

California's Groundwater Update 2013

A Compilation of
Enhanced Content for
California Water Plan
Update 2013

April 2015

State of California
Natural Resources Agency
Department of Water Resources

INTRODUCTION, SCOPE, AND FUTURE DIRECTIONS

Contents

Chapter 1. Introduction, Scope, and Future Directions.....	1
Introduction.....	1
Background, Scope, and Process for Enhancing Groundwater Content in the California Water Plan	2
Report Organization.....	4
California’s Groundwater – Future Directions	6
California Water Action Plan.....	7
2014 Drought State of Emergency	9
Sustainable Groundwater Management Act.....	11
Future Statewide Groundwater Efforts	15

Tables

Table 1-1 History of Groundwater Content in the California Water Plan	3
Table 1-2 Nexus between Governor’s Water Action Plan’s Action 6 and California’s Groundwater Update 2013	8
Table 1-3 Nexus between the Sustainable Groundwater Management Act Intent and California’s Groundwater Update 2013	14

Figures

Figure 1-1 Change in Groundwater Levels in Wells — Spring 2013 to Spring 2014	12
Figure 1-2 DWR’s Phased Approach for Achieving Groundwater Sustainability	17

Acronyms and Abbreviations Used in This Chapter

ACWA	Association of California Water Agencies
BMP	best mangement practice
CASGEM	California Statewide Groundwater Elevation Monitoring
DWR	California Department of Water Resources
GIS	geographic information system
GRA	Groundwater Resources Association of California
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
GWMP	groundwater management plan
IRWM	integrated regional water management
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SWRCB	State Water Resources Control Board

Chapter 1. Introduction, Scope, and Future Directions

Introduction

The primary goal of *California's Groundwater Update 2013: A Compilation of Enhanced Content for California Water Plan Update 2013* (California's Groundwater Update 2013) is to provide foundational information to improve the statewide and regional understanding of groundwater conditions and management programs. The set of data, information, and analyses developed will help set the stage for future Bulletin 118 and California Water Plan updates, and help local and regional agencies plan for sustainable groundwater management by providing an on-going reporting of essential groundwater data, information and analyses. A second goal is to identify data gaps and groundwater management challenges meant to serve as guideposts for prioritizing future groundwater data collection and funding opportunities. The final goal is to develop a set of recommendations to improve groundwater management in California.

California's Groundwater Update 2013 compiles and analyzes readily available groundwater information to characterize California's groundwater basins, aquifers, and well infrastructure. It also presents data and analysis related to groundwater monitoring efforts, aquifer conditions in response to extraction, groundwater management practices, and conjunctive management programs. It expands and enhances baseline groundwater information on a regional scale, identifies challenges associated with sustainable groundwater management, and helps guide implementation of diverse resource management strategies. The set of data, information, and analysis developed can help local and regional groundwater managers, as well as individual well owners, better understand California's hidden and commonly misunderstood resource. Statewide and regional findings, data gaps, and recommendations to improve groundwater management are also included. Some of the groundwater information presented in this report is summarized in the California Water Plan Update 2013, primarily in Volume 2, "Regional Reports."

This groundwater update is not intended to provide a comprehensive and detailed examination of local groundwater conditions, or be a substitute for local studies and analysis. However, where information is readily available, the update does report some aspects of the regional groundwater conditions in greater detail. This report does not include an analysis of the latest drought or a summary of the historic sustainable groundwater management legislation that was enacted in 2014.

Groundwater resources play a vital role in maintaining California's economic and environmental sustainability. During an average year, California's groundwater basins contribute approximately 38 percent toward the state's total water supply. During dry years, groundwater contributes up to 46 percent of the annual supply. Locally, many municipal, agricultural, and disadvantaged communities rely on groundwater for up to 100 percent of their water supply needs.

While some of California's groundwater basins are sustainably managed, and have been for several decades, many are not. Recent evaluations of high-use groundwater basins throughout the state have documented significant declines in groundwater levels, continued degradation of groundwater quality, and increases in the occurrence of land subsidence. Groundwater extraction in excess of the long-term natural and managed recharge has caused historically low groundwater elevations in many regions of

California. Looking to the future, population growth, climate change, ecosystem and instream flow requirements, and agricultural trends toward groundwater-dependent crops will continue to increase California's demand and reliance on groundwater resources.

A key aspect to improving groundwater management practices in California involves changing the way groundwater data are collected, shared, evaluated, and reported. Answering fundamental questions regarding groundwater supply and use versus sustainability requires a regular, consistent, and committed cycle of data collection, reporting, and assessment. Groundwater information collection and dissemination, which increases education and understanding, is a critical first step toward improving reliability of groundwater resources, restoring key ecosystem functions, and establishing resiliency that will help preserve these resources for future generations. Alignment of State, local, and regional programs, along with strategic prioritization of resource management actions, are additional important steps toward establishing a common framework for prioritizing and sustainably managing California's 515 alluvial groundwater basins and subbasins, as well as California's fractured bedrock aquifer systems.

Background, Scope, and Process for Enhancing Groundwater Content in the California Water Plan

Since publication of the first California Water Plan in 1957, the extent of groundwater data included in each update has varied. In general, as California's reliance on groundwater has increased, so too has the scope and extent of groundwater information in the California Water Plan (Table 1-1). During the last decade or more, fiscal challenges and the limited availability of groundwater data in many parts of the state have restricted attempts to better characterize regional groundwater conditions. During the same time period, investigation and reporting of groundwater conditions in California, via updates to California Department of Water Resources' (DWR's) Bulletin 118 (<http://www.water.ca.gov/groundwater/bulletin118.cfm>), were similarly hampered by fiscal limitations.

Although the 2005 and 2009 California Water Plan updates included vital groundwater-related resource management strategies, feedback from advisory committees and other stakeholder groups continued to highlight the overall lack of hydrologic region-specific groundwater information in the California Water Plan. California's Groundwater Update 2013 begins to fill this void by significantly expanding groundwater information in *California Water Plan Update 2013*. By leveraging funds from complementary water resource investigations, DWR was able to incorporate improvements in analytical tools and groundwater data reporting and build upon information from existing studies to summarize California's groundwater conditions on a hydrologic region and statewide scale.

Similar to *California Water Plan Update 2013*, much of the water supply and land use data included in California's Groundwater Update 2013 extends through water year 2010. The inventory and assessment of groundwater management plans in California, as well as a survey of statewide conjunctive management programs, extends through August 2012. A summary of groundwater monitoring efforts extends through 2013. This report does not include an analysis of the latest drought or a summary of the historic sustainable groundwater management legislation that was enacted in 2014. Current information regarding California's groundwater conditions, public updates on groundwater in response to the governor's 2014 drought emergency proclamations, and the Sustainable Groundwater Management Act are available from DWR's Groundwater Web site (<http://www.water.ca.gov/groundwater/index.cfm>).

The process to develop content for California’s Groundwater Update 2013 utilized the collaboration and outreach forums established for the California Water Plan. A topic-based Groundwater Caucus was formed to provide input on compilation, analysis, and presentation of groundwater data and methods. The California Water Plan’s State Agency Steering Committee, Public Advisory Committee, and Tribal Advisory Committee were periodically consulted to review and provide feedback on the developed groundwater information. Annual California Water Plan plenary meetings were used to provide groundwater content updates to a more comprehensive group of statewide water resource managers and a wide array of stakeholders. A listing of advisory group members is provided in Volume 1 of *California Water Plan Update 2013*.

California’s Groundwater Update 2013 was developed using resources, tools, and data generated and compiled by experienced groundwater staff from DWR’s four regional offices (Northern Region-Red Bluff, North Central Region-West Sacramento, South Central Region-Fresno, and Southern Region-Glendale), as well as staff from the Division of Integrated Regional Water Management and the Division of Statewide Integrated Water Management.

The groundwater quality content was reviewed and summarized by DWR staff, based on existing data and analyses developed by the State Water Resource Control Board’s (SWRCB’s) nine regional water quality control boards. Two Water Plan Public Advisory Committee members who represented the Groundwater Resources Association of California (GRA) (<http://www.grac.org/>) served as the co-chairs of the Groundwater Caucus. The Association of California Water Agencies (ACWA) (<http://www.acwa.com/>) and GRA also assisted with some of the outreach activities and collaboration on development of groundwater content. A full list of Groundwater Caucus members and report content contributors is provided in the “Acknowledgments” section at the beginning of this report.

Table 1-1 History of Groundwater Content in the California Water Plan

CWP Update	Groundwater Content in the California Water Plan
1957	Discussed groundwater primarily in terms of additional storage capacity and water supply.
1970	Discussed what is required to locally manage groundwater basins, including potential new regulations.
1974	Discussed groundwater policy to limit development. Described groundwater basin by region. Provided map of San Joaquin Valley aquifer levels in wet and dry periods.
1983	Acknowledged groundwater data limitations.
1987	Discussed overdraft. Provided examples of managed basins. Mentioned conjunctive use and the Kern Water Bank.
1993	Provided groundwater supply estimates. Provided groundwater use by hydrologic region.
1998	Described overdraft as unsustainable. Acknowledged relationship between overdraft rates and surface water supply availability.
2005	Introduced groundwater-related resource management strategies: <ul style="list-style-type: none"> • Conjunctive management and groundwater storage. • Groundwater and aquifer remediation. • Recycled Municipal Water. • Recharge Area Protection.

CWP Update	Groundwater Content in the California Water Plan
2009	<p>Expanded discussion of groundwater-related resource management strategies:</p> <ul style="list-style-type: none"> • Conjunctive management and groundwater storage. • Groundwater and aquifer remediation. • Recycled Municipal Water. • Recharge Area Protection. <p>Recommended expanded groundwater content for future CWP updates.</p>
2013	<p>Significantly expanded groundwater-related content in Volumes 1 through 4.</p> <p>Volume 1: The Strategic Plan:</p> <ul style="list-style-type: none"> • Identified groundwater-related challenges associated with degraded groundwater quality; declining groundwater levels; depleted groundwater basins; increased land subsidence; surface water depletion because of groundwater extraction, climate change uncertainties; funding uncertainties; inconsistent government planning, policy and regulations; and conflicting roles and responsibilities. • Identified the need for additional groundwater recharge; additional surface water storage for expanded conjunctive management; increased groundwater level monitoring, significantly expanded groundwater-related information in Volume 1, Chapter 1: Planning for Environmental, Economic, and Social Prosperity. • Described continued overdraft as an unacceptable condition of groundwater basins. • Included a Call for Action to restore groundwater quality, and identified existing unacceptable risks associated with overall depletion and degradation of groundwater resources. <p>Volume 2: Regional Reports:</p> <ul style="list-style-type: none"> • Description of groundwater basins and aquifer systems. • Groundwater supply and uses by region, county, and type of use. • Well infrastructure by county. • California Statewide Groundwater Elevation Monitoring (CASGEM). • Groundwater monitoring: groundwater levels, quality, and land subsidence. • Groundwater conditions and issues. • Inventory and assessment of groundwater management plans. • Inventory and assessment of conjunctive management programs. <p>Volume 3: Updated groundwater-related Resource Management Strategies:</p> <ul style="list-style-type: none"> • Conjunctive management and groundwater storage. • Groundwater and aquifer remediation. • Recycled municipal water. • Recharge area protection. <p>Volume 4: Reference Guide:</p> <ul style="list-style-type: none"> • Contains comprehensive stand-alone report on California's groundwater, including expanded groundwater content for California as a whole and by hydrologic region, with further breakdown of groundwater information by region, county, and planning area.

Report Organization

California's Groundwater Update 2013 is organized into five main components and a series of appendices:

- Statewide Findings, Data Gaps, and Recommendations.
- Chapter 1: Introduction, Scope, and Future Directions.
- Chapter 2: Statewide Groundwater Update.
- Chapters 3 through 12: Hydrologic Region Groundwater Updates.
- Appendices A through F:
 - Appendix A: Methods and Assumptions.
 - Appendix B: California Statewide Groundwater Elevation Monitoring (CASGEM) Basin Prioritization.

- Appendix C: Groundwater Use Data.
- Appendix D: Conjunctive Management Survey.
- Appendix E: Change in Groundwater in Storage.
- Appendix F: Land Subsidence.

The scope of groundwater content presented varies by hydrologic region according to the amount of readily available data and the complexity of regional aquifers. Because of the availability of data, the Central Valley groundwater basins allowed for more detailed analysis and reporting of aquifer conditions than other hydrologic regions. Analysis of aquifer conditions along coastal groundwater basins was limited, primarily because of lack of publically available data. Regions with limited availability of groundwater data are identified in the data gaps section of each hydrologic region chapter.

As shown in the preceding list, for statewide analysis and reporting of groundwater-related information, presentation of “Statewide Findings, Data gaps, and Recommendations” is followed by this chapter, “Introduction, Scope, and Future Directions,” and Chapter 2, “Statewide Groundwater Update,” which includes detailed information and analysis on groundwater resources from a statewide perspective.

Analysis and reporting of groundwater-related information for the 10 hydrologic regions was organized in Chapters 3 through 12 according to the following subject categories:

- Introduction.
- Findings, Data Gaps, and Recommendations.
- Groundwater Supply and Development.
 - Alluvial and Fractured Rock Aquifers.
 - Well Infrastructure and Distribution (1977-2010).
 - CASGEM Groundwater Basin Prioritization.
- Groundwater Use.
 - Average Annual Groundwater Supply (2005-2010).
 - Change in Annual Groundwater Supply (2002-2010).
- Groundwater Monitoring.
 - Groundwater Level Monitoring.
 - Groundwater Quality Monitoring.
 - Land Subsidence Monitoring.
- Aquifer Conditions.
 - Groundwater Occurrence and Movement.
 - Depth to Groundwater.
 - Groundwater Elevations.
 - Groundwater Level Trends.
 - Change in Groundwater in Storage (2005-2010).
 - Groundwater Quality.
 - Land Subsidence.
- Groundwater Management Planning.
 - Groundwater Management Plan Inventory.
 - Groundwater Management Plan Assessment.
 - Groundwater Ordinances.
 - Special Act Districts.
 - Court Adjudication of Groundwater Rights.

- Other Groundwater Management Planning Efforts.
- Conjunctive Management Inventory.
- References.

The hydrologic region chapters of California's Groundwater Update 2013 were written to allow each regional write-up to serve as a stand-alone report. Each of the subject categories in the statewide and hydrologic region chapters provides a similar overview of the subject content, methods and assumptions, and sources of information. Each of the hydrologic region groundwater updates includes a description of corresponding findings, data gaps, recommendations, and references for that specific region. The statewide findings, data gaps, and recommendations serve as a summary of those commonly identified at the regional level. Some hydrologic region chapters may not contain all categories of information shown in the preceding list because of lack of publically available data or resource constraints to complete the required analysis. More detailed information regarding the methods and assumptions used throughout the report are provided in Appendix A.

California's Groundwater – Future Directions

The information presented in California's Groundwater Update 2013 addresses recommendations from the 2005 and 2009 California Water Plan updates to expand statewide and hydrologic region groundwater content. The goal of this statewide effort was to compile available groundwater data and analyze those data to enable a more informed decision-making process regarding groundwater and its management. California's Groundwater Update 2013 builds upon the technical groundwater information presented in *California's Groundwater* (Bulletin 118-2003) (<http://www.water.ca.gov/groundwater/bulletin118.cfm>). The data collection phase of the California's Groundwater Update 2013 effort encompassed 2011 and 2012, and the analysis and report preparation phase occurred in 2012, 2013, and 2014.

During preparation of *California Water Plan Update 2013*, California experienced three of the driest water years on record (October 1, 2011 through September 30, 2014), with 2013 ending as the driest calendar year in recorded history for many parts of California. The 2014 water year ended with statewide precipitation at less than 60 percent of average and with California's major surface water reservoirs collectively holding 57 percent of average storage, or about 36 percent of total capacity. Cumulative reservoir storage in 1977, California's driest year on record, was approximately 5 million acre-feet less, but the state at the time had an estimated 15 million fewer people. The 2015 water year (starting October 1, 2014) is off to a dry start, and the 2014 calendar year was California's hottest year since record keeping began approximately 119 years ago.

The governor and the Legislature initiated a number of seminal groundwater-related actions in response to California's critically-dry conditions in 2013 and 2014, combined with the continued degradation of major aquifer systems with respect to overdraft, land subsidence, and quality, as well as the lack of a statewide vision for groundwater resource sustainability. Some of the major actions and initiatives include the Governor's California Water Action Plan, the 2014 Drought State of Emergency declarations, and the 2014 Sustainable Groundwater Management Act, which identify DWR as a lead agency and further expands DWR's role in responding to drought conditions and implementing sustainable water resource management practices. To execute these new actions, DWR has been allocated much-needed funding to build upon existing groundwater assessment efforts and develop the data, analyses, tools, and reporting systems that will help guide local groundwater management programs.

The following information highlights some of the recent groundwater-related actions, subsequent to the groundwater analyses provided in this report, to achieve groundwater sustainability in California.

California Water Action Plan

In January 2014, the Governor’s Office of Planning and Research, in cooperation with the California Natural Resources Agency, the California Department of Food and Agriculture, and the California Environmental Protection Agency, published the California Water Action Plan (http://resources.ca.gov/california_water_action_plan/). The California Water Action Plan addresses near- and long-term actions that focus on sustainable water resource management for California’s people, environment, industry, and agriculture, with the overarching goals to improve reliability, restore key ecosystem functions, and establish resilient resources that can be relied upon for future generations. Ten key actions identified in the California Water Action Plan include:

1. Make conservation a California way of life.
2. Increase regional self-reliance and integrated water management across all levels of government.
3. Achieve the co-equal goals for the Delta.
4. Protect and restore important ecosystems.
5. Manage and prepare for dry periods.
6. Expand water storage capacity and improve groundwater management.
7. Provide safe water for all communities.
8. Increase flood protection.
9. Increase operational and regulatory efficiency.
10. Identify sustainable and integrated financing opportunities.

The new data, information, and analyses presented in California’s Groundwater Update 2013 informs and provides the foundation from which to build and implement many of the 10 actions but specifically action 6, which calls for expanding water storage capacity and improving groundwater management. For example, the geographic information system (GIS) change-in-storage tool developed as part of California’s Groundwater Update 2013 can help identify what California regions have aquifer storage space available for implementing, or further expanding, groundwater recharge programs. The “tell-a-story” hydrographs included in Chapters 3 through 12 provide historical groundwater-level information to illustrate how past droughts and water management practices have affected local groundwater conditions. The groundwater management plan (GWMP) assessment conducted by DWR was the first comprehensive assessment of statewide groundwater planning efforts with respect to compliance with legislative requirements. The results of the GWMP assessment will help DWR establish guidelines and adopt regulations to evaluate and implement groundwater sustainability programs, develop regulations to modify Bulletin 118-defined groundwater basin boundaries, and explore frameworks for coordination agreements to manage groundwater more sustainably on a local or regional basis. For a summary of the linkage of the recommendations in the report to the *California Water Action Plan*, see Table 1-2.

Table 1-2 Nexus between Governor's Water Action Plan's Action 6 and California's Groundwater Update 2013

Action 6: Expand Water Storage and Improve Groundwater Management	California's Groundwater Update 2013 Recommendations, as Included in Action 6		
	Fully Included	Partially Included (The recommendations should be included in full in future revised Action 6)	Not Included (The recommendations should be included in future revised Action 6)
Provide Essential Data to Enable Sustainable Groundwater Management.	#4: Build essential data to enable sustainable groundwater management by expanding... the CASGEM Program.		#1: Promote public education about groundwater. #2: Improve collaboration, coordination, and alignment among...agencies...to help implement sustainable groundwater management. #3: Develop a statewide groundwater management planning Web site...to promote easy access to groundwater information. #8: Review analytical tools currently being used, and assist local agencies in developing improved tools, to assess conjunctive management and groundwater management strategies.
Support Funding Partnerships for Storage Projects.	#9: Increase local and regional groundwater recharge and storage to reduce groundwater depletion and enhance statewide groundwater resource resiliency.		
Update Bulletin 118, California's Groundwater Plan.	#5: Improve understanding of California's high and medium priority groundwater basins by conducting groundwater basin assessments. California's Groundwater Update 2013 serves as a foundation to develop the next update to Bulletin 118.		
Improve Sustainable Groundwater Management.		#6: Develop a GSP evaluation and implementation process,... prepare a BMP guidance document, ... evaluate... completeness of GSPs in high and medium priority basins, and develop improved standards and BMPs for sustainable groundwater management. #7: Advance sustainable groundwater management within the framework of IRWM.	
Support Distributed Groundwater Storage.	#9: Increase local and regional groundwater recharge and storage to reduce groundwater depletion and enhance statewide groundwater resource resiliency.		

Action 6: Expand Water Storage and Improve Groundwater Management	California's Groundwater Update 2013 Recommendations, as Included in Action 6		
	Fully Included	Partially Included (The recommendations should be included in full in future revised Action 6)	Not Included (The recommendations should be included in future revised Action 6)
Increase Statewide Groundwater Recharge.	#9: Increase local and regional groundwater recharge and storage to reduce groundwater depletion and enhance statewide groundwater resource resiliency.		
Accelerate Clean-up of Contaminated Groundwater and Prevent Future Contamination.	Collectively, all or some of the nine recommendations have the potential to reduce groundwater contamination and speed-up efforts to clean-up contaminated basins.		

Notes:

CASGEM = California Statewide Groundwater Elevation Monitoring; GSP = groundwater sustainability plan; IRWM = integrated regional water management

2014 Drought State of Emergency

On January 17, 2014, Governor Edmund G. Brown Jr. proclaimed a Drought State of Emergency (<http://www.water.ca.gov/waterconditions/declaration.cfm>), which directed state officials to take all necessary actions to prepare for anticipated drought conditions. In the state of emergency declaration, Governor Brown directed state officials to assist farmers and communities that are economically impacted by dry conditions and to ensure the State can respond if Californians face drinking water shortages. The governor also directed state agencies to use less water, hire more firefighters, and initiate a greatly expanded water conservation public awareness campaign called Save Our Water (www.saveourh2o.org). On April 25, 2014, the governor issued an executive order (<http://gov.ca.gov/news.php?id=18496>) to speed up actions necessary to reduce harmful effects of the drought and called on all Californians to redouble their efforts to conserve water.

Key measures in Governor Brown's drought declarations include: (1) asking all Californians to reduce water consumption by 20 percent and referring residents and water agencies to the Save Our Water campaign; (2) directing local water suppliers to immediately implement local water shortage contingency plans; (3) ordering the SWRCB to consider petitions for consolidation of places of use for the State Water Project and Central Valley Project, which could streamline water transfers and exchanges between water users; (4) directing DWR and the SWRCB to accelerate funding for projects that could break ground during 2014 and enhance water supplies; (5) ordering the SWRCB to put water rights holders across the state on notice that they may be directed to cease or reduce water diversions based on water shortages; and (6) asking the SWRCB to consider modifying requirements for releases of water from reservoirs or diversion limitations so that water may be conserved in reservoirs to protect cold water supplies for salmon, maintain water supplies, and improve water quality.

The governor's drought declaration in January 2014 required DWR to conduct analyses and prepare reports documenting impacts of drought and to post the results on its drought information Web site (<http://www.water.ca.gov/waterconditions/index.cfm>). One of the tasks assigned to DWR was the preparation, by April 30, 2014, of the report, *Public Update for Drought Response – Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring* (http://www.water.ca.gov/waterconditions/docs/Drought_Response-Groundwater_Basins_April30_Final_BC.pdf).

The following conclusions are from the executive summary of the April 2014 *Public Update for Drought Response* report:

- Groundwater levels have decreased in nearly all areas of the state since spring 2013, and more notably since spring 2010.
- Since spring 2008, groundwater levels have experienced all-time historical lows (for period of record) in most areas of the state and especially in the northern portion of the San Francisco Bay Hydrologic Region, the southern San Joaquin Valley, and also for the South Lahontan and South Coast hydrologic regions.
- In many areas of the San Joaquin Valley, recent groundwater levels are more than 100 feet below previous historical lows.
- The greatest concentration of recently deepened wells is in the fractured bedrock foothill areas of Nevada, Placer, and El Dorado counties.
- The Kaweah and Kings subbasins have the greatest numbers of deepened wells in an alluvial groundwater basin.
- Thirty-six alluvial groundwater basins that have a high degree of groundwater use and reliance may possess greater potential to incur water shortages as a result of drought. The basins exist in the North Coast, Central Coast, Sacramento River, Tulare Lake, and South Coast hydrologic regions.
- Of California's 515 alluvial groundwater basins, 169 are fully or partially monitored under the CASGEM Program.
- Forty of the high- and medium-priority basins are not monitored under CASGEM. There are significant CASGEM groundwater monitoring data gaps in the Sacramento River, San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions.
- Although there are 4,122 CASGEM wells and 39,429 voluntary wells in the Water Data Library groundwater level database, gaps in groundwater monitoring persist.
- Several areas of the state lack a current groundwater management plan that addresses all related requirements of the California Water Code.

The second executive order issued in April 2014 extended the January 2014 Drought State of Emergency and included additional actions to minimize harm from the drought. One of these actions directed DWR to expand upon the April 30, 2014 *Public Update for Drought Response's* groundwater analysis by including discussions of monitoring of land subsidence and agricultural land fallowing, among other important water management issues. On November 30, 2014, DWR released the report *Public Update for Drought Response – Groundwater Basins with Potential Water Shortages, Gaps in Groundwater Monitoring, Monitoring of Land Subsidence, and Agricultural Land Fallowing*. This report has been posted on DWR's Drought Information Web site (http://www.water.ca.gov/waterconditions/docs/DWR_PublicUpdateforDroughtResponse_GroundwaterBasins.pdf) and presents the following key findings:

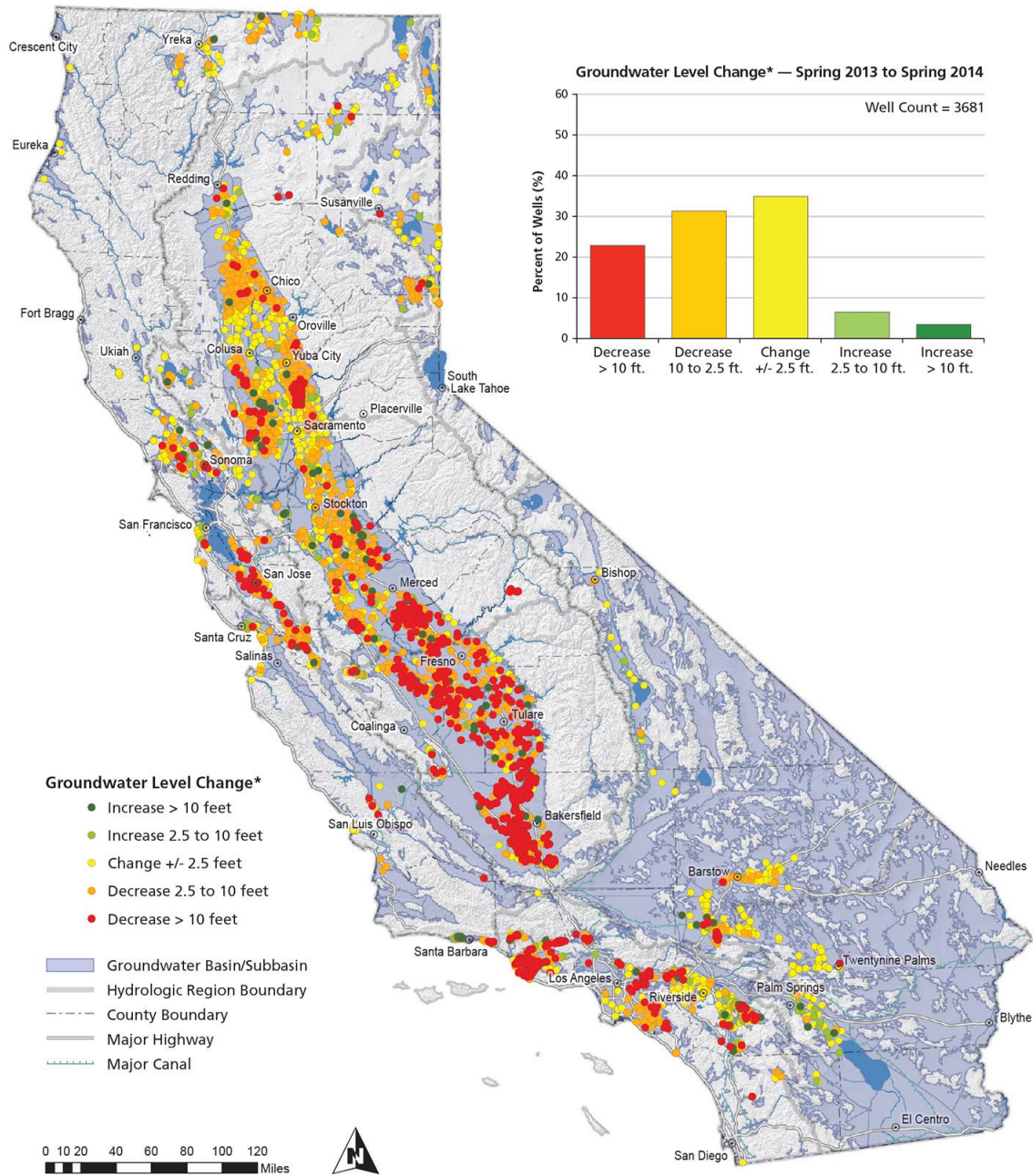
- Based on well completion reports received through September 2014, more than 350 new water supply wells are reported in Fresno and Tulare counties, and more than 200 water supply wells are reported in Merced County. More than 100 new water supply wells are reported in Butte, Kern, Kings, Shasta, and Stanislaus counties.
- Groundwater levels have decreased in many basins throughout the state since spring 2013, and more notably since spring 2010. Basins with notable decreases in groundwater levels are in the Sacramento River, San Joaquin River, Tulare Lake, San Francisco Bay, Central Coast, and South Coast hydrologic regions. Figure 1-1 (included as Figure 5 in the November 2014 *Public Update for Drought Response*) illustrates changes in groundwater levels at well locations from spring 2013 to spring 2014.
- Based on the available fall 2014 data, groundwater levels have decreased in many basins throughout the state since fall 2013.
- Based on the available data, there are many high- and medium-priority basins with spring 2014 groundwater levels ranking in the lowest 10th percentile of historical measurements.
- As of October 7, 2014, 34 of the 127 high- and medium-priority basins and subbasins are either partially or fully unmonitored under the CASGEM Program.
- For the high and medium priority basins, there are significant gaps in groundwater monitoring for the San Joaquin River, Tulare Lake, and Central Coast hydrologic regions.
- Subsidence is occurring in many groundwater basins in the state, especially in the southern San Joaquin River and Tulare Lake hydrologic regions.
- Because of the ongoing decline of groundwater levels, areas with a higher potential for future subsidence are in the southern San Joaquin, Antelope, Coachella, and western Sacramento valleys.
- A multi-agency research project led by NASA estimated that peak summer acreage of Central Valley land idled (because of drought impacts, normal agronomic practices, crop markets, etc.) in 2014 was 1.7 million acres, almost 700,000 acres more than in 2011, which was a wet year.

In large part, as a result of the data collection and analysis efforts conducted for California's Groundwater Update 2013, as well as development and vetting of a suite of maps, GIS change in storage tools, and groundwater level data synthesis through year 2010, DWR was able to quickly and efficiently respond to the drought declaration and produce comprehensive drought groundwater reports. The drought groundwater reports expanded the 2002-2010 groundwater level data assessed in California's Groundwater Update 2013 through year 2014, which greatly helped identify areas of California that were most at-risk of facing hardships related to lack of groundwater resources. As identified in this California's Groundwater Update 2013 report, many communities throughout California are 100-percent reliant upon groundwater.

Sustainable Groundwater Management Act

On September 16, 2014, Governor Brown signed historic legislation to ensure a sustainable supply of California's groundwater. The Sustainable Groundwater Management Act mandates the creation of local groundwater sustainability agencies (GSAs) that will, among other important tasks, monitor and report groundwater extraction and create sustainability plans that must achieve groundwater sustainability goals within 20 years of implementing a plan. DWR is given expanded responsibilities under the legislation, including requirements to revise groundwater basin boundaries and create guidelines for local agencies to follow when preparing their groundwater sustainability plans (GSPs).

Figure 1-1 Change in Groundwater Levels in Wells — Spring 2013 to Spring 2014



*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 11/08/2014. Data subject to change without notice.

Most of the recommendations made in California's Groundwater Update 2013 were included in the Sustainable Groundwater Management Act, as many of the stakeholder groups who guided the groundwater legislation were also important members of the *California Water Plan Update 2013* Public Advisory Committee and Groundwater Caucus. The data, analysis, and tools in California's Groundwater Update 2013 will provide the foundation from which to build and implement many of the actions included in the groundwater legislation. For a summary of the linkage of the recommendations in California's Groundwater Update 2013 to the Sustainable Groundwater Management Act, see Table 1-3.

DWR's Groundwater Web site (<http://www.water.ca.gov/groundwater/>) has up-to-date information on California's groundwater management planning efforts and includes a summary of the Sustainable Groundwater Management Act that was enacted in September 2014. The Sustainable Groundwater Management Act, which is a three-bill legislative package, includes the provisions of Senate Bill (SB) 1168 (Pavley), AB 1739 (Dickinson), and SB 1319 (Pavley). The groundwater legislation establishes a definition of sustainable groundwater management and requires local agencies to adopt GSPs for California's high- and medium-priority groundwater basins. Key milestones of the legislation include:

- January 1, 2015: Local agencies may no longer adopt or update SB 1938 GWMPs in high- and medium-priority groundwater basins.
- January 1, 2016: DWR adopts regulations to revise groundwater basin boundaries.
- June 1, 2016: DWR adopts regulations for evaluating and implementing GSPs and coordination agreements.
- June 30, 2017: GSAs (or equivalent) must be identified for all high- and medium-priority basins.
- January 31, 2020: High- and medium-priority basins subject to critical conditions of overdraft must be managed under a GSP.
- January 31, 2022: All other high- and medium-priority basins must be managed under a GSP.
- On April 1, following the adoption of a GSP and annually thereafter, GSAs must provide to DWR a report on sustainability progress.

Additionally, the legislation provides measurable objectives and milestones to reach sustainability, and outlines the backstop role of the SWRCB to intervene in groundwater management when local agencies are unable or unwilling to adopt GSPs.

Table 1-3 Nexus between the Sustainable Groundwater Management Act Intent and California's Groundwater Update 2013

Sustainable Groundwater Management Act Intent California Water Code Section 10720.1	California's Groundwater Update 2013 Recommendations, as Included in the Sustainable Groundwater Management Act (SGMA)		
	Fully Included	Partially Included (Recommendations should be included in full in future revised SGMA.)	Not Included (Recommendations should be included in future revised SGMA.)
To provide for the sustainable management of groundwater basins.		#6: Develop a GSP evaluation and implementation process, ...prepare a BMP guidance document,... evaluate...completeness of GSPs in high and medium priority basins, and develop improved standards and BMPs for sustainable groundwater management. #7: Advance sustainable groundwater management within the framework of IRWM.	#1: Promote public education about groundwater. #2: Improve collaboration, coordination, and alignment among...agencies...to help implement sustainable groundwater management.
To enhance local management of groundwater consistent with rights to use or store groundwater.	Collectively, all or some of the nine recommendations seek to enhance local management of groundwater.		
To establish minimum standards for sustainable groundwater management.		#6: Develop a GSP evaluation and implementation process, ... prepare a BMP guidance document, ... evaluate ... completeness of GSPs in high and medium priority basins, and develop improved standards and BMPs for sustainable groundwater management.	#3: Develop a statewide groundwater management planning Web site...to promote easy access to groundwater information.
To provide local groundwater agencies with the authority and the technical and financial assistance to sustainably manage groundwater.		#4: Build essential data to enable sustainable groundwater management by expanding...the CASGEM Program. #7: Advance sustainable groundwater management within the framework of IRWM.	#8: Review analytical tools currently being used, and assist local agencies in developing improved tools, to assess conjunctive management and groundwater management strategies.
To avoid or minimize subsidence.	Collectively, all or some of the nine recommendations have the potential to reduce or minimize subsidence.		
To improve data collection and understanding about groundwater.	#4: Build essential data to enable sustainable groundwater management by expanding...the CASGEM Program.	#5: Improve understanding of California's high and medium priority groundwater basins by conducting groundwater basin assessments.	

Sustainable Groundwater Management Act Intent California Water Code Section 10720.1	California's Groundwater Update 2013 Recommendations, as Included in the Sustainable Groundwater Management Act (SGMA)		
	Fully Included	Partially Included (Recommendations should be included in full in future revised SGMA.)	Not Included (Recommendations should be included in future revised SGMA.)
To increase groundwater storage and remove impediments to recharge.	#9: Increase local and regional groundwater recharge and storage to reduce groundwater depletion and enhance statewide groundwater resource resiliency.		
To manage groundwater basins through... local...agencies to the greatest extent feasible.	Collectively, all or some of the nine recommendations support and encourage managing groundwater basins through local agencies.		

Notes:

BMP = best management practice; CASGEM = California Statewide Groundwater Elevation Monitoring; GSP = groundwater sustainability plan; IRWM= integrated regional water management

Future Statewide Groundwater Efforts

The historic actions and initiatives summarized in California's Groundwater Update 2013 have made 2014 the "Year of Groundwater." For several decades, DWR has provided local agencies with necessary financial and technical resources to characterize groundwater basins, and has established recommendations for developing and implementing GWMPs. Simultaneously, the SWRCB has fulfilled its mission to preserve, enhance, and restore the quality of California's water resources, including groundwater quality. Because of the increased responsibilities placed on DWR and SWRCB by the Sustainable Groundwater Management Act, their complementary roles as California's lead sustainable groundwater management agencies have been reaffirmed. To ensure that policy and management decisions are based on the best available scientific data, transparency by all State agencies, opportunities for public participation, and accessible and user-friendly processes for making groundwater data available to the public is paramount.

Consistent with the recommended actions of the *California Water Action Plan* and the legislative requirements of the Sustainable Groundwater Management Act, local agencies and regional water management groups should continue to collaboratively work together to create effective and successful GSAs, while establishing local and regional priorities for groundwater planning, infrastructure projects, and groundwater recharge programs. Expanding groundwater recharge opportunities will require improved hydrogeological characterization of Bulletin 118-defined basins and new surface storage and infrastructure to store and convey water to recharge areas. While the State should provide available

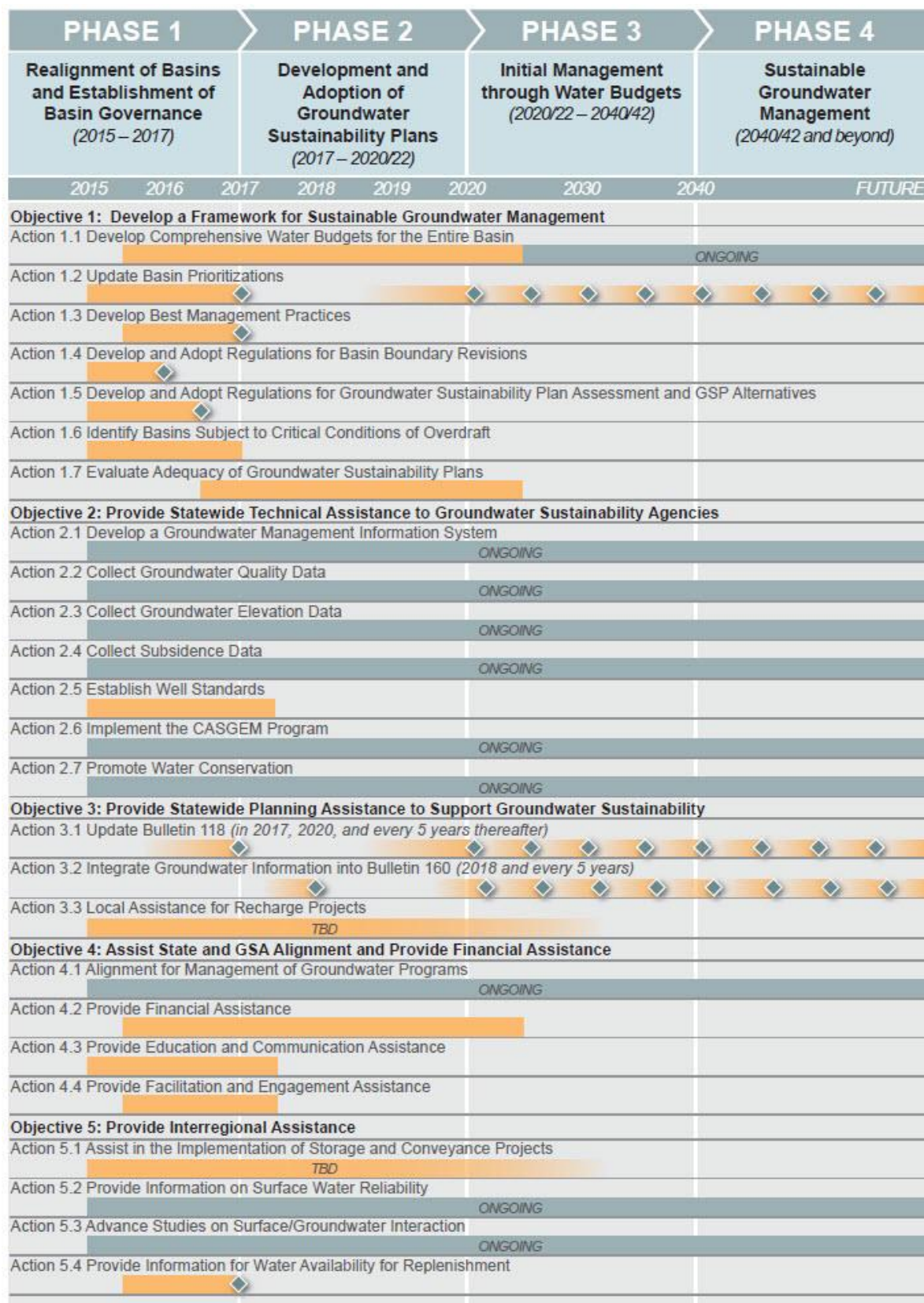
funding, technical support, and necessary guidance, it is the responsibility of local agencies to ensure that groundwater resources are sustainably managed at the groundwater basin level to collectively provide for California's diverse agricultural, urban, and natural resource needs.

Groundwater Sustainability Program Strategic Plan

A draft version of DWR's *Groundwater Sustainability Program Strategic Plan* (http://water.ca.gov/groundwater/sgm/pdfs/DWR_GSP_DraftStrategicPlanMarch2015.pdf) was released in March 2015 and describes DWR's roles and responsibilities related to the Sustainable Groundwater Management Act and outlines related actions from the *California Water Action Plan*. The *Groundwater Sustainability Program Strategic Plan* aims to document DWR's strategy in helping to implement groundwater sustainability; share information with those who have interests in or management responsibilities for groundwater; and describe the structure through which DWR implements specific actions in coordination with stakeholders and partners. DWR and the SWRCB are the two State agencies charged with helping to implement the Sustainable Groundwater Management Act. DWR's principal role is to provide guidance and support to local agencies across California to help them achieve a more sustainable future in water management — several actions must be completed by specific dates set forth in the Sustainable Groundwater Management Act to accomplish this. The *Groundwater Sustainability Program Strategic Plan* does the following:

- Describes current groundwater conditions in the state, demonstrating the unsustainable nature of current management practices and framing the critical need for action.
- Identifies legislation and other drivers of policy, including the Sustainable Groundwater Management Act, the *California Water Action Plan*, and Proposition 1 (Water Bond), which was passed in 2014.
- Identifies success factors in addressing the key challenges facing groundwater management in California.
- Describes the goals and objectives that guide strategic concepts necessary for program implementation and the DWR actions to address the goals and objectives.
- Presents an initial plan for DWR communication and outreach with partnering agencies, regional and local agencies, stakeholders, and the public.

Figure 1-2 (included as Figure 8 in the *Groundwater Sustainability Program Strategic Plan*) provides an overview of the phased implementation of DWR's numerous groundwater sustainability actions. The phased approach includes: (1) realignment of basins and establishment of basin governance, (2) development and adoption of GSPs, (3) initial management through water budgets, and (4) sustainable groundwater management. It will take years to achieve the ultimate goal of local sustainable groundwater management at a statewide scale. To achieve the key outcomes, DWR, SWRCB, and other State agencies will work together to implement the many actions listed in the *Groundwater Sustainability Program Strategic Plan*, and assist local agencies in achieving groundwater sustainability.

Figure 1-2 DWR's Phased Approach for Achieving Groundwater Sustainability



Edmund G. Brown Jr.
Governor
State of California

John Laird
Secretary for Natural Resources
Natural Resources Agency

Mark Cowin
Director
Department of Water Resources