

1.1 OVERVIEW AND NEED FOR A WATER MASTER PLAN

The City of Modesto's (City) water system currently serves a population of approximately 260,000 people in California's Central Valley. The City is currently the largest retail water supplier in Stanislaus County and has been providing potable water service to its urban area since 1895. The City's existing water service area consists of one large contiguous service area (defined by the City's current Sphere of Influence (SOI) and also includes Salida, portions of North Ceres, and several unincorporated Stanislaus County "islands" located within the City's SOI), and several smaller outlying service areas (including Grayson, Del Rio, Ceres (Walnut Manor), and portions of Turlock).

The City's water system consists of a little over 900 miles of transmission and distribution pipelines. A portion of the transmission mains traversing the City is owned and operated by the Modesto Irrigation District (MID), and these transmission mains deliver treated surface water from the Modesto Regional Water Treatment Plant (MRWTP) through a series of turnouts that have the ability to control water supply into the City's water distribution system. Within the contiguous service area, the City also has a total of 92 groundwater wells (77 of which are active), ten at-grade storage tanks, and nine active booster pump stations. In the outlying service areas, the City has 18 groundwater wells (17 of which are active), one at-grade storage tank (in Grayson) and one booster pump station (also in Grayson).

While the City is continually planning and designing water system improvements to ensure a safe, reliable and affordable water supply for its existing and future water customers, a comprehensive review of the City's water supplies and water system facilities has not been completed in many years. With the completion of the Phase Two Expansion improvements at the MRWTP earlier this year, making additional treated surface water supplies available to the City, and planned or on-going construction of new water system facilities throughout the City's service area, there is a need for a Water Master Plan (WMP) to evaluate the City water system's ability to meet existing and projected future water demands and identify improvements needed to address system deficiencies.

1.2 WATER SYSTEM MASTER PLAN OBJECTIVES AND TASKS

The objective of this WMP is to clearly define the City's long-term water supply and infrastructure needs, and to develop a WMP that will provide the flexibility and system reliability that the City needs to accommodate changing future conditions. The development of this WMP included working closely with City staff to lay out the likely future scenarios for expansion and upgrading of the City's water system, and to develop tools that will allow City staff to analyze future options.

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To accomplish these objectives, four Master Tasks were conducted, each with specific subtasks. These are outlined below:

<ul style="list-style-type: none">• Document the institutional knowledge and understanding of the key aspects of the City's water supplies and water transmission and distribution system.• Re-confirm the City's anticipated water demand requirements for the contiguous and outlying service areas at buildout.• Provide the City with foundational information with regard to the planning-level estimate of the groundwater available for the City to integrate into the City's future water supply plans.• Conduct a feasibility-level evaluation of the groundwater basin beneath the North Modesto service area for applicability and compatibility for an Aquifer Storage and Recovery (ASR) Program.• Compare and evaluate the availability and reliability of supplies to develop an integrated water supply plan that provides the City with the ability and flexibility to meet projected demands under a variety of hydrologic scenarios.
<ul style="list-style-type: none">• Update the City's overall water system service and performance standards to provide a foundation for the assessment of the City's water system.• Update and calibrate the contiguous area hydraulic water system model to demonstrate that it accurately reflects current system configuration, key facilities and operations.• Verify that the updated and calibrated contiguous water system model represents the time-varying system trends observed by the Supervisory Control and Data Acquisition (SCADA) system.• Set up the contiguous system hydraulic model for Extended Period Simulation (EPS) operational evaluations to provide conceptual guidance regarding summer and winter operating conditions.• Use the updated hydraulic models to identify capacity deficiencies and improvement needs for the contiguous water system.• Develop a comprehensive capital improvement program of distribution and transmission system needs.
<ul style="list-style-type: none">• Evaluate the City's renewal and replacement program.• Document current water system operations.• Evaluate conjunctive use operations.

With the completion of these tasks, this resulting WMP provides a comprehensive road map for City staff's future planning of its water system.

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1.3 AUTHORIZATION

West Yost Associates (West Yost) was authorized to prepare this WMP by the City in September 2014. West Yost's work on the WMP was supported by several subconsultants, including the following:

- RMC: Evaluation of Methods for Groundwater Operational Yield Analysis
— See Chapter 4 and Appendix F
- Todd Groundwater: Evaluation of USGS Groundwater Flow Model
— See Chapter 4 and Appendix G
- Pueblo Water Resources, Inc: ASR Evaluation
— See Chapter 5 and Appendix I

1.4 REPORT ORGANIZATION

This WMP is organized into the following chapters:

- Executive Summary
- Chapter 1. Introduction
- Chapter 2. Existing Water System
- Chapter 3. Water Demands
- Chapter 4. Existing Water Supply
- Chapter 5. Integrated Water Supply Plan
- Chapter 6. Water System Performance and Operational Criteria
- Chapter 7. Hydraulic Model Updates (Contiguous Service Area)
- Chapter 8. Existing Water System Evaluation (Contiguous Service Area)
- Chapter 9. Future Water System Evaluation (Contiguous Service Area)
- Chapter 10. Water System Operations Strategies (Contiguous Service Area)
- Chapter 11. Capital Improvement Program

The following appendices to this WMP contain additional technical information, assumptions and calculations:

- Appendix A: General Plan Land Use Evaluation
- Appendix B: City of Modesto General Plan Land Use
- Appendix C: Unit Water Demand Factor Calculations
- Appendix D: Projected Water Demand (Outlying Service Areas)

- Appendix E: Groundwater Operational Yield Memorandum (City of Modesto, 2005)
- Appendix F: Evaluation of Methods of Groundwater Operational Yield Analysis (RMC, March 2015)
- Appendix G: Steady-State MODFLOW and Transient-State OWHM (MERSTAN) Model Evaluation and Application for City of Modesto Projects (Todd Groundwater, September 2016)
- Appendix H: Wellhead Treatment Evaluation (West Yost, November 2017)
- Appendix I: Feasibility-Level Evaluation of Aquifer Storage and Recovery (ASR) (Pueblo Water Resources, August 2016)
- Appendix J: Contiguous Water System Hydraulic Model GIS Management and Model Updating Protocols Technical Memorandum (West Yost, November 2014)
- Appendix K: Hydrant Testing for Hydraulic Model Calibration Technical Memorandum (West Yost, June 2015)
- Appendix L: Summary of Hydrant Test Calibration Results
- Appendix M: HPR Placement for Model Calibration & Verification Technical Memorandum (West Yost, September 2015)
- Appendix N: Winter (12/03/15) Verification Results
- Appendix O: Winter (12/15/15) Verification Results
- Appendix P: Summer (07/09/13) Verification Results
- Appendix Q: Del Rio Outlying Service Area Summary
- Appendix R: Turlock Outlying Service Area Summary
- Appendix S: Grayson Outlying Service Area Summary
- Appendix T: Cost Estimating Assumptions
- Appendix U: Summary of Well Operational Status Changes

A separate Water System Hydraulic Model “Modeler’s Notebook” has also been prepared to accompany the delivery of the updated water system hydraulic model to the City. The “Modeler’s Notebook” documents the assumptions and details for each of the modeled water system facilities and each of the scenarios included in the hydraulic model. Use of the hydraulic model to evaluate the City’s existing and future conditions is described in Chapter 8 and Chapter 9, respectively.

1.5 ASSUMPTIONS AND LIMITATIONS

The analyses conducted for and described in this 2016 WMP are intended to provide the City with guidance for implementing future water system capital improvement projects and possibly water operations (due to the number of new water system facilities). The development of this WMP has involved a lengthy and detailed process, requiring the compilation and evaluation of

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extensive amounts of water system data over a two-year period. During this period, the region experienced a five-year drought and unprecedented mandatory water conservation measures. As such, by the time that the analysis had been completed and documented in this Water Master Plan, some of the data may appear dated. However, the City's water system is continually being improved and it would be impractical to update and revise the WMP analyses every time a system improvement is made.

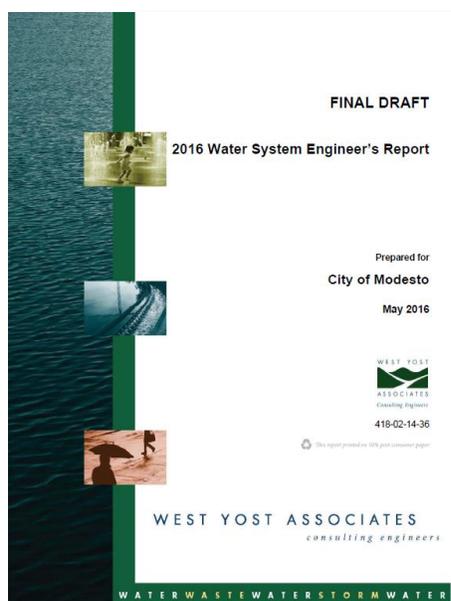
Specific data assumptions for this WMP included the following:

- Water demand data evaluated included data through the 2015 calendar year.
- The water system hydraulic model development was a lengthy process and included system data from the City's GIS database as of January 2015.
- Well status (i.e., out of service wells) is based on data provided by the City in October 2014.

Furthermore, as described in *Chapter 11 Capital Improvement Program*, it should be noted that the recommended Capital Improvement Program (CIP) only identifies improvements at a Master Planning level (to provide a basis for the water rates that will be required to support implementation of the CIP), and does not constitute a design of such improvements. Subsequent detailed design will be required to determine the exact sizes and locations of the proposed water system improvements and to refine the opinion of probable construction cost.

1.6 RELATED PLANS AND REPORTS

1.6.1 [2016 Water System Engineer's Report](#)



The 2016 Water System Engineer's Report completed in May 2016 describes and justifies the various CIPs that are needed to provide and maintain reliable water service (i.e., required supplies, storage volumes, pumping capacities, distribution facilities, system pressures, etc. under different demand conditions), identifies associated budgetary level cost estimates, and determines the cost allocations between existing rate payers and future users of the City water system. The Engineer's Report is an essential supporting document needed to conduct new water rate and capacity charge studies.

Since this WMP was not yet complete when the 2016 Engineer's Report was being prepared, the 2016 Engineer's Report was based on the capital improvements identified in the City's 2016/17 Fiscal Year preliminary CIP budget (as of February 2016), improvements based on the hydraulic analysis performed for and identified in

the City's 2010 Water System Engineer's Report that have not yet been implemented or constructed, and needed improvements derived from other studies.

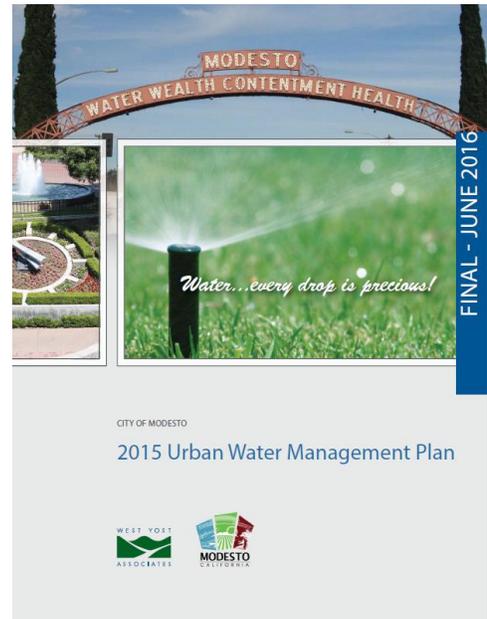
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1.6.2 2015 Urban Water Management Plan

The City's 2015 Urban Water Management Plan (2015 UWMP) was completed and adopted by the Modesto City Council in June 2016. The 2015 UWMP provides an evaluation of the availability and reliability of the City's water supplies under various hydrologic conditions through the year 2040 and compares them to projected water demands within the City's service area through 2040. The 2015 UWMP also describes the City's Water Shortage Contingency Plan and water conservation programs and their ability to reduce water demands when water supplies may be limited. The preparation and adoption of the 2015 UWMP is a California Water Code requirement for all urban water suppliers who supply more than 3,000 acre-feet per year (af/yr) of water or who serve more than 3,000 customers. The assumptions for availability and reliability of water supplies, as well as the water demand projections, included in the City's 2015 UWMP are consistent with those included in this WMP.



1.7 ACKNOWLEDGMENTS

The development of this WMP would not have been possible without the contributions of the City's dedicated and knowledgeable Utilities Department staff:

- Tamorah Bryant, Senior Civil Engineer, Water Resources Group
- Jack Bond, Senior Engineer (CIP), Retired
- Will Wong, Acting Utilities Director
- Jim Alves, Associate Civil Engineer
- Miguel Alvarez, Associate Engineer
- Dave Savidge, Water Systems Manager
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