that has changed very little since initial mapping / modeling efforts), and the Terracita High High Zone (representing a zone that has undergone numerous changes since initial mapping / modeling efforts).

Review a preliminary list of field codes for water system features to be identified during the GPS survey effort. Modify the list during discussion with the City and finalize during this initial review meeting. Include consideration for attributes of interest by the City Fire Department, Utility Maintenance Department, and Engineering Department. This scope of



services only includes collection of data on surface features that is readily available in the field when the survey is conducted. Completing attribute features and field codes through records search, as-built drawing review, GIS data extraction, excavation, and feature operation is not included as part of this work. Those features anticipated to be “not/if readily available” are designated below.

The following attributes have been initially identified by the City:

- Curb/stop boxes
  - Survey date
  - Location
  - Installation year (not readily available from field survey)
  - Public/private designation (not readily available from field survey)
  - Manufacturer (if readily available from field survey)
  - Size (if readily available from field survey)
  - Meter pit presence
  - Operational status
  - Account association (not readily available from field survey)
  
- Fire hydrants
  - Survey date
  - Location
  - Manufacturer
  - Public/private designation
  - Hydrant date
  - Green cap presence
  - White cap presence
  - Operational status (not readily available from field survey)
  - Cathodic protection presence (if readily available from field survey)
  - Tracer box presence (if readily available from field survey)
  
- Water valves
  - Survey date
  - Location
  - Manufacturer (not readily available from field survey)
  - Public/private designation (if readily available from field survey)
  - Cathodic protection presence (if readily available from field survey)
  - Turns for closure (by City staff if present)
  - Tracer wire presence (if readily available from field survey)
  - Operational status (not readily available from field survey)
  - Valve function (not readily available from field survey)
  - Size (not readily available from field survey)
  - Style (not readily available from field survey)

**251.3** Finalize Selection of Two Pressure Zones for GPS Survey and Develop Asset Inventory.  
Finalize selection of two pressure zones for the GPS field survey effort.

With City concurrence on selection of two zones for the GPS survey effort, develop an inventory of individual pressure zone assets (valves, hydrants, curb stops, etc.) to include in the GPS field survey effort along with the number of wells, booster stations, and reservoirs. Confirm inventory in each pressure zone is in agreement with revised pressure zone boundaries reviewed in previous tasks.

Conduct a review meeting with the City via conference call to review the asset inventory lists for the two selected pressure zones, and the final list of asset attributes.

### **TASK 253 – GPS Field Survey of Water Assets**

Once final pressure zones for the GPS survey are selected, a survey crew will GPS water system assets to define locational coordinates and ground surface elevations for valves, hydrants, PRV stations, master meters, curb stops, and private fire mains. Service line inclusion into the GPS survey is not planned. GPS survey will be conducted with a horizontal and vertical accuracy of +/- 0.3 feet.

**253.1** Review Existing Map Data Sources. Obtain and review existing infrastructure mapping and data sources for use during the field survey including current GIS maps, record drawings from past individual improvement projects, service line cards, and old “blue line” and “detail maps used prior to GIS.

**253.2** Conduct GPS Field Survey. Obtain locational coordinates and surface elevation data for items listed in the asset inventory. Utilize NAVD88 vertical elevation datum and South Dakota State Plane South Zone NAD 83 (2011) for this field survey effort. Complete initial efforts to field locate assets without assistance from the City. Adequate mapping is available to verify valve and hydrant locations. However, assistance from the City to locate curb stops and private fire mains is anticipated. If location of assets is unsuccessful, coordinate with the City to request further locate assistance by City field marking crews. It is anticipated that approximately 10% of the asset information will be unattainable using GPS technology. For these assets, collect locational coordinates and surface elevation data using conventional survey methods and equipment.

**253.3** Review Collected Data versus Anticipated Assets. Following completion of the field survey efforts, compile a summary of the survey results including (1) a comparison of data obtained versus inventoried assets, and (2) a comparison of NAVD88 based surface elevations versus the elevation obtained from previous tasks related to the system wide conversion of NGVD29 to NAVD88.

### **TASK 254 – GPS Survey of Service Lines**

Map five new service lines (from corporation stop to curb stop to meter pit to service entrance at building as available) with GPS location and field codes with the intent to map the services to a level that one-call locates can be conducted using the GPS mapped service line data.

Investigate an automated method of using GPS mapped data to create City Card Files for the service lines and incorporation of data into the City GIS database with the intent that future service lines

may be represented in the GIS database in the same way that water distribution mains currently are.

**TASK 255 – Document Results of GPS Field Survey and Service Line GPS Survey. Develop Plan for Surveying Balance of System**

The GPS field survey effort will generate data that will update the GIS database with regard to water system surface features that can in turn be used to refresh the water model in a future update.

**255.1** Compile GPS features into Comprehensive Geodatabase. Compile GPS survey information in a geodatabase, and deliver to the City. The City will incorporate the geodatabase information into the GIS database, update GIS linework, confirm connectivity, and eliminate orphan nodes as necessary.

**255.2** Document GPS Survey Results and Workflow. Following completion of the GPS field survey effort, develop a recommended workflow process to document the tasks, level of effort/time, and division of responsibilities between the City and Engineer. The recommendations will be used by the City to develop a measured approach to conduct GPS field surveys for the remainder of the water system pressure zones and for GPS surveys of new water service lines.

**255.3** GPS Survey Results and Workflow

Document the GPS field survey and service line GPS survey results and a recommended workflow methodology for surveying the balance of the distribution system assets in a summary TM.

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #13.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

**Task 257 – Workshop #13 – GPS Field Survey Workflows and Results**

Conduct workshop to review the GPS field survey results and recommended workflows developed during this phase. Revise recommended workflows based on input from the City and incorporate into documents prepared in Phase H (Definition of Policies, Processes, and Procedures)

Prepare and distribute workshop agenda at least 5 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**PHASE G DELIVERABLES**

Task	Deliverables
251.3	• Asset inventory lists for each of the two selected pressure zones

	<ul style="list-style-type: none"> <li>• Review Meeting</li> </ul>
255.1	<ul style="list-style-type: none"> <li>• GPS Survey geodatabase</li> </ul>
255.3	<ul style="list-style-type: none"> <li>• TM (GPS Survey Results and Workflow); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review at Workshop #13</li> </ul>
257	<ul style="list-style-type: none"> <li>• Workshop #13 agenda, review materials, and meeting minutes</li> </ul>

## PHASE H – DEFINITION OF POLICIES, PROCESSES, AND PROCEDURES

### Task 271 – Master Plan Updates, Amendments, and Revisions

Develop a Process and Procedure (P&P) Memorandum defining requirements and guidelines to be followed for amending, revising, and updating the Water Utility System Master Plan. Establish a frequency for updating the Master Plan and an outline of topics that are required for each major update such as population projections, land use projections, design year designations, etc. Establish procedures for documenting and incorporating smaller scale changes and revisions into the master plan using amendments. Apply the processes and procedures developed in this task to the 2008 Water Utility System Master Plan Report to establish how that master plan will continue to be utilized following completion of this project.

- Prepare and submit a topic based outline of the P&P Memo for City review and comment.
- Submit draft P&P Memo to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct review meeting with the City.
- Revise P&P Memo with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report.

### Task 273 – Model Maintenance and Updates

Develop a P&P Memorandum documenting work effort developed in Tasks 107, 123, 124, and 126 which develop procedures to update the hydraulic model from GIS data. The model maintenance procedures will rely on but not be limited to the INFOWATER GIS Gateway tools. Include development of procedures to update demands in the model based on new customer metered sales data, and allocation of demands into the hydraulic model. Include approach to maintain the integrity of master hydraulic model files under use simultaneously by multiple users. Procedures to transfer operating data (pump operations, etc.) from SCADA and other sources is not included as part of this task but will be included during Phase J (Training and Continuing Services Support).

- Prepare and submit a topic based outline of the P&P Memo for City review and comment.
- Submit draft P&P Memo to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.

- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct review meeting with the City.
- Revise P&P Memo with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report.

**TASK 275 – Water System Surface and Service Line Feature GPS Definition**

Develop a P&P Memorandum documenting work effort developed in Phase G, and defining a measured approach to (1) GPS survey for surface feature definition in GIS, and (2) GPS survey for service line data collection. Establish required survey procedures and submittal requirements for developers, surveyors, and engineering consultants relating to GPS survey requirements of new assets for inclusion as a construction phase deliverable in addition to the current “red line” drawing requirements.

- Prepare and submit a topic based outline of the P&P Memo for City review and comment.
- Submit draft P&P Memo to City and internal QA/QC team for review and comment. City will provide written review comments within 10 days after submittal of the memo.
- Conduct review meeting with the City.
- Revise P&P Memo with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report.

**Task 277 – Project Development Submittal Requirements for Evaluation and GIS/Model Integration**

Develop a P&P Memorandum defining submittal requirements for development plans and projects so that initial pipe sizing can be defined, new project information can be efficiently input/established in GIS, and information can be made available for subsequent GIS data extractions and hydraulic model updates.

- Prepare and submit a topic based outline of the P&P Memo for City review and comment.
- Submit draft P&P Memo to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct review meeting with the City.
- Revise P&P Memo with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report.

Develop the memorandum to also address submittal requirements that will allow the City to evaluate the infrastructure requirements of a planned development and its impact on existing City facilities. Establish:

- Initial, final, approved, and as-constructed submittal requirements/format including CAD layer standards, GIS attribute data, GPS field data for water main and service line as-constructed data (top of pipe coordinates and elevation, bend locations and elevation, corporation stops, curb stops, meter boxes, service entrance, etc.) for future one-call locates

- Procedures and submittal requirements for fire flow analysis requests.
- Fee schedules for hydraulic modeling services and GIS data integration
- Hydraulic model scenario management and GIS database management procedures for planned developments in various stages of approval (proposed but not approved; approved but not constructed; construction in progress; construction completed).
- Procedures and submittal requirements to allow the City to evaluate and determine the size/capacity requirements for proposed infrastructure as it pertains to developments and City projects.
- Procedures to incorporate completed projects into GIS and hydraulic model updates for future analyses or one-call utility locates.
- Procedures for having hydraulic modeling completed exclusively by the City versus allowing consultants to conduct modeling evaluations (with either a City owned work station or via distribution of the hydraulic model files directly to consultants).

### **Task 279 – Design Criteria Review and Amendments**

Review components of the City’s Infrastructure Design Criteria Manual (IDCM) as it relates to the following items:

- General review of Section 3 (Water and Wastewater Utilities) for water system components.
- More detailed review and recommended modifications to specific sections including:
  - 3.9.1 – Design Life
  - 3.9.2 – Design Criteria including (1) domestic water use criteria, (2) fire flow requirements, and (3) allowable pipe velocities.
  - 3.9.4 – Pressure
  - 3.9.6 – Fire Flows
  - 3.9.8 – Valves
  - 3.9.9 – Fire Hydrants
  - 3.9.15 – Design Calculations Submittal Requirements for Water Mains
  - 3.10 – Regional Water Facilities
  - Criteria supplements for 3.10
  - Tables 3-1 and 3-2
  - Figure 3.1 as it relates to dual water mains for streets with pavement widths exceeding 42 feet (arterials).

Review the City’s current water main oversizing policy and provide comments relating to applicability, functional implementation, and potential revisions. Qualitatively review the potential practice of granting an exemption to sizing water mains based on required fire flows if all properties in a development are equipped with fire sprinklers in buildings.

Develop proposed amendments to the IDCM and the water main oversizing policy for use in adoption of new/revised City requirements, documents, and ordinances.

- Prepare and submit a topic based outline of the IDCM amendments and water main oversizing policy for City review and comment.

- Submit draft amendments background and recommended revisions to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct review meeting with the City.
- Revise IDCM amendments with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report.

**Task 281 – Review of Potential Valve Closure Management Approaches and Systems**

Review potential GIS based systems and approaches that allows the City to manage, track, revise, and report on system valve positions. This would allow report generation indicating normal valve position/purpose (i.e. normally closed zone separation, normally open, etc.), current valve position (open or closed), and updating of valve position status as a result of maintenance activity.

- 281.1** Needs Assessment. Conduct a needs assessment by interviewing City staff to understand existing methods and establish desired functionality.
- 281.2** Strategy and Approach Development. Develop alternative strategies for handling and modifying GIS data during valve operation. Consider hardware/software alternatives, electronic accessibility alternatives, update frequency (real-time, daily, or other), reporting functionality,
- 281.3** Prepare TM. Document alternative strategies in a TM (Valve Closure Management Approaches and Systems) and recommend a preferred approach following City review of the TM.
- 281.4** Conduct review meeting with the City. Revise TM with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report and subsequent implementation by the City Prepare TM.
- 281.5** Implementation Assistance. Implementation of a GIS based valve closure management system will be completed by the City. Provide up to 40 hours of implementation assistance to City staff during the implementation period.

**Task 283 – Review of Potential Water System Base Map Accessibility Approaches and Systems**

Review potential GIS based systems and approaches for implementing field availability of high-resolution mapping of water system infrastructure using electronic accessibility systems, hardware devices, and software.

- 283.1** Needs Assessment. Conduct a needs assessment by interviewing City staff to understand existing methods and establish desired functionality.

- 283.2** Strategy Development. Develop alternative strategies and approaches for handling and modifying GIS based water system base maps during system operation and maintenance. Consider hardware/software alternatives and electronic accessibility alternatives.
- 283.3** Prepare TM. Document alternative strategies and approaches in a TM (Water System Base Map Accessibility Approaches and Systems) and recommend a preferred approach following City review of the TM.
- 283.4** Conduct review meeting with the City. Revise TM with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report and subsequent implementation by the City.
- 283.5** Implementation Assistance. Implementation of a GIS based water system base mapping for use in the field will be completed by the City. Provide up to 40 hours of implementation assistance to City staff during the implementation period.

**Task 285 – Review of IT Hardware Requirements for Hydraulic Modeling and GIS Functions in Public Works and Utility Maintenance**

Conduct a review and evaluation of IT hardware requirements for City staff in Public Works who will be involved with activities relating to future hydraulic model and GIS updates, ongoing, routine hydraulic modeling tasks, and graphics/mapping development related to the water utility system master planning. Recommend preferred hardware devices and other related equipment for efficient functionality.

Conduct a review and evaluation of IT hardware requirements for City staff in Utility Maintenance for data retrieval of maps and for data transfer of GPS survey information into GIS from the Utility Maintenance location. Recommend preferred hardware devices and other related equipment for efficient functionality.

Summarize IT hardware recommendations in a summary TM (IT Hardware Recommendations for Public Works and Utility Maintenance related to hydraulic modeling and GIS data retrieval).

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct review meeting with the City. Revise TM with changes agreed to with the City for inclusion into the Definition of Policies, Processes, and Procedures Report and subsequent implementation by the City.

**PHASE H DELIVERABLES**

Task	Deliverables
271	<ul style="list-style-type: none"> <li>• P&amp;P Memorandum Outline and Memo (Master Plan Updates, Amendments, and Revisions); One pdf format electronic copy, and one MS Word format electronic copy.</li> </ul>



	<ul style="list-style-type: none"> <li>• Review Meeting</li> </ul>
273	<ul style="list-style-type: none"> <li>• P&amp;P Memorandum Outline and Memo (Model Maintenance and Updates); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> </ul>
275	<ul style="list-style-type: none"> <li>• P&amp;P Memorandum Outline and Memo (Water System Surface Feature GPS Definition); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> </ul>
277	<ul style="list-style-type: none"> <li>• P&amp;P Memorandum Outline and Memo (Project Development Submittal Requirements for Evaluation and GIS/Model Integration); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> </ul>
279	<ul style="list-style-type: none"> <li>• Outline and IDCM Amendment – Fire Flow Criteria</li> <li>• Outline and IDCM Amendment – Water Main Oversizing</li> <li>• Review meeting</li> </ul>
281	<ul style="list-style-type: none"> <li>• Needs Assessment Interview Meeting</li> <li>• TM (Valve Closure Management Approaches and Strategies); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> <li>• Implementation Assistance (40 hours).</li> </ul>
283	<ul style="list-style-type: none"> <li>• Needs Assessment Interview Meeting</li> <li>• TM (Water System Base Map Accessibility Approachs and Strategies); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> <li>• Implementation Assistance (40 hours)</li> </ul>
285	<ul style="list-style-type: none"> <li>• TM (IT Hardware Recommendations for Public Works and Utility Maintenance related to hydraulic modeling and GIS data retrieval); One pdf format electronic copy, and one MS Word format electronic copy.</li> <li>• Review Meeting</li> </ul>

## PHASE I – CAPITAL IMPROVEMENT PLAN AND MASTER PLAN REPORT

### Task 301 – Recommended Capital Improvement Plan (CIP)

Compile and document a recommended CIP based on efforts completed in previous tasks for the following project categories:

- Distribution system operational improvements (capacity, operational, and reliability)
- Growth based improvements
- Facility replacement program
- Pipeline replacement program

Stage operational and growth based improvements for the short, medium, and long-term design years, and in one-year increments through first 10-year period.

Stage facility replacement projects into the CIP such that their replacement is completed prior to the expiration of their remaining useful life.

Stage pipeline replacement CIP projects in one-year increments through the first 10-year period based on replacing the highest priority pipelines first with available budget established for the replacement program. The pipeline replacement CIP for subsequent years will be established in 5-year periods to demonstrate 5-year funding requirements for the long-term replacement program.

Organize recommended CIP projects by pressure zone.

Document the recommended CIP in a summary TM along with maps, figures, and graphics.

- Submit draft TM to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.
- City will provide written review comments within the time frame defined in the City Review Framework Table.
- Conduct a review of the TM at Workshop #14.
- Revise TM with changes agreed to with the City for inclusion into the Master Plan Report.

### **Task 303 – Draft Master Plan Report**

Prepare and submit a draft Master Plan report focusing on the technical aspects of the water system planning effort and summarizing the project efforts and recommendations including:

- Historical and future water demands.
- Level of growth in each operational pressure zone
- Hydraulic model update and calibration.
- Existing system deficiencies.
- Surface water and ground water supply evaluations.
- Mountain View WTP capacity phasing plan.
- Short, medium, and long-term hydraulic analyses.
- Fire flows, reliability/redundancy and interconnections, water age/quality, system pressures and pressure zone boundaries.
- Facility criticality ratings and replacement plan.
- Pipeline criticality ratings and replacement plan.
- GPS field survey for GIS surface feature definition.
- Phased Capital Improvements Plan including Improvement, Growth, and Replacement Projects.
- Define how various chapters and sections of the 2008 Water Utility System Master Plan Report will continue to be utilized following completion of this project by identifying portions of that report that are to be replaced, left unchanged, or modified by work completed during this project.

In a separate document, prepare and submit a draft Definition of Policies, Processes, and Procedures report focusing on outcomes of Phase H

Compile TMs prepared during previous tasks into a separate document to accompany the Master Plan Report and document project background, interim deliverables, and City comments.

Submit drafts of both report documents to the City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.

City will provide written review comments within the time frame defined in the City Review Framework Table.

Conduct a review of both report documents at Workshop #14.

Revise report with changes agreed to with the City for inclusion into the final versions of each report.

**Task 305 – Workshop #14 - Capital Improvement Plan (CIP) and Draft Report Review**  
Conduct workshop to review the recommended Capital Improvement Plan (CIP) and draft report.

Prepare and distribute workshop agenda at least 7 working days prior to workshop. Prepare minutes to document discussion, meeting results, and action items within 5 working days after workshop.

**Task 307 – Final CIP and Master Plan Report**

Prepare a draft final master plan report incorporating revisions agreed to with the City in Workshop #14.

Submit draft final master plan to City and internal QA/QC team for review and comment. Conduct formatting/grammar QA/QC prior to submittal to City. Conduct technical QA/QC concurrent with review by City.

City will provide written review comments within the time frame defined in the City Review Framework Table.

Conduct a review of the draft final master plan at Workshop #15.

Revise the final master plan report with changes agreed to with the City, and submit the final report.

**PHASE I DELIVERABLES**

Task	Deliverables
301	<ul style="list-style-type: none"><li>• TM (Recommended CIP). Six hard copies. One pdf format electronic copy.</li><li>• Review at Workshop #14</li></ul>
303	<ul style="list-style-type: none"><li>• Draft Master Plan Report. Six hard copies. One pdf format electronic copy, , and one MS Word format electronic copy.</li><li>• Review at Workshop #14</li></ul>

305	<ul style="list-style-type: none"> <li>• Workshop #14 agenda, review materials, meeting minutes</li> </ul>
307	<ul style="list-style-type: none"> <li>• Draft Final Master Plan Report. Six hard copies. One pdf format copy.</li> <li>• Review at Workshop #15</li> <li>• Final Master Plan Report. Ten hard copies, and 10 accompanying CDs. One pdf format electronic copy, and .</li> <li>• Final project support files (INFOWATER model, iCIP model, etc.). 3 copies on CDs.</li> </ul>

## PHASE J – TRAINING AND CONTINUING SERVICES SUPPORT

### Task 331 – Training

The City has previously committed staff for maintaining and providing GIS and hydraulic modeling services. Through the model update and recalibration process, inform and train City staff in model structure, construction, scenario management, use of the model, and database interface. This phase arranges for on the job training as the work progresses so that City staff is fully involved in the modeling efforts and process as they occur. The following training tasks are planned:

**331.1** Weekly Technical Transfer Sessions. Conduct technical transfer sessions with City staff to share experience and demonstrate modeling tasks/activities as they are completed during the project. Conduct the technical transfer via internet video and audio sharing. Hands-On modeling practice by City staff during the sessions will be encouraged. Conduct technical transfer sessions on a weekly basis, with the session schedules adjusted to integrate with workshops and other project meetings.

**331.2** Critical Learning Topic Training. Conduct topic specific training for critical learning tasks as the work progresses. Conduct these training sessions onsite with either Engineer’s staff in Rapid City or City staff in Engineer’s Denver office. This training task includes 10 days of Engineer’s onsite time in Rapid City spread over four separate trips. Final training session topics will be finalized with the City, but could include:

- Model calibration
- Scenario management and datasets
- Model maintenance procedures
- Fire flow and water age analyses
- iCIP use for project identification

**331.3** Modeling Break-Out Sessions. Conduct modeling break-out sessions with the City as an extension of Workshops planned during progression of the work. Work with the City to determine the topics requiring additional discussion during individual break-out sessions. These break-out sessions are intended to last 2-4 hours and be conducted either immediately before or after planned workshops. 15 project workshops are planned and available to schedule concurrent modeling break-out sessions.

**331.4** Service Line GPS Survey and Line Card Development. Conduct training with the City’s Utility Maintenance staff to establish procedures for obtaining GPS data on water service

lines as described in Task 254 including GPS survey logistics and activities and development of line cards from the collected data.

### **Task 333 – Continuing On-Call Modeling Support Services**

Provide on-call, as-needed services for a 2-year period following completion of project tasks. On-call modeling support services are intended to provide additional training, operational analyses, and troubleshooting of model functionality where Engineer will act as an extension of City staff to provide specialized expertise or additional resource capability to accomplish tasks.

All on-call modeling support services will be authorized by task orders issued by the City. No work for on-call modeling services will be performed until the Task Order is final and approved by the City and Engineer. Task orders will be developed to include:

- A detailed statement of work to be performed
- The format and content of any deliverables which may be required
- A performance time schedule indicating when tasks are to be completed and/or deliverables submitted
- Estimates of hours and costs required to perform the statement of work along with upper cost limits not to be exceeded.

**Exhibit B**  
**Rapid City, South Dakota**  
**Water Utility System Master Plan and Hydraulic Model Recalibration/Update**  
**Fee Estimate Summary**

	<b>Project Services</b>	<b>Black &amp; Veatch</b>	<b>Banner</b>	<b>FMG</b>	<b>Reimbursable Expenses</b>	<b>Total</b>
A	Project Initiation, Recurring Meetings, and Management	\$91,687	\$32,633	\$30,577	\$2,477	\$157,374
	Workshops and Meetings - All Phases	\$85,723	\$28,098	\$16,715	\$63,135	\$193,671
B	GIS Data and Hydraulic Model Recalibration/Update	\$94,681	\$9,240	\$7,770	\$1,953	\$113,643
C	Hydraulic Modeling Analyses and Improvements Planning	\$196,219	\$56,299	\$3,481	\$3,818	\$259,818
D	Existing System Hydraulic Analyses for System Reliability/Redundancy, Fire Flow Evaluations, System Pressures, and Pressure Zone Boundaries	\$37,108	\$61,607	\$948	\$2,289	\$101,951
E	Water Facility Assessments and Replacement CIP Development	\$38,370	\$0	\$4,856	\$2,822	\$46,048
F	Pipeline Replacement Planning and CIP Development	\$52,712	\$3,170	\$3,765	\$922	\$60,570
G	GPS Field Survey for GIS Surface Feature Definition	\$7,781	\$0	\$91,337	\$2,951	\$102,068
H	Definition of Policies, Processes, and Procedures	\$73,279	\$13,031	\$8,911	\$1,541	\$96,762
I	Capital Improvement Plan and Master Plan Report	\$98,404	\$21,036	\$14,211	\$2,180	\$135,830
J	Training and Continuing Services Support	\$55,797	\$34,038	\$1,475	\$6,541	\$97,851
<b>TOTALS</b>		<b>\$ 831,761</b>	<b>\$ 259,151</b>	<b>\$ 184,046</b>	<b>\$ 90,628</b>	<b>\$ 1,365,586</b>

**EXHIBIT B**  
**Rapid City, South Dakota**  
**2015 Water Utility System Master Plan Update and Model Recalibration**  
**Level of Effort and Fee Estimate**

**Note: Cost for each task includes fee for both Engineer and Engineer's Subconsultants**

A	PROJECT INITIATION, RECURRING MEETINGS, AND MANAGEMENT	COST
101	Prepare and Finalize Project Execution Plan	\$5,600
103	Data Information Request	\$2,843
105	Review and Incorporation of Previous Reports	\$46,446
105	Additional level of effort for document reviews identified during study	\$8,512
107	GIS and Hydraulic Model Update Procedures	\$2,512
109	Distribution System Operation Review	\$3,776
111	Workshop #1 - Project Initiation, GIS/Model Update Approach, Operations Review, IDCM Review	COVERED IN WORKSHOPS/MEETINGS BELOW
113	Recurring Meetings	\$0
113.1	Bi-Weekly Project Management Call	\$18,047
115	Project Management and Administration	\$67,162
X1	Reimbursable Expenses	\$2,477
	<b>SUBTOTAL==&gt;</b>	<b>\$157,374</b>

A	PROJECT WORKSHOPS AND MEETINGS	COST
231.1/105/279	Review Meeting - Pipe Age/Material; Previous MP Reports; IDCM criteria and main oversizing	\$6,414
111	Workshop #1 - Project Initiation, GIS/Model Update Approach, Operations Review, IDCM Review	\$7,826
105/279	Review Meeting - Previous Master Plan Reviews; IDCM Design Criteria TM Review	\$4,784
251.3	Review Meeting - GPS Survey Pressure Zone Finalization, Inventory List, and Field Code List	\$626
135-209-235.2	Workshop #2 - Hydraulic Model Update and Future Demand Projections	
	Workshop #10 - Water Facility Inventory, Criticality, and Useful Life	\$5,449
	Review Meeting - Pipeline Replacement Risk Criteria and Scoring Methodology	
253.3	Review Meeting - GPS Field Survey Progress Update	\$1,204
147	Workshop #4 - Model Calibration; Surface/Groundwater Supply Schematics	\$6,730
217	Workshop #11 - Water Facility Replacement CIP	
241	Workshop #12 - Pipeline Replacement Priorities and Budget Strategies	\$6,703
257	Workshop #13 - GPS Field Survey Workflows and Results	
243	Review Meeting: Pipeline Replacement CIP	\$4,532
281.1	Needs Assessment Interviews: Valve Closure Management	
283.1	Needs Assessment Interviews: Water Base Mapping	\$3,292
285.1	Needs Assessment Interviews: IT Hardware Evaluation	
275	Review Meeting - P&P Memo - Water System Surface Feature and Service Line GPS Definition	\$1,199
150.4	Workshop #3 - Surface Water 1st and Groundwater 1st Supply Alternatives Review	\$6,396
281.4	Review Meeting: Valve Closure Management	
283.4	Review Meeting: Water Base Mapping	\$4,363
285.5	Review Meeting: IT Hardware Evaluation	
173.5	Review Meeting: TM Review - Fire Flow Analyses	\$2,985
151.4.B	East Side WTP Site Selection Criteria Review and Potential Location Site Visits	\$7,354
151.4.D	Workshop #16: East Side WTP Alternative Site Screening Evaluation	\$7,741
150.7	Workshop #5: Water Supply Alternatives Evaluation Results (Public Works Director Briefing)	\$6,153
273	Review Meeting: P&P Memo - Model Maintenance and Updates	\$4,728
171.5	Review Meeting: TM Review - System Reliability and Redundancy Analyses	
155	Workshop #6 - Medium-Term Hydraulic Analyses and Results	\$5,795
177	Workshop #9 - System Reliability, Fire Flow, and Pressure Zone Boundary Eval	\$4,662
277	Review Meeting: P&P Memo - Project Development Submittals Requirements	\$4,293
159	Workshop #7 - Long Term Hydraulic Analyses and Improvements	\$4,517
271	Review Meeting: P&P Memo - Master Plan Amendment and Revisions	\$1,796

**EXHIBIT B**  
**Rapid City, South Dakota**  
**2015 Water Utility System Master Plan Update and Model Recalibration**  
**Level of Effort and Fee Estimate**

165	Workshop #8 - Short Term Hydraulic Analyses and Improvements	\$3,624
301	Review Meeting; Recommended CIP for Master Plan Report	\$5,674
305	Workshop #14 - CIP and Draft Master Plan Review	\$6,635
307.2	Workshop #15 - Draft Final CIP and Master Plan Report Review	\$5,060
X1	Reimbursable Expenses	\$1,985
X2	Travel Costs	\$61,150
	<b>SUBTOTAL==&gt;</b>	<b>\$193,671</b>

B	GIS DATA AND HYDRAULIC MODEL RECALIBRATION/UPDATE	COST
121	Part 1 GIS Water System Feature Update	\$11,199
122	NGVD29 to NAVD88 Vertical Datum/Elevation Conversion	\$5,415
123	Part 1 GIS Data Extraction and Hydraulic Model Update	\$21,578
124	Develop Model Maintenance Procedures - TM	\$9,222
125	Part 2 GIS Water System Feature Update	\$19,025
126	Part 2 GIS Data Extraction and Hydraulic Model Update	\$9,196
131	Historical Population, Water Use, Metered Sales, Demand Patterns, Peaking Factors	\$7,938
131	TM (Historical Water Use, Demand Patterns, & Peaking Factors)	\$2,996
133	Future Service Population and Water Demand Projections	\$7,992
135	Workshop #2 - Hydraulic Model Update and Future Demand Projections	COVERED IN WORKSHOPS/MEETINGS ABOVE
139	Metered Sales Evaluation and Allocation to Hydraulic Model	\$4,542
141	Maximum Day 24-Hr EPS Model Calibration Data Development and Input	\$4,145
143	Maximum Day 24-Hr EPS Hydraulic Model Calibration	\$6,567
143	TM (Maximum Day Model Calibration)	\$1,875
147	Workshop #4 - Model Calibration, Exist Sys Deficiencies; Surface/Groundwater Supply Schematics	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$1,953
	<b>SUBTOTAL==&gt;</b>	<b>\$113,643</b>

C	HYDRAULIC MODELING ANALYSES AND IMPROVEMENT PLANNING	COST
150	Define Surface and Groundwater Supply Alternatives	\$0
150.1	Review 2008 Planning Documents and SWUT Related to WTP Location and Water Supply	\$4,890
150.2	Surface Water 1st Supply Strategy	\$39,624
150.3	Groundwater 1st Supply Strategy	\$26,446
150.4	Workshop #3 - Surface Water 1st and Groundwater 1st Supply Alternatives Review	COVERED IN WORKSHOPS/MEETINGS ABOVE
150.5	Define Balanced Supply Strategy	\$19,341
150.6	TM (Water Supply Alternatives Evaluation)	\$4,351
150.7	Workshop #5 - Water Supply Alternatives Evaluation Results & Public Works Director Briefing	COVERED IN WORKSHOPS/MEETINGS ABOVE
151	Medium-Term Hydraulic Modeling Analyses and Improvements Planning	\$0
151.1	Medium-Term Pipe, Valve, Pump, and Tank Model Facilities (Surface Water 1st, Groundwater 1st)	\$4,542
151.2	Medium-Term Demand Allocation	\$1,817
151.3	Medium-Term Analysis - Surface Water 1st	\$42,168
151.4	East Side WTP Preliminary Site Evaluation and Selection	\$0
151.4.A	Identify Potential Sites for new East Side WTP	\$5,950
151.4.B	Conduct Site Visits of Potential Sites and Select 3 Final Candidate Sites	COVERED IN WORKSHOPS/MEETINGS ABOVE
151.4.C	Develop Site Evaluation Criteria and Prepare Summary TM	\$9,935
151.4.D	Workshop #16: Conduct Alternative Site Screening Evaluation	COVERED IN WORKSHOPS/MEETINGS ABOVE
151.4.E	TM (East Side WTP Site Evaluation Summary and Recommendation)	\$7,857
151.5	Detailed Medium-Term Hydraulic Analyses & Improvements With Recommended Supply Alternative	\$20,147
151.5	TM (Detailed Medium-Term Hydraulic Analyses)	\$4,351
155	Workshop #6 - Medium-Term Hydraulic Analyses and Results	COVERED IN WORKSHOPS/MEETINGS ABOVE
157	Long-Term Hydraulic Analyses and Improvement Planning	\$0
157.1	Long-Term Pipe, Valve, Pump, and Tank Model Facilities	\$2,574



**EXHIBIT B**  
**Rapid City, South Dakota**  
**2015 Water Utility System Master Plan Update and Model Recalibration**  
**Level of Effort and Fee Estimate**

157.2	Long-Term Demand Allocation	\$1,666
157.3	Long-Term Hydraulic Analyses	\$22,365
157.3	TM (Long-Term Hydraulic Analyses)	\$4,048
159	Workshop #7 – Long-Term Hydraulic analyses and Results	COVERED IN WORKSHOPS/MEETINGS ABOVE
161	Short-Term Hydraulic Analyses and Improvement Planning	\$0
161.1	Short-Term Pipe, Valve, Pump, and Tank Model Facilities	\$2,120
161.2	Short-Term Demand Allocation	\$1,666
161.3	Short-Term Hydraulic Analyses	\$15,302
161.3	TM (Short-Term Hydraulic Analyses and Water Age Analyses)	\$4,066
163	Short and Medium-Term Water Age Analyses	\$10,774
165	Workshop #8 – Short-Term Hydraulic and Water Age Analyses and Results	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$3,818
	<b>SUBTOTAL==&gt;</b>	<b>\$259,817</b>

D	EXISTING SYSTEM HYDRAULIC ANALYSES (REDUNDANCY, FIRE FLOW, PRESSURE ZONES)	COST
171	System Reliability/Redundancy Analyses	\$408
171.1	Pressure Zone Reliability/Redundancy Evaluations	\$3,295
171.2	Identify Critical Facility Outage Potential	\$5,654
171.3	Identify Potential Critical Water Service Customers	\$2,912
171.4	Hydraulic Analyses to Improve Redundant Service Capabilities	\$12,297
171.5	TM (System Reliability/Redundancy Analyses and Improvement Recommendations)	\$7,147
173	Fire Flow Analyses	\$408
173.1	System-Wide Hydrant Capacities	\$9,879
173.2	Multiple Hydrant Fire Flow Analyses	\$8,976
173.3	Fire Hydrants with Potential to Cause Negative Pressures at High Ground Elevations	\$9,487
173.4	Recommended Improvements to Fire Flow Service	\$7,122
173.5	TM (Fire Flow Analyses)	\$5,512
175	Pressure Zone Boundaries and System Pressures	\$5,520
175	TM (Pressure Zone Boundary Analyses)	\$5,379
177	Workshop #9 - System Reliability, Fire Flow, and Pressure Zone Boundary Eval	COVERED IN WORKSHOPS/MEETINGS ABOVE
181	Final Medium, Long, and Short-Term Analyses	\$15,666
X1	Reimbursable Expenses	\$2,289
	<b>SUBTOTAL==&gt;</b>	<b>\$101,951</b>

E	WATER FACILITY ASSESSMENTS AND REPLACEMENT CIP DEVELOPMENT	COST
201	Review Water Facility Information and Compile Inventory Listing	\$4,468
205	Establish Criticality Ranking For Water Facilities	\$2,762
207	Establish Useful Life Values for Water Facilities	\$2,132
209	Workshop #10 – Water Facility Inventory, Criticality, and Useful Life Values	COVERED IN WORKSHOPS/MEETINGS ABOVE
211	Conduct Facility Site Tours and Determine Remaining Useful Life De-rating Score	\$7,076
213	Develop Facility Replacement Costs	\$12,564
215	Develop Facility Replacement CIP	\$8,524
216	Water Facility Assessment and Replacement CIP TM	\$5,700
217	Workshop #11 – Water Facility Replacement CIP	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$672
X2	Travel Costs	\$2,150
	<b>SUBTOTAL==&gt;</b>	<b>\$46,048</b>

F	PIPELINE REPLACEMENT PLANNING AND CIP DEVELOPMENT - 2015 WORK	COST
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**EXHIBIT B**  
**Rapid City, South Dakota**  
**2015 Water Utility System Master Plan Update and Model Recalibration**  
**Level of Effort and Fee Estimate**

231	Compile Pipe Installation Years, Materials, and Main Break History	\$198
231.1	Pipe Installation Year and Material	\$0
231.2	Transfer Installation Year and Material to GIS	\$4,096
231.3	Pipe Main Break History	\$4,254
231.4	Establish GIS Pipe Attribute Fields	\$1,324
233	Pipe Attribute Data	\$3,232
235	GIS Based Pipe Inventory Analysis and Development of Risk Criteria	\$0
235.1	Initial Analysis of Pipe Attribute Data	\$3,412
235.2	Develop Risk of Failure Criteria and Scoring Methodology (Review Meeting)	COVERED IN WORKSHOPS/MEETINGS ABOVE
235.3	Finalize Likelihood of Failure Criteria	\$2,740
235.4	Finalize Consequence of Failure Criteria	\$6,404
237	Risk of Failure and Replacement Priority Ranking Evaluation	\$8,061
239	Pipe Replacement Budget Strategy Evaluation	\$9,120
240	TM ( Pipeline Replacement Priority and Budget Strategy Evaluation)	\$5,189
241	Workshop #12 -- Pipeline Replacement Priorities and Budget Strategies	COVERED IN WORKSHOPS/MEETINGS ABOVE
243	Develop Pipeline Replacement CIP	\$11,618
X1	Reimbursable Expenses	\$922
	<b>SUBTOTAL==&gt;</b>	<b>\$60,570</b>

<b>G</b>	<b>GPS FIELD SURVEY FOR GIS SURFACE FEATURE DEFINITION</b>	<b>COST</b>
251	Pressure Zone Review, Selection, and Inventory Development	\$0
251.1	Review Revised Pressure Zone Boundaries	\$1,307
251.2	Initial Review and Selection of Pressure Zones for GPS Field Survey; Field Code Review	\$1,599
251.3	Finalize Selection of Two Pressure Zones and Develop Asset Inventory	\$1,317
253	GPS Field Survey of Water Assets	\$0
253.1	Review Existing Map Data Sources	\$6,869
253.2	Conduct GPS Field Survey - Pressure Zone 1 - Pindale	\$35,207
253.2	Conduct GPS Field Survey - Pressure Zone 2 - Terracita	\$24,732
253.3	Review Collected Data versus Anticipated Assets	\$5,881
254	GPS Survey of Service Lines	\$2,229
255	Document Results of GPS Field Survey and Develop Plan for Balance of System	\$0
255.1	Compile GPS Features into Comprehensive Shapefiles	\$10,247
255.2	Document GPS Survey Workflows and Results	\$4,487
255.3	TM (GPS Survey Results and Workflow)	\$5,242
257	Workshop #13 -- GPS Field Survey Workflows and Results	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$2,951
	<b>SUBTOTAL==&gt;</b>	<b>\$102,068</b>

<b>H</b>	<b>DEFINITION OF POLICIES, PROCESSES, AND PROCEDURES</b>	<b>COST</b>
271	Master Plan Updates, Amendments, and Revisions	\$909
	Prepare P&P Memo	\$5,504
	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
273	Model Maintenance and Update Procedures	\$1,164
	Prepare P&P Memo	\$5,284
	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
275	Water System Surface Feature and Service Line GPS Definition	\$1,179
	Prepare P&P Memo	\$3,977
	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
277	Project Development Submittal Requirements for Evaluation and Model Integration	\$1,660
	Prepare P&P Memo	\$7,627
	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE

**EXHIBIT B**  
**Rapid City, South Dakota**  
**2015 Water Utility System Master Plan Update and Model Recalibration**  
**Level of Effort and Fee Estimate**

279	Infrastructure Design Criteria Manual Review and Amendments	\$10,599
	Prepare P&P Memo	\$9,013
	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
281	Review of Potential Valve Closure Management & Water Base Map Approaches and Systems	\$0
281.1	Needs Assessment Interviews	COVERED IN WORKSHOPS/MEETINGS ABOVE
281.2	Strategy Development	\$8,469
281.3	Prepare TM	\$5,346
281.4	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
281.5	Implementation Assistance	\$6,705
283	Review of Potential Water System Base Map Accessibility Approaches and Systems	\$0
283.1	Needs Assessment Interviews	COVERED IN WORKSHOPS/MEETINGS ABOVE
283.2	Strategy Development	\$9,278
283.3	Prepare TM	\$5,199
283.4	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
283.5	Implementation Assistance	\$6,705
285	Review of IT Hardware Requirements for Hydraulic Modeling and GIS Functions-Public Works/Util Maint	\$3,955
285	Prepare TM	\$2,647
285	Review Meeting	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$1,541
	<b>SUBTOTAL==&gt;</b>	<b>\$96,762</b>
I	<b>CAPITAL IMPROVEMENT PLAN AND MASTER PLAN REPORT - 2017 WORK</b>	<b>COST</b>
301	Recommended Capital Improvement Plan	\$14,294
303	Draft Maser Plan Report	\$62,338
305	Workshop #14 - CIP and Draft Master Plan Review	COVERED IN WORKSHOPS/MEETINGS ABOVE
307	Final CIP and Master Plan Report	\$57,018
307	Workshop #15 - Draft Final CIP and Master Plan Report Review	COVERED IN WORKSHOPS/MEETINGS ABOVE
X1	Reimbursable Expenses	\$2,180
	<b>SUBTOTAL==&gt;</b>	<b>\$135,830</b>
J	<b>TRAINING AND CONTINUING SERVICES SUPPORT - 2015/2016 WORK</b>	<b>COST</b>
331	Training	\$0
331.1	Technical Transfer Sessions	\$21,750
331.2	Critical Learning Topic Training	\$11,440
331.3	Modeling Break-Out Sessions	\$12,304
331.4	Service Line GPS Survey and Line Card Development	\$1,475
333	Continuing On-Call Modeling Support Services	\$44,342
X1	Reimbursable Expenses	\$1,541
X2	Travel Costs	\$5,000
	<b>SUBTOTAL==&gt;</b>	<b>\$97,852</b>
<b>PROJECT TOTALS</b>		<b>\$ 1,365,586</b>

Note: City Project Manager and Engineer's Project Manager may mutually agree to reallocate level of effort and cost between Phases A-J and respective subtasks as needed to meet project objectives as long as the total fee is not exceeded.

**Exhibit C**  
**Rapid City, South Dakota**  
**Water Utility System Master Plan and Hydraulic Model Recalibration/Update**  
**Professional Services Rate Schedule**

Name	Role	Hourly Billing Rate			
		2015	2016	2017	2018
<b>Project Team Members Black &amp; Veatch</b>					
Paul Boersma	Project Principal	\$230	\$237	\$244	\$251
Shawn LaBonde	Project Manager	\$198	\$204	\$210	\$216
Variable	Quality Control Reviewer - Senior	\$198	\$204	\$210	\$216
Karen Burgi	Quality Control Reviewer - Mid	\$184	\$190	\$195	\$201
Variable	Quality Control Reviewer - Junior	\$170	\$175	\$180	\$186
Bo Johnston	Task Leader - Senior	\$158	\$163	\$168	\$173
Ed Koval	Task Leader - Hydraulic Modeling & Planning	\$147	\$151	\$156	\$161
Variable	Task Leader - Junior	\$136	\$140	\$144	\$149
Variable	Staff Engineer - Senior	\$131	\$135	\$139	\$143
Variable	Staff Engineer - Mid	\$120	\$124	\$127	\$131
Darrin Harris	Staff Engineer - Junior	\$109	\$112	\$116	\$119
Variable	Technical Specialists - Senior	\$198	\$204	\$210	\$216
Chris Tadanier	Technical Specialists - Mid	\$188	\$194	\$199	\$205
Amanda Zarazua	Technical Specialists - Junior	\$175	\$180	\$186	\$191
Variable	GIS Specialist - Senior	\$136	\$140	\$144	\$149
Brian Lendt	GIS Specialist - Mid	\$126	\$130	\$134	\$138
Variable	GIS Specialist - Junior	\$116	\$119	\$123	\$127
Variable	CAD Graphics and Tech Support - Senior	\$151	\$156	\$160	\$165
Thomas Hicks	CAD Graphics and Tech Support - Mid	\$126	\$130	\$134	\$138
Variable	CAD Graphics and Tech Support - Junior	\$101	\$104	\$107	\$110
Mike Dowell	Project Support Assistant - Senior	\$125	\$129	\$133	\$137
Sandie Masters	Project Support Assistant - Mid	\$106	\$109	\$112	\$116
Stephanie Lee	Project Support Assistant - Junior	\$87	\$90	\$92	\$95
<b>Project Team Members Banner Associates</b>					
Sig Zvejnieks	Project Principal	\$162	\$167	\$172	\$177
David LaFrance	Task Leader - Senior	\$129	\$133	\$137	\$141
Chad Bachman	Task Leader - Mid	\$124	\$128	\$132	\$135
Variable	Task Leader - Junior	\$119	\$123	\$126	\$130
Variable	Project Engineer - Senior	\$100	\$103	\$106	\$109
Variable	Project Engineer - Mid	\$93	\$96	\$99	\$102
Variable	Project Engineer - Junior	\$85	\$88	\$90	\$93
Variable	Staff Engineer - Senior	\$80	\$82	\$85	\$87
Bryan Lipp	Staff Engineer - Mid	\$71	\$73	\$75	\$78
Variable	Staff Engineer - Junior	\$60	\$62	\$64	\$66
Variable	CADD Drafting and GIS Specialist - Senior	\$94	\$97	\$100	\$103
Variable	CADD Drafting and GIS Specialist - Mid	\$68	\$70	\$72	\$74
Justin Huntley	CADD Drafting and GIS Specialist - Junior	\$51	\$53	\$54	\$56
Variable	Project Support Assistant - Senior	\$79	\$81	\$84	\$86
Variable	Project Support Assistant - Mid	\$60	\$62	\$64	\$66
Variable	Project Support Assistant - Junior	\$42	\$43	\$45	\$46
<b>Project Team Members EMS Engineering</b>					
Allen Foster	Technical Advisor	\$150	\$155	\$159	\$164
Jason Pettyjohn	Civil Engineer - Senior	\$115	\$118	\$122	\$126
Variable	Civil Engineer - Mid	\$100	\$103	\$106	\$109
Variable	Civil Engineer - Junior	\$85	\$88	\$90	\$93
Variable	CAD Technician	\$85	\$88	\$90	\$93
Variable	GIS Specialist	\$85	\$88	\$90	\$93
Variable	Registered Land Surveyor	\$85	\$88	\$90	\$93
Variable	Survey Crew Chief	\$65	\$67	\$69	\$71
Variable	Survey Technician	\$65	\$67	\$69	\$71
Variable	Project Support Admin	\$55	\$57	\$58	\$60
<b>Project Expenses</b>					
Direct Project Expenses				At-Cost; No Markup	
Engineer's Subconsultants				At-Cost; No Markup	
Vehicle Mileage				US Federal Government Rate	
Telephone Costs				No-Charge	
Technology Costs (computer use, office equipment, etc.)				No-Charge	
Travel Costs				At-Cost; No Markup	