1. Introduction to the 2016 Water Inventory and Analysis Report

1.1 Background

California's water resources are highly variable geographically, seasonally, and annually. Managing these resources in the face of increasing and competing demands has become increasingly difficult. Difficult decisions can be made easier with more and better data and analysis. The *2001 Water Inventory and Analysis Report* concluded that long-term trends in groundwater storage indicate that the groundwater basin is not in a state of decline. More than fifteen years have passed and circumstances have changed. For example, many groundwater dependent portions of the basin have shown a steady decline in groundwater elevations. Another indication of changing circumstances is that a significant number of monitoring wells have reached new historic low groundwater elevations. Some of the wells have periods of record going back fifty years. The generally dry hydrologic period, including the current historic drought, is likely driving the unprecedented decline in groundwater elevations. However, there are likely other factors involved, so qualitative presumptions cannot be the basis for groundwater management. The system is more complex and the stakes are too high. Water management decisions should be informed by comprehensive water analyses that account for the range of variables including the increased demand and the impact of climate change (warmer and dryer conditions).

The *2016 Water Inventory and Analysis Report* represents an important step forward in developing tools for water resource management. The *2016 Water Inventory and Analysis Report* utilizes the BBGM as a platform for analyzing data for current conditions and future analyses. The BBGM is a mathematical model that covers the extent of the Vina, West Butte, East Butte and North Yuba subbasins, otherwise referred to as the Butte Basin. The BBGM is a complete, physically based, hydrologic model, accounting for various sources and uses of water continuously over time. This allows for an examination of water supply and demand scenarios with outcomes that lie beyond the realm of historical experience, such as could result from land use changes, population changes, climate change, and/or prolonged drought periods. To maximize the benefits of the BBGM, the code and data inputs had to be updated. The BBGM was coded in the Integrated Water Flow Model (IWFM) version 2.4.1. The Department updated the BBGM to IWFM-2015 using version 4.1 of the IWFM Demand Calculator (IDC). IDC 4.1 provides improved characterization of ponded land uses (i.e., rice and wetlands) and stream diversion data. The previous version of the BBGM simulated historical conditions (precipitation, stream flow, land use, water deliveries and pumping, groundwater levels and stream-groundwater interaction) for 1970-1999. The time series inputs for the BBGM were updated to produce estimates of water supplies and demands throughout the model domain over the full simulation period (1970 through 2014). The outputs from the updated BBGM will be used to explore impacts from different scenarios (e.g., increased demand projections, climate change, droughts)

compared to current water supply and demand conditions. The results of the *2016 Water Inventory and Analysis Report* and upcoming analyses of changed conditions will provide the framework to support local dialogue on sustainable groundwater management.

1.2 Purpose and Scope

The purpose of the *2016 Water Resource Inventory and Analysis Report* is to present an overview of current county water supply and demand conditions. Urban, agricultural, and environmental water needs are estimated, reflecting conditions through water year 2014. The *2016 Water Inventory and Analysis Report* utilizes recent census data, land use data, Urban Water Management Plans and adopted General Plans to reflect the latest population, crop acreage and production, crop water requirement, environmental water use, water quality, and habitat quality data. The *2016 Water Inventory and Analysis Report* establishes a baseline for agricultural, urban, and environmental water availability and use in each of the subbasins of Butte County. The *2016 Water Inventory and Analysis Report* serves an important role by:

1. Integrating the Butte Basin Groundwater Model as a useful and productive tool.
2. Identifying how water demands have changed over the past fifteen years in different areas and the drivers of change.
3. Preparing water budgets for each sub-inventory unit to inform the local conversation regarding resource use and sustainability.
4. Assessing what the future may hold and how best to prepare by developing forecasts for future urban and agricultural water demands and developing climate change hydrology scenarios for future groundwater model runs and associated analyses.

The *2016 Water Inventory and Analysis Report* continues the approach of dividing Butte County into sub-inventory units. The subinventory units were employed in the *2001 Water Inventory and Analysis Report* and are represented in the BBGM. The subinventory units were developed on the basis of groundwater subbasins and common water sources. The principal Bulletin 118 groundwater subbasins within the County have been designated as inventory units. These include Vina, West Butte, East Butte, and North Yuba. In addition, the Foothill, and Mountain inventory units encompass the non-valley portions of the County. Each inventory unit has been further divided into subinventory units. Twenty subinventory units are included within the County, representing water suppliers or unorganized areas with common water sources and uses (Figure 1.1).

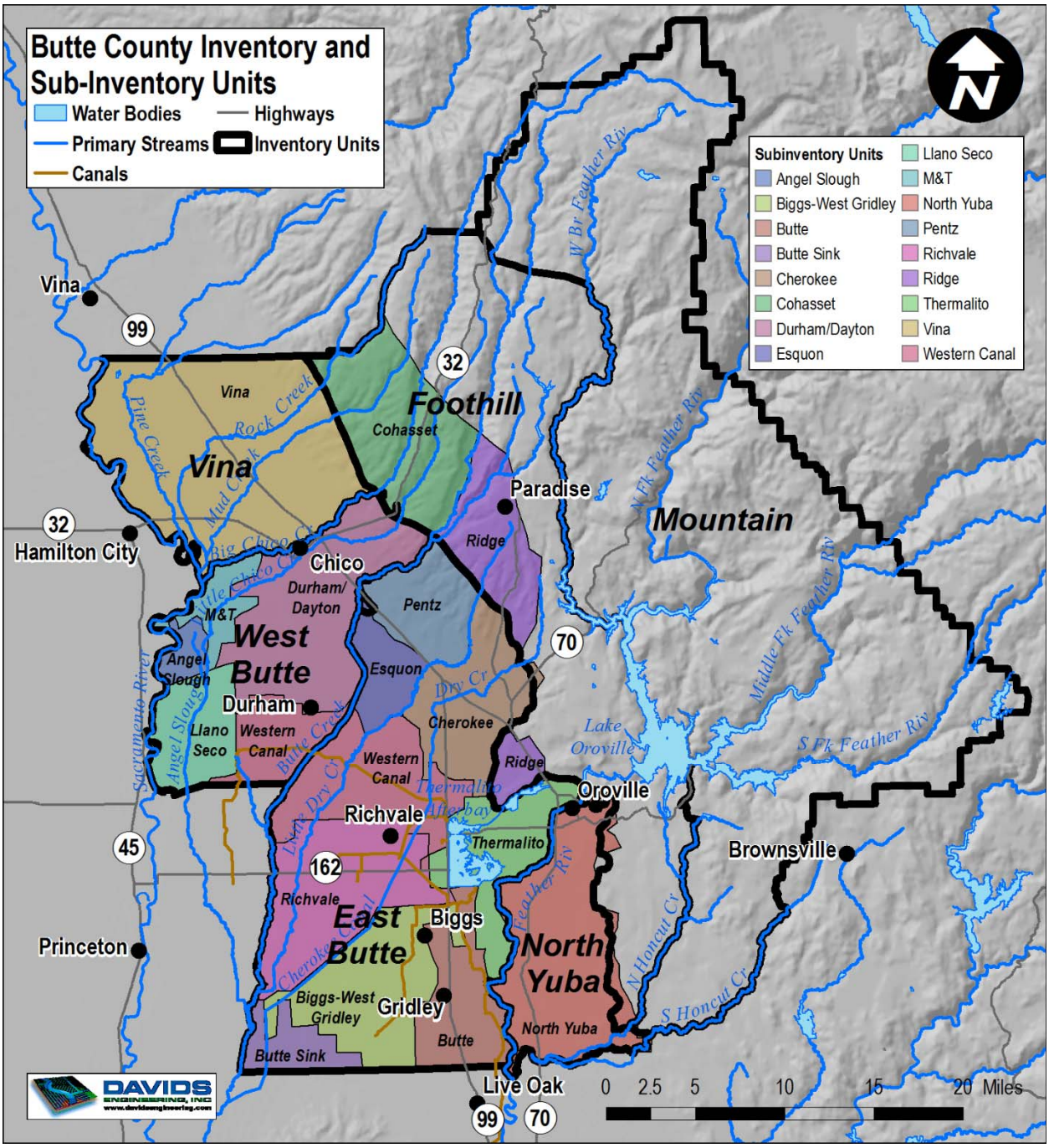

Figure 1.1. Butte County Water Inventory and Analysis Inventory Units and Subinventory Units.

The *2016 Water Inventory and Analysis Report* benefits from the detailed water balance analyses developed as part of the Feather River Regional Agricultural Water Management Plan (FRRAWMP) (NCWA 2014). The FRRAWMP study area extends from the Sacramento River and Sutter Bypass in the west to the Feather River in the east and from Western Canal Water District in the north to the Freemont Weir in the south. An objective of the *2016 Water Inventory and Analysis Report* is to ensure consistency

between these efforts to ensure that the most current understanding of the surface and groundwater hydrology of the Butte Basin is incorporated into the County's water management planning.

1.3 Relationship to the Sustainable Groundwater Management Act (SGMA)

The Sustainable Groundwater Management Act (SGMA) went into effect in January 2015. One of the key principles of SGMA is that each groundwater basin has unique characteristics and challenges; therefore, groundwater is best managed at the local level, and local agencies should have the tools they need to sustainably manage their resources. Another principle is when local agencies cannot or will not manage their groundwater sustainably, the State will intervene. To avoid state intervention, groundwater sustainability agencies must be formed by June, 2017 and implement groundwater sustainability plans that will bring the basin into sustainability in 20 years. Local public agencies with water management, water supply or land use authority are eligible to be a groundwater sustainability agency. The components of groundwater sustainability plans (GSPs) are subject to regulations adopted by the Department of Water Resources. A water budget with potential use of a groundwater model is a required component of a GSP. The initiation of the *2016 Water Inventory and Analysis Report* predated the enactment of SGMA. The *2016 Water Inventory and Analysis Report* and SGMA share a similar goal of basing local sustainable groundwater management decisions on a set of analytical analyses. The utilization of the BBGM to develop water budget scenarios will likely meet SGMA requirements. However, the GSP regulations establish that specific input and projection parameters (e.g., precipitation, ET, hydrology, climate change, land use, etc.) be based on standards set by DWR. The regulations allow local agencies to use other data provided that they can demonstrate that the data are of sufficient quality. It is possible that the data and forecast parameters in the *2016 Water Inventory and Analysis Report* and subsequent analyses may not match the standards set by DWR for GSPs. Some of the data may be acceptable to DWR for GSP compliance while others may not. The result may be that some of the data used in the *2016 Water Inventory and Analysis Report* may be modified for the GSP(s) scheduled for submission in 2022.

1.4 Acknowledgments

The *2016 Water Inventory and Analysis Report* was prepared under the leadership and ingenuity of Dr. Christina Buck, Department of Water and Resource Conservation, and the team from Davids Engineering led by Grant Davids and Byron Clark and supported by Ken Loy and Mandy Ott of West-Yost Associates. Davids Engineering developed the time series data for the BBGM and produced an analysis of drought impacts. The Department was responsible for operating the model and providing model results to Davids Engineering for analysis and presentation in the Water Inventory and Analysis report. Davids Engineering conducted the special analysis of drought impacts. The *2016 Water Inventory and Analysis Report* benefited from the input of a Project Advisory Committee. The advisory committee was comprised of members of the Butte County Water Commission, Technical Advisory Committee (TAC) and County staff. The

members of the Advisory Committee included Paul Gosselin (Water and Resource Conservation), Vickie Newlin (Water and Resource Conservation), Dan Breedon (Development Services), George Barber (Water Commission), David Skinner (Water Commission), Joe Connell (TAC), Pete Bonacich (TAC), and Richard Price (TAC). Finally, the *2016 Water Inventory and Analysis Report* was made possible by the policy leadership and financial support of the Butte County Board of Supervisors. Through the leadership of the Board of Supervisors, Butte County will be positioned to sustainably manage water resources for the foreseeable future.

Information provided by the Feather River Regional Agricultural Water Management Plan was also critical to the report. We appreciate the partnership with Western Canal Water District, Richvale Irrigation District, Butte Water District and the Biggs-West Gridley Water District. The report benefited from collaboration with California Water Service Chico, California Water Service Oroville, M&T Ranch, Rancho Esquon, and other water managers. Finally, public presentations before the Butte County Water Commission and at other meetings provided meaningful input.

1.5 Contents of the Water Resource Inventory and Analysis Report

The *2016 Water Inventory and Analysis Report* is structured to be generally consistent with the previous version of the *Water Inventory and Analysis Report*. One major difference is that the section on Water Suppliers and Managers was moved to Appendix A. The *2016 Water Inventory and Analysis Report* includes the following Sections:

- Section 1. Introduction to the 2016 Water Inventory and Analysis Report
- Section 2. Inventory and Analysis Methodology
- Section 3. Land Use and Cropping Patterns
- Section 4. Climate and Hydrology
    - 4.1 Climate
    - 4.2 Surface Water Hydrology
    - 4.3 Groundwater Hydrology
- Section 5. Historical Water Demands and Supplies
- Section 6. Future Water Demands and Supplies
- Section 7. Conclusions and Recommendations
- Section 8. References

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