CITY OF RAPID CITY

RAPID CITY, SOUTH DAKOTA 57701

Public Works Department

Engineering Services Division

300 Sixth Street

Telephone: (605) 394-4154 Fax: (605) 355-3083

Web: www.rcgov.org

MEMORANDUM

TO: Public Works Committee, Mayor Allender, and City Council

FROM: Terry Wolterstorff, PE
Public Works Director

SUBJECT: Water Utility System Master Plan Update and Model Recalibration, Project No. 13-2141/CIP No. 50817

DATE: 09/08/2015

The City's current Utility System Master Plan was adopted in 2008 and projected utility requirements to the year 2030. This project is a comprehensive update that will allow the City to plan for future growth, improve water system operation, and support development occurring within the Rapid City service area.

The master plan update and accompanying water distribution system hydraulic model recalibration will allow the City to accomplish the following objectives:

- Systematically provide for growth and replacement of water utility infrastructure over a 100-year planning period, and determine short-term (10-year) to long-term (100-year) capital infrastructure needs necessary to provide reliable, high quality service to customers.
- Develop and document surface water and groundwater supply philosophies and the infrastructure needed to deliver drinking water using those philosophies.
- Provide the development community with an improved guide and tool for cohesive utility planning and design.
- Train/mentor City staff on use of the distribution system hydraulic model.

The master plan update and model recalibration project is organized into 10 phases. A brief description of each technical phase is included below. For each of the 10 phases the contract

budget amount and whether the phase addresses The Water Advocacy Task Force Updated Recommendation or is a staff/operations recommendation is also indicated.

Phase A – Project Initiation, Recurring Meetings, and Management

Phase A provides administrative management, technical oversight, project initiation activities, and travel for all project Phases. Sub phases of Phase A are:

- Management – preparation and implementation of project execution plan, allocated budget amount $157,374.
- Project Workshops with staff and stakeholders, allocated budget amount $132,521.
- Travel expenses, allocated budget amount $61,150.

Phase B – GIS Data and Hydraulic Model Recalibration/Update, Allocated budget amount $113,643, Task Force

In this phase, a state-of-the-art hydraulic model recalibration and update is developed that will be utilized not only during this project but on all future master plan updates as well. Integrating the City's Geographical Information System (GIS) database with the recalibrated hydraulic model provides the City with an efficient and accurate way to keep the hydraulic model updated. The recalibration effort includes (1) conversion of water system elevation data to the City's current vertical datum; (2) an update to demand projections, peaking factors, and water use patterns; and (3) an updated hydraulic model calibrated to the existing system's operation using 24-hour extended period simulation methods. City staff provides an important contribution to this phase by assuring that the current water system infrastructure is accurately represented in the GIS database. The GIS information is then extracted into an updated hydraulic model for the recalibration effort.

Phase C – Hydraulic Modeling Analyses and Improvements Planning, Allocated budget amount $259,818, Task Force

This phase develops and evaluates numerous alternatives that are critical to Rapid City's approach to long-term drinking water supply. Drinking water supply and the infrastructure needed to deliver it is evaluated during this phase for three planning periods including (1) short-term 10-year needs (2025); (2) medium-term 30-year needs (2045) for a Tier 1 growth boundary; and (3) long-term 100-year needs (2115).

Critical to this phase's effort is the evaluation and comparison of three potential water supply alternatives based on infrastructure cost and operational functionality. The supply alternatives include (1) emphasis on surface water supply to the maximum extent possible utilizing groundwater only for demands in excess of the surface water capacity; (2) use of groundwater during an extended drought when surface water availability is restricted or during an operational emergency; and (3) a balanced supply strategy allowing for use of both surface water and groundwater sources to meet demands.

Additionally, this phase's effort includes the evaluation of potential locations for new surface water treatment plant capacity at either the existing Mtn. View water treatment plant or at a new location east of the Hogback in the eastern sections of Rapid City's service area.

Phase D – Existing System Hydraulic Analyses, Allocated budget amount $101,951, Task Force

While the focus of Phase C is on the water system's future needs and configuration, Phase D utilizes the recalibrated hydraulic model to identify deficiencies in the existing water system and develop improvements needed to minimize or eliminate those deficiencies. Hydraulic analyses and evaluations are oriented at hardening system reliability and redundancy for critical facilities during outages; improving water system fire-fighting capabilities; and adjusting system pressures into normally accepted ranges. This phase seeks to identify and improve or eliminate deficiencies present within the existing water system.

Phase E – Water Facility Assessments and Replacement Capital Improvement Plan (CIP) Development, Allocated budget amount $46,048, Task Force

From a long-term planning perspective, each facility within the Rapid City drinking water system has a finite, useful life before its replacement becomes necessary. This phase deploys an asset management methodology to define the remaining useful life for each water system facility, establish a replacement year, and estimate a replacement cost for inclusion into the City's CIP. The criticality of each facility is established based on a consequence of failure which factors into the facility's remaining useful life. In addition, site tours are conducted to qualitatively assess existing conditions, identify immediate deficiencies in need of repair, and determine if facility replacement should be accelerated or can be delayed.

Phase F – Pipeline Replacement Planning and CIP Development, Allocated budget amount $60,570, Task Force

Recognizing the potential risk of buried water distribution pipe failure, this Phase establishes a pipeline replacement CIP program based on a logical prioritization of replacement needs and a basis for an annual replacement budget. Based on pipe data such as age, material, previous break history, operating pressure, and corrosion potential, every buried pipe in the system is associated with a risk-of-failure score and a consequence-of-failure score. Using the relative scores, each pipe is then placed into a replacement priority ranking with pipes scoring both high risk and high consequence at the top. Recognizing that all system pipes cannot be replaced at once, a pipe survival curve methodology is applied to establish alternative budget framework strategies for a long-term, annual pipeline replacement program needed to manage aging pipeline infrastructure.

Phase G – GPS Field Survey for GIS Surface Feature Definition, Allocated budget amount $102,068, Staff/Operations

The work conducted in Phase B establishes an integrated link between the GIS database and the hydraulic model. As a result, it is important that existing water distribution system features be

accurately represented with locational coordinate and elevation data in the GIS database thereby allowing for efficient hydraulic model updates in the future. This Phase includes field GPS surveys for surface features (valves, hydrants, curb stops/boxes) in two of the City's 18 pressure zones to establish necessary resources, work flow, and procedures required to conduct this survey for the balance of the water system on another project. The data collected can potentially be utilized for other purposes such as utility locates, maintenance operations, and system inventory data.

Phase H – Definition of Policies, Processes, and Procedures, Allocated budget amount $96,762, Task Force and Staff/Operations

This phase reviews the City's current engineering policies and procedures on a number of topics relevant to operation of the water utility, and defines new procedures or revisions to existing processes for implementation by City staff. Specific policy and procedure recommendations will be made on the following topics:

- Master Plan Updates, Amendments, and Revisions
- Hydraulic Model Maintenance and Updates
- Water System Surface and Service Line Feature Definition
- Project Development Submittal Requirements for Evaluation and GIS/Hydraulic Model Integration
- Rapid City Infrastructure Design Criteria Manual (IDCM) Review and Amendments
- Review of Potential Valve Closure Management Approaches and Systems
- Review of Potential Water System Base Map Accessibility Approaches and Systems
- Review of IT Hardware Requirements for Hydraulic Modeling and GIS Functions in Public Works and Utility Maintenance

Phase I – Capital Improvement Plan (CIP) and Master Plan Report, Allocated budget amount $135,830, Task Force

In this phase, information and results from the previous work effort is used to develop the City's water system CIP, and all information is compiled into a Master Plan Report. The CIP includes (1) distribution system operational improvements (Phase D); (2) growth based improvements (Phase C); (3) facility replacement program (Phase E); and (4) pipeline replacement program (Phase F).

Phase J – Training and Continuing Services Support, Allocated budget amount $97,851, Staff/Operations

Training of the City staff on use of the recalibrated hydraulic model is a critical objective of this project so that future model updates and hydraulic analyses can be conducted by City staff. This phase deploys several training methods such as weekly technical transfer sessions, critical learning topic training, and modeling break-out sessions. The training will allow City staff to

become familiar with the hydraulic model's capabilities and the methods to model scenarios as they arise.

In addition, this phase allows the City to request on-call, as-needed services from the Engineer in support of hydraulic modeling activities to provide additional training, operational analyses support, and troubleshooting of model functionality where the Engineer will act as an extension of City staff by providing specialized expertise or additional resource capability to accomplish tasks.