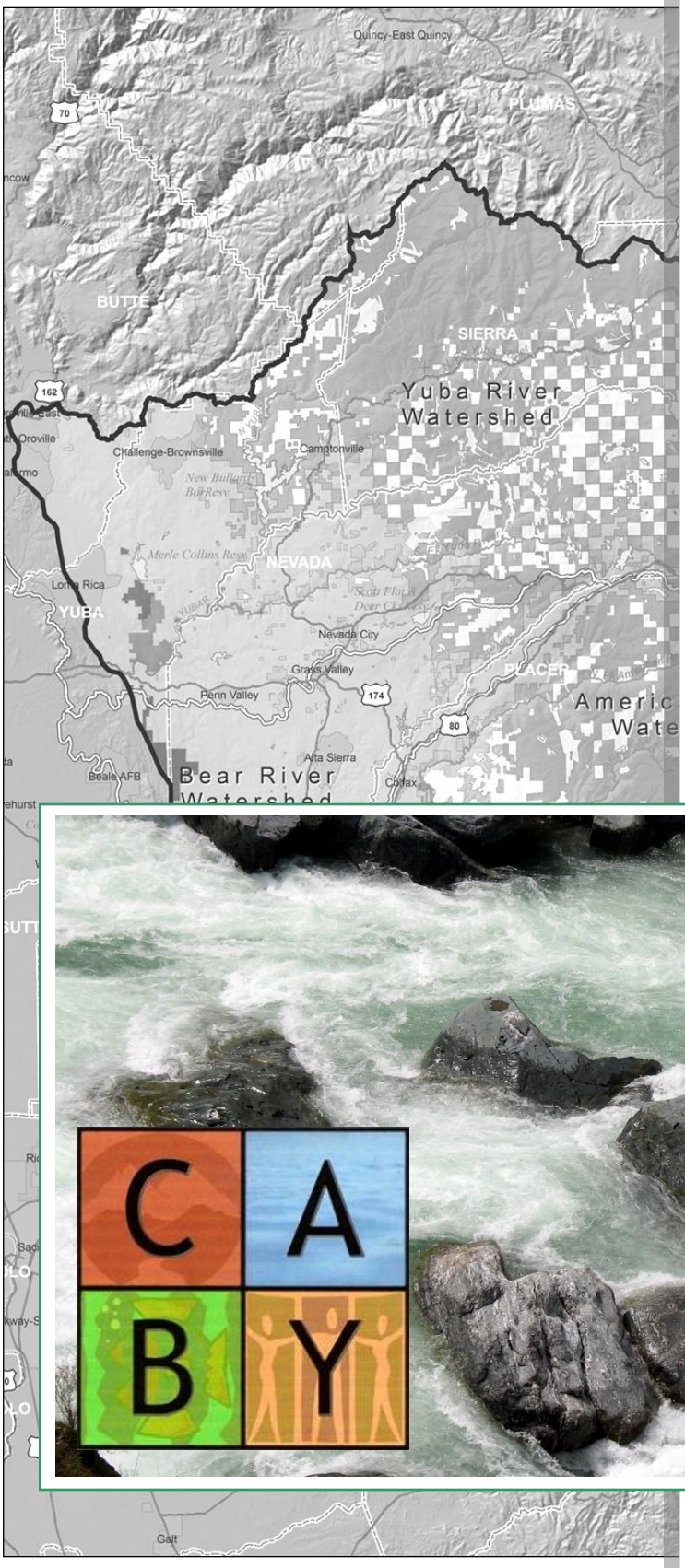
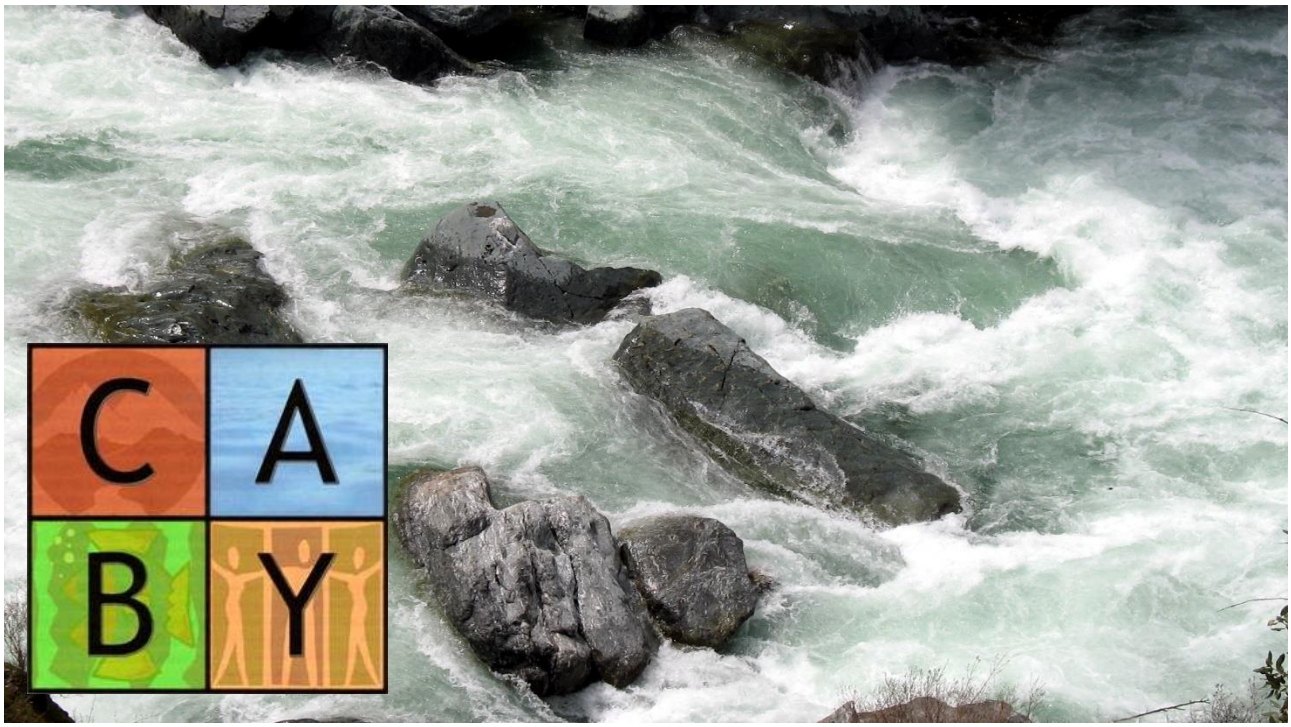


INTEGRATED REGIONAL WATER MANAGEMENT PLAN

COSUMNES
AMERICAN
BEAR
YUBA

WATERSHEDS, CALIFORNIA



2021 Update

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APPENDICES

List of Acronyms

AF	acre-feet
AF/AC	acre-feet per acre
ARC	American River Conservancy
BMP	best management practice
CABY	Cosumnes, American, Bear, and Yuba
CAP	Climate Action Plan
CEQA	California Environmental Quality Act
CO_2	carbon dioxide
CVP	Central Valley Project
CWC	California Water Code
DAC	disadvantaged community
DMS	Data Management System
DWR	California Department of Water Resources
EDCWA	El Dorado County Water Agency
EID	El Dorado Irrigation District
EJ	environmental justice
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FRT	Federally Recognized Tribes
GDPUD	Georgetown Divide Public Utility District
GHG	greenhouse gas
GIS	geographic information system
gpcd	gallons per capita per day
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
JPA	Joint Powers Authority
LCMMP	Land Cover Mapping and Monitoring Program
MCFA	Mountain Counties Funding Area
MHI	Median Household Income
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NFRT	Non-Federally Recognized Tribes
NGO	Nongovernmental Organization
NID	Nevada Irrigation District
OEHHA	Office of Environmental Health Hazard Assessment
O&M	Operations and Maintenance
PCWA	Placer County Water Agency
PG&E	Pacific Gas and Electric Company
RAP	Region Acceptance Process
RMS	Resource Management Strategies
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board

SB	Senate Bill
SG	Stakeholder Group
SGMA	Sustainable Groundwater Management A
SMUD	Sacramento Municipal Utility District
SNC	Sierra Nevada Conservancy
SWEEP	Sierra Nevada Watershed Ecosystem Enhancement Project
SWIM	Sacramento Watershed Information Module
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRCP	Stormwater Resource Plan
TAC	Technical Advisory Committee
UARP	Upper American River Project
UC	University of California
USBR	U.S. Bureau of Reclamation
USFS	U.S. Forest Service
UWMP	Urban Water Management Plan
WEAP	Water Evaluation and Planning model
WG	Work Group
WMI	Water Management Initiative
YCWA	Yuba County Water Agency

Chapter 1
Introduction

1.1 Background

The borders of the Cosumnes, American, Bear, and Yuba (CABY) Integrated Regional Water Management (IRWM) region were accepted through the 2009 California Department of Water Resources (DWR) Region Acceptance Process (RAP). The region borders of the CABY IRWM Plan (IRWMP) were established through the RAP and were based on similarities in the physiography of the watersheds, socioeconomics, hydrology, geology, hydrogeology, water storage and delivery infrastructure, and land use. The areas within the region also have similar or closely related policy issues and management entities.

The 2007 IRWMP was updated and replaced by the 2014 CABY IRWMP, which will subsequently be replaced by this document to be fully compliant with the 2016 IRWM Proposition 1 Guidelines, prepared by the DWR. The current CABY Regional Water Management Group (CABY RWMG)—as described in Chapter 4, Governance—is the entity responsible for implementing the IRWMP. The CABY RWMG is made up of representatives from agencies and nonprofits in equal numbers.

1.2 Purpose of the 2021 CABY IRWMP Update

The purpose of the 2021 CABY IRWMP Update is to accomplish the following:

- Define and update the current water resources and environmental conditions
- Document and characterize key issues, challenges, and potential sources of conflict
- Identify and update management goals and objectives, including those for water supply, water quality, environment and habitat, land use, and recreation
- Evaluate and update alternative water management strategies and identify opportunities for cooperative actions among water resource management entities and key stakeholders
- Incorporate findings from state-mandated needs assessment of the CABY region disadvantaged communities to ensure the involvement of disadvantaged communities (DACs), economically distressed areas (EDAs), or underrepresented communities (collectively referred to as DACs) in IRWM planning efforts.
- Provide an implementation plan for priority projects
- Establish an ongoing planning framework and management structure from which local water management policies, projects, and programs can be formulated, evaluated, and implemented
- Incorporate new climate change research that is relevant to the region, update resource management strategies and methodologies of project selection, and plan accordingly
- Add discussion of water, culture, and sediment management as resource management strategies relevant to the CABY region
- Review water quality concerns in the region and identify any issues not previously discussed

- Inclusion of elements from the California Water Plan with responsiveness to the following legislative items:
    - **AB 685 –** Establishes state policy that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes
    - **AB 52 –** Requires the California Environmental Quality Act (CEQA) lead agency to consider effects on tribal cultural resources and conduct consultation with California Native American tribes
    - **AB 1249 –** Requires IRWM regions with nitrate, arsenic, perchlorate, or hexavalent chromium contamination to include specific information in their IRWMP regarding the location, impact, actions, and needed actions to address the contamination; it also requires applications from these IRWM regions to include information regarding how projects in the application will address these contaminations and if there are not projects, to explain why not
    - **AB 1739 –** The Sustainable Groundwater Management Act, creates a framework for sustainable local groundwater management by requiring local agencies to establish a new governance structure, known as Groundwater Sustainability Agencies, prior to developing groundwater sustainability plans for groundwater basins or subbasins
    - **Executive Order B-29-15 –** Requires agricultural water suppliers that supply water to more than 25,000 acres to include in their required 2015 Agricultural Water Management Plans a detailed drought management plan that describes the actions and measures the supplier will take to manage water demand during drought
    - **SB 985 –** Requires development of a stormwater resource plan and compliance with these provisions to receive grants for stormwater and dry weather runoff capture projects from a bond act that was approved by voters after January 1, 2014
    - **SB 208 –** Requires a RWMG to provide DWR with a list of projects that benefit a disadvantaged community (DAC), or where the project proponent is a nonprofit organization or a DAC, within 90 days of notice that a grant has been awarded. Within 60 days of receiving the project information, DWR is to provide advanced payment of 50% of the grant award

Piecemeal planning constrains the range of potential solutions to the region's most pressing conflicts and increases the potential for competition amongst managers and user groups. In response to this, the active groups and agencies in this region have established a planning framework for institutional involvement and multi-stakeholder participation. The proposed governance structure will allow for collaborative management of IRWMP planning and implementation of water resources and implementation of projects.

By building on the wealth of hands-on watershed restoration experience, project-scale monitoring, and institutional capacity, it will become possible to expand water management and planning capabilities when water management conflicts require larger-scale solutions.

1.3 Coordination with Other IRWMPs

Other regions throughout California are developing IRWMPs to address water management issues. In some cases, the regions' water management issues transcend the geographic boundaries. Coordinating with adjacent regional planning efforts is particularly important as the CABY region contributes water supplies to other IRWMP regions and may affect or be affected by water quality in other areas.

The CABY IRWMP development has included outreach and coordination with other regional planning efforts as needed to discuss water policy, implementation projects, data management, monitoring, or other water management issues.

The following are adjacent regional planning efforts with which CABY has coordinated:

- American River Basin
- Mokelumne Amador Calaveras
- Yuba County
- Upper Feather River Watershed
- Tahoe Sierra

1.4 Document Organization

This IRWMP is organized by chapters that describe the current issues, management needs, resource conditions, strategies, and plans to implement projects in the CABY region.

Chapter 1, Introduction: This chapter introduces the purpose and vision of the IRWMP.

Chapter 2, Stakeholder Involvement: This chapter provides a detailed description of the CABY IRWMP planning process, including a thorough description of the unique and effective process of stakeholder participation and consensus decision making. The core of the CABY IRWMP is based on the cooperative and transparent nature of the CABY planning process.

Chapter 3, Coordination: This chapter describes the efforts the group has undertaken to involve and collaborate with federal and state agencies, adjacent IRWM regions, and other key groups with an interest in the CABY region and/or the Sacramento Region Funding Area, of which CABY is a part.

Chapter 4, CABY Governance: This chapter describes the historic and current governing structure of the organization, including how decisions are made, which entities participate in decision making, and how the network of work groups serve to advance CABY issues and objectives.

Chapter 5, Region Description: This chapter describes the regional geology, soils, hydrology and groundwater, water supply infrastructure, subwatersheds, land and water use, biological resources, social and cultural characteristics, and the economic conditions in the CABY region.

Chapter 6, Water Quality: This chapter describes the water quality conditions throughout the CABY region. Detailed information is provided on water quality concerns, such as mercury, sediment, temperature, and contaminants.

Chapter 7, Water Supply: This chapter presents a broad water demand forecast for the CABY region. Understanding the magnitude of future water demands and any potential changes to existing water demands allows managers to make recommendations that will meet or manage demands for water quality and quantity into the future.

Chapter 8, Water and Land Use: This chapter provides a descriptive summary of the IRWMP's relation to local pre-existing management plans (mandatory documents) that have statutory authority or legal

standing. These plans describe the current management obligations that affect water resources and decision making in the region.

Chapter 9, Issues and Objectives: This chapter describes the major issues and conflicts affecting the management and conditions of water resources. The issues presented were identified in the CABY planning work groups. The CABY IRWMP goals and objectives are then presented in the context of the issues that they seek to address and mitigate. The goals and objectives are the sources from which unique strategies and on-the-ground actions will be formulated (i.e., implementation projects).

Chapter 10, Resource Management Strategies: This chapter addressed the resource management strategies included in the State Water Plan in detail, and includes a matrix that presents each measure and a clear statement of its relevance to the CABY region and the IRWMP document.

Chapter 11, Climate Change: This chapter describes the historic conditions and trends, projected trends, identified vulnerabilities, and available adaptive management strategies in the CABY region. This section includes the results of extensive work group interaction and assessment, and includes an appendix that focusses on the relationship of fuel and fire to the projected changes in regional precipitation.

Chapter 12, Project Review Process: This chapter describes the project review process that will include projects in the IRWMP. The extensive integration process used by project sponsors to achieve the maximum number of multi-objective, multi-benefit, and multi-stakeholder projects is also described.

Chapter 13, Plan Performance and Monitoring: This chapter describes how the IRWMP will be evaluated using project and plan performance measures, monitoring, and adaptive management.

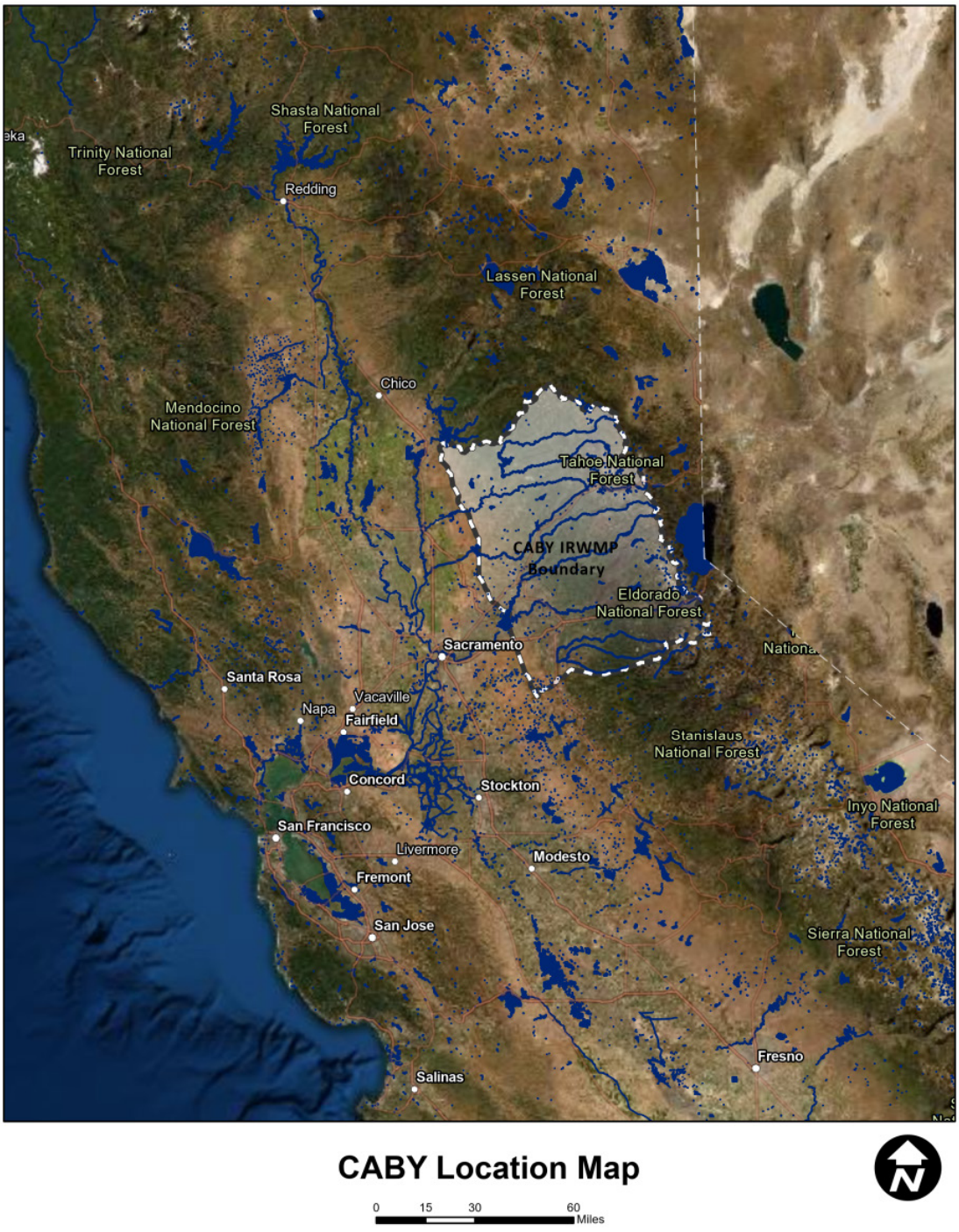
Chapter 14, Impacts and Benefits: This chapter describes the projected impacts and benefits of both project- and IRWMP-level implementation.

Chapter 15, Technical Analysis: This chapter describes the ongoing data management mechanisms and technical aspects and analyses that are essential to scientific understanding and measurement of effective change to water resources.

Chapter 16, Finance: This chapter describes both the process and reliability of obtaining project-level funding and the mechanisms and strategies open to the group to sustain the RWMG, overall IRWMP implementation, and other aspects of maintaining a strong and durable group to support IRWM activities in the region.

Appendices: This chapter includes supporting documents, the project list, background information, references, geographic information system (GIS) metadata for maps, DAC assessment, and the project solicitation and prioritization documents.

Figure 1-1 – CABY Location Map



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Chapter 2
Stakeholder Involvement

Stakeholder involvement is key to successful implementation of the Cosumnes, American, Bear, and Yuba (CABY) Integrated Regional Water Management Plan (IRWMP). The first CABY IRWMP was initiated in 2005 by a diverse group of water suppliers and purveyors, governmental agencies, recreation and business interests, and watershed stewardship groups representing various CABY watersheds. Following this extensive and comprehensive planning effort, the IRWMP was adopted in 2007 by 25 organizations in the region. The initial CABY stakeholder process and public outreach informed as many stakeholders as possible about IRWMP development and garnered widespread support during IRWMP preparation and beyond. Since its inception, the CABY group has been noted for the diversity of its membership and the efforts members have made to achieve genuine collaboration. A central aspect of the CABY effort has been its continued and ongoing outreach to groups, communities, agencies, organizations, and Tribes across the region. CABY has consistently added new member organizations since 2005. As a result, 42 CABY member organizations adopted the 2013 IRWMP. Once finalized, this CABY IRWMP Update 2021 will be available for adoption.

This chapter describes the processes that CABY employs to ensure ongoing and active participation in the IRWMP decision-making process by a variety of stakeholders, including those who may be affected by the IRWMP. The chapter describes the methods and strategies that will be used by the stakeholders to continue the development of an integrated and adaptive planning effort focused on finding solutions that support both common and individual objectives for the region.

2.1 CABY Stakeholders

CABY stakeholders are essential to identifying issues, populating resource management strategies, and developing objectives. Perhaps most important, when an IRWMP is adopted, stakeholders are integral to making an IRWMP come alive by incorporating those objectives into their respective work and by securing funding and implementation of its programs and projects.

CABY provides opportunities for involvement for three primary types of stakeholders. The first group includes those organizations that have adopted the IRWMP and constitutes the primary advisory body for CABY – the CABY Stakeholder Group (CABY SG). The second group is those organizations that are members of the CABY SG, but are unable to officially adopt the IRWMP because they are either Tribes, which are sovereign nations, or regional/federal entities. Tribes are able to submit projects for inclusion in the IRWMP. The third group, known as interested stakeholders, includes those groups or organizations that participate and have expressed an interest in CABY but have not adopted the IRWMP because of complex adoption requirements, limited staff capacity for meetings, or other reasons. The interested stakeholders are not able to submit projects for inclusion in the IRWMP.

Most of the major stakeholders in the region with responsibility for, or interests in, water management issues are CABY adoptees. These stakeholders include water management agencies, conservation groups, counties, regional watershed collaborative, recreational interests, agricultural interests, and disadvantaged communities. Table 2-1 provides a list of CABY IRWMP 2013 adoptees. A list of CABY IRWMP 2021 adoptees will be posted on the CABY website (https://cabyregion.org/) once agencies, non-profits, Tribes and other stakeholder groups have been given the opportunity for adoption. Table 2-2 includes interested stakeholders and organizations.

Table 2-1
CABY SG Members/2013 IRWMP Adoptees

Water Agencies and Community Services Districts (CSDs)			
Alleghany County Water District	Camptonville CSD	Downieville Public Utilities District	El Dorado County Water Agency
El Dorado Irrigation District	Georgetown Divide Public Utilities District	Grizzly Flats CSD	Nevada Irrigation District
North Yuba CSD	Placer County Water Agency	Washington County Water District	–
Conservation Groups/Nongovernmental Organizations			
American Rivers	American River Conservancy	American River Watershed Group	Bear Yuba Land Trust
Dry Creek Conservancy	Natural Heritage Institute	Protect American River Canyons	Save Auburn Ravine Salmon and Steelhead
The Sierra Fund	Sierra County Land Trust	Sierra Nevada Alliance	Sierra Streams Institute
South Yuba River Citizens League	The Nature Conservancy	The Sierra Club (Mother Lode Chapter)	Upper American River Foundation
Wolf Creek Community Alliance	Yuba Watershed Institute	Cosumnes Culture and Water Ways	–
City and County Agencies			
City of Colfax	City of Downieville	City of Grass Valley	City of Nevada City
City of Placerville	City of Sierra	Fire Safe Council of Nevada County	North San Juan Fire Protection District
Nevada County	Placer County	Sierra County	Sierra City Fire District
Regional/Federal Entities			
El Dorado County Resource Conservation District	Georgetown Divide Resource Conservation District	Mountain Counties Water Resources Association	Nevada County Resource Conservation District
Placer County Resource Conservation District	—	—	—
Watershed Groups/Councils			
American River Watershed Group	American Basin Council of Watersheds	Bear River Watershed Group	Yuba-Bear Watershed Council
Cosumnes Coalition	—	—	—
Recreation			
American River Recreation Association	California Outdoors	Gold Country Fly Fishers	Northern California Council, Federation of Fly Fishers

Table 2-2 CABY Interested Stakeholders			
Apple Hill Growers	El Dorado County	Nevada County	Sierra Business Council
Sierra Native Alliance	Sierra Nevada Conservancy	Sierra Water Work Group	Yuba County

2.1.1 Water Purveyors, Wastewater Agencies, and Hydroelectric Generators

The CABY Regional Water Management Group (RWMG) includes the four main water agencies in the region (see Figure 2-1, CABY Region Agency Boundaries)—El Dorado Irrigation District (EID), El Dorado County Water Agency (EDCWA), Placer County Water Agency (PCWA), and Nevada Irrigation District (NID). CABY membership also includes many of the small community water purveyors, such as Georgetown Divide and Downieville Public Utility Districts, Washington County and Alleghany County Water Districts, Grizzly Flats and Camptonville Community Services Districts, and the City of Placerville.

2.1.1.1 El Dorado Irrigation District

EID is a water utility serving nearly 108,000 residents in El Dorado County. EID was formally organized in 1925 under California's Irrigation District Law (California Water Code Section 20500 et seq.). EID provides drinking water for homes, schools, agriculture, and businesses, and supplies recycled water to irrigate yards and public landscapes. EID also wholesales water to the City of Placerville. EID's facilities and delivery infrastructure for drinking water include 1,200 miles of pipeline, 40 miles of ditches, 6 treatment plants, 33 storage reservoirs, and 21 pumping stations.[1] Additionally, EID owns and operates the El Dorado Hydroelectric Project, Federal Energy Regulatory Commission (FERC) No. 184.

2.1.1.2 El Dorado County Water Agency

EDCWA is not a water provider. The agency was formed by special act of the California State Legislature in 1959, and its boundaries are coterminous with those of El Dorado County. Among EDCWA's authorities are the power to contract for water and to finance and construct, operate, and maintain works for the storage and transmission of water. EDCWA may contract for the sale of water-to-water purveyors, but is not permitted to retail water directly to customers. EDCWA has undertaken the role of overall county water planning and securing new water supply for the county.[2]

The residents of El Dorado County purchase their water from six water purveyors: EID, Georgetown Divide Public Utility District, Grizzly Flats Community Services District, the City of Placerville, South Tahoe Public Utility District, and Tahoe City Public Utility District.

2.1.1.3 Placer County Water Agency

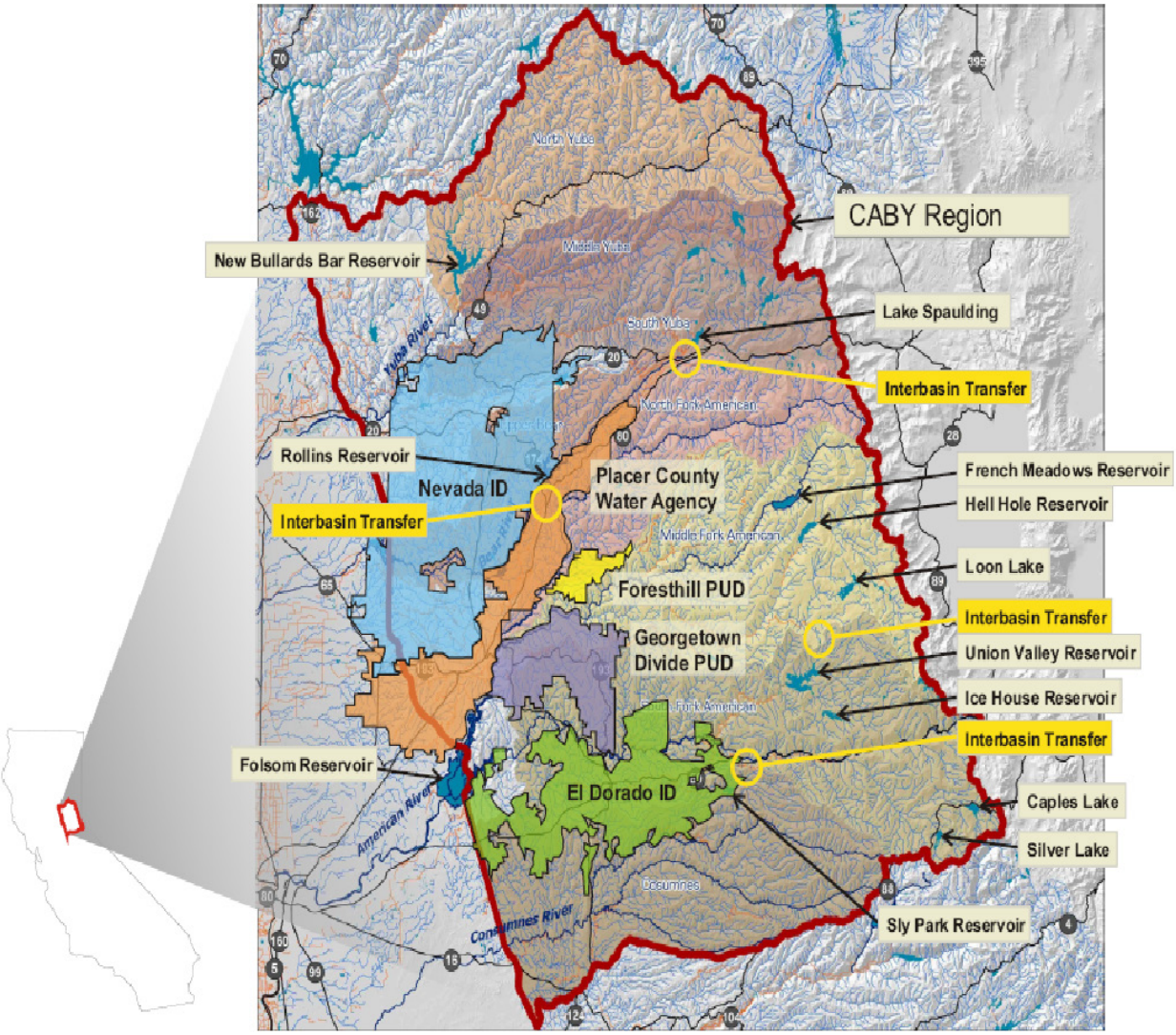
PCWA was created under state legislation entitled Placer County Water Agency Act, adopted in 1957. PCWA carries out a broad range of responsibilities, including water resource planning and management, retail and wholesale supply of irrigation and drinking water, and production of hydroelectric energy. PCWA is the primary provider of water to Placer County residents.[3] PCWA owns and operates the Middle Fork American River Hydroelectric Project, FERC No. 2079.

[1] EID 2006b.

[2] EDCWA 2003.

[3] PCWA 2006.

Figure 2-1 – CABY Region Agency Boundaries



2.1.1.4 Nevada Irrigation District

NID was formed in 1921 to provide a reliable year-round water supply to its local constituents. The NID manages 287,000 acres and supplies water to homes, farms, and businesses. NID water produces electricity and provides for public recreation. A significant component of NID's operations is the Yuba-Bear Hydroelectric Project, FERC No. 2266.

2.1.1.5 Small Community Water Districts

Georgetown Divide and Downieville Public Utilities Districts, Washington County and Alleghany County Water Districts, and Grizzly Flats and Camptonville Community Services Districts have all adopted the IRWMP (see Table 2-3).

Table 2-3
Small Community Water Districts

Agency	Number of Hook-Ups	Water Source	DAC
Alleghany County Water District	**To Come**	**To Come**	Yes
Camptonville Community Services District	72 or 74	Campbell Gulch – propriety rights through water resources	Yes
Downieville Public Utilities District	230 +/–	Polly Creek	Yes
Georgetown Divide Public Utilities District	4,000	Stumpy Meadows	No
Grizzly Flats Community Services District	600	Surface water – Big Canyon/North Canyon Diversion (North Fork Cosumnes Tributary)	Yes
Washington County Water District	122	Own water rights (pre-1914), water conveyed by NID from Bowman Lake via Canyon Creek	Yes

Note: DAC = Disadvantaged Community; NID = Nevada Irrigation District.

2.1.1.6 Wastewater Agencies

The majority of the unincorporated region is currently served by individual septic systems. However, within unincorporated cities, wastewater treatment in the CABY region is handled either through urban-scale, city-operated treatment plants (e.g., Nevada City, Grass Valley, Auburn, Colfax, and Placerville); by community services districts that serve smaller, more isolated populations (e.g., Applegate and Plymouth); or by private entities, such as mobile home parks, that operate their own wastewater system (see Table 2-4). Additionally, EID owns and operates wastewater treatment facilities within some unincorporated communities in El Dorado County. The City of Auburn is exploring participation in a regional water treatment system in Lincoln.

Generally, wastewater treatment facilities in the region have a history of performing well; however, budgetary constraints, stormwater infiltration, and aging collection infrastructure does present ongoing operational and maintenance considerations for several communities, such as Placerville, Colfax, and Grass Valley.

Table 2-4
Wastewater Treatment Facilities

Agency	Facility	Community
Auburn	Auburn Wastewater System	Auburn
Colfax	City of Colfax WWTP	Colfax
EID	El Dorado Irrigation District	El Dorado Hills, Deer Creek, Camino Heights, and Gold Ridge Forest
Grass Valley	Grass Valley WWTP	Grass Valley
Nevada City	Nevada City WWTP	Nevada City
Newcastle	Newcastle Sanitary District	Newcastle
Nevada County	Nevada County Sanitation District No. 1, Cascade Shores WWTP	Zones 1, 2 , and 4-10 of Nevada County
Placer County Department of Facility Services	Applegate WWTP	Applegate
Placer County Department of Facility Services	SMD No. 1 WWTP	North Auburn
Placerville	City of Placerville WWTP	Placerville
Plymouth	Plymouth WWTP	City of Plymouth

Note: WWTP = Wastewater Treatment Plant; EID = El Dorado Irrigation District; SMD = Storage Module Device.

2.1.2 Municipal and County Governments

Cities and counties have jurisdiction and statutory authority over local land use and were included in the CABY IRWMP planning process (see Figure 2-1). This is important because of the critical linkage between planning process and management actions related to local land use and water management. In addition, the CABY planning framework included detailed evaluation of the adopted city and county land use, and the CABY IRWMP seeks to be consistent and complementary to these plans.

The CABY region includes all or portions of nine counties—Plumas, Yuba, Butte, Sierra, Nevada, Placer, El Dorado, Amador, and Alpine. The portions of the CABY region that are in Plumas, Butte, Amador, and Alpine are extremely small, and are primarily uninhabited or very sparsely populated rural areas. Placer, El Dorado, and Sierra Counties adopted the 2019 IRWMP; CABY members in the remaining counties continue to work toward IRWMP adoption.

The majority of the incorporated cities in the CABY region adopted the 2019 IRWMP, including Placerville, Colfax, Grass Valley, and Nevada City. CABY continues to work with the remaining incorporated cities in the region to gain adoption of the IRWMP.

2.1.3 Native American Tribes

The CABY region includes both Federally Recognized Tribes (FRTs) and Non-Federally Recognized Tribes (NFRTs). FRTs have sovereign powers (a unique political status that requires government-to-government relationships). FRTs generally have paid staff and clear points of entry for outreach (e.g., Environmental Director and Tribal Council), whereas NFRTs often do not. Further, individual NFRT members may themselves be geographically dispersed, making outreach more difficult.

The Tribal entities contacted during the CABY outreach process include the Buena Vista Rancheria, Wilton Rancheria, Miwok Tribe of the El Dorado Rancheria, Ione Band of Miwok Indians, Jackson Band of the Mi-Wuk, Nashville-El Dorado Miwok, Strawberry Valley Rancheria, Colfax-Todds Valley Consolidated Tribe, Tsi-Akim Maidu, Shingle Springs Band of Miwok, Washoe Tribe of Nevada and California, Nevada City Rancheria, Nisenan Tribe, Cosumnes Culture and Water Ways, United Auburn Indian Community, El Dorado County Indian Council, California Indian Environmental Alliance, Sierra Native Alliance, and the Tyme Maidu/Berry Creek Rancheria.

As part of the DWR required DAC assessment, CABY identified a need to improve outreach and inclusion of recognized and "traditional" tribes in the region. A protocol for working with tribal entities is under development by the Foothills Nisenan Nevada City Rancheria.

2.1.4 Nongovernmental and Community Organizations

The nongovernmental organizations bring significant experience in successfully conducting and implementing watershed assessment, planning, and restoration on various scales. These organizations work on a wide variety of issues in the watersheds, including ecosystem restoration, cultural resource stewardship, watershed education, and land conservation.

2.1.5 Recreational Interests

Recreational interests are important participants in the CABY RWMG because they offer a unique perspective on water supply management issues and have an economic stake in water use. Recreational participants include anglers, whitewater enthusiasts, and trail users.

2.1.6 Industry Organizations and Agricultural Interests

Since its inception, agriculture has been an important component of the IRWMP. The agricultural organizations in the CABY SG include regional conservation districts and agricultural commissioners and associations.

2.1.7 Regional Watershed Collaboratives

The regional watershed collaboratives involved in CABY are composed of an array of other organizations that address issues of importance to CABY on a watershed or a subwatershed basis.

2.1.8 Disadvantaged Community

Out of the 23 disadvantaged communities (DACs) in the region (see Table 2-5), a total of four adopted the 2013 IRWMP (thus becoming part of the CABY SG). CABY has invited the remaining 19 DACs to participate in meetings and/or project development activities. The Mountain Counties Funding Area is currently assessing DAC needs, funded by a Department of Water Resources (DWR) grant. When the assessment is complete, it is likely that additional DACs will be identified and invited to participate. As part of the DWR required DAC assessment, CABY collaborated with the Mountain County Funding Area (MCFA) to reach out to the region's DAC communities with the goal of supporting development of projects for inclusion in the final plan.

2.2 The Process Used to Identify Stakeholders

As part of its overall outreach, CABY seeks input from all regional stakeholders, not just those likely to offer formal input to the planning activities or adopt the IRWMP. A collaborative process involving a wide variety of interests not only broadens the collective understanding of regional water issues and improves project development, but also offers a forum for resolving conflicts among participants. It attempts to achieve a balance among water interests to best serve the region.

At CABY's inception, staff from the EID initiated the stakeholder outreach effort and identified a broad list of potential participants. EID used recommendations from each recruited entity to systematically expand the list of possible interested parties, and conducted a survey of agencies, organizations, and entities in the region with interest in water management (using the initial list of possible types of participants provided by the DWR in the program guidelines). Over time, this list has been refined; groups have responded by (1) active participation and IRWMP adoption, (2) requests to remain on the mailing list with varied levels of participation, and (3) participation only in targeted meetings or work groups.

Through its member groups, committed participants, and staff, CABY has continued to recruit participation by ongoing outreach, recruiting over 20 additional IRWMP adoptees since the original IRWMP was adopted in 2007 by 25 entities. As part of the DWR required DAC assessment CABY used the state's definition of DAC's to identify DAC's in the region and targeted outreach to DAC leaders in area towns, small cities, and neighborhoods. This included city water engineers, sanitation district directors, water tenders for small developments such as mobile home parks. Two public workshops convened in the CABY region created an opportunity for dozens of representatives from DAC communities to participate in the planning process.

The CABY SG in its formative stages identified diverse participation as a guiding principle for CABY's development. This principle has supported the recruitment of new RWMG members every year since the IRWMP's original adoption. In particular, the outreach activities for this IRWMP Update have targeted disadvantaged, Tribal, and Latino communities with substantive outreach efforts.

As a means to ensure organizational diversity, consistent participation, and effective management, the CABY SG drafted a charter that formalized the group's structure and protocols for decision making, membership, and communication.

2.2.1 Regional Water Management Group Levels of Participation

2.2.1.1 Interested Parties

Interested parties receive all CABY meeting notices and materials, attend meetings, participate in discussions, and are invited to participate in CABY project development activities. While they are integral to identifying issues, developing resource management strategies, and defining objectives, they do not participate in the formal decision-making process of the organization. All interested parties are encouraged to adopt the IRWMP. The formal decision-making process is discussed in Section 2.5.

2.2.1.2 IRWMP Adoptees (or CABY Stakeholder Group)

During preparation of the 2013 IRWMP Update, the existing CABY SG determined that any entity that adopted the IRWMP would become a part of the ongoing governance of the organization through the CABY SG.

Numerous entities have adopted the IRWMP since the initial round of adoptions. Generally, an organization that wishes to adopt the IRWMP identifies a representative (and an alternate) to participate in CABY meetings and other activities. Similar to interested parties, adoptee representatives attend meetings regularly and participate in discussions and project development activities. An important distinction from interested parties is that adoptees may submit projects to CABY for possible integration into the IRWMP.

2.2.2 Ongoing Outreach to Invite New Stakeholders

Since CABY's initial 2005/2006 outreach, CABY has used its existing membership to identify other groups and individuals with an interest in water resource management in the region, or that can help meet the IRWMP objectives.

CABY stakeholders have focused increasing attention on recruiting underrepresented communities (e.g., DAC, Tribal, and Latino) to participate, and on entities that have a more complex and time-consuming adoption process, such as counties. In addition, CABY stakeholders perform targeted outreach to broaden participation in four specific constituent groups: business, agriculture, Tribal, and Latino. CABY's outreach to business groups involves direct one-on-one contacts as well as presentations at business organizations and associations; agricultural groups are targeted primarily through the Resource Conservation Districts. See Sections 2.2.5.2 and 2.2.5.3 for a more detailed explanation of the Tribal and Hispanic outreach efforts.

CABY promotes access to its IRWMP activities and collaboration in the process in several specific ways:

1. Quarterly CABY SG meetings, open to all stakeholders and the public.
2. The CABY website (cabyregion.org) includes information about the IRWMP, individual member groups, and members' projects. CABY members also use the website to receive input from the public and other members regarding specific projects and proposals.
3. CABY stakeholders attend the formal meetings of many of its member groups (upon invitation) and provide information regarding CABY activities at those meetings.
4. Work Group (WG) meetings to develop multi-stakeholder, multi-objective projects on topics such as water supply and drought relief, fish passage and habitat, working landscapes, citizen stewards, Tribal outreach, and DACs through the Mountain Counties Funding Area Needs Assessment.

CABY strategies for stakeholder participation also include the following:

1. Facilitating the involvement of stakeholders by providing planning or informational sessions, holding planning meetings in accessible locations, accommodating requests for interpreters and translators, or providing electronic forms of media.
2. Making meeting notices, agendas, and minutes available to the public via the CABY website, providing seating and writing space for stakeholders who wish to observe CABY meetings, posting ground rules for public input during meetings, and allotting time for public input at its meetings.
3. Recruiting, disseminating information, and facilitating input by others (this is a specific charge of the CABY SG).
4. Sustaining stakeholder involvement by recognizing it during meetings and according it the same importance as any other input, questions, or requests. Being prepared to hear what stakeholders say, and respecting the passion they bring to their participation.

The WG meetings have been and remain an important part of CABY's ongoing outreach. WGs are initiated to address specific issues pertinent to CABY stakeholders. A variety of stakeholders participate in the WG meetings, some of whom are CABY SG members, IRWMP adoptees, and interested parties, and some of whom have no previous interactions with CABY. The WG structure has led a wide variety of organizations to adopt the IRWMP, and has increased participation and diversity in CABY activities in general.

In addition, project galleries are periodically included at CABY SG meetings. Project galleries include short presentations from individual project sponsors, followed by a period of individual Q&A sessions. Presenters include both CABY members and interested parties. These galleries allow CABY members to receive information on project activities throughout the region, to provide feedback on those activities, and to cultivate relationships with a variety of stakeholders.

To ensure that the current IRWMP is reviewed and adopted by as many stakeholder groups as possible, the CABY RWMG members keep relevant entity and agency board members informed throughout the planning process regarding the contents of the IRWMP.

2.2.3 Recommendation of Additional Stakeholders

Existing stakeholders alert the CABY RWMG to the existence of newly identified stakeholders, the formation of new groups, and/or opportunities to recruit additional departments or divisions within a member agency. These newly identified stakeholders are sent CABY meeting notices and materials, are contacted in person by CABY representatives, and/or are invited to attend the ongoing meetings.

2.2.4 Identification of Stakeholders through Water Management Issues

As part of the extensive WG-based project development activities within CABY, additional stakeholders have been identified and targeted for recruitment. For example, the historical Western Placer Creeks WG focused on developing projects to support anadromous fish in low-elevation headwater creeks in the western portion of the IRWMP area. Save Auburn Ravine Salmon and Steelhead and Dry Creek Conservancy began to attend these meetings and ultimately became CABY adoptees. The Working Landscapes and Mountain Meadow WGs have similarly brought new stakeholders into the CABY process. The primary vehicle for bringing new interest-based stakeholders has been and continues to be the WG structure.

People have participated in the WGs because CABY's mission aligns with their agency's or organization's mission. CABY also facilitates involvement in response to emerging issues, such as noxious weed eradication (e.g., scotch broom), climate change, or wildfire events. These emerging issues can and have changed the priorities and urgency of a given issue. As stated above, project development activities have proven to be key to early recruitment of new stakeholders.

2.2.5 Targeted Outreach to Underrepresented Groups

CABY established a framework document to ensure participation from a wide variety of stakeholders, including underrepresented groups, entitled CABY Outreach Plan for DAC and Communities Possibly Affected by Environmental Justice Issues (see Appendix B, Memorandum of Agreement and Resolution of Support). The following section provides a definition of CABY region DACs, and is followed by a discussion on outreach barriers in these communities.

One of the most significant barriers to sustained engagement in CABY by Tribes and DAC community members is a lack of dedicated funding for Tribal/DAC attendance at meetings and participation in the planning and grant-making processes. The Sierra Fund has identified a best practice to address this barrier: nongovernmental organizations with sufficient capacity can attract foundation funding to provide stipends to Tribes and DACs to increase their engagement in CABY. This model benefits CABY by increasing stakeholder diversity and therefore better understanding diverse perspectives on water issues. The model benefits Tribes and DACs by ensuring that their interests are heard and incorporated into planning and projects, and it benefits the nongovernmental organizations engaging in capacity building by strengthening relationships and potentially gaining partners for future projects.

2.2.5.1 Disadvantaged Communities

Early on, CABY conducted a series of outreach calls to DACs within the region to describe the IRWMP planning process and explore potential membership in the CABY SG. In fall 2006, CABY outreach to DACs focused on identifying and informing the appropriate community representatives about IRWMP development, determining if the community had a public works department or other department that might have potential projects, and when appropriate, identifying potential projects that might assist CABY in addressing its goals and objectives. Through this work, it became clear that many DACs lacked staff and resources to participate consistently in the process, develop projects, or prepare a project application. Therefore, CABY conducted a third intensive round of outreach that began in early 2007 and continued through 2010. Outreach included extensive face-to-face meetings with DAC staff, boards of directors, and volunteer representatives on a regular basis. The CABY team expended hundreds of hours in meetings, work sessions, trainings, and direct technical assistance—with the dual purpose of directly involving the DACs in the work and structure of CABY and developing projects to implement the IRWMP's objectives of benefitting critical water supply and water quality needs of DACs. See Appendix C, Community Needs Assessment, for a complete description of the DAC Outreach Plan.

Since 2010, outreach to DACs has been conducted primarily by CABY stakeholders. One example is recent work by the Placer County Water Agency to reach out to communities that may utilize raw water (constructed conveyance customers) to provide treated water for household use. The Mountain Counties Funding Area Needs Assessment is currently underway.

As a result of this effort, the IRWMP includes a significant number of projects that originated from and/or benefit DACs in the region and are a part of the CABY implementation effort. An additional direct result is the successful Proposition 84, Round 1 Implementation Grant inclusion of 18 projects, 14 of which were for DACs. Furthermore, 9 of the last 10 entities that adopted the IRWMP were DACs recruited as part of the CABY outreach process.

Objectives for DAC Outreach:

1. Use a phased approach to outreach that gradually reaches greater numbers of people living in DACs; utilize census data as it becomes available to identify and outreach to new DACs.
2. Recognize the financial and economic challenges of DACs and use a go-to-them approach as much as possible, rather than a come-to-us approach.
3. Work with DACs to develop projects from the current IRWMP projects list.
4. Work with DACs to identify critical water resource-related issues and priorities.
5. Work with DACs to identify and develop new projects to address identified issues and priorities.
6. Work with DACs to increase their capacity for fundraising to sustain the long-term success of DAC projects.

7. Work with other project sponsors to identify DACs that are or may be included in emerging opportunities for collaboration.
8. Seek to build long-term relationships between CABY and DACs.

For a full explanation of the 12 strategies by which CABY proposes to achieve these objectives, see Appendix C. This appendix also includes materials developed in support of and/or as a result of outreach efforts.

2.2.5.2 Native American Communities

Since its inception, CABY has made numerous efforts to engage Tribes in the IRWMP process. While some of these efforts achieved modest success in the form of project development collaboration, in general CABY's efforts to involve Tribal members have not resulted in substantive Tribal engagement. Initial efforts included direct outreach to FRTs, which was met with varying degrees of interest by Tribal members and/or Tribal Councils, but which did not result in sustained communication or collaboration. A second round of outreach focused on project development and involved members from both FRTs and NFRTs. This effort produced several tribally designed projects that remain in the CABY project suite. However, participation in project development did not translate into participation in the CABY SG meetings, resulting in a lack of Tribal representation in this critical CABY advisory body. A third round of outreach was designed and coordinated by the California Environmental Indian Alliance based on feedback that recruitment by individuals who were themselves Tribal members would be more appropriate. This third effort included outreach to not only Tribal members resident to the CABY region, but also to Tribal members with ancestral links to the region. This round of outreach did not meet the desired outcomes and did not result in ongoing working relationships between the CABY SG and Tribal members. As part of IRWMP implementation, the CABY SG has reaffirmed its intention and commitment to achieve meaningful participation by Tribal entities and continues to focus energy on this area of outreach. Therefore, a fourth round of collaboration will be undertaken with the objective of identifying meaningful options for engaging CABY Tribal members in the planning process. This process has already begun and includes development of a series of recommendations by Tribal members to the CABY RWMG to assist in developing ongoing discussions and engagement. This is being addressed through the Mountain Counties Funding Area Needs Assessment.

2.2.5.3 Hispanic Communities

The Hispanic population is rapidly increasing within the CABY IRWMP area, and today, Hispanics/Latinos comprise the largest ethnic minority population in the CABY region. This group, however, has not traditionally engaged in planning processes such as the IRWMP due in part to linguistic, cultural, and historic barriers.

The Latino population is as diverse in its origins as the Anglo population, representing multiple countries in the southern hemisphere. There are Latinos who are native English speakers who were born in the United States or moved here at a relatively young age and Latinos who have immigrated here and have limited English fluency.

CABY stakeholders have devised strategies for engaging DAC and Spanish-speaking communities in CABY. For example, the Sierra Fund has hired a bilingual community organizer to provide a conduit for Spanish-speaking families in Nevada County to discuss their needs and concerns related to water and other environmental health issues and to provide opportunities to participate in decision making related to water issues. The Sierra Fund is developing some of its materials in Spanish and is building out a Spanish-language area on its website.

Objectives for Hispanic/Latino Outreach:

1. Use an iterative, phased approach to outreach that gradually includes greater numbers of Hispanics/Latinos that seeks preliminary information about salient water-related issues, and then confirms and focuses outreach on those areas.
2. Recognizing the financial and economic challenges of such communities, utilize a go-to-them approach as much as possible, rather than a come-to-us approach.
3. Where practical, collaborate with existing agencies and organizations that focus on Hispanic/ Latino communities to expand our reach and success.
4. Reduce problems associated with language barriers by providing key materials in Spanish.
5. Work to identify projects that address Hispanic/Latino issues and priorities, and provide in-kind technical assistance for planning and project design.
6. Work with CABY project sponsors to identify opportunities for collaboration that will benefit Hispanic/Latino communities.
7. Look to the longer-term horizon of the IRWMP; seek to have representatives of Hispanic/Latino communities become more involved, working toward the eventual goal of having representatives regularly participating in CABY meetings, committees, WGs, and document review.
8. Seek to identify awareness and understanding of Environmental Justice within the Hispanic/ Latino community; identify local environmental justice concerns.
9. Seek to identify barriers to Hispanic/Latino participation in the IRWMP process, and identify possible solutions.

For a full explanation of the 14 strategies by which CABY proposes to achieve these objectives, please see Appendix C.

2.3 Definition of Disadvantaged Communities

A DAC is defined as a community with an annual median household income (MHI) of less than 80% of the statewide annual MHI. Based on the U.S. Census American Community Survey 5-Year Data: 2012–2016, 17 communities within the CABY region are now identified as DACs (MHI is $51,026 or below). The statewide annual MHI in California for this dataset was $63,783.[4] The communities in the CABY region that qualify as DACs are listed in Table 2-5 and in Chapter 5, Table 5-5. Table 2-5 also includes communities that had been identified as a DAC in the 2013 IRWMP based on 2010 census data, but for which data is not available in this American Community Survey 5-year Dataset (marked with "—"). The communities that meet the DAC definition change somewhat each time the census data is updated.

[4] California Department of Water Resources DAC Mapping Tool: https://water.ca.gov/Work-With-Us/Grants-And-Loans/Mapping-Tools

Table 2-5
Disadvantaged Communities in the CABY Region

County	Census Places	MHI ($)*
Amador	River Pines	$49,569
	Plymouth	$41,750
	Kirkwood	—
El Dorado	Placerville	$42,793
	Georgetown	$42,946
	Grizzly Flats	$44,390
	Outingdale (pending DAC needs assessment)	—
	Gold Beach (pending DAC needs assessment)	—
Nevada	Soda Springs	—
	Graniteville (between Alleghany and Washington on Meadow Lake Road)	—
	Washington	—
	North San Juan	$27,500
	Grass Valley	$35,524
	Rough and Ready	$40,821
	Nevada City	$43,770
	Penn Valley	$40,668
Placer	Newcastle	$40,313
	Colfax	$44,004
	Dutch Flat	$46,750
Sierra	Downieville	$43,125
	Alleghany	—
	Pike	—
Yuba	Dobbins (just east of Oregon House)	$31,397
	Camptonville	$42,500
	Smartsville	$25,227

Notes: MHI = Median Household Income; DAC = disadvantaged community.
* Places without an MHI listed have no data available at this time.

This list does not include some areas of poverty that are not identified by the DWR mapping tool because of disparity of income in the census tracts. CABY is currently engaged in the DWR-mandated DAC assessment to help identify these communities.

2.3.1 Disadvantaged Community Involvement Program

In 2017, the Sierra Institute for Community and Environment was selected by representatives from each Integrated Regional Water Management (IRWM) region in the Mountain Counties Funding Area to be the applicant for the Proposition 1 Disadvantaged Community Involvement Program. The Disadvantaged Community Involvement Program has three components: (1) community capacity assessment, (2) water/wastewater system needs assessment, and (3) Tribal orientation, program planning, and needs assessment.

The Sierra Institute for Community and Environment coordinated the various components and led workshops to gather information about capacity in each community in the CABY IRWM region. Their report, Community Well-Being & Water and Wastewater Needs Assessments for Cosumnes-American-Bear-Yuba (CABY) IRWM is listed in Appendix C and key findings are incorporated in the plan.

The Sierra Water WG has been retained to lead the effort to identify the water management needs of DACs in each IRWM in the Mountain Counties Funding Area. During workshops, staff will summarize the preliminary water and wastewater needs assessment gathered from surveys, and then review all challenges and concerns by topic area. They will attempt to capture all the technical needs of all water and wastewater purveyors and stakeholders in the IRWM, and finally present an overview of the Proposition 1 Implementation Grant application, along with next steps and final reporting.

Tribal engagement and coordination is another key feature of this program, with the goal of increasing Tribal presence, leadership, and advocacy in the regional water management decision-making process alongside local and state agencies, and to prepare Mountain Counties Tribes to submit competitive projects for IRWM state funding.

2.4 Technology and Information Access

Active participation in the IRWM planning effort requires well-informed stakeholders, as a lack of information among participants can interfere with meetings, intra-regional communication, and problem solving. Regardless of their level of participation, stakeholders must have the opportunity to understand the reasons for the IRWMP. But not all stakeholders have equal access to the Internet or electronic means of communication. To overcome this obstacle, CABY takes into account a variety of potential barriers and does not rely solely on Internet access to involve potential participants.

In addition, the CABY IRWMP planning and implementation activities have always been an open process: (1) all CABY meetings are open to the public, (2) CABY SG agendas are sent out in advance of meetings and posted on the CABY website, and (3) at each meeting the public is given an opportunity to comment. Members of the CABY RWMG and the CABY SG contribute names of organizations and agencies to assist in the outreach effort. (See discussion of the CABY RWMG and CABY SG roles in Section 2.5.) The interested parties list is broad and includes anyone interested in information about the development and outcome of the CABY IRWMP planning effort.

Following is a brief overview of CABY's efforts to overcome both technological and cultural barriers in an effort to reach all interested stakeholders.

2.4.1 Outreach to Eliminate Barriers

The CABY region is primarily rural. The incorporated communities are located along the three major transportation corridors in the region—Interstates 80 and 50 and State Route 49. The region supports almost no public transportation and those communities that do have such systems do not serve any adjacent areas. The terrain in the upper elevations is mountainous, and most of the rural areas do not have cable, reliable dish/satellite access, or other methods of systematic Internet access. Furthermore, winter weather travel can be complicated by snow at higher elevations.

Taken as a whole, these conditions create special challenges within the more rural and frequently disadvantaged areas. Here, alternative strategies have been employed. Many of the community groups

or public service districts in the more rural portions of the region are contacted directly by phone or by the U.S. Postal Service to notify them of meetings or upcoming events. In some cases, CABY members individually contact DACs or other interests in proximity to their places of work to make sure that these smaller groups know about CABY. Several members receive hard copies of meeting materials upon request. Carpooling and the use of targeted local meetings have also proven to be successful strategies.

The CABY RWMG orients new attendees as part of the recruitment process and in support of ongoing involvement to the extent possible. The CABY RWMG members who accomplish outreach to new organizations and entities make every effort to explain to potential stakeholders their role in the process.

2.5 Decision-Making Process

The CABY stakeholder decision-making process is described in the Chapter 4, Governance. The CABY RWMG is committed to engaging stakeholders as decision makers.

Chapter 3
Coordination

This chapter describes the processes that the Cosumnes, American, Bear, and Yuba (CABY) Regional Water Management Group (RWMG) has put in place to facilitate coordination between in-region stakeholders, adjacent Integrated Regional Water Management (IRWM) regions, and the full spectrum of federal, state, and local agencies in both planning and implementation throughout the decision-making process. The intent of this section is to demonstrate how the CABY RWMG has taken action to avoid overlap, duplication of effort, and integrated planning efforts at multiple levels with diverse stakeholders.

3.1 Coordination within the CABY Region

CABY RWMG's local members, project proponents, and stakeholders coordinate IRWM-related activities and efforts through a variety of means, including CABY RWMG meetings, CABY Stakeholder Group (CABY SG) meetings, and posting proposed project-related and stakeholder meetings and activities on the CABY website. The RWMG is the core group that meets to advance IRWM-related activities, and does so by supporting ongoing outreach, interacting with regional partners, and utilizing the website and extensive mail group to share information and announce meetings. Substantive coordination is also achieved through the ongoing activities and meetings associated with stakeholder-driven Work Groups (WGs). The CABY RWMG WGs have been a key element of regional outreach since CABY RWMG's inception. These WGs bring together nongovernmental organizations, federal agencies, local agencies, and water agencies to discuss project development and integration, implementation strategies, emerging issues, opportunities for collaboration between (and recruitment of) stakeholders not represented in individual WGs, and related activities. This coordination is designed to eliminate overlap and maximize the opportunity for stakeholders to combine activities and streamline efforts.

CABY RWMG has consistently made efforts to ensure that the representatives of the CABY member groups communicate with their agencies, groups, and organizations to ensure awareness of CABY RWMG activities, both at the overall planning level and the implementation level. CABY RWMG team members frequently make presentations to various boards and governance groups for the same purpose. Additionally, as part of CABY RWMG's ongoing recruitment process, new groups are identified and contacted based on the recommendations of existing members and stakeholders, as well as through ongoing outreach across the region.

The CABY RWMG and SG meetings provide a venue for airing emerging issues and potential conflicts. Over the years, these meetings have been the venue where early warning about new questions, problems, and/or competing interests has occurred. The typical trajectory for addressing an emerging issue is as follows: an issue is either brought to a meeting and placed on the agenda, or is raised within an individual meeting. CABY RWMG group and decision-making processes are outlined in the Chapter 4, Governance.

It is important to note that substantial informal coordination also occurs between CABY RWMG members as many CABY RWMG stakeholders belong to similar organizations, attend professional gatherings, and are partners on a variety of projects. These informal conversations have led to the resolution of numerous issues over the years, with the outcomes reported back to the group.

Additionally, as discussed in Chapter 4, the governance structure specifically mandates a strong intraregional approach to project design and implementation. As stated previously, the internal structures that support consistent and coherent coordination at the project level include the CABY SG, CABY RWMG, and WG meetings. CABY RWMG organizes much of its activity and meeting agendas to address specific development of regional-scale projects integrated across issues, stakeholder interests, and geographic areas/watersheds. This project-level coordination optimizes cost savings, project efficiencies, and helps resolve conflicts. CABY RWMG often sets aside a portion of a CABY SG meeting to discuss upcoming proposed projects and activities of interest to stakeholders. This strategy has formed the backbone of CABY RWMG membership interactions since 2006.

3.2 Coordination with Neighboring IRWM Regions

Coordination with neighboring IRWM regions is undertaken through the Mountain Counties Funding Area (MCFA) coordination, the Round Table of Regions discussions, the Disadvantaged Community Issue Identification process (as needed on a project-by-project basis), and ongoing discussions amongst the IRWM regions on topics of mutual concern.

Adjacent regional IRWM planning efforts include the following:

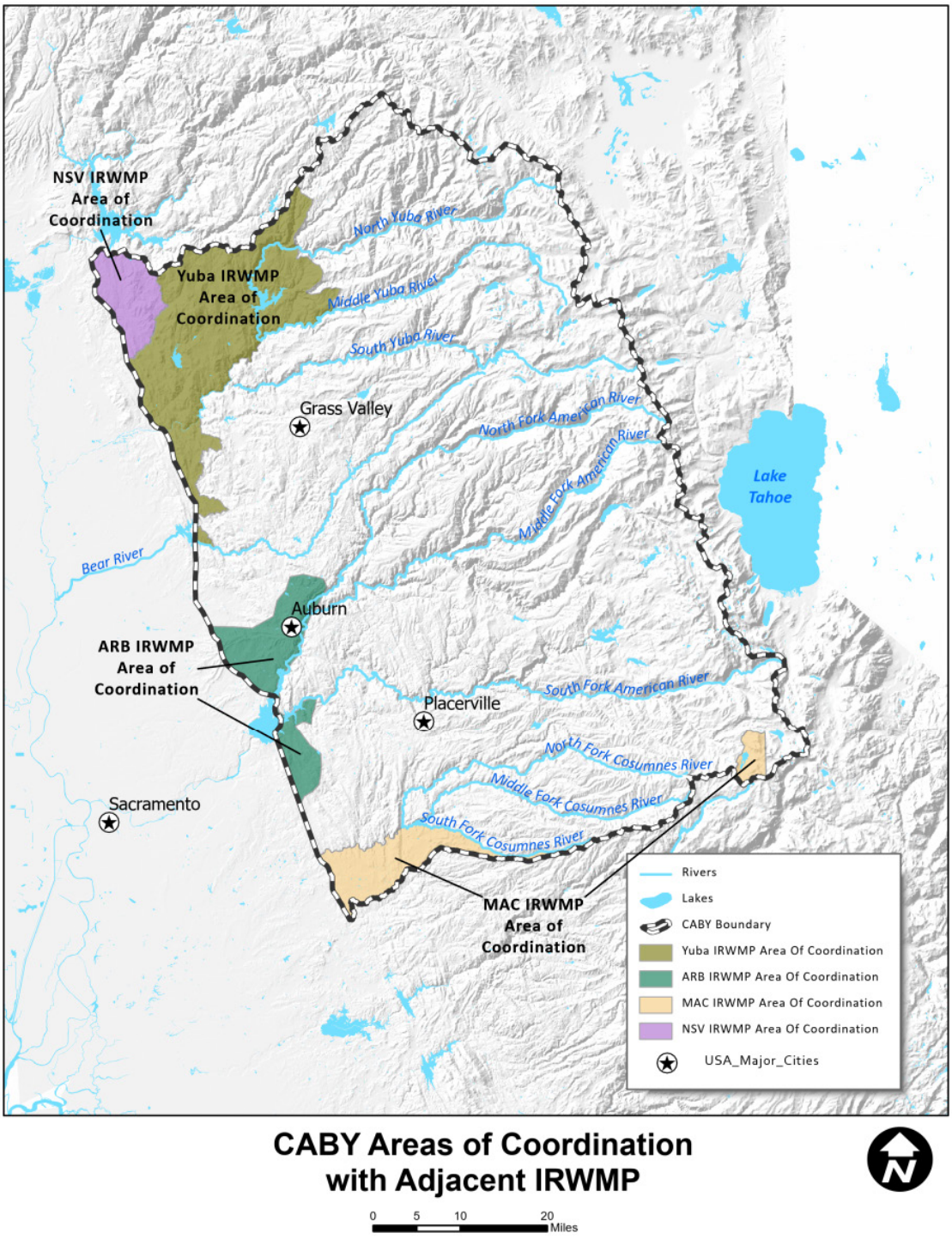
- Upper Feather River Watershed
- American River Basin
- Yuba Integrated Regional Water Management Plan (IRWMP)
- Mokelumne-Amador-Calaveras
- North Sacramento Valley Group
- Tahoe-Sierra

CABY RWMG has maintained both formal and informal contacts with each of these regions. The contacts range from regular and/or structured interactions to causal and opportunistic conversations or coordination. Further, these contacts are maintained by CABY RWMG members and stakeholders, as well as by formal CABY RWMG representatives.

Geographic information system (GIS)-based review of the northwest CABY boundary resulted in the determination that the original boundary had been extended outside of the Yuba River watershed into an area that drained primarily into the Feather River. This oversight was corrected through a revision to the northwest boundary with the Four-Counties IRWM region (now the North Sacramento Valley Group). Thus, the CABY region has a boundary overlap with three of the six adjacent IRWMPs (see Figure 3-1).

CABY stakeholders work with adjacent IRWMPs to develop a strategy for cooperation and coordination in areas where boundaries overlapped on projects of mutual interest on a project-by-project basis.

Figure 3-1 – Overlap with Adjacent IRWMPs



3.2.1 Memorandum of Understanding

CABY RWMG negotiated a Memorandum of Understanding (MOU) with each of the coordination areas. The MOU addresses the following:

- Issues of participation of IRWMPs in the meetings and work sessions of the adjacent region
- Identification of mutual interests
- Coordination on both functionally and regionally based projects
- Mutual support in fundraising efforts
- Options for joint preparation of projects
- Sharing of technical information and data

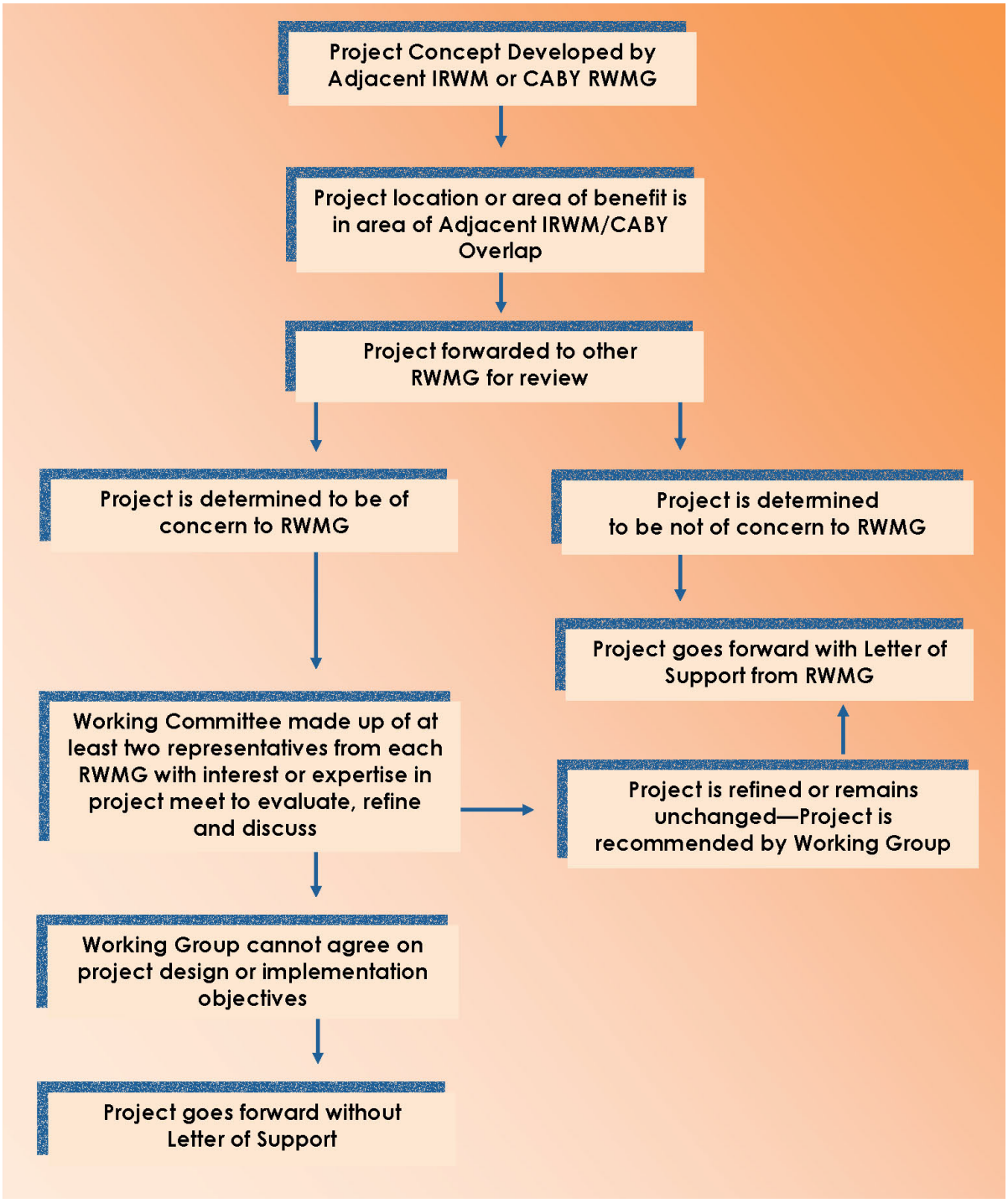
3.2.2 Joint Project Development Process

CABY RWMG has negotiated a single project development process for each of the IRWMP overlap areas (see Figure 3-2, Joint Project Development Process). Basically, if either RWMG develops a project in the area of coordination, then the RWMG originating the project will arrange to present the project details to the other RWMG (or their designated entity, such as an RWMP, SG, or WG). If no issues or concerns are raised, then the project will move forward with a letter of support from the overlapping RWMG. If a concern or issue is raised, then a committee made up of at least two representatives from each RWMG with interests or expertise in the project will be formed to evaluate and refine the project. If the committee cannot agree on the project, then the project will go forward without a letter of support from the adjacent IRWMP. However, if the committee agrees on a final project description and identifies partners and benefits supportive of each IRWMP, then the project will move forward with a letter of support from the overlapping RWMG.

3.2.3 Ongoing Coordination with Adjacent IRWM Regions

As discussed in Chapter 5, Region Description, CABY's regional boundaries address the region's water management priorities, hydrological demands, water-related infrastructure, and issues of environmental stewardship. CABY's regional boundaries have also proven beneficial by prompting collaborations and discussions with adjacent IRWMPs, as well as within the Proposition 84 Sacramento Region Funding Area. Coordinating with adjacent regional planning efforts is particularly important as the CABY region contributes water supplies to other IRWMP regions and may affect or be affected by water management decisions made in other areas.

Figure 3-2 – Joint Project Development Process



Interactions associated with specific projects or particular project types (e.g., mountain meadow restoration, and fuel and fire management) also involve stakeholders and groups from several adjacent IRWM areas in meetings, workshops, seminars, and other activities that bring people together to collaborate and solve problems across IRWM boundary lines.

Finally, representatives from CABY RWMG have maintained direct contact with representatives of the Sierra IRWM regions and the Mountain Counties Funding Area via periodic meetings and outreach that brings representatives together to discuss emerging issues, responses to Department of Water Resources (DWR) guidelines and Proposal Solicitation Package (PSP) releases, identification of possible joint projects, and other similar topics.

3.2.4 Coordination with IRWMPs in the Mountain Counties Funding Area

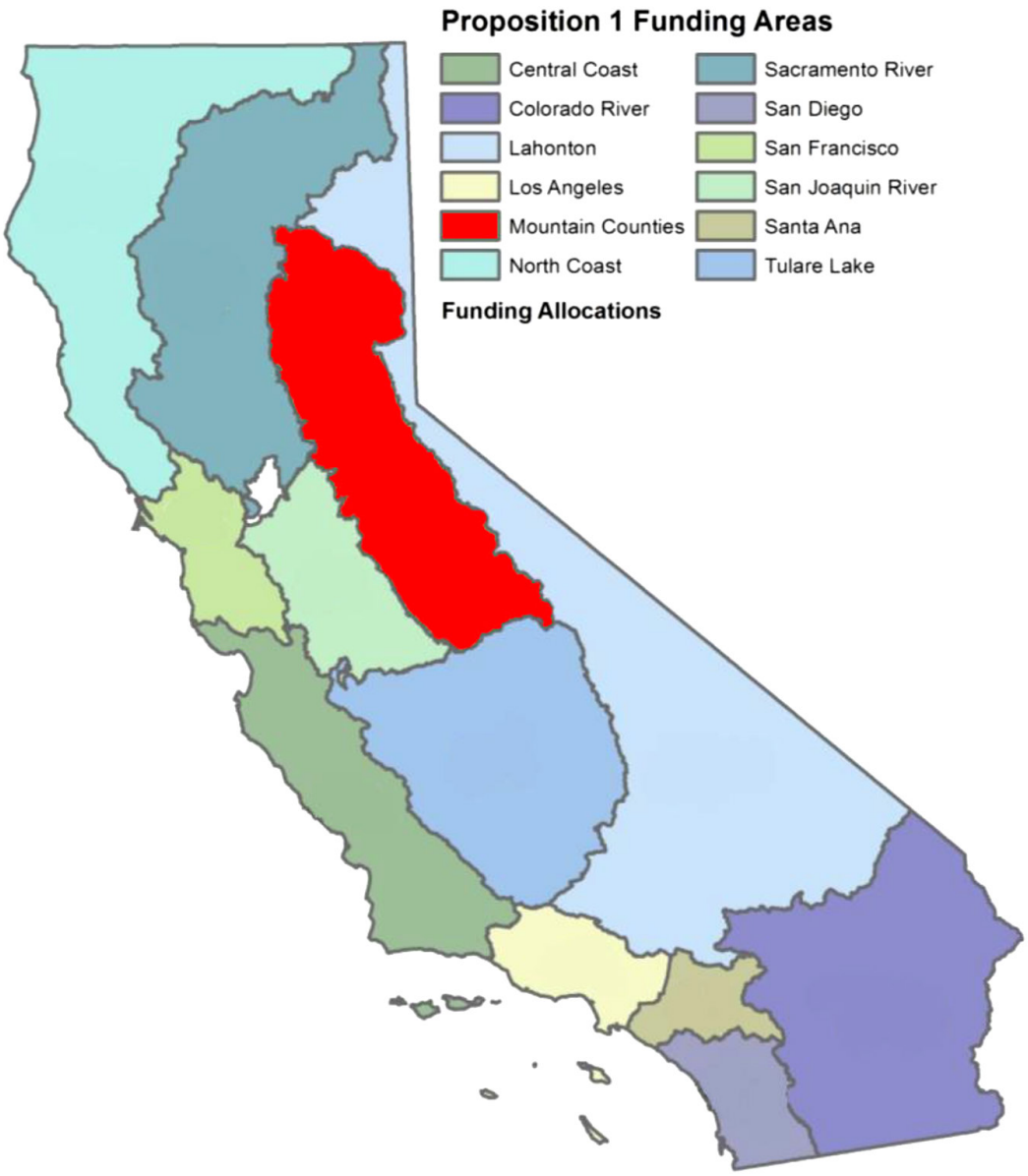
CABY RWMG representatives are actively participating in planning activities undertaken by the MCFA. This group meets periodically to address issues and topics of common concern, equity of implementation funding within the region, and mechanisms for intraregional project development and coordination.

Ongoing meetings have also focused on several specific objectives that include the following:

- Ensuring that adjacent or overlapping regions define an appropriate level of coordination
- Recognizing the need for additional planning, and the need for state funding to support it, in all of the independent regions
- Exploring the concept of an equitable implementation funding distribution among regions within the MCFA
- Sending a common message that the MCFA, as the major source of water for much of the rest of the state, should receive a significant portion of the interregional funds

The MCFA is one of the 12 hydrologic region-based Funding Areas as identified in the California Water Plan and Proposition 1, as demonstrated in Figure 3-3.

Figure 3-3 – Mountain Counties Proposition 1 Funding Area



3.3 Agency Coordination

CABY RWMG coordinates with state, federal, and local agencies through three levels of interaction, and each offers a platform for assistance in communicating and cooperating between and among stakeholders. The first level involves direct communication, such as CABY SG meetings and WGs wherein agencies participate directly with CABY RWMG members as meeting participants. At the CABY SG level,

topics are addressed on a 'big-picture' scale, whereas the WGs address topics in more detail. The second level of interaction involves CABY member outreach to agencies with mutual interests and whose missions overlap with CABY goals and objectives. Oftentimes CABY members are familiar with state personnel, and they will conduct informal outreach with these agencies. The third level of interaction is less direct and typically involves website research, informal meetings, and telephone discussions with agency staff regarding a specific task or question. In the aggregate, these three levels of outreach and coordination have resulted in thorough involvement between local federal agency staff and departments, and a wide variety of CABY RWMG members and governance structures/committees.

As discussed in this section, a variety of state, federal, and local agencies are important to the development of the CABY IRWMP and implementation of projects. Much of the agency involvement depends on staff availability, funding, and mutual interests.

3.3.1 State Agencies

The Regional Water Quality Control Board (RWQCB) was a key participant in development of the IRWMP. The CABY watersheds and implementation actions defined in the CABY IRWMP are important to the management and protection of water quality in the region, not only for the CABY RWMG participants, but also for those areas of California that rely on water originating in the CABY region. The CABY IRWMP defines actions consistent with the RWQCB Water Quality Control Plan (Basin Plan) and associated watershed management initiatives.

CABY RWMG consistently coordinates efforts with state agencies, including the Sierra Nevada Conservancy (SNC). The SNC attends CABY SG meetings and participates in CABY WGs. Through the project development effort, CABY RWMG will continue to communicate with SNC regarding regional projects and opportunities for future funding to realize these projects.

3.3.2 Federal Agencies

Large portions of lands within the CABY region are under federal jurisdiction; therefore, federal agencies play a key role in the development of the CABY IRWMP. The U.S. Forest Service (USFS) and both Tahoe and Eldorado National Forests are critical to the planning effort. Representatives from these agencies have extensive experience in forest management and water quality and habitat protection, which is incorporated into the IRWMP. As discussed in Chapter 12, Project Review Process, both the Tahoe and Eldorado National Forests have put forward a number of environmental restoration projects in the upper watersheds that are particularly helpful to addressing climate change. USFS has invested significant time in collaborating on the development of multistakeholder/multibenefit regional, integrated projects, namely Meadows, Mercury Abatement, and Forest Health (see Chapter 12). Finally, USFS staff members have been dedicated and active participants in CABY SG meetings since its inception, and are represented on all of the major CABY WGs.

3.3.3 Local Agencies

Local jurisdictions have statutory authority over local land use and water management, and as such, were involved in the planning process (see Table 2-1). This was important to address the critical linkages between planning processes and management actions related to local land use and water management.

The CABY Planning Framework includes detailed evaluations of the city and county land use plans, and the CABY IRWMP seeks to be consistent with and complement these plans. CABY RWMG expanded its

outreach efforts during the 2012 update process to include all local counties and municipalities within the region, and specifically rural, disadvantaged communities in Nevada and Sierra Counties. As a result, CABY's RWMG local agency participation in the planning process, as well as in project development, has grown significantly in the Yuba, Bear, and American River watersheds.

The local environmental health departments typically do not directly participate in CABY RWMG. However, CABY RWMG coordinates with them as part of disadvantaged community outreach and project implementation. This can involve telephone interviews and in-person meetings, depending on the task. CABY RWMG has and continues to recruit local communities to participate in the CABY SG and WGs. As a result of this consistent outreach, three cities and two counties have adopted the CABY IRWMP and have become active CABY RWMG participants. The recruitment efforts continue, and are expected to result in additional local adoptions of the IRWMP.

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Chapter 4
Governance

4.1 Purpose

Integrated Regional Water Management (IRWM) is provided for under Division 6, Part 2.2 of the California Water Code (CWC), which is known as the IRWM Planning Act (Act). The Cosumnes, American, Bear and Yuba (CABY) Regional Water Management Group (RWMG) developed the following governance chapter to clarify roles and relationships, and to guide decision making, implementation, and future updates to the IRWM Plan (IRWMP). A primary goal of this chapter is to facilitate meaningful stakeholder engagement in the development and implementation of the IRWMP for the CABY region.

The IRWMP is not a legally binding document. Rather, it is a regional compact with accompanying commitments. Once an organization endorses the IRWMP by execution of a Resolution of Support (ROS) by its governing board or authorized representative, the Act of endorsement comes with responsibilities to participate in implementation and understanding that the IRWMP is a living document and will need to change over time.

4.2 CABY IRWM Composition

California Water Code Section 10539 defines a RWMG as a group in which "three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements in Sections 10540 and 10541, participate by means of a joint powers agreement, memorandum of understanding, or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies."

CABY Stakeholder Group (SG) has a diversified set of participants that include water agencies, municipalities and other public agencies, and numerous nonprofit organizations. The U.S. Forest Service and traditional Tribal representatives also participate in CABY IRWM.

CABY's RWMG is comprised of a minimum of two water agencies and an equivalent number of non-water agency members from the SG. Based on this composition, the RWMG satisfies the minimum number of agencies with statutory authority over water supply and water management within the CABY region, and includes other organizations that are also integral for the development and implementation of the CABY IRWMP. The relationships between these individual member organizations that compose the RWMG are ad hoc in nature. The operating policies of the RWMG are contained in this Governance chapter. A Memorandum of Agreement (MOA) exists between the RWMG members that defines the RWMG membership, purpose and extent of these relationships.

4.3 Governance Structure, Roles and Responsibilities

4.3.1 CABY Regional Water Management Group

Since the 2014 IRWMP update, the CABY RWMG has been comprised of eight appointed members, four water agency members and four members selected by the CABY SG who are not water agency members (see Figure 4-1). This group's responsibilities are as follows:

1. Perform decision making, logistics, communication and scheduling; provide recommendations for process modifications, grant application preparation, applicant selection, selection of a fiscal sponsor for CABY IRWM-related work; and address other issues needing attention in between CABY SG meetings. The RWMG coordinates with the SG and presents relevant information to the stakeholders, who have an advisory role, and to the public at large.
2. Lead the development of IRWMP modifications, including preparation of substantive proposals and grant applications, including selection of a fiscal agent.
3. Develop and update the CABY IRWMP Project List, which may include periodic calls for projects that are associated with funding opportunities.
4. Act as the decision-making body of the CABY IRWM and making decisions in accordance with the rules set out in Section 4.4, CABY IRWMP Decision-Making Process while considering CABY SG opinions on any proposal.
5. Meet formally with the CABY SG at least once per year at an annual meeting in December. Additional meetings may be held if requested and will be scheduled as needed.
6. Meet informally amongst its members at least once per quarter.
7. If appointed, serve for a minimum of two (2) years. Representatives of the CABY RWMG must be appointed at the last meeting of the year, held in December. An administrator and secretary will be elected by the CABY RWMG in December of each year and will have the following responsibilities:

Administrator

1. Convene and lead meetings.
2. Serve as the point of contact for the CABY RWMG.
3. Coordinate and administer SG ROS list and Project List.

Secretary

1. Coordinate and schedule meetings; prepare agendas and summaries.
2. Post meeting announcements to the CABY IRWM website and disseminate meeting materials to CABY RWMG and CABY SG members.

These positions will rotate annually amongst the RWMG members. In the event an Administrator or Secretary leaves the CABY RWMG, the position will be assigned to a remaining RWMG member. The positions will be shared between a water agency with statutory authority over water supply or water management pursuant CWC Section 10539 and a non-governmental organization (NGO).

In addition to the responsibilities identified in this chapter, the CABY RWMG shall comply with the requirements of Chapter 4 of the Act to develop, adopt, and implement the CABY IRWMP:

1. The CABY RWMG shall:
    a. Publish a notice of intention to prepare an update to the existing CABY IRWMP, and any subsequent updates thereto, in accordance with Section 6066 of the California Government Code.
    b. Upon completion of the updated CABY IRWMP, the CABY RWMG shall publish a notice of intention to adopt the IRWMP in accordance with Section 6066 of the California Government Code and shall adopt the IRWMP in a public meeting of the RWMG in accordance with California Water Code Section 10543.

c. Each of the Stakeholders shall adopt the updated CABY IRWMP in accordance with the procedures and requirements for taking such action.

2. The CABY RWMG shall prepare subsequent updates to the existing CABY IRWMP to ensure compliance with requirements of the Act. Any update to the CABY IRWMP shall meet the requirements of Section 10541 of the Act and the guidelines adopted by the California Department of Water Resources (DWR), as amended from time to time, referenced therein.
3. The CABY RWMG shall be responsible for the development and adoption of a list of programs and projects consistent with CABY IRWMP project solicitation and evaluation process. The CABY RWMG shall receive proposals for such projects or programs and shall, from time to time, update its list of such projects or programs.

CABY IRWM Water Agency Appointments to the RWMG: CABY SG members representing the water agencies that have adopted a ROS for the 2021 CABY IRWMP with jurisdictional responsibility to provide water supply and water management to communities within the CABY region will appoint representatives to the RWMG to ensure compliance with the terms specified in the CWC as described above. This will include a minimum of two (2) RWMG members, and may be increased depending on the level of interest and participation in the CABY IRWM planning process. This number shall not exceed four (4) representatives to maintain a manageable group that is capable of supporting the planning activities, participation in timely meetings and a desire to achieve consensus. After a water agency is appointed, its representative will be selected by the agency's governing board or authorized individual. If the water agency selecting the RWMG member needs to change an appointed representative it will notify the CABY RWMG of the change and will take appropriate administrative action to appoint a new representative to the CABY RWMG.

CABY SG Appointment: Members of the CABY SG who are not water agency representatives will appoint an equal number of representative organizations to the RWMG as are appointed by the water agency members to sit on the CABY RWMG. At least one of the non-water agency seats will be designated as a Tribal seat and if not claimed, will be filled by another appointed non-water agency member. If the non-water agency members need to change their appointed representatives, the CABY RWMG will notify the CABY SG and water agency members of the required change as soon as it is aware of the situation. At the next CABY SG/CABY RWMG meeting, an action item will be placed on the meeting agenda to elect a new CABY RWMG representative.

4.3.2 CABY SG

This group is comprised of organizations, governmental agencies, Tribal groups, and disadvantaged communities (DACs) that have formally adopted the most current CABY IRWMP and have interests in water management across the CABY geographic region. Each entity will select a designee to represent its views on the CABY SG. The group's responsibilities are as follows:

1. Act as the advising body of the IRWMP. The group identifies issues of concern and presents them to the RWMG for discussion and action if necessary.
2. Appoint the non-water agency members to serve on the CABY RWMG.
3. Generate content, review drafts, and submit materials to the CABY RWMG for consideration and inclusion in the IRWMP.

4. Attend CABY SG meetings consistently and, if unable to attend any session, send an approved alternate to represent the organization. However, use of alternates is not encouraged because this can interfere with the continuity of discussion. Additional meetings will be scheduled as needed.

4.3.3 CABY Working Groups

From time to time, CABY SG members will be asked to participate in topical or issue-specific Working Groups (WG). Each WG established by the CABY RWMG prepares recommendations for the CABY RWMG and CABY SG's consideration on a specific topic or action. Specific areas may include, but are not limited to, water supply, water quality, groundwater management, watershed management, and environment and habitat protection. WGs ensure a focused approach to identifying and developing projects that support IRWMP implementation. WGs are convened on an as-needed basis for IRWMP updates, grant proposals, project selection, and other final products and remain active until product completion. The responsibilities of each WG are as follows:

1. Take direction from the CABY RWMG to work towards a final product. Develop recommendations and bring forward the full range of opinions on any assignment to inform the CABY RWMG's decisions.
2. Attain membership that balances interests and diversity but stays within workable numbers in order to facilitate in-depth discussions. WGs should seek additional participants from outside the CABY SG to increase the diversity of interests represented, provide input from across the region, provide additional expertise to the WG, and recruit new members for CABY IRWM, or for other reasons deemed necessary by the WG. CABY SG members may participate in more than one WG.
3. Aim to have members from all watersheds to emphasize integration with respect to the area each WG is examining.
4. As an individual, consistently attend WG meetings and complete the work assigned in a timely manner.

4.3.4 Public Forum

The Public Forum includes members of the general public as well as organizations interested in the CABY IRWM process who may seek information about CABY IRWM activities either by attendance at meetings or through other means of communication. The CABY IRWM process will seek input from the Public Forum on the IRWMP's direction, content, and implementation. Interested eligible organizations are welcome to become CABY SG members. CABY RWMG and CABY SG have the following responsibilities to address the Public Forum:

1. Speak on CABY IRWM's behalf upon approval through the CABY IRWM decision-making process. Without approval, members are asked to speak only for their organization when asked by external parties, including the media, about CABY's IRWMP.
2. Post meeting announcements and summaries online.
3. Develop informational materials for the public.
4. CABY IRWM representatives may be appointed by the CABY RWMG to provide presentations on the status of the IRWMP effort at meetings, conferences, or other venues. CABY SG members are strongly encouraged to work with the CABY RWMG to provide or arrange presentations about the group's work to increase awareness of the IRWMP.

4.4 CABY IRWMP Decision-Making Process

Working toward consensus (agreement among all participants) is a fundamental principle of the CABY IRWM process. The IRWMP was developed through a consensus-based decision-making structure and continues to make most of its decisions in this way.

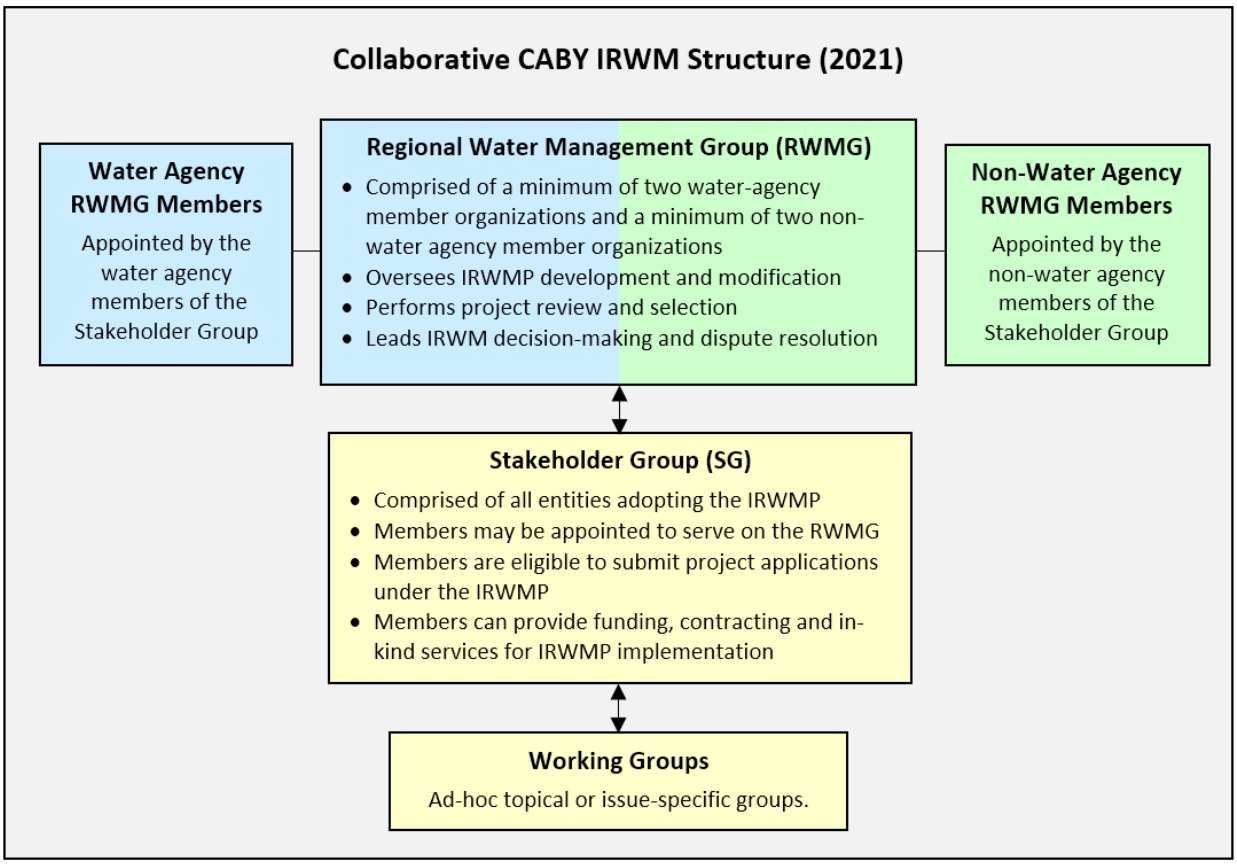
The CABY RWMG shall not limit itself to strict consensus if one hundred percent (100%) agreement among all participants cannot be reached after all interests and options have been thoroughly vetted, explored, discussed, and considered. Less-than-consensus decision making shall not be undertaken lightly.

If, after full exploration and discussion, the CABY RWMG cannot come to one hundred percent (100%) agreement, it will make a decision based on the following protocol: a majority of the CABY RWMG water agency member representatives must support, and a majority of the CABY RWMG non-water agency member representatives must support, a proposal that is before the RWMG in order for that decision to prevail.

A quorum is required for a decision to be valid and consists of a minimum of a majority of the current non-water agency members and a majority of the current water agency members of the RWMG membership as indicated in the executed CABY RWMG MOA. While regular attendance by the same representative is strongly encouraged, if an RWMG member cannot attend a meeting, that member may send a proxy from the member's own organization or agency.

If the issue before the RWMG pertains to pending litigation between two entities in the CABY RWMG, the litigant(s) cannot participate in a vote due to an existing conflict of interest.

Figure 4-1 – CABY IRWM Organizational Structure, Including the Regional Water Management Group (RWMG), Relationship to Water Agency Members, Stakeholder Group, and Working Groups



4.5 Conflict Resolution Process

The CABY RWMG encourages the use of the following conflict resolution process:

1. The RWMG recommends that the disputants first meet independently to discuss, and if possible, resolve the conflict.
2. If a resolution cannot be achieved independently, a formal, written request may be submitted to the RWMG for discussion of the conflict during an RWMG meeting.
3. The RWMG will invite the disputants to a meeting of the RWMG to clarify their respective concerns. The RWMG will ask clarifying questions and document the nature of the conflict in meeting minutes. If relevant, the RWMG will make recommendations for next steps.
4. In reaching decisions the RWMG will follow CABY's governance structure.

4.6 Balanced Access and Opportunity for Participation

The CABY IRWM-planning process makes a concerted effort to include and engage all the stakeholders within the region in IRWMP development. The vast majority of the stakeholders in the region with responsibility for, or interests in, water management issues are represented in the CABY SG. The

governance structure supports this effort through member, WG, and/or consultant outreach to DACs, Tribal governments, ethnic communities, and public outreach programs.

The WG structure has proven particularly effective in creating opportunities for participation. The WGs change meeting venues frequently and provide call-in options to enable a wide variety of individuals to attend without having to drive across the region for each meeting.

Due to the widely-used high-speed internet, CABY IRWM has frequently conducted teleconferencing meetings or other similar participation strategies and will implement these programs to increase participation and ease.

CABY SG has worked closely with federally- and state-recognized Tribes in the region and traditional regional Tribes. Projects responding to the needs and interests of Tribal organizations and other underrepresented groups have been incorporated into the CABY IRWMP project lists and have been funded in two successful grant applications. In order to maintain regular communication and ensure representation of Tribes in the region, CABY SG has designated one of the non-water agency seats of the CABY RWMG to be filled by a representative from a Tribal organization.

CABY SG is committed to increasing the involvement of DAC members in our work at both a project and governance level. CABY SG is working collaboratively with other IRWM regions in the Mountain County Funding Area to develop and deploy the Needs Identification and Engagement activities required by the DWR. Appendix C presents the "Disadvantaged Community Involvement Program, Community Well-Being and Water and Wastewater Needs Assessments" (Community Needs Assessment Report) prepared by the Sierra Institute for Community and Environment (Sierra Institute) and the Sierra Water Workgroup (2020). This report provides the RWMG with insight into opportunities to improve Tribal and DAC representation in both project and IRWMP development, as well as the development of leadership roles within the CABY SG.

4.7 Communication Protocols and Processes

4.7.1 Internal CABY IRWM Communication and Information Sharing

CABY IRWM has developed a number of methods for sharing information among CABY SG members. Formal methods of communication include the CABY IRWM website (discussed in more detail in Chapter 15, Technical Analysis), meeting announcements and summaries, and emails or notices sent to the CABY SG members.

The CABY RWMG meets informally amongst its members at least once per quarter. These meetings are primarily to discuss upcoming activities, priorities for the year, and the research and data results for ongoing projects. The SG members are invited to attend these meetings.

All data and information collected during CABY IRWM-planning activities are made available to SG members and interested parties via the CABY IRWM website and direct correspondence. Meeting announcements and materials are posted online and sent out via a Google-group email, along with project development information, meeting summary notes, project application forms, consultant contact information, and electronic versions of the IRWMP and CABY IRWM annual reports. In addition, CABY SG members use the website to post project information for review and public comment.

The CABY RWMG will continue to ensure that the CABY IRWM website (see www.cabyregion.org) is maintained and will identify a responsible party and funding source.

4.7.2 CABY IRWM Communication and Information Sharing – General Public

The CABY IRWMP planning and implementation efforts are open processes. CABY IRWM meetings are open to the public, agendas are emailed to interested parties and posted on the CABY IRWM website at least one week in advance of meetings, meeting summary notes are emailed and posted on the website after each meeting, and the public is given an opportunity to participate and provide comments at the CABY SG meetings and through the CABY IRWM website (www.cabyregion.org). Regular emails to interested parties also include invitations to meeting calendars, announcements, and informational articles of interest.

At times, CABY IRWM has had very limited participation by the general public. However, more recently, as part of the DWR-funded Mountain County Funding Area DAC Involvement needs assessment process, CABY IRWM has sponsored three major public events reaching out to DAC communities and Tribal entities to understand their needs and concerns regarding water issues. CABY RWMG continues to strategize methods for engaging a wide public interest and participation in the IRWM process.

4.8 Implementation Actions

4.8.1 IRWMP Adoption

Under the policy initially adopted in 2009 and confirmed via the process of preparation of this IRWMP and revisions to the governance structure, organizations/agencies/groups must adopt the IRWMP in order to be part of the SG. Further, project sponsors or proponents are not able to submit projects for funding through the IRWMP unless they are CABY SG members and have adopted the updated IRWMP document.

Proof of adoption or re-adoption must be in the form of a written resolution. Adoption of the IRWMP by the RWMG and individual project proponents is included as Resolution of Support located in Appendix B of this IRWMP.

4.8.2 Interim IRWMP Update Process

As described in Section 4.3, Governance Structure, Roles, and Responsibilities, the CABY RWMG is the body that will initially consider any needed updates to the IRWMP. Recommendations for either update or amendment can be brought to the CABY RWMG through the CABY SG, WGs, or suggestions by individual members. Interim changes could include annual updates to the project list, identification of emerging issues or conflicts, refinements to the governance structure, update of the CABY IRWMP adoptee list, documenting outcomes of IRWMP performance and project performance monitoring, documentation of data management activities, or updates on implementation activities. These interim changes would take the form of appendices to the document until officially integrated into the full document during a formal IRWMP amendment process. At a minimum, the CABY RWMG will consider the need for any IRWMP updates annually as part of its performance review process (as discussed in Chapter 13, Plan Performance and Monitoring). Furthermore, the RWMG will publish a notice of intent to prepare an IRWMP in accordance with Section 6066 of the California Government Code and provide notice to DWR of potential projects to benefit DACs in the region.

4.9 Formal IRWMP Amendment Process

A formal IRWMP amendment process will be initiated when the number of interim update appendices indicate that the IRWMP is at risk of being out of date, new guidelines emerge from the state that require a systematic IRWMP update, or individual revisions are considered to be of such significance that the CABY RWMG agree a formal amendment is necessary. In any of these cases, the CABY RWMG would seek to reach consensus as to whether a formal amendment is required, how it would be accomplished, and how it would be funded. The RWMG will publish a notice of intent to prepare an IRWMP in accordance with Section 6066 of the California Government Code. Once the IRWMP is complete, the RWMG will publish a notice of intent to adopt the IRWMP in accordance with California Government Code Section 6066 and adopt the IRWMP in a public meeting of the RWMG (CWC Section 10543).

4.10 Long-Term Implementation

Each group in the governance structure is expected to make decisions and suggestions with consideration of long-term implementation of the IRWMP, specifically with a twenty (20)-year planning horizon in mind. A planning horizon of twenty (20) years is primarily utilized in this IRWMP when speculating regarding population changes and the associated water and infrastructure needs that will accompany them. Most activities may be planned on a timeline much shorter than twenty (20) years; however, these efforts culminate in the broader goals of climate resilience and sustaining the region over twenty (20) years. The IRWMP discusses strategies that can take multiple years to accomplish that will need to adapt to the current political and fiscal climate and are therefore reliant on diligent management. Some groups have additional roles that support these long-term efforts. For example, CABY RWMG members are expected to serve for a minimum of two (2) years, and most RWMG members have served for over five (5) years. The long-term commitment of stakeholders in the CABY region is illustrated by the continued interest and dedication that can be quantitatively measured annually as staff time committed to this planning process, grant funding that has been received, and financial support provided by the water agency and nonprofit member organizations.

For example, the Sierra Fund has long maintained the CABY IRWM website and managed two of the implementation grants, and remains prepared to serve in the role of fiscal administrator if called upon. Additionally, the water agencies have the capacity and institutional ability to support the CABY IRWMP and have provided financial and staff support since CABY IRWM's inception, in addition to managing implementation grants and supporting organizational needs including meetings and facilitation.

The IRWMP update process will ensure that the IRWMP is responsive to changes in priorities for CABY SG members. This process will ensure that the IRWMP is reflective of the state of the region and that projects are developed to meet current regional needs and objectives in alignment with long-term IRWMP implementation.

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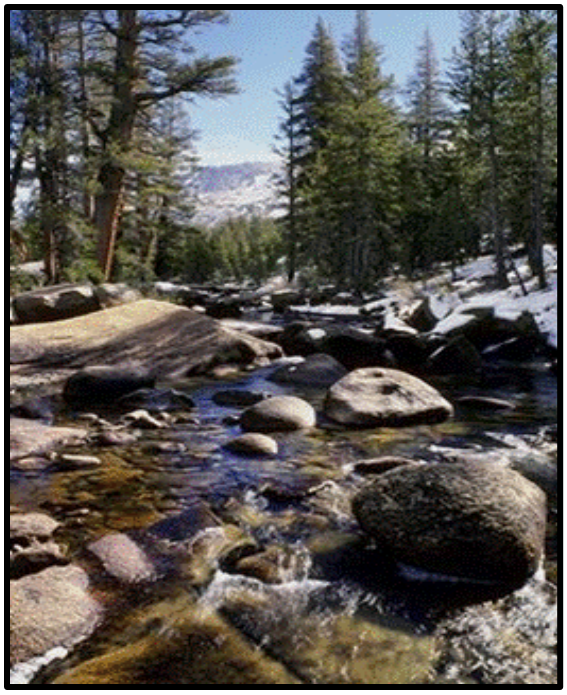
Chapter 5
Region Description



The Cosumnes, American, Bear, and Yuba (CABY) region consists of 4 watersheds and 12 subwatersheds situated within the north central Sierra Nevada in California. The area extends from the northern parts of the Yuba River watershed in Yuba, Nevada, and Sierra Counties to the southern part of the Cosumnes River watershed in Amador County. The CABY region land area comprises 4,351 square miles, or about 30% of the Mountain Counties Area as defined in the State of California Department of Water Resources (DWR) Water Plan Update.[1] All four watersheds include headwaters that drain large volumes of water into the Sacramento and Mokelumne Rivers, ultimately serving the Sacramento Delta ecosystems. The CABY region encompasses only 2.4% of California's total land base and is home to a small fraction of California's population, but its significance both ecologically and economically cannot be measured by its size or number of residents. Further, it is a significant source-water contributor to out-of-region uses, including Sacramento Delta ecological needs.

The CABY region is geographically diverse with a broad range of elevation, slope, aspect, and soils characteristics. The IRWM plan area ranges in elevation from 400 feet at Folsom Reservoir at the western border to over 9,000 feet at the crest of the Sierra Nevada at the eastern border. The region's geographic diversity, combined with variations in average temperatures and precipitation, supports a wide variety of vegetation communities. Many of these habitats are considered ecologically sensitive; the region supports 121 species and 9 habitats of special concern.[2]

At the same time, the CABY region provides significant economic resources to the entire state, serving as the source headwaters and contributing a significant portion to California's water supply, including flows for the Bay-Delta system, the Central Valley Project, and the State Water Project. Moreover, the CABY watersheds generate thousands of megawatts of hydroelectric energy serving communities far beyond the region through California's electrical grid system.

Proposition 1 authorized $510 million in IRWM funding to 12 hydrologic region-based funding areas. The $510 million was divided based on population such that the sparsely populated Mountain Counties Funding Area (MCFA) of the Sierra Nevada received the least amount of money ($1.3 million) despite providing 60% of the state's developed water supply. Prior to allocating the implementation funds, each Funding Area is required to complete a Disadvantaged Community Involvement program designed to ensure the involvement of DACs in IRWM planning efforts and close the gaps of funded activities across a spectrum of communities. CABY undertook this mandate by hiring an independent consultant to consult

[1] DWR 2013.

[2] California Department of Fish and Wildlife 2012

with communities throughout the region in order to articulate community needs and capacities to address their water and wastewater needs.

While the CABY region's role as a key resource provider for the state is recognized, the visibility and significance of its environmental issues are not. This stems, in part, from misperceptions of the Sierra Nevada as a pristine area. The environmental issues that impact rural areas of California are different from urban concerns and are often not accounted for in state-level decision-making mechanisms. For example, CABY's Disadvantaged Community Involvement report clearly calls out the problems inherent in CalEnviroScreen for identifying pollution burdens on communities in rural mountainous areas. Rural forest communities that struggle with low SES do not qualify as DAC under CalEnviroScreen because they lack data. A paucity of measures for constituent air, water, and soil pollution is treated by EnviroScreen as if there are no pollution burdens.

This chapter presents an overview of the environmental setting in the CABY region that is critical to managing natural resources and understanding the sometimes competing interests within the region. The section also presents an overview of the internal boundaries and social and cultural, demographic, and economic attributes of the region.

The previous CABY 2007 Integrated Regional Water Management Plan (IRWMP) includes detailed descriptions of various geographic conditions that remain unchanged. The geologic history of the Sierra Nevada and soils in the CABY region are incorporated by reference from the 2007 IRWMP. Additionally, Appendix D, Region Description Supplement, includes additional detail on CABY habitat and biology. Finally, the topics of water quality, major water-related infrastructure, and land use are further described in Chapters 6, 7, and 8. Issues and objectives are discussed in Chapter 9.

5.1 CABY Region Watersheds and Water Systems

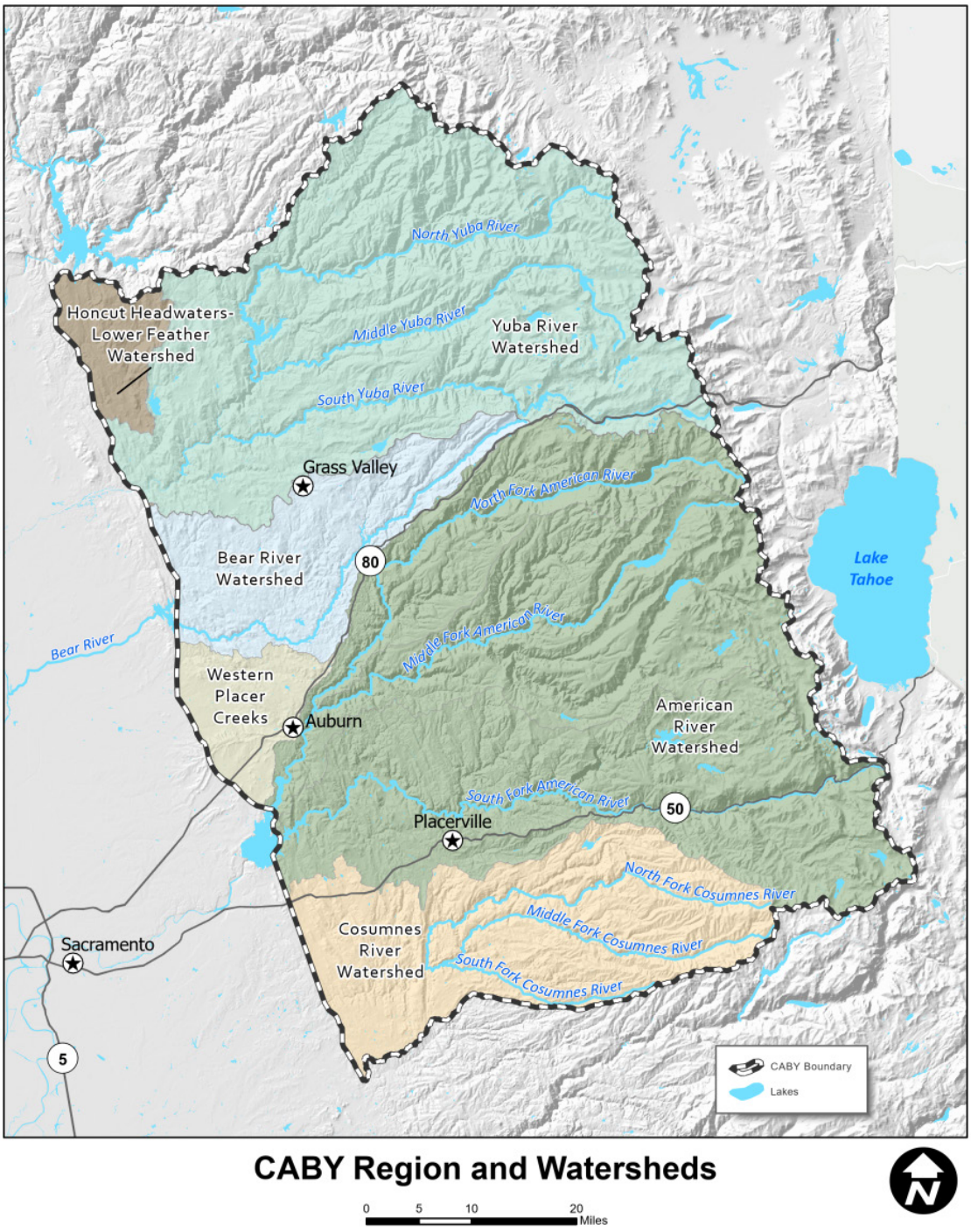
The CABY planning region consists of the upper watersheds of the Cosumnes, American, Bear, and Yuba Rivers, which combine to form a major drainage area of the western slope of the Sierra Nevada range, from the mountain crest to the Central Valley. The CABY region eastern boundary is defined by the headwaters of the four rivers that flow west from the Sierra Crest; the western boundary follows the 400-foot elevation line, creating a purposeful delineation between upper and lower watersheds, and the northern and southern boundaries are defined by the Yuba and Cosumnes watersheds, respectively (see Figure 5-1).

The principal rivers in the planning region are shown in Figure 5-2, and described fully in Section 5.1.4, Hydrology and Water Resources, and 5.1.5, Subwatersheds. The combined water storage capacity of the CABY region watersheds represents a significant portion (nearly 30%) of the total water storage capacity in the Mountain Counties Region that generates 65% of the water supply for California.[3] Major hydroelectric and flood-control reservoirs include French Meadow, Hell Hole, Union Valley, New Bullards Bar, Englebright, Folsom, Combie, Fordyce, Bowman, Camp Far West, Spaulding, Rollins, Union Mine, Icehouse, Loon Lake, Gerle Creek, Forebay, Silver Lake, and Caples Lake Reservoirs. Major lakes and reservoirs used primarily for local water supply include Jackson Meadows, Merle Collins, and Jenkinson Lake. There are also hundreds of small, natural lakes within the CABY region situated primarily within the upper reaches of the watersheds.

[3] DWR 2009

Figure 5-1 – CABY Regional Setting

Figure 5-2 – CABY Region and Watersheds



5.1.1 Geology and Soils

The landscape is characterized by rugged, steep topography with deeply incised canyons. The Sierra Nevada range is dominated by granitic rock, but also includes many types of igneous, sedimentary, and metamorphic rocks. The geologic history consists of hundreds of millions of years of uplift, erosion, volcanism, and glaciation.

The CABY region is characterized by crystalline basement bedrock exposed along the central watercourses through the downstream portions of the watersheds. Much of the side slopes and upper headwater portions of the watersheds are composed of various volcanic and superjacent sedimentary materials.

The climate, topography, surface processes, and biota interact to produce the Sierra Nevada soils of the CABY region. The soil properties in this region are varied and strongly influenced by the underlying bedrock.

5.1.2 Precipitation

The climate is characterized by mild, wet winters and hot, dry summers, but the variability in climate over the project area is great due to the topographic and elevation ranges. Precipitation generally increases with elevation in the CABY region, and average annual precipitation ranges from 22.5 inches in the lowest, most western elevations of the planning region to 85 inches in the highest elevations. Snow generally falls near 3,500 feet in elevation in the winter and rarely reaches as low as the valley floor.[4] Average temperatures in the region generally decrease from west to east with elevation; in the summer months, temperatures tend to be warmer in the lower elevations (70°F–100°F) and cooler at the higher elevations (60°F–80°F). The winter months are mild at the lower elevations (45°F–60°F), and cooler at the higher elevations (30°F–40°F). Moreover, there is a wide variety of micro-climatic variations across the CABY region that are based on local topography and airflow that affect local ecosystem characteristics.

In addition to the east–west gradient of precipitation, the northern portion of the CABY region receives proportionally more precipitation than the southern portion. For example, the Cosumnes, the South Fork of the American, and the Middle Fork of the American headwater areas all average 75 inches of precipitation annually. The majority of the Yuba River's upper watershed also receives 75 inches per annum or more. Much of the precipitation in the higher elevations of the CABY region is in the form of snow. Though rain-on-snow events can happen frequently in the spring, this snowmelt provides a major source of water for the region and for the state during the dry summer months. Throughout the CABY region, as with most of California, a majority of the rainfall occurs between November and April.[5]

The crest of the Sierra Nevada forms a near impenetrable barrier to storm systems moving in an easterly direction from the Pacific Ocean. This forces the systems to deposit most of their precipitation along the west slope of the range. The plentiful precipitation west of the Sierra Crest provides rivers with enough flow and energy to carve deep V-shaped canyons, evident in the higher elevations of the four watersheds.

5.1.3 Hydrology and Groundwater

A groundwater basin is defined as an area underlain by permeable materials capable of furnishing a significant supply of groundwater to wells, or storing a significant amount of water. It includes both the

[4] NID Urban Water Management Plan 2005

[5] www.cnrfc.noaa.gov/rainfall_data

surface extent and all of the subsurface fresh-water-yielding material. These underground reservoirs, along with the surface waters, compose the water resources of the CABY region.

Groundwater basins are delineated for some parts of California and subdivided into subbasins to distinguish groundwater systems. Many of these boundaries are not precise, and little is known about the hydrogeology and groundwater levels of many of the basins. The CABY planning area occurs primarily in the Sacramento River Hydrologic Region (the Yuba, Bear, and American watersheds); the Cosumnes River watershed portion of the planning area is located in the San Joaquin Hydrologic Region. In 2005, the DWR published the California Water Plan Update, which added the Mountain Counties Area as a Hydrologic Region. The Mountain Counties are portions of the headwater areas of the Sacramento and San Joaquin Rivers, and contain the foothill and mountain areas of these two hydrologic regions. The counties that constitute the CABY planning area are all within the Mountain Counties Area. Therefore, much of the information that follows is from the Mountain Counties Area Regional Report in the California Water Plan Update 2009.

5.1.4 Hydrology and Water Resources

The largest of the four watersheds in the CABY region is the American, which comprises 1.2 million acres and roughly 46% of the planning area. The Yuba watershed is second largest and includes 900,000 acres and roughly 33% of the planning area. Together, these two watersheds represent approximately 78% of the planning area while the Bear and Cosumnes watersheds comprise the remaining 22% (roughly 8% and 14%, respectively).

It is the mandated responsibility for all federal agencies to identify potential additions to the National Wild and Scenic Rivers Systems. Agencies assess eligibility through their inventory and planning processes and then manage eligible segments accordingly. The El Dorado National Forest and Tahoe National Forest recommended Wild and Scenic designations for river segments are shown in Table 5-1. Congress will determine whether to designate these recommended rivers for inclusion in the National Wild and Scenic Rivers System.

Table 5-1
Eligible Rivers for the National Wild and Scenic Rivers System

Watershed	Reach	Eligibility Class	Status	Land Management Agency
Name?	Caples Creek	Wild	Eligible	ENF
	Lower Rubicon River	Scenic/Wild	Recommended	ENF
	Middle Fork American River (below Rubicon River)	Recreation	Suitable	ENF
	Middle Rubicon River	Wild/Recreation	Recommended	ENF
	North Fork of Middle Fork American River	Wild/Scenic	Eligible	ENF, TNF
	North Fork of North Fork American River	Wild	Designated	ENF, TNF
	Pyramid Creek	Wild	Eligible	ENF
	Rubicon River	Wild/Scenic	Eligible	ENF
	Silver Fork of South Fork American River	Recreation	Eligible	ENF
	South Fork American River	Recreation	Eligible	ENF
	Upper Rubicon River	Scenic	Recommended	ENF

Table 5-1
Eligible Rivers for the National Wild and Scenic Rivers System

Watershed	Reach	Eligibility Class	Status	Land Management Agency
Cosumnes River	Middle Fork Cosumnes River	Recreation	Eligible	ENF
	North Fork Cosumnes River	Recreation	Eligible	ENF
Yuba	Big Granite Creek	Wild	Eligible	TNF
	Canyon Creek	Scenic	Recommended	TNF, Plumas National Forest
	Lower South Yuba River	Recreation/Scenic	Recommended	TNF
	North Yuba River	Recreation/Scenic	Recommended	TNF

Note: ENF = El Dorado National Forest; TNF = Tahoe National Forest.

5.1.5 Subwatersheds

Although the State of California recognizes up to nearly 300 subwatersheds within the CABY boundary, for the purposes and scales of this IRWM planning effort, the CABY region is divided into 11 major subwatersheds. Table 5-2 lists these subwatersheds and the major river drainages. The combined watersheds drain large volumes of water that flow into the Sacramento and Mokelumne Rivers. The Mokelumne River joins the San Joaquin River in the eastern portion of the Central Valley, and the Sacramento and the San Joaquin Rivers form the Sacramento/San Joaquin River Delta. This is an expansive inland river delta consisting of many small, natural and human-made sloughs that create a system of isolated lowland islands and wetlands defined by dikes or levees.

The headwaters of the four rivers originate in the Sierra Nevada and flow west into the Central Valley. There are four main watersheds in the CABY region and 11 subwatersheds (see Table 5-2 and Figure 5-3, CABY Region: Major Sub-Watershed Boundaries). Each of the watersheds is described separately, and each river's tributaries and hydrologic issues are highlighted later in this section.

Table 5-2
CABY Major Subwatersheds and Land Areas

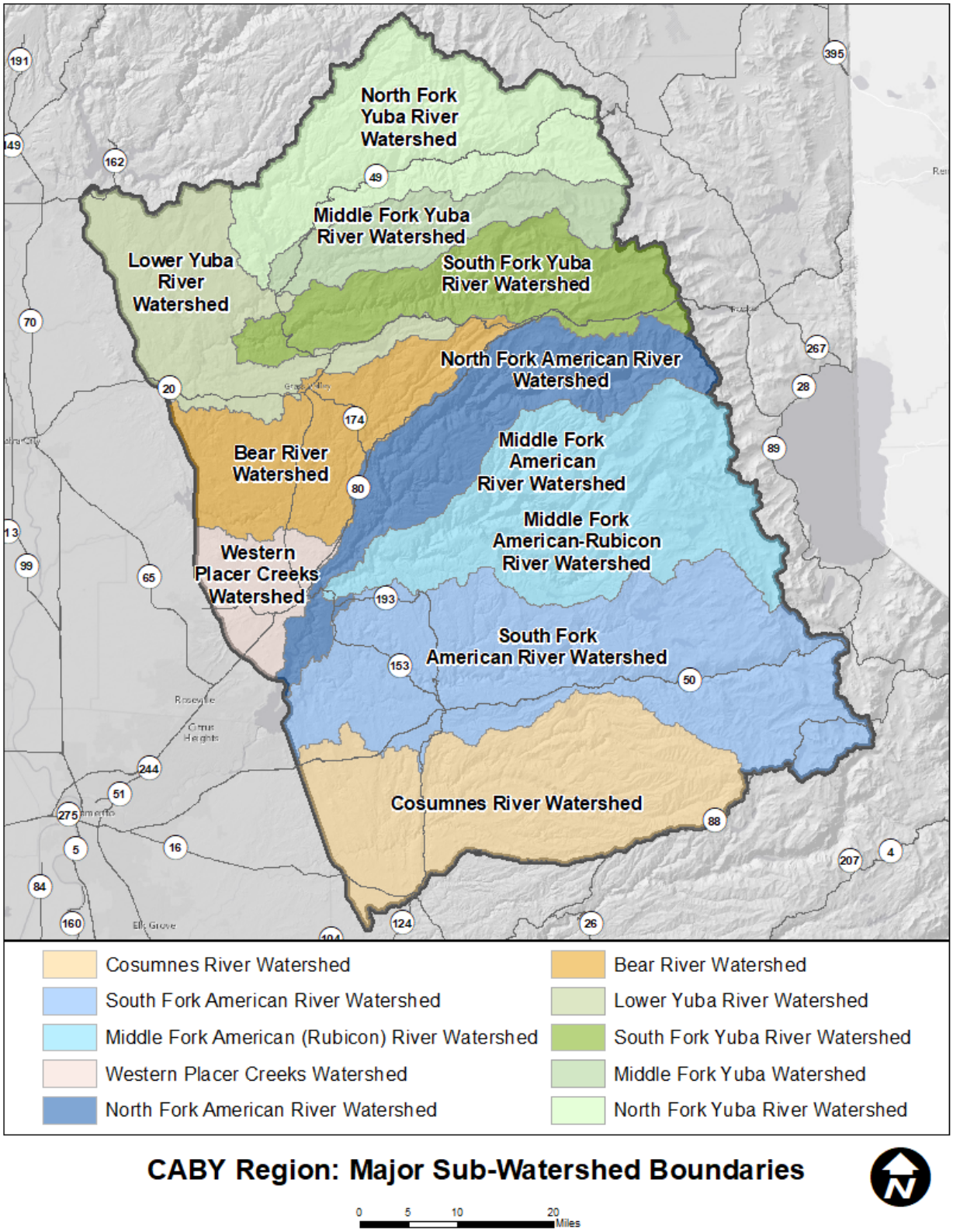
Watershed	CABY Subwatershed	Acres	% of CABY Region
Yuba	North Yuba	314,118	11.5
	Middle Yuba	134,992	4.8
	South Yuba	225,895	8.3
	Yuba River	165,063	6.0
	Total Watershed	**840,068**	**30.6**
Bear	**Total Watershed**	**220,168**	**8.1**

Table 5-2
CABY Major Subwatersheds and Land Areas

Watershed	CABY Subwatershed	Acres	% of CABY Region
American	North Fork American	247,584	9.1
	Middle Fork American	192,273	7.1
	Rubicon	202,051	7.4
	South Fork American	542,230	19.9
	West Placer Creeks	85,443	3.1
	Total Watershed	**1,269,581**	**46.7**
Cosumnes	**Total Watershed**	**390,340**	**14.3**
CABY	**Total Acres**	**2,720,157**	**100.0**

Note: Percentages are rounded to the nearest tenth of a percent, and may not always add up to 100%.

Figure 5-3 – CABY Region: Major Sub-Watershed Boundaries



1. YUBA RIVER WATERSHED

The Yuba River has three forks (North, Middle, and South Yuba) that converge northwest of Nevada City/Grass Valley. The North Yuba and the Middle Yuba Rivers converge below New Bullards Bar Reservoir and form the main stem of the Yuba River. The Yuba River flows into the north arm of Englebright Reservoir, while the South Yuba feeds the south arm. The Yuba River flows west out of Englebright Reservoir, and eventually out of the CABY region and into the Feather River at Marysville. The Feather River is tributary to the Lower Sacramento River, which eventually flows into the San Joaquin Bay-Delta. The Yuba River watershed, from the crest of the Sierra Nevada to the confluence at the Feather River, near Marysville, is approximately 1,340 square miles; elevations in the watershed range between 9,100 feet to 30 feet above sea level.[6] The portion of the Yuba River watershed within the CABY region is over 900,000 acres, or roughly one-third of the CABY region.

There are over 100 jurisdictional dams (impoundments over 25 feet tall and that hold more than 50 acre-feet of water) or diversions in the Yuba watershed. The diversions convey water to local users and to users in the Bear River and the North Fork American River watersheds. A large amount of water is diverted from the watershed at Lake Spaulding on the South Fork for irrigation and power generation.

Fordyce Lake, Lake Wildwood, Jackson Meadows Reservoir, Merle Collins Reservoir, New Bullards Bar Reservoir, Lake Spaulding, and Englebright Reservoir are some of the more prominent water bodies in the watershed.

Englebright Dam marks the division between the Upper and Lower Yuba River. It was completed in 1941 to capture gold-rush era hydraulic mining debris that threatened downstream areas with floods. Englebright Reservoir has a storage capacity of 45,000 acre-feet and provides hydrogeneration and recreational opportunities. Wild chinook salmon (*Oncorhynchus tshawytscha*) spawning habitat exists below Englebright Dam, but lacks fish passage facilities to the Upper Yuba River.[7] Flows on the Lower Yuba River below Englebright Dam are managed to protect chinook salmon and steelhead trout (*Oncorhynchus mykiss*) per the Lower Yuba River Accord.[8]

This largely forested watershed has been impacted by historic mining, timber harvest, high road density (compared with other, more rural western forests), dams and diversions, and residential development.[9] The patchwork of land ownership in the watershed presents land and watershed management challenges. Several potential or actual impaired water bodies are listed in the Yuba River watershed. The Upper Yuba is also considered a priority watershed for action by the state under the California Unified Watershed Assessment.

Below are descriptions of the four Yuba subwatersheds in the North, Middle, and South Yuba Rivers and the main stem Yuba (from the confluence of the North and Middle Yuba Rivers through Englebright and out of the CABY region to the west).

[6][5] Upper Yuba River Studies Program Study Team 2003

[7] Upper Yuba River Studies Program Study Team 2003

[8] Lower Yuba River Accord 2007

[9] Shilling

1a. NORTH YUBA RIVER SUBWATERSHED

The North Yuba flows for 45 miles from the Yuba Pass area and is the largest subwatershed in the Yuba basin, draining an area of approximately 314,000 acres. Just downstream of its alpine headwaters, it follows along Highway 49, past Downieville, where it is joined by the Downie River. As it continues in a westerly direction, it is joined from the north by three significant tributaries: Goodyears Creek, Canyon Creek, and Slate Creek. The North Yuba River flows into the north arm of New Bullards Bar Reservoir (owned and operated by Yuba County Water Agency), and Willow Creek flows into the south arm of the reservoir. New Bullards Bar dam is Pacific Gas & Electric's largest power producer. The North Yuba River contributes nearly 50% of the total natural flow of the Yuba River originating above the foothills.[10]

1b. MIDDLE YUBA RIVER SUBWATERSHED

The Middle Yuba watershed drains an area of approximately 135,000 acres situated between the larger North and South Yuba Rivers. The Middle Yuba River originates from springs near Meadow Lake in the high Sierra near the crest and initially flows northwest, then west-southwest to its confluence with the North Yuba just south of New Bullards Bar Reservoir. Just downstream from its headwaters, the Middle Yuba River passes through Jackson Meadows Reservoir, the largest impoundment in the subwatershed. Just downstream are Milton Reservoir and the Milton-Bowman Canal, which diverts most of the water from the Middle Yuba River subwatershed to the South Yuba River subwatershed.

Downstream of Milton Reservoir, the Middle Yuba River flows west, just south of Lafayette Ridge. Draining the north slope of Lafayette Ridge and the south slope of Pliocene Ridge, a major tributary to the Middle Yuba, Kanaka Creek enters the Middle Yuba from the north in the lower half of the watershed. Kanaka is a Clean Water Act 303(d) listed water body (see Tables 6-1 and 6-2 for complete lists and details on 303[d] water bodies in the CABY region) due to arsenic contamination from historic resource extraction (mining). Other factors, such as low flows and high temperatures on the South and Middle Yuba Rivers, along with the legacy of sediment from hydraulic mining, have contributed to problems for the cold-water-adapted aquatic communities. Downstream of Kanaka Creek is the Middle Yuba River's largest tributary, Oregon Creek; it enters the river just upstream of the confluence with the North Yuba, just downstream of New Bullards Bar Reservoir. The Our House Reservoir moves water from the Middle Yuba River to New Bullards Bar Reservoir.

1c. SOUTH YUBA RIVER SUBWATERSHED

The South Yuba River originates near Castle Peak/Donner Pass in the high Sierras. The source of the South Yuba River is near the Sugar Bowl Ski Resort in the Mount Disney/Mount Lincoln area. This 225,000-acre subwatershed borders the Middle Yuba River to the north; the main stem of the Yuba to the north, west, and south; and the Bear River and North Fork of the American River to the south. From its headwaters, the river parallels Interstate 80 until it merges with Lake Spaulding, a very important water management impoundment. The Yuba-Bear Project (Federal Energy Regulatory Commission [FERC] No. 2266) and the Drum-Spaulding Project (FERC No. 2310) originate at Lake Spaulding. Fordyce Creek also feeds Lake Spaulding from the northeast as it drains the high country surrounding Fordyce Lake, another large impoundment in the subwatershed.

Downstream of Lake Spaulding, the river drains west, separated from the Middle Yuba by the San Juan Ridge to the north and a series of small ridges to the south (that separate the South Yuba drainage from

[10] Upper Yuba River Studies Program Study Team 2003

the Upper Bear and Deer Creek drainages). Along this stretch, several tributaries, including Fall Creek, Canyon Creek, Scotchman Creek, and Poorman Creek feed the South Yuba River. Near the Malakoff Diggings area (one of the largest placer mining sites in the region), Humbug Creek, a 303(d) listed waterway for sediment, mercury, copper, and zinc, enters the South Yuba.

Thirty-nine miles of the South Yuba River (between Lake Spaulding and Englebright Reservoir) are designated as a California Wild and Scenic River and a federally recommended Wild and Scenic River. It is used heavily for recreational purposes. One important recreational access point is the Highway 49 Bridge. A few miles downstream of the bridge the South Yuba flows into the main stem of the Yuba at Englebright Reservoir.

2. YUBA RIVER SUBWATERSHED

The 165,000-acre Yuba River subwatershed spans the width of the entire Yuba River watershed. The main stem of the Yuba River is formed by the confluence of the North Yuba and the Middle Yuba Rivers just downstream of New Bullards Bar Reservoir. The main stem of the Yuba and the South Yuba Rivers form the north and east arms of Englebright Reservoir. Englebright Reservoir is a debris dam built by the U.S. Army Corps of Engineers in 1941. The U.S. Geographical Survey has recently characterized the quantity and contamination levels of sediment in Englebright,[11] and it is now a Clean Water Act 303(d) listed site (Table 6-1).

Dry Creek, a major tributary in this subwatershed, begins northwest of New Bullards Bar Reservoir near the CABY boundary, and flows south through Merle Collins Reservoir, and eventually into the Yuba River just west of the CABY boundary.

Deer Creek drains an area of 90 square miles, is a major tributary in the Upper Yuba watershed, and provides water to the Bay-Delta System. Deer Creek enters the Yuba River below Englebright Dam, just below Lake Wildwood. The Deer Creek watershed is the most developed in the Yuba basin, as Deer Creek runs directly through Nevada City. Consequently, the Deer Creek watershed has been significantly degraded, and contains three Clean Water Act 303(d) water bodies listed for mercury or pH. The three water bodies are Scotts Flat Reservoir on Deer Creek, Deer Creek itself, and Little Deer Creek, a tributary to Deer Creek and the main water supply for the City of Nevada City.

Just west of the CABY boundary and 12 miles from the confluence with the Feather River, Daguerre Point Dam serves as a point of diversion to irrigators to the north and south of the Yuba. At roughly 20 feet tall, Daguerre has been identified by federal, state, and local agencies as an impediment to fish passage, and as such, affects the species complement of the entire Upper Yuba.[12]

3. BEAR RIVER WATERSHED

The 75-mile-long Bear River originates at about 5,000 feet elevation, roughly 20 miles west of the crest of the Sierra Nevada in northern Placer County, just southwest of Spaulding Lake. Its general course through the CABY planning area is southwest and west to the Feather River. The Bear River forms the boundary between Nevada and Placer Counties for much of its course. The watershed is wedged between two much larger watersheds, the Yuba to the north and the American to the south, and consists of 220,000 acres.

[11] Upper Yuba River Studies Program Team 2003

[12] Upper Yuba River Studies Program Team 2003

Over 990 miles of streams, creeks, and rivers lie within the Bear River watershed. The watershed also contains over 2,000 miles of roads; consequently, approximately 45% of the streams in the watershed are within 100 meters of a public road.[13] The Bear River watershed is heavily managed for water conveyance and is considered the region's hydraulic workhorse, conveying water for consumption and energy generation from the Upper Yuba, Upper American, and from its own headwaters and tributaries into the Middle and Lower Bear, Lower American, and the associated foothill creek-ravine region.[14] Areas of this watershed have been severely degraded by historic hydraulic mining and mercury contamination. Four waterways within the watershed are listed under the Clean Water Act Section 303(d) for mercury contamination (Lake Combie, Camp Far West Reservoir, Upper Bear River, and Rollins Reservoir—largely because mercury is captured in sediments behind dams), one for bacteria (French Ravine), and one creek (Wolf) is listed for fecal coliform.

The Bear River is fed by the Drum Canal from Spaulding Lake (located on the South Yuba River), which enters the river at the Drum Afterbay, a few miles downstream of the headwaters. The small reach above the Drum Afterbay is termed the Upper Bear River, and is a 303(d) listed reach for mercury contamination (see Chapter 6, Water Quality). The Middle Bear flows out of the Drum Afterbay and enters Dutch Flat Reservoir, where the waters of the Boardman Canal enter after running through Alta Powerhouse with the waters from Lake Alta. Dutch Flat also has a powerhouse through which the waters flow before returning to the riverbed. The Bear continues to roughly parallel Interstate 80. Just before Rollins Reservoir, a 303(d) listed water body and the largest impoundment in the upper watershed (774 acres), Steephollow Creek enters the Bear River from the north. At this point, Steephollow Creek is nearly as long as the Bear River itself. Steephollow Creek is separated from the Bear River by Lowell Hill Ridge to the south and from Greenhorn Creek by Chalk Bluff Ridge to the north.

Greenhorn Creek, another significant tributary to the Bear River, forms the north arm of Rollins Reservoir, while the Bear River forms the northeast arm. Greenhorn Creek is not a 303(d) listed water body; however, a 1999–2001 U.S. Geographical Survey study found mercury and methylmercury to be pervasive within surface waters and sediments, and present in local invertebrates and frogs in the Greenhorn Creek watershed.[15]

The Bear River discharges from Rollins Reservoir and flows southwest into Lake Combie, located near the community of Meadow Vista and a 303(d) listed water body. Lake of the Pines is a reservoir on Magnolia Creek, located northwest of Lake Combie, and is an area with heavy development pressure. Downstream of Lake Combie, the Bear River turns west and is fed from the north by Magnolia Creek and then Wolf Creek. Wolf Creek and French Ravine are 303(d) listed water bodies for fecal coliform and bacteria, respectively. Wolf Creek flows through Grass Valley, a major urbanized area in the watershed.

Downstream of the confluence with Wolf Creek, the Bear River enters Camp Far West Reservoir, bisected by the CABY boundary. The largest water body in the Bear watershed at 1,945 acres, Camp Far West is 303(d) listed due to mercury contamination. The Lower Bear River runs from Camp Far West Reservoir to the confluence with the Feather River, and moves outside the CABY region.

[13] Nevada County Resource Conservation District 2004

[14] Yardas and Eberhart 2005

[15] USGS Scientific Investigations Report 2004-5251

4. *AMERICAN RIVER WATERSHED*

The American River watershed drains almost 2,000 square miles and includes portions of Placer, El Dorado, and Sacramento Counties. The American River originates at the crest of the Sierra Nevada just west of Lake Tahoe, within the Tahoe and El Dorado National Forest boundaries. The American River has three forks, the North, Middle, and South; originates in alpine areas; flows generally west through the Sierra foothills; and converges east of Sacramento where the main stem fills Folsom Reservoir. Below Folsom Reservoir, the American River flows southwest through Sacramento and into the Sacramento River.

Major streams in the watershed include the Rubicon River (and its forks), Duncan Creek, Long Canyon Creek, and Silver Creek. The main reservoirs and lakes in the watershed are Folsom, French Meadows, Hell Hole, Union Valley, Ice House, Lake Valley, Loon Lake, Silver Lake, Slab Creek, and Stumpy Meadows.

Most watershed channels in the region consist of moderately steep gradients and are confined by narrow V-shaped valleys. Riparian vegetation varies by elevation and geology, but generally has considerable cover where undisturbed by human activities and unhindered by bedrock and/or boulders; where present, primary vegetation includes herbaceous species, with middle stories of alder, willow, and cottonwood, depending on elevation.[16] The watershed has been influenced by natural events, such as fire, floods, and fluctuating flows; and activities, such as mining, grazing, timber management, and recreation.[17] These events and activities are sediment sources for streams in the watershed along with natural mass wasting events (i.e., rockfalls, debris slides, debris torrents, and bank erosion).[18] In general, the quality of water in the American River is high from the headwaters to its confluence with the Sacramento River. It is low in alkalinity, mineral content, and organic and microbial contamination.[19]

5. *NORTH FORK AMERICAN RIVER SUBWATERSHED*

The North Fork American River is 85 miles long and originates in eastern Placer County in the Tahoe National Forest. It flows west and then southwest, passing southeast of the town of Colfax and through Clementine/North Fork Reservoir; it receives the Middle Fork American four miles below the North Fork Reservoir Dam. The North Fork American River drains approximately 387 square miles, making it the second largest subwatershed in the American River watershed.

6. *MIDDLE FORK AMERICAN RIVER SUBWATERSHED*

The Middle Fork American River is approximately 65 miles long, flows west-southwest from its headwaters through French Meadows Reservoir, receives the Rubicon River, and then converges with the North Fork American River just northeast of the City of Auburn. The Middle Fork American River drains almost 200,000 acres. Placer County Water Agency (PCWA) owns five hydroelectric plants on the Middle Fork American River (FERC No. 2079). The research PCWA completed for its FERC relicensing on the Middle Fork contributes greatly to the knowledge base in the region regarding the Middle Fork and other major waterways in the CABY region.

[16] Placer County Water Agency 2010c

[17] Placer County 2006-2005 Physical Habitat Characterization Study

[18] Placer County 2006-2005 Physical Habitat Characterization Study

[19] Sacramento Groundwater Authority 2003

7. RUBICON RIVER SUBWATERSHED

The Rubicon River subwatershed is located between the Middle Fork American subwatershed to the north, and the South Fork American subwatershed to the south. The Rubicon River is approximately 60 miles long and has a watershed area of almost 184 square miles. The headwaters of the Rubicon River are in the Crystal Range, in the Desolation Wilderness of El Dorado National Forest. The Rubicon River flows through Rubicon Reservoir and Hell Hole Reservoir, and then is joined with the South Fork Rubicon River; it converges with the Middle Fork American River approximately 20 miles northeast of Auburn. The boundary between Placer and El Dorado Counties runs along the Rubicon River for much of its length between Hell Hole Reservoir and the confluence with the Middle Fork American. The Rubicon has been designated as a Wild Trout Stream from its confluence with the Middle Fork American River upstream to Hell Hole Reservoir. There are relatively few roads into the watershed, and the rugged nature of the river valley tends to keep recreational use low.

8. SOUTH FORK AMERICAN RIVER SUBWATERSHED

The South Fork American River (90 miles long) flows west from its origins in the high Sierra in the Eldorado National Forest, receives Silver Creek, a major tributary, and flows past Coloma (the site where Sutter discovered gold in California), where it then turns southwest, receiving Weber Creek before entering Folsom Reservoir. The South Fork American subwatershed is the largest American River subwatershed, draining almost 850 square miles. Sacramento Municipal Utility District operates eight hydroelectric powerhouses, El Dorado Irrigation District operates the El Dorado Powerhouse, and Pacific Gas & Electric operates one powerhouse on the South Fork American River. The stretch between Slab Creek Reservoir and Folsom Reservoir is on the 303(d) list for mercury.

9. WEST PLACER CREEKS SUBWATERSHED

The West Placer Creeks subwatershed is located entirely in western Placer County and encompasses portions of the following towns: Auburn, Bowman, Loomis, and Newcastle. The subwatershed drains the Sierra Nevada foothills from just east of Auburn to the CABY boundary in the west, and encompasses 85,442 acres of the CABY region ranging in elevation from over 2,100 feet near Lake Theodore, to 400 feet at the CABY boundary.

This subwatershed is classified as part of the American River watershed, although the West Placer Creeks do not flow to the American River. Instead, the creeks discharge flows into the East Side Canal in southeastern Sutter County, which then flows into the Cross Canal, and ultimately into the Sacramento River near Verona.[20]

The West Placer Creeks drain in a west-southwest direction, flowing from the higher elevation foothill areas on the east side of the watershed towards the Central Valley. The subwatershed contains the headwaters of Coon Creek, Antelope Creek, Clover Valley Creek, Auburn Ravine, Markham Ravine, and Doty Ravine, a tributary to Coon Creek. Other tributaries to Coon Creek include Dry Creek and Rock Creek.

The West Placer Creeks subwatershed contains several water impoundments, most of which are related to hydroelectric projects (e.g., Wise Forebay, Halsey Forebay, and Halsey Afterbay). The largest water

[20] Placer County and Auburn Ravine/Coon Creek Coordinated Resources Management Plan Planning Group 2002

body in the subwatershed is Rock Creek Lake, a reservoir for the Drum-Spaulding Hydroelectric Project.[21] Since these watersheds are relatively small, very little of the streamflow is from natural runoff. Most of the streamflow is water conveyed from the Yuba, Bear, and American River watersheds to meet domestic and agricultural needs in western Placer County and southeastern Sutter County.[22]

Through a collaborative process, the West Placer Creeks have been identified as essential habitat for migrating fish into the Yuba River watershed. Discussions through several CABY Work Groups are taking place as part of the Placer County Water Agency FERC negotiations.

10. COSUMNES RIVER WATERSHED

The Cosumnes River, the most southerly river in the CABY region, flows for over 80 miles (50 miles within CABY) from its headwaters in the Sierra Nevada west to the Mokelumne River, and eventually the San Joaquin Delta. The 390,340-acre watershed area located within the CABY region has three main forks: the North, Middle, and South. The elevation of the watershed ranges from nearly 8,000 feet in the upper Sierra Nevada to less than 400 feet in the east where the Cosumnes exits the CABY region. The upper reaches of the Cosumnes River are in the Eldorado National Forest, while the lower reaches flow through one of the most biologically rich regions in California's Central Valley, consisting of riparian forests, wetlands, vernal pool-dotted grasslands, and blue oak woodlands.

The majority of the watershed area within the CABY region is in El Dorado County, with a small portion extending into Amador County. The remainder of the watershed flows through Sacramento County. The Cosumnes watershed is home to many towns and unincorporated areas, including all or portions of Plymouth, El Dorado Hills, Cameron Park, Pollack Pines, Shingle Springs, and Diamond Springs. All of these communities (excluding Plymouth) are located in the northern portion of the watershed and straddle the boundary between the American and Cosumnes watersheds.

The Cosumnes is the last free-flowing river on the west slope of the Sierra, without rim dams. Because the Cosumnes is free of tall dams, it has intact geomorphic processes that allow transport of sediment and woody debris through the watershed and an intact storm pulse. These processes are critical for sustaining habitat for salmonids and amphibians. However, there are several dams, diversions, and ditches on the three main forks and tributaries that convey water for agricultural, municipal and other purposes. The most significant dam in the watershed is Sly Park Dam/Jenkinson Lake, originally part of the Central Valley Project, but later transferred to El Dorado Irrigation District's (EID) management as part of its irrigation and water storage system. Sly Park Dam/Jenkinson Lake is located in the North Fork Cosumnes watershed and includes Sly Park Dam and Jenkinson Lake on Sly Park Creek, and Camp Creek Diversion Dam on Camp Creek.[23] Jenkinson Lake is the largest reservoir in the Cosumnes watershed, providing 41,000 acre-feet of storage capacity. Additionally, Jenkinson Lake is EID's largest single source of water, providing an average of 23,000 acre-feet per year to the District.[24] Several other dams and diversions exist in the Cosumnes watershed, both privately and publicly owned. The many diversions significantly decrease dry season flows, and contribute to passage barriers for anadromous fish.

[21] FERC 2013

[22] Placer County and Auburn Ravine/Coon Creek Coordinated Resources Management Plan Planning Group 2002

[23] Bureau of Reclamation 2006

[24] El Dorado Irrigation District 2005

11. NORTH FORK COSUMNES SUBWATERSHED

The Cosumnes and its three main forks flow in a west-southwest direction until the river converges with the Mokelumne, outside the CABY boundary.

The 136,103-acre North Fork Cosumnes watershed is the largest of the three subwatersheds and contains some of the larger tributary streams in the watershed, including Camp Creek, Clear Creek, Squaw Hollow Creek, Steely Fork, and Sly Park Creek. A dam on Sly Park Creek creates Jenkinson Lake, a major reservoir for EID. Jenkinson Lake is also supplied by a diversion from Camp Creek.

12. MIDDLE FORK COSUMNES SUBWATERSHED

The Middle Fork Cosumnes watershed encompasses 85,597 acres and contains a few large tributaries, specifically Dogtown, Sopiago, and Spanish Creeks.

13. SOUTH FORK COSUMNES SUBWATERSHED

The South Fork Cosumnes is the smallest of the three subwatersheds, encompassing only 43,168 acres. The South Fork originates further west than the other two forks near Cooks Station, California. The primary tributaries of the South Fork Cosumnes are Scott Creek and Cedar Creek. The South Fork and Middle Fork Cosumnes join one mile east of the confluence with the North Fork. The three forks join to form the Cosumnes River that flows west for approximately 13 miles prior to exiting the CABY region. The 13-mile stretch of the mainstream Cosumnes River within CABY accounts for the remaining 125,472 acres of the Cosumnes River watershed located within the CABY region. Note that the total watershed area includes the lower Cosumnes Mokelumne subwatershed.

5.1.6 Vegetation Communities

The Sierra Nevada encompasses 88 plant community types as defined by California's Natural Heritage Division. Sierra mixed conifer forest and blue oak woodland are the most extensive types, covering 2,300 and 2,100 square miles, respectively. Sixty-seven plant community types have a mapped distribution greater than 10 square miles. Widespread types exhibit considerable floristic variation from the northern to southern ends of the range and are best analyzed on a subregional basis. Of California's 7,000 vascular plant species, about 50% occur in the Sierra Nevada. Of these, more than 400 species are found only in the Sierra Nevada, and 200 of those are considered rare.[25]

The CABY region supports a wide variety of vegetation communities, as the planning region encompasses a broad spectrum of environmental conditions, such as elevation, slope, aspect, soils, and precipitation. Using the CALVEG[26] classification system developed by the California Department of Forestry and Fire Protection (CDF), 49 distinct vegetation/land cover community types were identified in the CABY region boundaries. Roughly one quarter of the planning area (26%) is covered by the Sierra Mixed Conifer series, which includes ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and incense cedar (*Calocedrus decurrens*), among others. The Westside Ponderosa Pine Forest, characterized by an open coniferous canopy, is dominated by its namesake ponderosa pine. It has a typically sparse understory of shrubs and young trees and covers approximately 16% of the CABY region. The Foothill Pine-Oak Woodland, dominated by foothill pine (*Pinus sabiniana*) and blue oak (*Quercus douglasii*) covers about

[25] Sierra Nevada Ecosystem Project 1996

[26] California Gap Analysis 1998. And: http://www.fs.fed.us/r5/rsl/publications/rsmapping/ca-landcovercooperative.pdf#search=%22CALVEG%20CDF%22

10% of the planning area. The Sierra Mixed Conifer, Westside Ponderosa Pine Forest, and Foothill Pine-Oak Woodland cover types occupy over half of the CABY region's 2.8 million acres.

A complete list of vegetation communities and their acreages and percent cover in the CABY region are listed in Appendix D, Table D-3. The vegetation communities include several different oak woodlands, mixed pine and other conifer communities, several different chaparral communities, and a few scrub vegetation types. The most common heavily modified landscapes include non-native grasslands (2.6%), agricultural land (2.0%), mid-elevation conifer plantations (1.2%), and urban or developed land (1.0%). Most of these cover types are in the western part of the region where elevation, soil type, slope, and access facilitate anthropogenic disturbance.

Impacts to plant populations have come largely from settlement, grazing, logging, fire suppression, and climate change. The plant species of special concern, along with habitats and species of concern of other life forms (amphibians, birds, invertebrates, reptiles, and mammals), are presented below. While riparian plant communities often contain a high percentage of the most rare and unique plant species, out of several habitat types with these qualities – the foothill woodland and chaparral communities – have been particularly damaged and fragmented by changes in agriculture and settlement. Invasion of non-native plant species has been most pronounced in the foothill areas and is associated with livestock grazing and settlement patterns.[27]

Catastrophic Wildfire: Historically, fire played an important role in maintaining diverse landscapes in the CABY region. Accumulated fuels resulting from fire suppression and land management practices have increased the fuel loads and risk of catastrophic fire in many parts of the region.

5.1.6.1 Invasive Species

Terrestrial plant communities are threatened by the establishment and spread of non-native, invasive species. Species such as yellow star thistle, spotted knapweed, invasive brooms (Scotch, Spanish, and French), and Himalayan blackberry are pervasive in most of the lower elevation watersheds, especially in the Cosumnes and American watersheds.

Aquatic invasive species invasions, such as quagga mussels and other exotics, is anticipated without extreme vigilance from aquatic managers and the public. Threats from aquatic invasives are particularly insidious because of the interconnections between streams systems, and thus the ability for invasives to spread quickly.

5.1.7 Biological Resources – Species and Habitats of Special Concern

About 300 terrestrial vertebrate species (including mammals, birds, reptiles, and amphibians) use the Sierra Nevada as a significant part of their range, and more than 100 others use the Sierra Nevada as a minor part of their range. In total, about 60% of the state's vertebrate fauna occur in the Sierra Nevada to some extent. Thirteen species are restricted (endemic) to the Sierra Nevada region; the CABY region supports many of these.

The region contains a number of sensitive, threatened, and endangered species. Information regarding species and habitats of special concern within the planning area is supplied by the California Department

[27] Sierra Nevada Ecosystem Project 1996

of Fish and Wildlife. The California Natural Diversity Database records documented occurrences of 121 species and nine habitats of special concern within the CABY planning boundary.[28] Appendix D, Table D-1 lists the number of species of concern for each life form and the number of habitats of concern in the CABY region. A complete list of these species and habitats, including their common and scientific names (for species only), state and federal status, and the number of documented occurrences within the CABY region is also provided in Appendix D, Table D-2.

Species of Special Concern: Fifty-four species of terrestrial vertebrates (18% of the Sierra fauna) are considered at-risk by state or federal agencies, and are listed as endangered, threatened, special concern, or sensitive. The most important identified cause of the decline of Sierra vertebrates is the loss of habitat, especially foothill and riparian habitats, and late successional forests. In the Sierra, 82 terrestrial vertebrate species are considered dependent upon riparian (including wet meadow or lakeshore) habitat; 20 of these are considered at-risk. Eighteen species are dependent upon late successional forests; five of these are at-risk. Although few Sierra species appear to require closed forest canopies, many more depend upon the presence of large old trees, snags, and downed logs in all Sierra woodland and forest communities for some part of their life cycle.[29]
The Foothill Yellow-Legged Frog (*Rana boylii*) is one of the best-known endangered species in the CABY region. The PCWA FERC relicensing process has helped shed light on the frog's needs for survival and reproduction. As new empirical data becomes available through project monitoring activities, expert judgment may indicate that alternate management strategies are required.[30]

Habitats of Special Concern: The habitats of special concern include four types of fish-bearing streams, three types of wetlands (seep, fen, and bog), a chaparral habitat in the lowlands, and a montane forest habitat. The important habitats within the CABY region are not limited to those listed in the California Natural Diversity Database. Eighty-five terrestrial vertebrate species require west-slope foothill savanna, woodland, chaparral, or riparian habitats to retain population viability; 14% of these are considered at-risk. The number of species actually declining in the foothill zone of the Sierra Nevada is undoubtedly far greater because so much critical habitat has been converted to urban and residential use. Many of these species do not rate state or federal listing because their distributions include habitat in other parts of the state.

Efforts are underway to protect important habitats in the region, as described in the following pages.

- *Western Placer Creeks*

The Western Placer Creeks (WPC) are a series of creeks that begin in the Sierra Nevada foothills in western Placer County and flow west into Sutter and Sacramento Counties, ultimately making their way into the Sacramento and American Rivers just north of the Sacramento-San Joaquin Delta. Much recent attention has been given to the need to restore the Delta for the recovery of salmon and steelhead trout in California. However, simply restoring the Delta is only one component of addressing the life cycles of these important fish species. Once fish pass through the Delta, viable habitat is needed for successful spawning and rearing. With their positive regional characteristics and collaborative stakeholders, the Western Placer Creeks are an ideal region to help address California's declining native fishery populations in a cost-effective manner, and it constitutes a high-priority restoration area for the CABY region.

[28] California Department of Fish and Wildlife 2012
[29] Sierra Nevada Ecosystem Project 1996
[30] Placer County Water Agency 2010

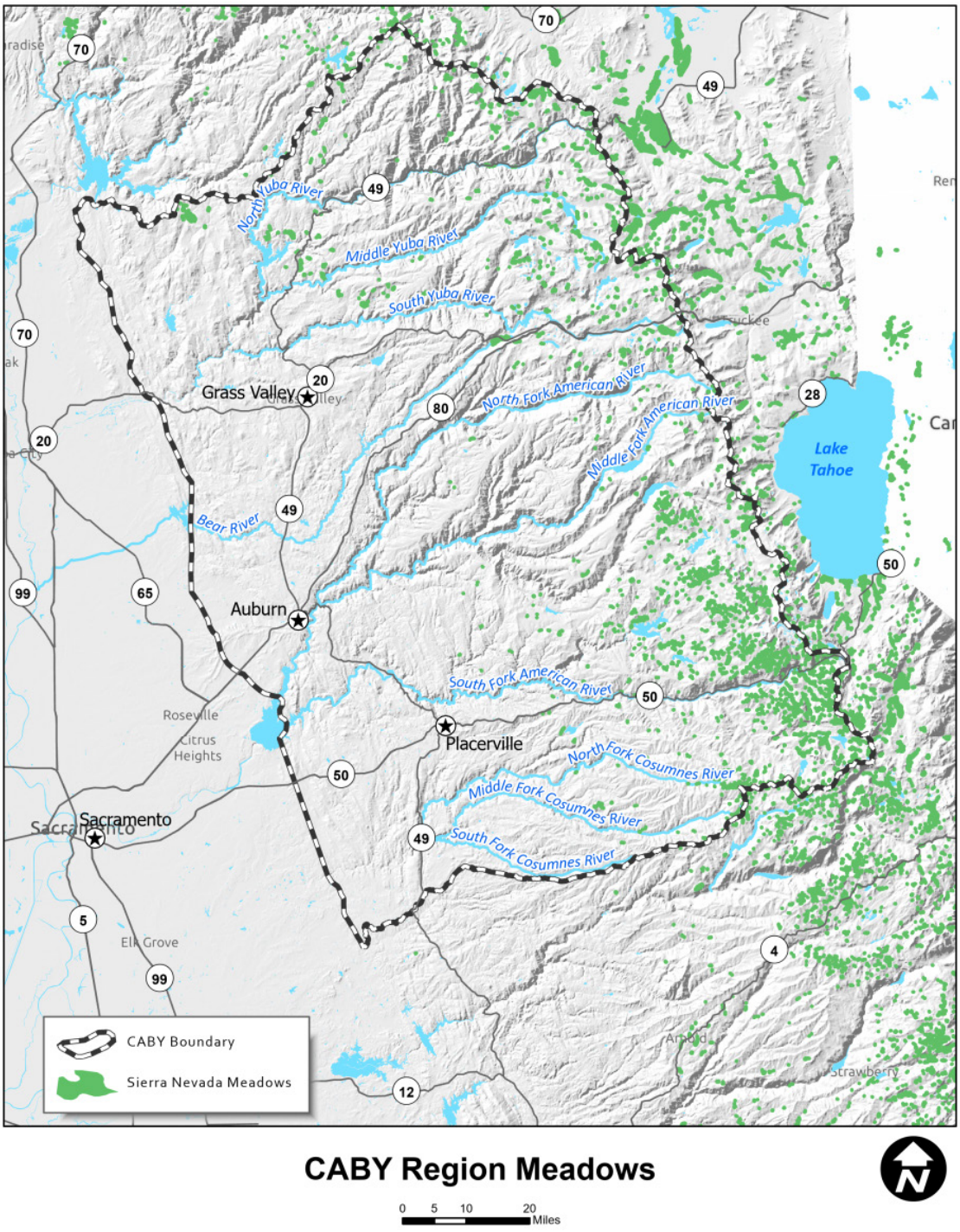
Many of the stakeholders in the WPC Work Group (WG) have participated extensively in PCWA and Nevada Irrigation District permitting and FERC processes, in some cases using perspectives and information developed in the committee to inform the FERC process, and in some cases using FERC work to inform WPC work. The primary outcomes of the WPC WG process are (1) the recommendation that a baseline assessment be prepared using information developed during the FERC process as well as location-specific data collection and evaluation, and (2) the desire to develop an integrated suite of projects based on defensible science that would materially increase the habitat values and therefore the fish populations in the region. It is the hope of CABY stakeholders that these activities will reprioritize WPC in federal agencies' restoration concerns as a viable alternative or option to introducing fish above the dams. Participants are actively lobbying that the WPC area be a design option inside the larger picture of fish restoration negotiations throughout the larger region.

- *Mountain Meadows and American Rivers' Research*

Sierra Nevada meadows are iconic California features that are highly valued for their plant and wildlife diversity, forage for livestock, water conservation, cultural heritage, and recreational uses. Some describe montane meadows as keystone to mountain ecosystems and watersheds. Formed by glacial processes, these areas occur where sediment and water converge from the surrounding drainage area, making them places of high moisture availability in what can be an otherwise water-limited landscape.
While meadows cover only a small fraction of the overall land area in the CABY region, as shown in Figure 5-4, their condition is critical to that of the broader region and to the economic vitality of those who rely upon them for livestock forage. The natural productivity of meadows prompted settlers and other groups to put them to use, sometimes intensively. Over time, many of these meadows have become degraded, either historically or more recently, impacting humans and the wildlife that depend on them. As knowledge grows of the natural and economic benefits that well-managed Sierra meadows can provide, there has been a surge of interest among ranchers, conservation groups, and others in the CABY region to invest in the revitalization of these dynamic natural systems.

Historical Impacts on Sierra Meadows: Mountain meadows have been impacted by human activity for centuries. Historically, impacts on mountain meadows include mining, road building associated with timber extraction, livestock grazing, fire suppression, and water diversions. Land uses that have affected the health and status of mountain meadows began with domestic livestock grazing by the Spaniards in the 17th century. The discovery of gold in the mid-19th century increased the exploitation of mountain meadow resources in the CABY region to support mining activities. In the 20th century, as the state's population grew, the need for agricultural and municipal water in California's Central Valley and coastal areas drove the construction of elaborate and extensive water transport and delivery systems and hydroelectric power facilities throughout the water-rich western slope of the Sierra Nevada. Many of these diversions and irrigation ditches were developed to support historic mining and transitioned to water-delivery use. Diversion and irrigation ditches formed a vast network that altered local and regional stream hydrology. Waves of timber harvesting and associated road construction further intensified erosion and sediment delivery in rivers and meadow streams. While brought to the region by the global travel of humans, invasive non-native plant and animal species proliferated in the wake of road construction and other soil disturbances. Changes in fire frequency, cycles of wetter and drier weather conditions, and reduced water-holding capacity within meadows due to downcutting of streams, have facilitated conifer encroachment in some mountain meadows.

Figure 5-4 – CABY Region Meadows



The Benefits of Healthy Mountain Meadows: Many environmental and habitat values are attributed to mountain meadows. Several threatened, endangered, and rare plants are found only in Sierra wet meadows; and vulnerable, threatened, and endangered animal species rely upon mountain meadows for all or part of their habitat needs. Healthy mountain meadows store water and help to provide clean water. When streams overtop their banks in meadow ecosystems, the water flows across adjacent areas. The flow of water is slowed by the vegetation, allowing it to percolate into the ground. The natural capacity of a meadow to absorb floodwaters and recharge water held in subsurface soil and rocks (groundwater) allows for storing and releasing of groundwater over a long period of time. In this way, meadows help lower in-stream water temperatures and may increase dry-season flows downstream. This cool, late-summer water supply can be critical for many species of native fish and other aquatic life. Healthy meadows also help control erosion of soil and resulting sedimentation of streams. Excessive sedimentation within streams cause problems for aquatic life, reduces the quality of drinking water, and increases the costs of water treatment. Healthy mountain meadows act as natural filters, helping to reduce erosive action of floodwaters and the amount of sediment transported downstream, thus protecting water quality.

Mountain meadows also include important cultural sites. They have been an essential part of Native American cultures for millennia. Plants unique to these meadows provided abundant materials to indigenous cultures for medicine, food, and basket weaving. Significant prehistoric archaeological sites are located in mountain meadows, indicating their importance to the native peoples of the Sierra.

Mountain meadows continue to be important sites for livestock grazing. The Sierra Nevada currently supports several hundred square miles of public and private meadows used as rangeland. Nearly half of these meadows are privately owned and many have been stewarded by ranching families for generations. Healthy mountain meadows, both privately and publicly owned, offer reliable forage for local ranches and support healthy ecosystems. Healthy mountain meadows provide increased forage compared to degraded systems. In addition, privately owned meadows provide green space (compared to developed space) that many enjoy.

Contemporary Threats: Current and projected population growth, loss of green space to development, and climate change are some of the biggest threats to the ecosystem services provided by mountain meadows. These areas currently experience increased recreational visits. Some meadows continue to be intensively grazed by livestock. Privately owned ranches continue to be sold to developers. Climate change has altered the timing and amount of water that supports these ecosystems. Impacts from some historic disturbances continue to degrade the ecosystems where they occurred and will not heal without restoration efforts.

Over the last 10 years, there have been a series of meadow restoration demonstration projects in the Sierra, resulting in initial, quantifiable results that indicate that large-scale meadow restoration in the Sierra will likely provide multiple benefits, including water supply, water quality, and habitat.

5.1.8 Fisheries

The major rivers and streams in the region once supported native fish (splittail [*Pogonichthys macrolepidotus]*, chinook salmon, coho salmon [*Oncorhynchus kisutch*], steelhead trout, Pacific lamprey [*Lampetra tridentate]*, white sturgeon [*Acipenser transmontanus*]) and currently support a recreational fishery (steelhead trout, brown trout [*Salmo trutta*], mackinaw trout [*Salvelinus namaycush*], and red bass

[*Lutjanus bohar*]). Anadromous fish are nearly extinct from Sierra rivers due to dams, impoundments, and degraded stream conditions.[31]

The river systems, wetlands, lakes, reservoirs, ponds, and small alpine streams in the planning area provide a variety of aquatic habitats that support a varied fishery. Native and non-native species are present in most waterways of the CABY region. Historically, the main streams in the region supported runs of wild chinook salmon and steelhead trout, which had access to many miles of prime spawning habitat in the upper watersheds. In the CABY region, the last remaining runs of these anadromous fish can be found on the Lower Yuba River (below Englebright Dam) and the Cosumnes River, which supports a population of fall-run chinook salmon.[32] In the 1990s, chinook salmon and steelhead trout in the Sacramento River and its tributaries were listed under the federal Endangered Species Act. Winter-run chinook salmon is listed as endangered and spring-run chinook salmon and steelhead trout are listed as threatened.

Dams and impoundments, which block fish access to streams and alter stream flow patterns and temperatures, together with degraded conditions above dams, have led to a huge loss in the historic habitat of anadromous fish.[33] For example, on the North Fork of the Yuba River, chinook salmon and steelhead trout used to access waterways as far east as Sierra City. Englebright Dam, very close to CABY's western boundary near the valley floor, halted that migration in 1941, cutting off many dozens of miles of habitat and resources to this now-endangered species.[34] However, the reservoirs also have been shown to provide more consistently cool temperatures throughout the season, to the benefit of many cold-water species.[35] Also, some studies show reservoirs as having good habitat for some types of fish, including some native fish.[36]

Other native fish species found in the watersheds include:

- California roach (*Lavinia symmetricus*)
- Hardhead (*Mylopharodon conocephalus*)
- Pacific lamprey
- Sacramento pikeminnow (*Ptychocheilus grandis*)
- Sacramento sucker (*Catostomus occidentalis*)
- Splittail, listed as federal threatened
- White sturgeon

Additionally, native fish are being out-competed by non-natives, such as red eye bass (*Micropterus coosae*), Grenn sunfish (*Lepomis cyanellus*), and brown trout. Non-native fish species found in the watersheds include:

- Green sunfish
- Brown trout
- Smallmouth bass *(Micropterus dolomieu)*
- Brown bullhead *(Ameiurus nebulosus)*

[31] SNEP 1996

[32] Yoshiyama, et al. 2001

[33] Sierra Nevada Ecosystem Project 1996

[34] op.cit Yoshiyama, et al.

[35] The PCWA FERC relicensing work included an examination of temperature fluctuations on the Middle Fork of the American River, including the Rubicon. This information may be viewed in the maps section of PCWA 2010b.

[36] PCWA 2011b

- Kokanee salmon *(Oncorhynchus nerka)*
- Carp *(Cyprinus carpio)*
- Red eye bass

Another consideration for healthy fisheries is the system bioenergetics, or the circulation of energy in the system. This can be measured, in part, by the availability of food for fish, of which macro-invertebrates play a large role. The PCWA relicensing process generated data on macroinvertebrate drift, and found that a consistent pattern in the drift density was not present in the data, but that generally the study region (North and Middle Forks of the American River) showed less than 20% drift density compared to highly productive trout streams. Predictably, along with the lower density, the size trend of the macroinvertebrates was generally small, with few larger than five millimeters. These results are similar to those found in other studies. Increasing food availability (by 10% and 20%) increased fish growth at all study sites.[37]

The fisheries of the CABY watersheds are managed by the California Department of Fish and Wildlife. Particular reservoirs and streams are stocked with game fish for recreational purposes. Many of the reservoirs in the region provide excellent fishing opportunities.[38]

5.1.9 Likely Climate Change Impacts

Climate models project that this region will warm by 2°F to 4°F in the winter and 4°F to 8°F in the summer by the end of the century.[39] Precipitation is less predictable, especially within the region's microclimates, but the increase in temperature is projected to bring about a higher level of evapotranspiration, and thus less available moisture overall, even in areas that experience increased precipitation.

Across the Sierra, snowmelt occurs three to six weeks earlier than it did 60 years ago. With rising temperatures, more precipitation now falls as rain than snow. This has serious implications for a region where snowpack has historically served as a reservoir, a reliable slow-melting source of water for the rest of California. As snow melts sooner and faster and combines with precipitation increasingly falling as rain rather snow, uncertainty in water storage and release will confront water managers and hydropower producers. Flooding impacts increase with storm intensity and higher winter precipitation events, while summer streamflows are expected to diminish over the season, compromising domestic and environmental water supply and quality, and engendering tough choices for water managers and policy makers.

Projected climate impacts for this region include:

- Reduced streamflow and water supply in the long term that will generate hard choices for water managers, and potentially increased conflicts between human and environmental uses;
- Reduced water quality from the direct effects of rising temperatures to the indirect effects of eutrophication, increased algal growth, release of mercury methylation, increased sedimentation from increased winter runoff, and decreased vegetative cover due to fire;

[37] PCWA 2011

[38] CDF&W website

[39] Safford, H.D., M. North and M.D. Meyer. *Chapter 3: Climate Change and the Relevance of Historical Forest Conditions*, *Managing Sierra Nevada Forests.* Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Stations. Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf

- Increased wildfire potential and, in particular, catastrophic wildfire with consequences for forest function, ecosystem health, and social and economic costs;
- Upslope movement of vegetative communities as temperatures rise;
- Potential fragmentation and/or degradation of habitat for stream-dependent species and elevationally dependent species in particular – species that are confined in their ability to move or re-adapt;
- Greater colonization and numbers of both terrestrial and aquatic invasive species;
- Increased flooding with greater storm intensity and higher winter precipitation;
- Inability of water infrastructure designed for a historic flow regime to accommodate increased winter peak flows;
- Reduced viability for heat-sensitive crops – berries, mandarin oranges, grapes, and apples – and a potential reduction in agro-tourism, although alternative crops may begin to be viable here; and
- Effects on the region's recreation industry from lower summer flows, both rafting and reservoir-based use.

CABY water agencies are among the savviest in the state, having incorporated climate modeling into their respective management projections for some years now, and responding to those projections with adaptive conservation and operational strategies. Federal, state, and local agencies, and Non-Governmental Organizations have responded as well, with innovative responses to create climate resiliency on the ground—forest management strategies that account for the upslope movement of species, restoration of mountain meadows to enhance the slow releases from the region's watershed, and use of alternative energy production. Table 11-2 displays the region's vulnerabilities and suggested adaptive strategies, developed by CABY's climate Technical Advisory Committee and updated during the CABY IRWM Plan Update 2021 process. CABY recognizes that the consequences of climate change will likely be felt disproportionately by DAC communities and that it is therefore necessary to involve these communities in decision-making related to climate change.

5.2 CABY Region Boundaries, Overlapping IRWM Regions, and Land Uses

This section describes the CABY internal IRWM boundaries and basic land uses of the region. The municipalities, service areas of individual water, wastewater, flood control districts, and land use agencies are described further in Chapter 8, Water and Land Use.

5.2.1 Rationale for the CABY Regional and Internal Boundaries

The CABY region consists of 2,786,285 acres and encompasses all or part of nine counties. Three counties make up the largest portion (77%) of the CABY planning area: El Dorado (36%), Placer (23%), and Nevada (18%). Six remaining counties include smaller portions of the CABY region: Sierra, Yuba, Plumas, Amador, Butte, and Alpine. The CABY upper watershed planning region was defined by the resource issues unique to the Sierra Nevada; the water supply infrastructure connectivity between watersheds on the western slope; and the willingness of water suppliers, power producers, watershed groups, and Non-Governmental Organizations to work together to develop a regional water management plan.

From a watershed perspective, CABY's northern, eastern, and southern boundaries are coterminous with the watershed boundaries of the Cosumnes, American, and Yuba Rivers. These rivers are included in the planning area from their source in the high Sierra to the point at which they exit the foothill region and

enter the flat valley region. The western boundary follows the 400-foot elevation line, creating a purposeful delineation between upper and lower watersheds.
The CABY IRWMP region borders were based on the similarities in the physiography of the watersheds, socioeconomics, hydrology, geology, hydrogeology, water storage and delivery infrastructure, and land use. The area also has similar or closely related policy issues and management entities. In addition, water purveyors within the CABY region are tied together by water delivery infrastructure. Through pipes, canals, reservoirs, lakes, and pumps, water from Nevada Irrigation District (NID) in the northernmost watershed of the planning area can be delivered to EID in the south. This makes CABY a man-made watershed in and of itself. Operational policies and decisions by each water agency, along with stakeholder interests, affect the entire CABY region.
Three of CABY's water agencies (EID, NID, and PCWA) draw on at least two of the rivers each for supply, sharing that surface water supply with the neighboring water agency. The fourth CABY water management agency, El Dorado County Water Agency, does not draw water, but manages the water resources of El Dorado County. Extensive infrastructure exists to divert water between watersheds within the CABY region.

The rationale behind the establishment of boundaries for the CABY region is directly related to the physical rather than political attributes of the area. It is important to note that the CABY region is discrete for specific reasons: the upper watershed environments and resource management issues are distinct from those in the lower reaches; there are a number of sensitive, threatened, and endangered species that are unique to the area; upper elevation groundwater systems differ vastly from lower elevation and valley floor systems; CABY's stakeholder community is quite different from that of the valley floor's; and issues of source-area water resources are unique to CABY given our region's inclusion of the headwaters of the four rivers.

5.2.2 Overlap with Other IRWM Regions

As discussed in Chapter 3, Coordination, the CABY IRWM region contains minor overlap with three adjacent IRWM regions: the Mokelumne-Amador-Calaveras IRWM to the south, the American River Basin IRWM to the west, and the Yuba Region IRWM to the northwest. These are strategic overlaps, and an approach for coordination has been negotiated with the overlapping regions: a two-part strategy including the development of a Memorandum of Understanding for ongoing collaboration in 2010, and a project development process to be applied in each overlapping region. If either IRWM region proposes a project in an area of overlap, that region presents the project details to the other IRWM region.

CABY does not receive water supplied from the Sacramento-San Joaquin Delta. The CABY region supplies and provides flood control benefits to the Sacramento-San Joaquin Delta.

5.2.3 Land Uses

Main population centers in the CABY region are Alta Sierra, Auburn, Nevada City, Colfax, Foresthill, Grass Valley, Loomis, Meadow Vista, North Auburn, Placerville, Plymouth, Pollock Pines, Shingle Springs, El Dorado Hills, and Cameron Park. These population centers are confined primarily to the western part of the project area in the lower elevations (see Figures 5-1 and 5-2).

Historically, the economies of the mountain and foothill communities of the Sierra Nevada have been tied to the land. Over the last few decades, the CABY region has experienced a shift in land use away from

traditional rural land uses, such as timber harvesting, livestock grazing, and irrigated agriculture, and toward rural residential developments. However, vineyard acreage has increased in El Dorado County.

This trend has largely been driven by an influx of new residents into this area in the early 1970s.[40] CABY's population is expected to grow at a rapid rate. California Department of Finance projects a population increase in the Mountain Counties, in which all CABY counties are located, of 85% between 2000 and 2050. This would be an increase of 373,732 people in the CABY region alone between 2000 and 2050.[41]

Private lands constitute 56% of the CABY region. Private ownership in the western part of the CABY region consists mostly of residential and/or agricultural holdings, while timber companies own a large percentage of the private lands in the upper watersheds and managed them for commercial timber production. About 50% of the Yuba River watershed is owned by private individuals or corporations. In the Bear River watershed, 87% is privately owned, making most stretches of the Bear River inaccessible to the public. Private entities control approximately 60% of the American River watershed and about 70% of the Cosumnes River watershed.

About 43% of the region is owned and managed by federal agencies (primarily Tahoe and El Dorado National Forests, and to a lesser extent, Plumas National Forest, the Bureau of Land Management, Bureau of Reclamation, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Bureau of Indian Affairs. Most of the higher-elevation lands are under management by the Forest Service (Table 5-3). Public lands are often in a one-square-mile checkerboard ownership, a remnant of historic railroad development. Present-day impacts of such patterns present challenges to land managers, including timber producers, wildlife managers, and the national forests.

Table 5-3
Ownership by Government Class and Name in the CABY Region

Owner	Name	Acres	Percent of Region
Federal	Army Corps of Engineers	1,596	0.1
Federal	Bureau of Indian Affairs	148	<0.01
Federal	Bureau of Land Management	66,446	2.4
Federal	Bureau of Reclamation	24,538	0.9
Federal	Forest Service	1,117,281	40.1
Federal	U.S. Air Force	71	<0.01
Private	Various	1,550,257	55.6
State	Department of Fish and Wildlife	21,238	0.8
State	Parks and Recreation	4,708	0.2
Total		**2,786,283**	**100.0**

A variety of land uses occur in the CABY region. Most are associated with natural resource uses (see Table 5-4 that follows). Agricultural land use is generally confined to lower elevations.

[40] Wacker et al. 2002
[41] DWR 2009

Table 5-4
Land Cover of the CABY Region

Land Cover	Acres[1]	Percent of Region
Agricultural Land	54,798	2
Bare Exposed Rock	48,224	2
Black Oak Woodland	170,975	6
Blue Oak Woodland	39,777	1
Canyon Live Oak Forest	49,590	2
Chamise Chaparral	30,229	1
Foothill Pine-Oak Woodland	269,648	10
Huckleberry Oak Chaparral	14,818	1
Interior Live Oak Forest	70,783	3
Interior Live Oak Woodland	44,257	2
Jeffrey Pine-Fir Forest	102,602	4
Lodgepole Pine Forest	39,402	1
Mid-elevation Conifer Plantation	32,494	1
Mixed Montane Chaparral	107,142	4
Non-Native Grassland	71,441	3
Permanently Flooded Lacustrine Habitat	25,295	1
Red Fir (Lodgepole Pine)-Western White Pine Forest	50,841	2
Red Fir Forest	173,229	6
Sierran Mixed Coniferous Forest	740,867	27
Sierran White Fir Forest	29,707	1
Urban or Built-up Land	26,487	1
Valley Oak Woodland	13,931	1
Westside Ponderosa Pine Forest	450,005	17

Notes:
[1] Values are according to the 2012 IRWM Plan Update; new information was not available at this time. LCMMP mapping used to develop regional estimates of land cover.

The amount of land devoted to agriculture (including grazing land) and forestry has decreased significantly from 1957 to 2001, giving way to residential land uses. For example, in Nevada County agricultural land use decreased from 33% to 10% between 1957 and 2001, while private land under rural residential and recreational use had increased from 30% to 70% between this same time frame. Mining and other commercial uses dropped to 2%, and timber land uses decreased from 31% to 18% between 1957 and 2001.[42] Agricultural land is used primarily for vineyards, Christmas trees, citrus trees, berries, deciduous orchards, and pasture in El Dorado County; and rice, walnuts, cattle and calves, nursery, and pasture and range in Placer County.[43]

[42] Walker et al. 2003
[43] Placer County RCD

The effects of urbanization and suburbanization are increasing in the CABY region, as the population growth of the region is outpacing that of the state. Presently, urban areas only constitute 1.4% of the land cover in the CABY region, but this is expected to change as the region accommodates a large increase in population per projections from the Department of Finance, Department of Water Resources, or both. Growth in the CABY region will affect the extent of open spaces and cause significant impacts on natural resources.[44] At the same time, it brings with it a larger tax base to pay for essential community services that are otherwise limited in rural areas. With the elimination of traditional land uses, such as timber harvesting, farming, and ranching, local rural economies are more dependent on development- and tourism-related revenues.

5.3 CABY Region – The Social and Cultural Environment

5.3.1 Social and Cultural Attributes

The scenic beauty and abundant recreational opportunities in the CABY region attract nationwide tourism. Popular activities include mountain biking, boating, swimming, fishing, and hiking in the summer, and downhill skiing, snowmobiling, and cross-country skiing in the winter. The South Fork American River is one of the most popular whitewater runs for rafting and kayaking in California. The Cosumnes River is enjoyed for its kayaking, camping, birding, hiking, mountain biking, and rock climbing opportunities. Recreational opportunities are more limited in watersheds where the landownership is primarily private, such as the Bear River watershed.

The cultural resources of the Sierra Nevada are some of the main assets that attract people to the area, and have contributed to our knowledge and understanding of California prehistory. The value of these assets is immeasurable, but more importantly, these resources cannot be replaced once they are destroyed. Archaeological resources, such as prehistoric and historic artifacts, buildings, and other cultural objects, are distinctive and unique features of this landscape. Additional efforts to strengthen management and further incorporate the region's cultural resources is explored in Chapter 10, Resource Management Strategies.

5.3.2 Economic Conditions and Trends

The growing metropolitan population in the Sacramento area is spilling into the CABY region, fueling demand for water and other natural resources. An increase in the population over the past decade can be attributed to an increase in professional services, industries, and residential developments. Population centers are mostly in the foothills of the Sierra Nevada and along the major Sierra highways (Highways 49, 50, and 80).

Current population figures for the CABY planning area are estimated at 723,000. The population has increased substantially in the area, with a 41% increase in Placer County from 2000 to 2010 — the fastest growing county in the Sacramento Metropolitan Region and exceeding average growth rates for the Bay Area and for California as a whole. Placer County has grown approximately 12.8% between 2010 and 2018.[45] El Dorado County also experienced an increase, with a 5.3% change in population from 2010 to

[44] Sierra Nevada Ecosystem Project 1996

[45] U.S. Census Bureau Population Estimates Program (PEP) 2018

2018.[46] Nevada County, which has a generally smaller population and economy, grew just 1% between 2010 and 2018. Yuba County experienced an 8.2% population increase between 2010 and 2018.
The CABY region is a contributor to the economy of the Sacramento Metropolitan Region. Traditionally, jobs in the CABY region were focused in areas of agriculture, timber, and mining. Over the past few decades the economy has been shifting to services, manufacturing, and technological industries. Professional and business services, financial activities, construction, trade, transportation, and utilities make up the majority of the industry sector. Natural resources and extractive industries have decreased in both economic makeup and percent of job contributions in the past 10 years, and are now a small part of the industry sector.

The DACI report found that rural communities in the CABY region have a complex relationship with the urban areas proximate to them. Many individual communities and the CABY IRWM as a whole benefit from proximity to urban centers. At the same time distance from these urban centers often creates rural, sparsely populated communities with few amenities to attract wealthy residents, businesses, or political attention which result in lower community capacity and SES. Poorer communities can be obscured at the Census tract scale if they are surrounded by wealthier areas and it is important to consider scale when identifying DACs.

The business community in Placer County, for example, is generally growing at a greater pace than the rest of California. The county specializes in educational and health services and trade, transportation, and utilities. Before the housing bust, Placer County was an employment leader in the construction sector; it is likely that this will rebound with the economy. Nevada County reported that 46 of the businesses within the county in 2008 offered some type of service to their customers, making the services sector the most prominent industry in Nevada County. Construction and retail came second and third, with 16% and 14% of the business in the county, respectively (mirroring the state).[47]

Employment in the CABY region tracks generally with the state as a whole. While Placer County increased its labor force 49% between 2000 and 2009 (higher than the Sacramento Region, Bay Area, or California), its unemployment rate in 2017 was 5.6%. Information from the 2009-2010 Economic Profile[48] indicates a slight uptick in Nevada County unemployment numbers in 2008, similar to California as a whole, and the last year that unemployment information is available for the county.

Tourism is an extremely important contributor to economic activity in the Sierra Nevada; this is especially true in the CABY region. Nevada County reports that the total annual travel expenditures within the county rose by 28% between 2000 and 2007, slightly higher than the percent gain between those same years by California as a whole. This translates to approximately 3,400 travel-generated jobs in Nevada County in 2007, or 5.7% of the total workforce.[49] El Dorado County estimates recreation and tourism income in 2008 was over $604 million, and the leisure and tourism industry has been the highest employer in the county since 1995. The agricultural output in El Dorado County included over $16 million in fruit and nut production, including nearly $6 million in wine grape production in 2010.[50] Additionally, agricultural tourism has grown in the last decade. Destinations such as Apple Hill in El Dorado County bring

[46] U.S. Census PEP 2018
[47] CED 2010
[48] CED 2010
[49] CED 2010
[50] County of El Dorado, 2011

in about $20 million per year and generate approximately 200 jobs for the region,[51] and agricultural activities in Placer County contributed over $65 million in gross production in 2010.[52] These activities also bring in tax revenues to city and county general funds, paying for the important services enjoyed by residents of the region, as well as providing employment for a percentage of the workforce. The DACI report noted that communities possessing a large number of vacation homeowners who are only present seasonally were found to have high socioeconomic status (SES) but in many cases low community capacity as vacation homeowners were not present to be active in the communities.

5.3.3 Disadvantaged Communities (DACs)

5.3.3.1 Definition of DAC Based on DWR Guidelines

In the IRWMP process, a DAC is defined as a community with an annual median household income (MHI) that is less than 80% of the statewide annual MHI. As of 2016, DWR has determined that 28 communities within the CABY region are identified as DACs or SDACs (MHI is at or below $51,026 or $38,270, respectively). The statewide annual MHI in California in 2016 was $63,783.[53] The communities in the CABY region that qualify as DACs are listed in Table 5-5 and in Table 2-5.

Table 5-5
Communities in the CABY Region Designated as Disadvantaged[1]

County	Census Places	MHI ($)[2]
Alpine	Kirkwood	—
Amador	River Pines	49,569
	Plymouth	41,750
El Dorado	Georgetown	42,946
	Placerville	42,793
	Grizzly Flats	44,390
Nevada	Soda Springs	—
	Graniteville	—
	Kingvale	—
	Washington	—
	North San Juan	27,500
	Grass Valley	35,524
	Rough and Ready	40,821
	Nevada City	43,770
	Penn Valley	40,668
Placer	Newcastle	40,313
	Dutch Flat	46,750
	Colfax	44,004
	Foresthill	—

[51] Sacramento Regional Research Institute, 2008

[52] Placer County 2010 Crop Report, available here: http://www.placer.ca.gov/Departments/Agriculture/AgrCropRpts.aspx

[53] American Fact Finder: http://factfinder2.census.gov/; accessed 6/2019

Table 5-5
Communities in the CABY Region Designated as Disadvantaged[1]

County	Census Places	MHI ($)[2]
Plumas	Little Grass Valley	—
	La Porte	—
Sierra	Downieville	43,125
	Alleghany	—
	Goodyears Bar	—
	Pike	—
Yuba	Dobbins	31,397
	Camptonville	42,500
	Smartsville	25,227

Notes:
1 DWR DAC Mapping Tool 2019.
2 Places without an MHI listed have no data available at this time.

Water management decision making sometimes ignores the historic, economic, environmental, and social burdens of disadvantaged communities. These communities reside amid the economically viable water infrastructure, but rarely directly benefit from the economics of water resource supply and demand. Therefore, as part of this IRWM planning process, these DACs will be assisted in identifying their water and natural resource needs. A socioeconomic assessment of the CABY region combined with consultative, community-based inquiries of community capacity undertaken by the Sierra Institute during its DACI process provides a metric to understand how communities in the CABY region are able to respond to internal and external stressors related to water and wastewater needs. The results of this inquiry will be useful to CABY for planning purposes as well as setting priorities and selecting projects for funding.

Virtually all of the MCFA is disadvantaged in some way – by poverty, a large number of female-headed households (that are on average poorer) with children receiving public assistance, limited capacity, vulnerability to natural disasters, or distance from resources. The community workshops conducted as part of the DACI process asked about specific water and wastewater issues. Here is a summary of the major themes which emerged from these consultations.

Climate Change Related Issues
Vulnerability in responding to climate change.
Concern about storage and conveyance in the face of climate change.
Drought and timber die-off impacts on drinking water.
Additional drinking water supplies. Need for deeper wells.
Climate change impacts on groundwater wells.
Climate change impacts on the snowpack.

Fire Related Issues
Drinking water and fire suppression intermingled.
Wildfire and enough water storage to suppress large wildfires.
Adequate water pressure to suppress wildfire.
Need better mapping for fire response.
Overgrown roads and limited evacuation routes.

Infrastructure Issues
Aging infrastructure and water leaks; impacts on conservation goals.
Old treatment systems in need of upgrades.
Stormwater collection.
Drainage maintenance issues.

Mining Related Issues
Legacy mining toxins.
Small water providers are concerned with the cost to treat contaminants.

Human Impacts on Water Quality
Mobile home parks and wastewater transport into rivers.
Increase in homeless encampments and the impact along rivers.
Impact on water quality and fishery from ORV use and non-maintained roads.
Water supply and fish habitat.
Illegal pot grows contributing to degradation of water quality.

Independent Wells and Septic
Wastewater is mostly septic tanks with many residents on wells.
Need for sampling protocols for water quality (technical assistance need).

Enabling disadvantaged communities to participate as stakeholders in public forums to influence decisions that will economically benefit them is an objective of CABY. Such benefits may focus on recreation revenue generating plans, or water development projects that can improve local employment and quality of life. This commitment is reflected by one regional non-profit's decision to fund a community organizer position to work with disadvantaged communities to identify needs and elevate their concerns among decision-makers.

5.3.4 Regional Cultural History and Native American Tribes

The CABY region's landscape and water sources have been shaped by a wide variety of human activities over thousands of years. Native Americans were attracted to water sources such as rivers and lakes in the CABY region for the purposes of sustenance and places of spiritual gathering. These watersheds were used by Native American to hunt and gather; burning in the valleys and meadows was also a common practice to clear hunting grounds. Native American Tribes occupying the lower slopes of the western Sierra Nevada at the time of contact with European-based cultures were the Hill Nisenan or Southern Maidu and the Sierra Miwok. These Tribes had many social gathering sites throughout the region – often close to rivers and streams. Ceremonies and rituals related to the seasons and harvesting of food took place at these social gathering sites where the Native American Tribes made customized basketry, feather robes, and other elaborate ceremonial costumes.[54] Many were killed or displaced by contact with the Spanish in the 1700's (mostly from disease) and by later Euro-American settlement. Today, identified Native American Tribes and/or residents in the CABY region include the Washoe Tribe of Nevada and California, the Shingle Springs Band of Miwok, the Tsi-Akim Maidu, United Auburn Indian Community, the Foothills Nisenan Nevada City Rancheria, and the Colfax-Todds Valley Consolidated Tribe. The Tribal entities who were contacted during the CABY outreach process are discussed in Chapter 2, Section 2.1.3.

[54] GDRCD 2003

Though many of the Native American artifacts were destroyed by placer mining, their important archeological resources remain in the region. Evidence of prehistoric uses in the area, such as camps, along with more recent activities, such as pioneer trails, bridges, mining features, and logging camps, can be found throughout the region and testify to the historic uses of the area and the need to protect these important cultural sites. Native American Tribes continue to use the region for traditional uses, including basket weaving and ceremonial harvests by the Tsi-Akim; however, the availability of materials is contingent on the health of the watersheds in which they grow.

The discovery of gold at Sutter's Mill along the American River in 1848 led to the California Gold Rush of 1849 and played an important part in U.S. history. There are over 1,500 gold rush era historic and Native American cultural sites in the American River canyons, many of which are eligible for inclusion in the National Historic Register.[55]

The cultural resources of the Sierra Nevada are some of the main assets that attract people to the area. In addition, the cultural resources found in the watershed have contributed to our knowledge and understanding of California prehistory. The value of these assets is immeasurable, but more importantly, these resources cannot be replaced once they are destroyed. Archaeological resources, such as prehistoric and historic artifacts, buildings and other cultural objects, are distinctive and unique features of this landscape. These resources add to the spirit and ambiance of the small communities located in the watershed.

[55] Friends of the River 2006

Chapter 6
Water Quality

High water quality is vital to natural processes and human activities. Water quality is considered an essential issue to Cosumnes, American, Bear, and Yuba (CABY) Integrated Regional Water Management stakeholders, who share a common concern for its protection within the region. The CABY region generally experiences high water quality that typically meets and exceeds state and federal regulatory standards, with a few critical exceptions. Sediment, mercury, water temperature, and aquatic invasive species are issues that must be addressed now and into the future to ensure continued high water quality in the CABY region. Best management practices and activities to maintain high water quality and restore areas with less than ideal water quality vary by issue and by site.

This chapter describes problem areas and includes cases that result from historic activities that caused degradation, especially in the foothill elevations. Specific strategies for addressing water quality issues are discussed in Chapter 9, Issues and Objectives, and Chapter 10, Resource Management Strategies.

6.1 Regulatory Overview for Water Quality

The Integrated Regional Water Management Plan (IRWMP) is guided by the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins, as well as various watershed management initiatives and water quality goals and objectives set forth by CABY IRWMP stakeholders and adopted by at least one agency (local, federal, or state) with statutory authority in the CABY region. The relevant plans address water quality protection and enhancement as well as wetland, ecosystem, environmental, and habitat restoration and improvement, recreation, and public access. Summaries of each plan and how they relate to this document are included in this section.

6.1.1 Water Quality Control Plan for the Sacramento River and San Joaquin River Basins

The State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs) are responsible for protecting California's water resources. The RWQCBs are located within nine regions of California based on major watersheds. The Sacramento and San Joaquin River Basin Plan addresses water quality within the four CABY watersheds. The preparation and adoption of regional basin plans is required by the California Water Code (Section 13240) and the federal Clean Water Act. Basin plans are adopted and amended by RWQCBs under a structured process involving public participation and state review. Basin plans are designed in accordance with the State Control Plan, adopted by the SWRCB, and include water quality criteria to protect designated beneficial uses of waterways.

6.1.1.1 Basin Plan Goals and Objectives Related to CABY IRWMP

The Basin Plan sets forth an implementation and monitoring plan to achieve water quality objectives and preserve the designated beneficial uses assigned to each water body and associated tributaries. Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters to protect against degradation of "domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (California Water Code Section 13050[f]). Water quality conditions are stated in terms of whether there is water of sufficient quality and quantity to protect or enhance those stated beneficial uses.

The identified beneficial uses as stated in the Basin Plan are as follows:

Beneficial Uses:

- Municipal and domestic supply
- Water contact recreation
- Preservation of biological habitats of special significance
- Agricultural supply
- Non-contact water recreation
- Industrial service supply
- Commercial and sport fishing
- Rare, threatened, or endangered species
- Industrial process supply
- Aquaculture
- Groundwater recharge
- Warm freshwater habitat
- Tribal and subsistence fishing
- Freshwater replenishment
- Cold freshwater habitat
- Navigation
- Estuarine habitat
- Hydropower generation
- Wildlife habitat

Water quality objectives included in the Basin Plan set criteria for meeting the IRWM Plan's goals for several water quality parameters. Parameters identified in the Basin Plan for both surface waters and groundwaters are listed below.

Inland Surface Waters:

- Bacteria
- Biostimulatory substances
- Chemical constituents
- Color
- Dissolved oxygen
- Floating material
- Oil and grease
- pH
- Pesticides
- Radioactivity
- Salinity
- Sediment
- Settleable material
- Suspended material
- Tastes and odors
- Temperature
- Toxicity and turbidity

Groundwater:

- Bacteria
- Chemical constituents
- Radioactivity
- Tastes and odors
- Toxicity

6.1.2 Watershed Management Initiative for the Sacramento Hydrologic Region (2003)

In 1996, the SWRCB and RWQCBs adopted the Watershed Management Initiative (WMI) to better address water quality issues on a watershed scale. The premise of the WMI is that water quality and ecosystem problems are best prioritized, addressed, and solved at the local watershed level rather than at the

individual discharger, water body, or state agency level. The WMI facilitates input and involvement of local stakeholders and provides an avenue to achieve water quality improvements and to develop unique and effective solutions based on the individual characteristics of each watershed. The WMI makes more efficient use of limited state resources and serves as a tool to establish partnerships with watershed stakeholders to achieve common water quality goals in a collaborative, integrated fashion.[1]

Agencies and organizations representing the Yuba and American Rivers are participating in the Bay Delta Water Quality Control Plan update. This is anticipated to be resolved in the near future.

The Central Valley Region Chapter WMI is split into sections based on major watersheds. The Sacramento Hydrologic Region section includes the American, Bear, and Yuba watersheds; the Cosumnes is included in the San Joaquin Hydrologic Region section. Many of the issues addressed in RWQCB's Central Valley Region Chapter 2003 WMI – Central Valley Reports are identical to the CABY region's water quality issues (see Chapter 9, Issues and Objectives). These common issues include metals, sedimentation, and temperature.

Many of the regionwide activities listed in Section II of the Central Valley Region WMI are currently unfunded, including the following:

- Expand the level of support in watersheds where staff is currently active and expand activities into additional subwatersheds;
- Expand work with watershed groups to develop grant ideas and proposals;
- Work with local planning agencies to bridge the gap between land use and water quality planning;
- Work closely with agencies involved in associated activities, such as salmon restoration and wetland enhancement;
- Coordinate monitoring efforts within a watershed and integrate regional board programs with those of other agencies and organizations; and
- Provide continuity between project development, implementation, and post-project monitoring of state or federally funded projects.

The CABY Stakeholder Group provides a forum consisting of diverse stakeholders to potentially address the unfunded WMI activities.

6.1.2.1 WMI for the San Joaquin Hydrologic Region

The WMI for the San Joaquin Hydrologic Region includes the Cosumnes River, but only to a minor degree. The State of the Watershed Report for the San Joaquin River Watershed only mentions the Cosumnes once in the chapter. However, many of the issues described above for the Sacramento River Region are relevant in the Cosumnes watershed.

6.1.3 Water Projects that Match Water Quality with Water Use

Many of the CABY region's water systems are designed to match water quality to the appropriate type of use. The California Water Plan Update 2013 describes the effort to match water quality to use:

[1] SWRCB 2013.

> Matching water quality to use is a management strategy that recognizes that not all water uses require the same water quality. One common measure of water quality is its suitability for an intended use; a water quality constituent often is only considered a contaminant when that constituent adversely affects the intended use of the water. High-quality water sources can be used for drinking and industrial purposes that benefit from higher quality water and lesser quality water can be adequate for some uses.

For example, in general it is inefficient to use expensive and highly valued treated water for irrigation purposes. Recycled water and untreated (raw) water are better options for irrigation and landscaping. The following presents an overview of various CABY Regional Water Management Group (RWMG) projects that are considered a good match for water quality with water use.

Matching Water Quality to Agricultural/Landscape Uses

Recycled Water Programs: A number of water purveyors in the CABY region are developing recycled water supplies that can be treated to Title 22 standards. The use of recycled water serves as a source of water that offsets the demand for potable water. For example, El Dorado Irrigation District uses recycled municipal water in the El Dorado Hills and Cameron Park areas for landscape purposes. This is considered a better match of water quality to the type of water usage.

Matching Water Quality to In-Stream and Ecosystem Use

Promoting In-Stream Uses: Ambient, in-stream water must be suitable to support a wide range of aquatic habitats and conditions. Water quality for in-stream uses must meet physical, chemical, and biological objectives specific to the habitat and in-stream needs. The seven integrated projects that make up the CABY Mercury Initiative provide a good example of CABY RWMG's efforts to improve water quality for in-stream and ecosystem use. The projects are designed to address the region's oldest and longest neglected water quality impacts: mercury and sediment drainage from abandoned mines. Mercury is a powerful neurotoxin that can cause decreased reproductive success. This has been documented in fish-eating birds, but the neurotoxic effects hold true for any vertebrate species, including humans.[2] Of particular concern are animals that have a diet made up primarily of fish, such as river otters and osprey. The CABY region was the scene of the most intensive mining and related mercury pollution in California.[3]

The seven projects in the CABY Mercury Initiative are designed to improve overall watershed function by:

1. Improving habitats with less contamination from suspended sediment and mercury;
2. Improving infiltration to the vadose zone[4] as opposed to surface runoff from surfaces devoid of soil from hydraulic mining practices; and
3. Reducing sediment sources that drain into and fill CABY region reservoirs and result in shallow, warm-water habitat where formerly a deeper, cooler habitat provided cold-water refuge.

Matching Water Quality to Drinking Water Use

Protect Public Health: To avoid the additional cost of treatment, and to provide multiple barriers of protection for public health, it is best that drinking water supplies start with the highest quality source

[2] C. Monohan, 2013

[3] California Department of Conservation 2003.

[4] The soil or vadoze zone is the unsaturated region of soil extending from the ground surface to an underlying aquifer or geologic formation.

water available. The CABY RWMG project entitled Canal Water Quality Monitoring and Evaluation Program is designed to keep people from throwing yard waste, household garbage, and carcasses into drainage canals that may be used for domestic consumption downstream.

6.2 Current and Future Water Quality Conditions

Surface water quality for human consumption is considered very high in the CABY region. Water quality concerns for ecosystems, however, include methyl mercury, temperature, and sediment, as well as other legacy mining contaminants at designated Clean Water Act Section 303(d) locations, as shown in Figure 6-1. These contaminants are not considered significant in the context of drinking water supplies or treatment.

The mid-elevation watersheds were compromised in certain areas by historic land use practices, beginning with mining more than 150 years ago.[5] Historic gold mining, such as hydraulic and/or placer mining, caused heavy metal contamination and in some areas completely altered stream geomorphology. Significant deposits of mining debris still persist in many stream reaches and behind debris control dams of the CABY region, especially within watersheds around the 2,000–5,000-foot elevation range: these sites contribute to degraded water quality.

Water quality within these middle- and lower-elevation watersheds has also been impacted by historic and ongoing practices, such as historical timber harvest in riparian areas that resulted in increased sediment delivery to streams, alteration of natural sediment regimes for restoring natural spawning habitat for anadromous species, and stormwater runoff causing degraded aquatic habitat and chemical and bacterial contamination of water bodies.[6] More recently, these same foothill regions are under pressure from development and land use conversion. Poor livestock grazing practices, recreation activities, and runoff from roads impact riparian areas in this region as well.

Poorly constructed roads in the CABY region sometimes contribute to stream sediment due to erosion. In some areas, off-highway vehicle use contributes sediment to streams that affect in-stream flows for aquatic species and impact riparian areas. Finally, natural events, such as powerful storms, can cause floods, slope failures, and excessive erosion, especially in areas with highly erosive soils on steep terrain that have lost vegetative cover—the risk of erosion and slope failure is increased by unrestored hydraulic mine sites, logging activities, and areas destroyed by catastrophic wildfires.

Catastrophic wildfire poses the largest threat to watershed health and water quality. The reduction or elimination of vegetation that results from wildfires increases the erosivity of soils and leads to accelerated rates of sedimentation in water bodies. It also leaves areas with steep terrain more vulnerable to landslides, mudflows, and other mass wasting events. In addition, high heat at ground level can bake organic matter, reducing permeability and increasing runoff, and further accelerating erosion and sedimentation rates. Wildfires have also been found to increase mercury, as well as nitrates, in forest water bodies; this could be attributed to sediment methylization of mercury bound to organic matter and in runoff.[7]

[5] West Placer County Conservation Strategy 2004

[6] Yuba River Monitoring Program 2000

[7] Kelly 2006.

Healthy forests are intrinsically linked to high-quality water. Healthy riparian corridors improve water quality by capturing sediment, slowing runoff rates, and providing shade. In addition, healthy forests can increase infiltration rates, improving both groundwater quantity and surface water quality.

Recent watershed assessment studies using national protocols (the Watershed Condition Framework) conducted by the Tahoe and Eldorado National Forests indicated water in the upper watersheds is of good quality overall. However, as described in Section 6.2.2, the region does experience challenges in specific problem locations and for designated beneficial uses for natural ecosystems.

6.2.1 CABY Region Drinking Water Quality

One of the primary uses of the CABY region watersheds is as a source of drinking water supply. The California Department of Public Health requires all surface water suppliers to conduct a watershed sanitary survey and update that study every 5 years. The watershed sanitation surveys conducted in the CABY region have found the watersheds to have excellent drinking water quality, as demonstrated by the most recent Update to the American River Watershed Sanitary Survey[8] (also known as Source Water Assessment). The study was jointly conducted by 11 participating water utilities, identifies key findings, and presents recommendations for source and treated water protection. The study focused on constituents of interest for drinking water purposes, including turbidity, fecal coliform, *Escherichia coli* (*E. coli*), *Giardia*, *Cryptosporidium*, total organic carbon, disinfection by-products, and other detected constituents that have a primary or secondary drinking water standard.

The study identified seven potential contaminating activities: forest management, recreation, river corridor use, urban runoff, wastewater, industrial facilities, and source water spills. The study concluded the American River provides source water that is "an excellent supply for drinking water. There are no persistently detected contaminants and the source water can be treated effectively with direct, conventional and membrane filtration."

The 16 study recommendations focus on assisting the participating water utilities with meeting all drinking water treatment and regulatory compliance goals, identifying opportunities for coordination with outside agencies to address potential source water quality impacts, and encouraging the implementation of effective stakeholder activities to protect source water quality.

The Nevada Irrigation District (NID) teamed up with the Placer County Water Agency (PCWA) in the most recent update of its Watershed Sanitary Survey for the Yuba and Bear watersheds. This survey describes the susceptibility and types of constituents that may come into contact with the drinking water source, and confirmed that the Yuba and Bear watersheds have very low levels of contaminants. Those contaminants found are usually associated with wildlife and human recreational activities.[9] NID's continuous monitoring of seven water treatment plants includes source water entering the treatment system, water in the treatment processes, and the treated water. The survey indicates that NID can expect no loss of water used for urban purposes due to water quality impacts.[10]

[8] Source: American River Watershed Sanitary Survey December 2003

[9] Source: NID Water Quality Report for 2011 (reported in 2012)

[10] Source: NID Agricultural Water Management Plan December 2012, Pg. 3-9

For rural areas that rely on private wells, water quality is largely unknown within the CABY region. The Disadvantaged Community outreach may identify water quality issues that CABY RWMG may address in the future.

6.2.2 Clean Water Act Section 303(d) List

While drinking water supplies in the CABY region remain of high quality, the 2014 and 2016 Clean Water Act Section 303(d)-listed water bodies in the planning area are classified as impaired because they are unable to support certain designated beneficial ecosystem functions; these are listed in Table 6-1. The heavy metal pollution legacy (primarily mercury) is the most high-profile water quality contaminant in the region that poses significant risks to aquatic organisms and ecosystem health. Mercury is introduced here in the context of Section 303 (d) listings, while bioaccumulation of mercury is discussed in the "Mercury" section that follows.

The Upper Yuba has 22 water bodies (Cherokee Creek, Upper Castle Creek, Oregon Creek, Deer Creek [multiple sections], Humbug Creek, Kanaka Creek, Kentucky Creek, Rock Creek, Scotchman Creek, Shady Creek, Poorman Creek, Spring Creek, Squirrel Creek, Yuba River [including North and South Forks], Lake Wildwood, New Bullards Bar Reservoir, Englebright Reservoir, and Scotts Flat Reservoir) that are listed as impaired due to mercury, arsenic, copper, iron, chromium, E. coli, dissolved oxygen, zinc, sediment/siltation, and/or pH. The Upper Bear watershed has 11 impaired water bodies (Wolf Creek, Lake Combie, French Ravine, Upper Bear River, Rollins Reservoir, Gold Run, Lower Bear River, Little Deer Creek, Yuba River [South Fork], Zayak [Swan] Lake, French Ravine, and Camp Far West Reservoir), mostly due to mercury, copper, chlorpyrifos, and/or iron contamination, but with secondary contamination from fecal coliform, bacteria, and water temperature. The North Fork American River watershed has five water bodies listed as impaired (North Fork American River, Folsom Lake, Hell Hole Reservoir, Loon Lake, and Oxbow Reservoir) for mercury contamination, while the South Fork American River watershed has four listed (South Fork American River [below Slab Creek], Coon Hollow Creek, North Canyon Creek, and Slab Creek Reservoir) for mercury, E. coli, toxicity, and/or the chemical DDE.[11]

The State of California identified the Bear River and South Fork Yuba River as Priority 1 Impaired Watersheds[12] requiring restoration to improve water quality as a result of the large amounts of mercury.

[11] California Resources Agency 2004, EPA 2006

[12] RWQCB Basin Plan 2018

Table 6-1
2014 and 2016 Clean Water Act Section 303(d) List of Water Quality Limited Segments Within the CABY Region (Listed from North to South)

Watershed	Water Body	Pollutant/ Stressor	Potential Sources	Estimated Size Affected	Expected Total Maximum Daily Load (TMDL) Completion Date
Yuba	Cherokee Creek	pH	Resource Extraction	5.8 miles	2027
	Castle Creek, Upper	pH	Resource Extraction	4 miles	
	Oregon Creek (Yuba and Sierra Counties)	Copper and Iron	Resource Extraction	19 miles	
	Deer Creek (Nevada County, Above Scotts Flat Reservoir)	pH	Resource Extraction	.71 miles	
	Deer Creek (from Deer Creek Reservoir to Lake Wildwood, Nevada County)	E. coli, Mercury, and pH	Resource Extraction	16 miles	
	Deer Creek (Yuba County)	pH	Resource Extraction	4.3 miles	
	Humbug Creek	Chromium, Iron, Mercury, Copper, Sediment/Siltation, Zinc, and pH	Resource Extraction	2.2 miles	
	Kanaka Creek	Arsenic	Resource Extraction	9.7 miles	
	Kentucky Creek	Iron, Dissolved Oxygen, and pH	Resource Extraction	5.9 miles	
	Rock Creek	pH	Resource Extraction	9.2 miles	
	Scotchman Creek	Copper, Iron, and pH	Resource Extraction	3.7	
	Shady Creek	Copper, Iron, and pH	Resource Extraction	11 miles	
	Poorman Creek	Copper and pH	Resource Extraction	14 miles	
	Spring Creek	Coper and Iron	Resource Extraction	6.2 miles	
	Squirrel Creek	E. coli	Resource Extraction	12 miles	
	Yuba River	Chromium and Mercury	Resource Extraction	45 miles	
	Yuba River, North Fork	Mercury	Resource Extraction	37 miles	
	Yuba River, South Fork (Headwaters to Spaulding Reservoir)	Copper and pH	Resource Extraction	18 miles	
	Lake Wildwood	Mercury	Resource Extraction	289 acres	

Table 6-1
2014 and 2016 Clean Water Act Section 303(d) List of Water Quality Limited Segments Within the CABY Region (Listed from North to South)

Watershed	Water Body	Pollutant/ Stressor	Potential Sources	Estimated Size Affected	Expected Total Maximum Daily Load (TMDL) Completion Date
	New Bullards Bar Reservoir	Mercury	Resource Extraction	3864 acres	
	Englebright Reservoir	Mercury	Resource Extraction	754 acres	
	Scotts Flat Reservoir	Mercury	Resource Extraction	660 acres	
Bear	Bear River, Upper	Mercury	Resource Extraction	10 miles	2015
	Lake Combie	Mercury	Resource Extraction	362 acres	
	Rollins Reservoir	Mercury	Resource Extraction	774 acres	2016
	Wolf Creek	Fecal Coliform	Agriculture, Urban Runoff/ Storm Sewers, Recreational Activities (non-boating)	23 miles	2019
	Gold Run	Mercury	Resource Extraction	1.9 miles	2021
	Bear River, Lower	Chlorpyrifos, Copper, and Mercury	Agriculture, Resource Extraction	21 miles	2023
	Camp Far West Reservoir	Mercury	Resource Extraction	1,945 acres	2027
	Little Deer Creek	Mercury	Resource Extraction	4.1 miles	
	Yuba River, South Fork (Spaulding Reservoir to Englebright Reservoir)	Chromium, Copper, Iron, Mercury, and Water Temperature	Resource Extraction	48 miles	
	Zayak (Swan) Lake	Mercury	Resource Extraction	26 acres	
	French Ravine	Indicator Bacteria	Land Disposal	1.7 miles	
American	North Fork American River	Mercury	Resource Extraction	71 miles	2027
	North Canyon Creek	E. coli and toxicity	Resource Extraction	3.1 miles	
	Coon Hollow Creek	DDE and Toxicity	Resource Extraction	1.7 miles	

Table 6-1
2014 and 2016 Clean Water Act Section 303(d) List of Water Quality Limited Segments Within the CABY Region (Listed from North to South)

Watershed	Water Body	Pollutant/ Stressor	Potential Sources	Estimated Size Affected	Expected Total Maximum Daily Load (TMDL) Completion Date
	Slab Creek Reservoir	Mercury	Resource Extraction	242 acres	
	Folsom Lake	Mercury	Resource Extraction	11064 acres	
	Hell Hole Reservoir	Mercury	Resource Extraction	1370 acres	2021
	Loon Lake	Mercury	Resource Extraction	988 Acres	
	South Fork American River	Mercury	Resource Extraction	71 miles	
	Oxbow Reservoir	Mercury	Resource Extraction	65 acres	

Source: SWRCB (State Water Resources Control Board). *2014 and 2016 California Integrated Report*. https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml

In many places, mercury concentrations violate federal water quality limits as well.

The SWRCB and nine RWQCBs are currently in the process of developing a statewide policy to control mercury in California's waters. Key elements of the policy will include:

1. A control program for mercury in the state's reservoirs, and
2. New standards (objectives) for mercury in the tissues of certain species of fish.

This policy will have serious cost implications for CABY region water managers, as well as to ratepayers from potential pass-through charges.

Figure 6-1 – 303(d) Listed Water Bodies in California

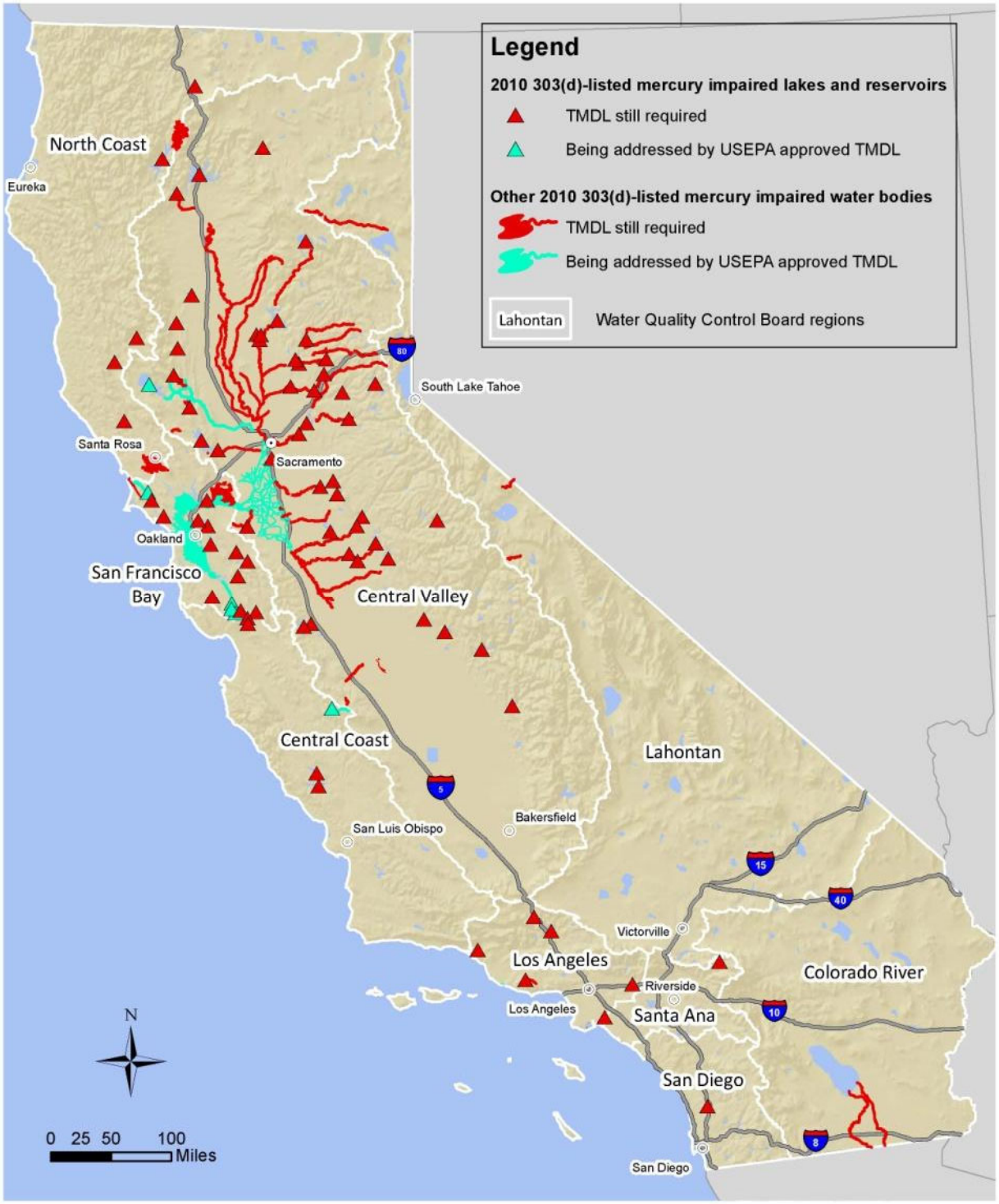
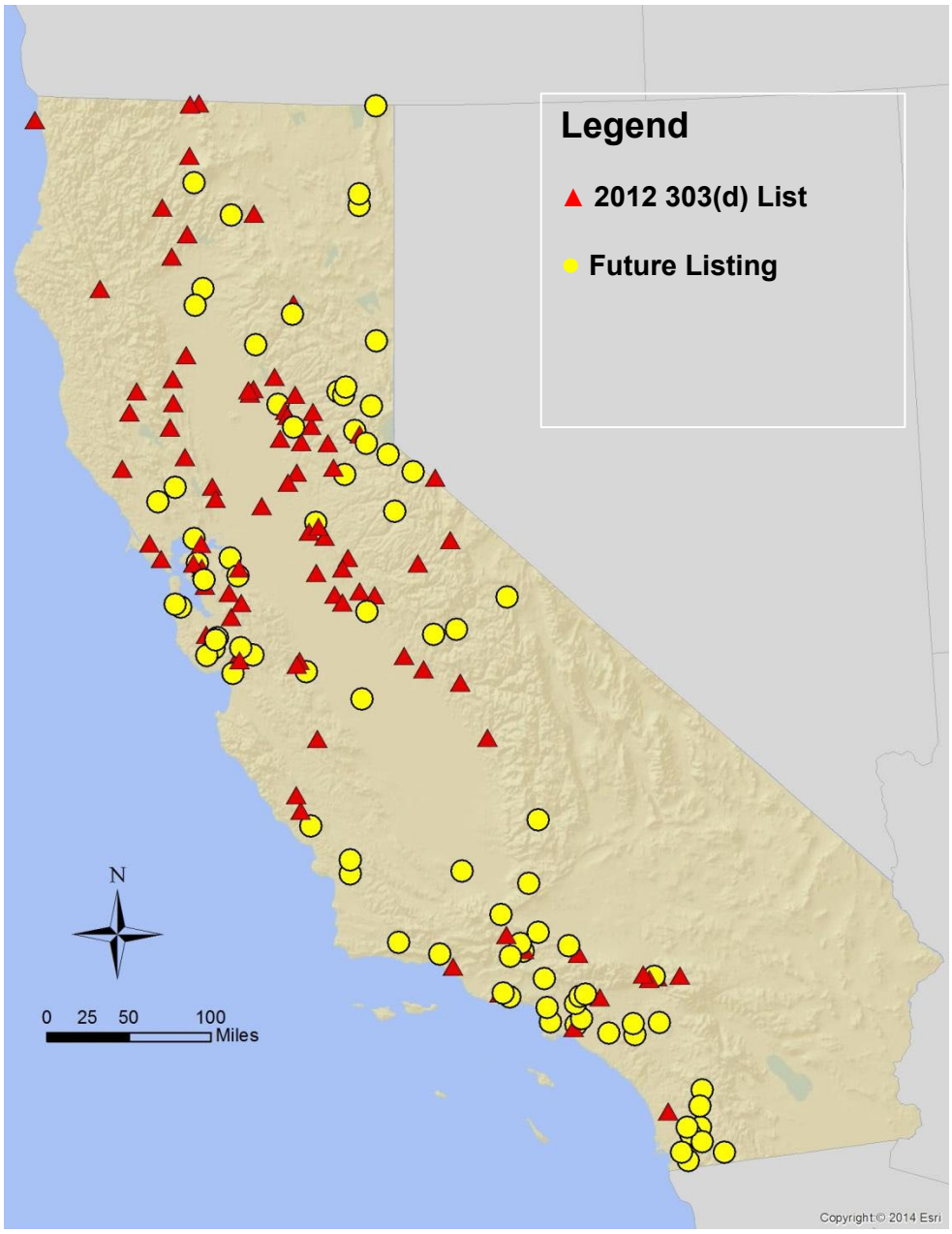


Figure 6-2 – Mercury-Impaired Reservoirs



As displayed in Figure 6-1 and Figure 6-2, the CABY region includes a high concentration of listed water bodies compared to other regions in the state.

The CABY Sediment and Mercury Abatement Initiative, a bundle of seven projects funded in 2014 and completed in 2018, helped to collaboratively develop best practices for addressing headwater sources of mercury and sediment, including abandoned hydraulic mine sites and downstream reservoirs. In addition, data was collected to examine fish tissue mercury levels and promote the development of site-specific safe eating guidelines for locally caught fish. Project partners held quarterly Mercury Forum meetings to share information and lessons learned, and The Sierra Fund (grant manager) continues to convene

stakeholders on these issues at their quarterly Headwater Mercury Source Reduction Technical Advisory Committee (TAC) meetings.

Mercury in Fish: Reducing Human Exposure

In aquatic ecosystems, even small amounts of mercury can biomagnify and bioaccumulate to dangerous levels in predatory sportfish, such as black bass (*Micropterus salmoides*) and large brown trout (*Salmo trutta*). The primary human exposure pathway to mercury is the consumption of contaminated fish. Mercury is a developmental neurotoxin and can produce serious and irreversible health complications. Sensitive populations to the health impacts of mercury include women of childbearing age, children, and especially fetuses.

The California Office of Environmental Health Hazard Assessment (OEHHA) is the state agency that issues fish consumption advisories to provide safe eating guidelines for sport fish based on the level of mercury and other chemicals (e.g., PCBs) in fish tissue. Advice is communicated in terms of species, demographic group, and the recommended maximum number of servings that can be safely consumed within one week. OEHHA has issued a number of site-specific fish consumption advisories for water bodies in the CABY region, documented in Table 6-2. In addition, OEHHA has issued statewide advisories that apply to water bodies without site-specific advice, including California lakes, reservoirs, and coastal locations.

Table 6-2
Water Bodies in the CABY Region with Specific OEHHA Fish Consumption Advisories

Streams Listed as Impaired	County	Fish Advisory	Species
Yuba River Watershed			
North Fork and Middle Fork of the Yuba River	Sierra, Nevada, Placer, and Yuba	Mercury, 2018	Black Bass, Pikeminnow (*Ptychocheilus oregonensis*), Sacramento Sucker (*Catostomus occidentalis*), and Rainbow Trout (*Oncorhynchus mykiss*)
New Bullards Bar Reservoir	Yuba	Mercury, 2017	Black Bass, Carp (*Cyprinus carpio*), Kokanee Salmon (*Oncorhynchus nerka*), Sunfish (*Scientific name*), Rainbow Trout
South Fork of the Yuba River	Nevada	Mercury, 2018	Black Bass, Sacramento Sucker, Rainbow Trout, Brown Trout
Englebright Lake	Yuba and Nevada	Mercury, 2009	Black Bass, Rainbow Trout, Sunfish
Deer Creek	Nevada and Yuba	Mercury, 2018	Brown Trout
Rollins Reservoir	Nevada and Placer	Mercury, 2009	Channel Catfish (*Ictalurus punctatus*)
Lake Combie	Nevada and Placer	Mercury, 2009	Black Bass, Sacramento Sucker
Bear River	Nevada, Placer, Sutter, and Yuba	Mercury, 2018	Black Bass, Brown Trout, Channel Catfish, Sunfish, Rainbow Trout, Sacramento Sucker
Camp Far West Reservoir	Yuba, Nevada, and Placer	Mercury, 2009	Sunfish Species, Black Bass Species, Channel Catfish

Table 6-2
Water Bodies in the CABY Region with Specific OEHHA Fish Consumption Advisories

Streams Listed as Impaired	County	Fish Advisory	Species
American River Watershed			
Hell Hole Reservoir	Placer	Mercury, 2016	Brown Trout, Crayfish (*Procambarus* sp.), Kokanee Salmon, Lake Trout (*Salvelinus namaycush*)
French Meadows Reservoir	Placer	Mercury, 2016	Rainbow Trout, Crayfish, Brown Trout
Folsom Lake	Sacramento, El Dorado, and Placer	Mercury, 2008	Sunfish, Rainbow Trout, Channel Catfish, Chinook King Salmon (*Oncorhynchus tshawytscha*), Black Bass,
Cosumnes River Watershed			
Lower Cosumnes River	El Dorado	Mercury, 2018	Asian Clam (*Corbicula fluminea*), American Shad (Alosa sapidissima), Rainbow trout; Common Carp, Crayfish, Sunfish, Sacramento Sucker, Black Bass, Catfish, Crappie (*Pomoxis*sp.), Striped Bass (*Morone saxatilis*), and White sturgeon (*Acipenser transmontanus*)
Jenkinson Lake	El Dorado	Mercury, 2017	Rainbow Trout, Sunfish, Black Bass

Sources:

SWRCB (State Water Resources Control Board). 2019. *2014 and 2016 California Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) – Statewide; 303(d) list - Excel file (includes potential sources)*. https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml.
OEHHA (Office of Environmental Health Hazard Assessment). 2019. "Fish Advisories Map." https://oehha.ca.gov/fish/ca-fishmap.

Mercury in Fish: Data Collection

Fish tested in the Combie Reservoir (Largemouth bass [*Micropterus salmoides*] and Sacramento sucker) and in tributaries of the Yuba River were among the highest in mercury in a statewide survey completed by the SWRCB's Surface Water Ambient Monitoring Program.[13] The findings from the most comprehensive survey of fish in the Yuba and Bear watersheds[14] found that fish tissue levels meet and exceed OEHHA and Food and Drug Administration screening levels (0.3 ppm mercury in fish tissue).

- Englebright Reservoir: All smallmouth bass (*Micropterus dolomieu*)and spotted bass (*Micropterus punctulatus*) that were >1 foot and >250 grams (1/2 lb.) had levels >0.3 ppm;
- Scotts Flat Reservoir: Most largemouth bass >1 foot and >500 grams (1 lb.) had levels >0.3 ppm;
- Rollins Reservoir: Most channel catfish and most largemouth bass >1 foot and >400 grams had levels >0.3 ppm;
- Combie Reservoir: All largemouth bass >1 foot and >400 grams had levels >0.7 ppm;
- Camp Far West: All spotted and largemouth bass and channel catfish >1 foot and >300 grams had levels >0.5 ppm, half of the spotted bass exceeded FDA level of 1.0 ppm; and
- Bear River at Dog Bar Road and Little Deer Creek at Pioneer Park: Half of brown trout sampled >10 inches and >200 grams had levels >0.3 ppm.

PCWA conducted methylmercury studies between 2007 and 2010 looking at concentrations in sport fish. About 55% of fish exceeded the OEHHA's guidelines for methylmercury, and over 16% of crayfish

[13] Davis et al. 2010.
[14] May et al. 1999.

exceeded the standard.[15] Data concerning mercury and methylmercury in water, sediment, and biota from sites in the Bear River watershed are available online (http://ca.water.usgs.gov/mercury/bear-yuba/).[16]

Since 2015, The Sierra Fund has identified water bodies without site-specific advisories in the CABY region and collected fish tissue data to inform OEHHA fish consumption advisories. Definition (TSF) has collected enough data to allow OEHHA to develop new site-specific advisories for three reservoirs in the CABY region. TSF continues to identify fish tissue data gaps to ensure that fish collection efforts are undertaken at other high priority sites. In addition, TSF launched a project in 2015 to protect public health by posting OEHHA fish consumption advisories at regional lakes and reservoirs. This annual volunteer event continues to improve access to important tools to make healthy fish consumption choices.

To access current fish consumption advisories for California water bodies, visit OEHHA's website: https://oehha.ca.gov/fish/advisories.

6.2.3 Water Quality Data and Federal Energy Regulatory Commission Relicensing

Seven hydroelectric projects in the CABY region recently conducted, or are currently conducting, water quality studies and analyses as part of the Federal Energy Regulatory Commission (FERC) relicensing efforts. The data collected as part of relicensing provides substantive detail on baseline water quality conditions and the associated ongoing water quality monitoring further increases the accuracy and specificity of the baseline data. As later described, the extraordinary research, data, and analyses have contributed significantly to our understanding of the water quality conditions within the CABY region and led to the development of a CABY program to utilize these data as a platform for water quality data collection throughout the region.

The four hydroelectric projects with associated water quality studies fall within the American watershed and include the Upper American River Hydroelectric Project,[17] the El Dorado Hydroelectric Project,[18] the Chili Bar Hydroelectric Project,[19] and the Middle Fork American River Hydroelectric Project.[20] Two additional hydroelectric projects in the northern CABY region recently completed relicensing studies and analyses. These two projects include the Drum-Spaulding Hydroelectric Project[21] and the Yuba-Bear Hydroelectric Project.[22] Another hydroelectric project in the northern CABY region, the Yuba River Hydroelectric Project,[23] is currently conducting studies that are scheduled to be completed within the next three years.

[15] PCWA 2010d.
[16] Wiener et al. 2003.
[17] SMUD 2005.
[18] EID 2006.
[19] PG&E 2005.
[20] PCWA 2010.
[21] PG&E 2013.
[22] NID 2013.
[23] YCWA 2016.

CABY's 2010 IRWMP planning grant application identified the studies conducted for relicensing PCWA's Middle Fork American River Project as particularly relevant due to its focus on three of the CABY region's primary issues: water quality, fish, and mercury. These three issues were first identified in early 2006 as priorities in the region at CABY's initial meetings as an RWMG. Because PCWA's relicensing studies are directly related to the CABY RWMG's priorities, these studies were identified as a cost-share in this IRWMP update. Each relicensing study includes clear descriptions of the study objectives, study area, approach, data analysis, and results.

PCWA's relicensing study issues of water quality, fisheries, and mercury contamination were taken into account with the CABY region's issue prioritization. The draft relicensing documents were distributed to various stakeholders, including resource agencies, Native American Tribes, nongovernmental organizations, and members of the public to solicit further feedback. Each study was subjected to a 60- or 90-day public comment period, depending on the topic. A final study plan addressing comments on relicensing studies was prepared and distributed. PCWA shared the final studies with the CABY organization as well as individual stakeholders.

6.2.3.1 Relicensing Cost-Share Tasks

The following paragraphs present brief descriptions of the relevant relicensing documents identified as cost-share tasks for this IRWMP and how these studies contribute the CABY RWMG's top priority issues. Studies from three hydroelectric projects informed the regional description by adding detail about potential issues and by identifying particular locations of concern. These hydroelectric projects are listed in Table 6-3.

Table 6-3
FERC Relicensing Documents Relevant to the CABY IRWMP

FERC Project	FERC Project License ID	Expiration	Licensee Involved
El Dorado	184	October 2046	El Dorado Irrigation District
Middle Fork American River	2079	February 28, 2013	Placer County Water Agency
Yuba-Bear	2266	April 30, 2013	Nevada Irrigation District

Western Placer Creeks (WPC) Work Group: The WPC located in the American watershed is one of the longest-lasting work groups in the CABY region, and its efforts have benefited significantly from relicensing studies conducted in the region. For example, baseline fisheries data collected as part of PCWA's relicensing studies, in combination with the Yuba River Hydroelectric Project relicensing data, provide a framework and scope for fish population baseline analyses that can be conducted in the WPC region. This example serves as a standard to integrate relicensing studies and data into future studies in the watershed.

Resource Management Strategies: The PCWA data informed the selection of state-approved CABY region resource management strategies and led to the identification of two additional CABY region strategies.

Issues, Objectives, and Conflicts: The data from PCWA relicensing studies were used by CABY RWMG to confirm and inform priority issues, such as water quality, mercury, and fisheries. The data provide a baseline condition in specific areas that allows for comparison in certain locations. The CABY Stakeholder Group requested other relicensing data be added to the suite of background documentation.

6.2.3.2 Development of a CABY Region Searchable Database

CABY will maintain a list of relevant searchable water quality databases for our region on the CABY website.

6.2.4 Future Water Quality Conditions

Future water demands in the CABY region are projected to increase substantially over the next three decades (see Chapter 7, Water Supply). Development pressures in the CABY region can impact both natural and constructed water supply systems and create a greater level of disturbance through roads, canals and pipes, and general traffic. These disturbances may take place in previously remote areas, such as forest ecosystems. The CABY region stakeholders are interested in programs that consider the link between natural resource management and California's water supply.

For example, it has been increasingly noted that forest ecosystems play a critical role in delivering clean water for the public. The Forest Service launched a program that identifies areas of interest for protecting surface water quality called Forests to Faucets.[24] On a macro scale, the Forests to Faucets data identifies areas that supply surface water, have consumer demand for this water, and are facing significant development threats. The mapping done in this program shows the link between forests and the provision of surface water – a key watershed-based ecosystem service.

6.2.5 Quality of Groundwater, Imported Water, and Water from Storage Facilities

6.2.5.1 Groundwater

As discussed further in Chapter 7, about 5% of the water supply in the Mountain Counties Area is from groundwater, which is generally used in single family homes, though it is included as part of a few public water systems.[25] The groundwater resources of the region are poorly understood. Most of the water management agencies within the region (i.e., irrigation and water districts) do not use groundwater resources as a primary water supply. The only organizations that manage the use of groundwater resources and water quality are the cities and counties that issue well drilling permits and mandate water quality testing.

6.2.5.2 Imported Water

No water is imported to the CABY region from outside basins, although California relies on water exported from the CABY watersheds. There are some inter-basin transfers within the CABY region, discussed in Chapter 7, Water Supply.

6.2.5.3 Water from Storage Facilities

Water storage facilities in the CABY region include upper-elevation reservoirs that predominantly capture snowmelt and precipitation, and mid-elevation reservoirs that are predominantly rain fed. These reservoirs are used for consumptive, irrigation, hydroelectric generation, environmental/beneficial uses, and recreation. In specific locations, some mid-elevation storage facilities experience water quality issues resulting from sedimentation and legacy mining; however, the high-elevation reservoirs have very good water quality with no major issues.

[24] http://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml

[25] DWR 2009

Water supply and distribution infrastructure in the CABY region between reservoirs is one of the most complex systems in the state, with water moving between elevations and between watersheds as part of the overall water system distribution network. This network is developed and maintained by Pacific Gas & Electric, NID, and PCWA to the north; and El Dorado Irrigation District, Georgetown Divide Public Utilities District, and Sacramento Municipal Utility District to the south. As mentioned earlier, water quality of the distribution system is generally not considered an issue, except in specific locations. For example, mercury-laden sediment occurs within the upper reaches of Rollins and Combie Reservoirs, and water temperatures in the upper reaches of those reservoirs become warmer due to the shallow waters.

6.2.6 Compliance with AB 1249

Assembly Bill (AB) 1249 (California Water Code Section 10541) requires Integrated Regional Water Management regions to provide specific information in their IRWMP regarding nitrate, arsenic, perchlorate, or hexavalent chromium contamination. IRWMPs are required to include a description of the location, extent, and impacts of the contamination; actions undertaken to address the contamination; and additional action needed to address the contamination. In order to comply, the CABY RWMG sent out a request for information relevant to each of these constituents to water resource managers across the Region. The following sections summarize information relevant to these constituents across the CABY region.

El Dorado County

The west slope in El Dorado County does not have any significant plumes or impacts to water from nitrate, perchlorate, or hexavalent chromium. There is some arsenic in this area that is naturally occurring, and there are some small water systems that have arsenic concentrations that exceed the human health thresholds, but it is not considered "contamination." There are no known anthropomorphic sources of arsenic within El Dorado County.

The county recently had their Local Area Management Plan approved by the Water Board that has more stringent requirements for septic systems and protocols to determine impacts if there are system failures.

Nevada Irrigation District

Nitrate is sampled in raw water in campground wells and is one of the post-treatment constituents for treated water prior to distribution. There have been no identified issues with nitrate contamination; therefore, no actions are required.

Arsenic is sampled in post-treatment finished water at treatment plants prior to distribution. Arsenic has not been detected; therefore, no action is required.

Perchlorate is monitored annually at all treatment plants in finished water prior to distribution. Perchlorate has not been detected; therefore no action is required.

Until recently, hexavalent chromium was annually monitored at treatment plants post-treatment, prior to distribution. This monitoring was recently suspended as the Maximum Contamination Level was repealed for consideration. Low levels have been detected at all treatment plants. Since the levels are below state maximum contaminant levels, no action is required.

Placer County Water Agency (PCWA)

PCWA tests for these contaminants at all water treatment plants, two groundwater wells, the American River, and at the pump station located in Auburn. All detections are below the maximum contaminant levels; therefore, no action is required.

6.3 Water Quality Protection and Improvement Needs in the CABY Region

Water emanating from the CABY region watersheds is generally of high quality; nonetheless, sediment, mercury, bacterial contamination, water temperature, and prevention of aquatic invasive species are all areas of focus to ensure continued high water quality in the CABY region now and into the future.

6.3.1 Sedimentation and Erosion

Although sediment is a natural component of mountain river systems, it can present challenges to watershed management in the CABY region. Sedimentation can cause reductions in storage reservoir capacities, reducing the ability reservoirs have to capture storm runoff and increasing the risk of flooding. Sedimentation can also increase water treatment costs and adversely impact aquatic biota and habitat. Sedimentation is a natural process, but human activity has accelerated that process in some areas within the CABY region. In general, sedimentation is increased when soil cover is reduced or eliminated. Historic mining activities, especially hydraulic mining, created conditions where mercury-laden sediment continues to move within CABY watersheds at Malakoff Diggins, at Rollins Reservoir, and in the Bear River above Combie, for example. Some ongoing ground-disturbing activities produce sediment that can be transported by runoff into waterways. High intensity forest wildfires and lack of management post-fire can result in landslides and accelerated erosion and sedimentation.

Some levels of erosion and sediment deposition are important for riverine processes, including providing substrate for spawning, and sediment for streambank and floodplain development. Active watershed stewardship is necessary to prevent excessive sedimentation in the CABY region from becoming problematic. Excessive sediment deposition moving through the riverine system into storage reservoirs can create high levels of turbidity and stress aquatic organisms as well as reduce reservoir capacity. For example, NID estimates that about 12,000 acre-feet of reservoir storage capacity, or 18%, has been lost at Rollins Reservoir since its construction in 1965 due to sedimentation.

Massive amounts of sediment draining from eroding hydraulic mining sites also impacts water quality and water storage in the CABY region. Today, historic hydraulic mining sites exhibit extreme badlands topography, and continue to erode massive amounts of sediment contaminated with mercury during storm events. For example, a study at Malakoff Diggins Hydraulic Mine found that as much as 3,000 lbs/min of sediment were being discharged during storm events.[26] The Sierra Fund's 2015 Humbug Creek Watershed Assessment found that Humbug Creek, which drains the Malakoff Diggings hydraulic mine pit, contributes an estimated 500 tons of sediment and an estimated 100 grams of mercury to the South Yuba River per year.[27] The CABY Sediment and Mercury Abatement program addressed sediment using erosion control and water filtration technologies at the source at Malakoff Diggings and Relief Hill Mine, which both drain into the Yuba watershed (see Chapter 12, Project Review Process, for project details).

[26] DWR 1987.

[27] Monohan, Carrie (2014). Humbug Creek Watershed Assessment and Management Recommendations. The Sierra Fund. Available at https://www.sierrafund.org/humbug-creek-report-2015/

6.3.1.1 Studies and Findings by Drainage

Yuba Watershed

The Yuba River watershed also contains a significant amount of sediment as a result of historic mining. Historic hydraulic mining directed high-pressure water cannons at exposures of Eocene gravel and washed the excavated sediment slurry through mercury-laden sluice boxes. Hydraulic mine tailings were conveyed into adjacent watercourses, leading to dramatic increases in sediment loads and severe aggradation. Gilbert[28] estimated that hydraulic mining contributed approximately 682 million cubic yards of sediment to Yuba River channels. Extensive remobilization of stored hydraulic-mining sediment began as early as 1861 when severe winter storms delivered substantial volumes of sediment to the Central Valley. The California Debris Commission built many debris control dams to trap hydraulic-mining sediment mobilized in the Upper Yuba River watershed, the last of these was the Englebright Dam constructed in 1941. The majority of the Middle Yuba River and South Yuba River channels have since recovered their pre-mining bed elevations; however, significant volumes of hydraulic mining sediment remain stored in wide mainstem reaches and in smaller upland tributaries of these two rivers. Studies of the Yuba River and adjacent watersheds suggest that these smaller tributaries are asymptotically incising toward pre-mining channel-bed elevations; therefore, remobilization of hydraulic mining sediment continues to affect sediment yields from impacted basins and contribute to lost water storage space in reservoirs.[29]

Sediment loads in the Yuba watershed can be attributed to other human activities, such as past timber harvest practices, road construction associated with rural housing development, and recreation. A tributary of the South Yuba River, Humbug Creek, is listed as a 303(d) water body under the Clean Water Act for sediment. The Upper Yuba is considered a priority watershed for action by the state under the California Unified Watershed Assessment. The high concentrations of suspended sediment in the Humbug Creek watershed can be attributed to abandoned mines in the Malakoff Diggings Historical State Park, and clear-cuts on private lands.[30]

West Placer Creeks

The West Placer Creeks are in a condition and location to facilitate local repopulation of anadromous fish. Because of a present population of fish and the accessibility of the fish to the creek network, there is a possibility for augmenting the fish population in this area.[31] There are, however, some restoration efforts and improvements in water quality needed. In many portions of Antelope Creek and Clover Valley Creek the stream channel has high sediment loads and a lack of pools. Creating pool habitats, reducing sediment input to the channel, cleaning stream gravels to promote increased aquatic insect production, and ensuring that riparian vegetation is allowed to reproduce would improve conditions here and in many other areas. Improving sediment transport through the system would be an overall benefit to aquatic organisms in general. The physical habitat conditions in the channel, specifically the amount of sediment, are a limiting factor for juvenile fish production. A major reduction in the quantity of sediment entering

[28] Gilbert 1917.

[29] Curtis, J.A., Flint, L.E., Alpers, C.N., Wright, S.A., and Snyder N.P. (2006). Sediment transport in the Upper Yuba River Watershed, California, 2001–03. In U.S. Geological Survey Scientific Investigations Report 2005-5246, 74 pp. Retrieved October 23, 2006, from http://pubs.usgs.gov/sir/2005/5246/

[30] Schilling, F. (n.d.). State of the Yuba: an assessment of the Yuba River watershed. Nevada City, CA: University of California

[31] Donald Bren School of Environmental Science and Management, Master of Environmental Science and Management Class of 2003 Group Project Brief (2003). Available on the web at www.bren.ucsb.edu

the channel is critical to improving hatching and emergence success and long-term juvenile rearing capability.[32]

Bear Watershed

The Bear River contains a large volume of mining sediment largely from two tributaries: Greenhorn and Steephollow Creeks. Sediment is stored in its main channel where three storage reservoirs are present. Due to its low-elevation headwaters (5,000-foot elevation), relatively low average annual discharge (around 273,000 acre-feet), and protracted sediment releases from water storage reservoirs, this sediment has not been flushed, but continues to be a potential problem for fish habitat in the river.[33] The storage reservoirs have an infill of sediment that continues to increase in depth and reduce the storage capacity. In addition to sediment, the Bear River is listed on the U.S. Environmental Protection Agency 303(d) list for mercury due to legacy mining practices. This high volume of mining sediment, in combination with restricting levees, has caused the Lower Bear channel to become deeply incised.[34] Additionally, the Bear River channel has not returned to pre-mining levels due to two main factors: (1) as mentioned, the Bear River headwaters are at relatively low elevations, resulting in discharges of low-to-moderate magnitude, and (2) hydraulic mining sediment was of much larger magnitude than in other local watersheds.[35]

American Watershed

High intensity wildfires, such as the Star Fire of 2000, pose a significant threat in this and other CABY watersheds. Heat at ground level can bake organic matter, reducing permeability and increasing runoff, thus leading to accelerated erosion and sedimentation.

Past management activities in the watershed have resulted in soil compaction and erosion (e.g., roads, landings, and skid trails) in some areas. These areas have altered hydrologic function and are at increased risk of surface runoff and gully erosion. Gully erosion is typically initiated by channelized water runoff from areas where water cannot infiltrate the soil, such as roads.[36]

Tributaries to the Middle Fork have been negatively impacted by inadequate management during the past, including activities such as mining, over-grazing, road construction, and timber harvesting. Today, these land use practices are heavily regulated and land managers have advanced their management practices, increasing watershed health. PCWA has completed sediment transport studies in the Middle Fork as an accompaniment to their FERC relicensing process. Duncan Canyon, which flows into the Middle Fork downstream of French Meadows Reservoir, periodically transports large amounts of bedload (cobble and gravel deposition), even though the channel is relatively stable. This sediment is principally derived

[32] Bailey Environmental (2003). Streams of western Placer County aquatic habitat and biological resources resource assessment. Prepared for Placer County Planning Department. Lincoln, CA: Bailey Environmental

[33] James, L. A. (1988). Historical transport and storage of hydraulic mining sediment in the Bear River, California: A study of the timing, volume and character of hydraulic mining sediment production and channel responses to the sediment as well as present conditions

[34] Eberhart, Allan (2006). White Paper: Bear River Watershed Assessment. Retrieved June 6, 2006, from http://motherlode.sierraclub.org/4-BearRiver.htm

[35] Ibid, James, L. A.

[36] MacDonald, L. and Coe, D. (2005). Sediment production and delivery from the unpaved forest roads in the Sierra Nevada. Geophysical Research Abstracts, Vol. 7, 08831

from natural channel downcutting in the numerous unstable seasonal tributaries, as well as from some bank undercutting along the main channel, exacerbated by periodic natural peak flow events.[37]

Cosumnes Watershed

A 2003 inventory of the Cosumnes watershed focused on channel and watershed processes as sources of sediment within the watershed. These include processes that contribute sediment through either lateral movement of the stream channel (bank erosion and bar formation), or vertical movement of the streambed (degradation and aggradation). The inventory included channel classification, a bank stability survey, a ground-disturbance survey, and an analysis of historical geomorphology. It found that, in the Mountain Section (in the upper watershed), 81% of the streambanks surveyed had negligible amounts of bank instability, 17% had moderate amounts, and 2% had significant amounts of instability. In the Foothill and Valley Sections, 8% of stream banks surveyed had negligible amounts of bank instability, 33% had moderate amounts, and 59% had significant amounts of instability. Findings from the ground-disturbance survey of 244 disturbed sites (representing 5,381 acres), indicated that almost half the sites (120) were located in the upper watershed.[38] Erosion from land use activities, roads, and Off Highway Vehicle use contribute sediment throughout the Cosumnes River watershed.

Recent surveys of spawning gravel indicate that they are cemented by silt. This silt may have been introduced into the river primarily by past mining, grazing, road construction, and forestry practices.[39]

In the Middle Fork Cosumnes River, sediment is being deposited and bank stability is being affected near Dogtown Creek due to suction dredging. Most of the disturbance consists of channel excavations, cobble piles, and bank cuts in the active channel, lower banks, and floodplain areas. All areas of the watershed have relatively high road densities and near-stream road densities compared to other watersheds in the Sierra Nevada.[40]

In the North Fork Cosumnes River, as on other CABY rivers, many land use activities, past and present, have the potential to cause excessive erosion. Potential consequences of accelerated erosion include a reduction in the productive capacity of the soil, adverse effects on water quality, and heightened potential for landslides.[41]

[37] USDA Forest Service, Tahoe National Forest (n.d.) Middle Fork American River watershed assessment. Nevada City, CA: USDA Forest Service

[38] Jones & Stokes and Northwest Hydraulic Consultants (NHC) (2003). Cosumnes River Watershed inventory and assessment: phase two. Sacramento, CA: Jones & Stokes

[39] Philip Williams and Associates (PWA) and The Nature Conservancy of California (TNCC) (1997). Analysis of opportunities for restoring a natural flood regime on the Cosumnes River floodplain. San Francisco, CA: TNCC; The Nature Conservancy of California (TNCC) (1992). Cosumnes River Watershed strategic plan. San Francisco, CA: TNCC; Hart and Engilis (1995). Middle Cosumnes River Watershed: River corridor and vernal pool/grassland study areas. San Francisco, CA: The Nature Conservancy of California; Quidachay, K.B., Britting, S., Ehrgott, A. (2000). Upper Cosumnes River watershed conservation project: environmental assessment. Coloma, CA: American River Conservancy

[40] USDA Forest Service, Eldorado National Forest (2002). Middle Fork Cosumnes River Watershed landscape and road analysis. Placerville, CA: USDA Forest Service

[41] USDA Forest Service, Eldorado National Forest (2002). North Fork Cosumnes River Watershed landscape and road analysis. Placerville, CA: USDA Forest Service

6.3.2 Mercury Methylation

Mercury contamination and attendant mercury methylation is a pervasive issue in the Bear, American, and Yuba River watersheds.[42] Moreover, management and restoration of the Bay-Delta ecosystem is complicated by mercury contamination from historic mining sites in the Sacramento and San Joaquin River watersheds, the principal sources of fresh water for the Bay-Delta system. Mercury-laden sediment now contaminates downstream reaches of streams and rivers. A challenge to scientists and managers involved with restoration of this ecosystem is to avoid increasing exposure of biota to methylmercury, a toxic form of mercury. The methylation of mercury makes the pollutant bio-available, and if consumed, is a neurotoxin. Methylmercury readily accumulates in organisms and biomagnifies (concentrates) in fish and wildlife at the top of aquatic food webs. Documented consequences of methylmercury pollution and consequent dietary exposure include: (1) direct adverse effects on the health of fish, wildlife, and humans; (2) contamination of fishery resources that diminishes their nutritional, cultural, socioeconomic, and recreational benefits; and (3) create barriers to traditional cultural uses of fish by the First Nation's people in the region.

From 1900 to 1960, several billion cubic meters of alluvial material was dredged for gold, and millions of pounds of mercury was discharged. These alluvial dredge fields are generally downstream from dams on the major tributaries – including the Yuba, American, and Bear Rivers – and are situated in floodplains that provide critical habitat to anadromous fish. Many of the dredge fields contain mercury-contaminated tailings from hydraulic-mining activities that took place further upstream before dams were constructed. Additional mercury was released in association with dredging processes at these alluvial sites. The release of mercury from gold mines in the Sierra, and the form of mercury in those mines, has not been extensively studied; however, initial observations indicate that it may be more readily methylated. Elemental mercury and gold-mercury amalgam are often visible in streams draining hydraulically mined areas of the Sierra Nevada and in the dredged goldfields downstream, such as those on the Yuba and American Rivers. Data concerning mercury and methylmercury in water, sediment, and biota from sites in the Bear River watershed are available online.[43,44]

The United States Geological Survey (USGS) estimates that up to 8,000,000 of the 26,000,000 pounds of mercury used in the Sierra Nevada may have been 'lost' during gold recovery, including during hydraulic mining. The mercury is present in the bottom of rivers and reservoirs, as well as in pits, sluices, and tunnels remaining in abandoned mine lands where it can be mobilized. It is transported by erosion and runoff as elemental mercury, in ionic form (i.e., Hg^{2+}), in dissolved form, adsorbed to particles, and as droplets of the metal. Real-time high frequency water quality monitoring will help inform management on when and how much mercury is propagating downstream. Water quality parameters can be used as proxies for Hg concentrations.

6.3.2.1 Studies and Findings of Non-listed Sites

The following discussion is focused on watershed-level studies outside the Clean Water Act Section 303(d) listed sites.

[42] Alpers et al. 2005.

[43] http://ca.water.usgs.gov/mercury/bear-yuba/

[44] Wiener, J.G., Gilmore, C.C., and Krabbenhoft, D.P. (2003). Mercury strategy for the Bay-Delta Ecosystem: a unifying framework for science, adaptive management, and ecological restoration. La Crosse, Wisconsin: University of Wisconsin

The Nevada County RCD commissioned mercury studies through the USGS in 2001-2003 to track levels of mercury in fish on the Bear River. One of the findings is that "fish from reservoirs and streams in the Bear-Yuba watersheds […] have bioaccumulated sufficient mercury to pose a risk to human health."[45] For example, Camp Far West has a 'do not eat fish advisory' for bass and catfish (see http://oehha.ca.gov/fish/so_cal/campfarwest.html).

PCWA conducted methylmercury studies between 2007 and 2010 that looked at concentrations in sport fish. The PCWA studies consisted of the collection of over 140 fish samples at FERC project reservoirs (Hell Hole, French Meadows, Ralston Afterbay, and Middle Fork Interbay), and at one river site, and the collection of crayfish from French Meadows and Hell Hole Reservoir. A state-certified laboratory completed the fish-tissue analyses, and the results were compared to the State Office of Environmental Health Hazard Assessment guidelines. About 55% of fish exceeded the OEHHA's guidelines for methylmercury, and over 16% of crayfish exceeded the standard.[46]

The USGS and others are conducting measurements of mercury and methylmercury in the biota, sediments, and waters in reservoirs and near/within abandoned mine lands of the Yuba/Bear systems. There are not currently direct measurements being done for the atmospheric deposition of mercury; however, mercury can originate from the atmosphere, and this form of mercury can become bioavailable. There are only a few measurements for the waters and sediments of the Upper Bear and Yuba Rivers and their tributaries. Though research is limited, it is known that mercury is leaking gradually from abandoned mine tunnels, sluice boxes, and pits. Dredge tailings are thought to be a potential hotspot, as is sediment disturbance during secondary mining near abandoned mine features, or in contaminated sediments. Mercury is assumed to be slowly migrating downstream in the creeks and rivers, temporarily lodging in the benthic sediments and pockets in the channel bedrock.[47]

6.3.3 Other Contamination

Non-sediment, non-mercury contaminants in the CABY region potentially include microbes and biological contamination. Possible sources of these pollutants can include recreation, agricultural discharges and practices, stream and bank alterations, illegal dumping, timber harvest, and wildlife.[48]

Public lands within the CABY region have experienced significant increases in recreation activity in the last 20 years. More than 50,000 recreationists raft and kayak the American River annually, rendering it one of the most intensely utilized recreational river systems in the nation. Similarly, from 1997 to 2001, the number of Off Highway Vehicles in use on national forests increased by almost 40%. These advances expand opportunities for Americans to enjoy public lands; however, they point to a need for sound management practices to ensure the protection of soils, water quality, and wildlife habitat.

[45] Alpers, CN, MP Hunerlach, JT May, and RL Hothem. Mercury Contamination from Historical Gold Mining in California. Fact Sheet #: 2005-3014 Version 1.1. U.S. Geological Society. Sacramento, CA. 2005. Available from: http://pubs.usgs.gov/fs/2005/3014/fs2005_3014_v1.1.pdf.

[46] PCWA 2010d

[47] Schilling, F. (n.d.). Mercury contamination in the Yuba and Bear Watersheds. Nevada City, CA: University of California

[48] Black & Veatch Corporation and Standish-Lee Consultants (2002). Watershed sanitary survey update and source water assessment. Sacramento, CA: Black & Veatch Corporation

Although a relatively small percentage of the CABY region is urbanized, increasing development and the conversion of lands to impervious surfaces can result in pollutant spikes during storm events.[49] Extreme runoff from urban areas results in unnatural flow surges and carries hydrocarbons, bacteria, lawn chemicals, and a host of other pollutants to the river systems.

6.3.3.1 Studies and Findings on Other Contaminants

Water quality monitoring conducted by PCWA during its relicensing process for the Middle Fork Hydroelectric Project (FERC No. 2079) showed high water quality throughout the Middle Fork watershed. Coliform sampling of natural waters was a component of the voluntary monitoring done by PCWA during the same study, and all study sites and times were found to be less than 200 colonies/100mL, except for one location during the fall sampling (300 colonies/100mL; at river mile 2.9 on Long Canyon Creek).[50] Identifying sources and management strategies regarding biological contamination requires more research, especially as recreational use increases. The Tahoe and Eldorado National Forests recently conducted environmental analyses to determine the effects of motorized vehicle use on National Forest System lands, and they developed guidelines for that use.[51,52] Creating public awareness and providing education for land use best management practices can help prevent biological contamination.

Studies have shown the conversion from rangeland and forest to housing subdivisions and commercial developments can increase the amount of impervious surfaces and can introduce urban pollutants to stream systems.[53] Wolf Creek, a tributary to the Bear River, is listed as a 303(d) water body for *E. coli* (see Table 6-1). However, this is likely an isolated issue as the most recent Watershed Sanitation Survey Update conducted on the American River watershed resulted in findings of excellent water quality in all categories sampled throughout the watershed (see Section 6.1.1, Water Quality Control Plan for the Sacramento River and San Joaquin River Basins).

6.3.4 Water Temperature

Water temperature is an important water quality parameter in the CABY region. Water temperatures can affect aquatic ecosystems by altering the water's ability to hold essential and beneficial dissolved gases (such as oxygen) in solution, as well as affecting mercury methylation, as mentioned earlier, and the hospitability of the water body to exotic species, such as invasive mussels, as well as the inhospitability for temperature-sensitive native species. Water temperatures may be influenced by dams, releases of surface water from reservoirs, water diversions and in-stream flows, riparian canopy, and could be affected by climate change through an altered hydrology.

6.3.4.1 Studies and Findings on Temperature

In California, the timing and amounts of water released from reservoirs and diverted from streams are legally regulated with consideration of their effects on various native aquatic species, especially those listed as threatened or endangered under the federal and state Endangered Species Acts, and additional designated species of regulatory concern. These include winter-run and spring-run Chinook salmon, Coho

[49] Schmitt, J., and A. Michael (2004). Rainfall infiltration under urban soil surface conditions – experiment and model results. In 13th Annual Soil Conservation Organization Conference: Conserving Soil and Water for Society: Sharing Solutions. Brisbane, July 2004

[50] PCWA 2008

[51] Eldorado National Forest 2008

[52] Tahoe National Forest 2010

[53] Ibid. Booth, D.B.

salmon (*Oncorhynchus kisutch*), coastal and Central Valley forms of steelhead and rainbow trout. Conversely, some amphibians require a different water temperature than those identified as ideal for salmon and steelhead. California constitutes the warm, southern end of the geographic range of most of these species. By 2100, climate change is expected to cause a considerable rise in average air temperature, raise water temperatures, greatly reduce snowpack volume, and shift the seasonal pattern of surface water runoff to more in winter and less in spring and summer. These physical changes are likely to influence water temperatures and thus the ecology of aquatic life in the region. In many low- and middle-elevation California streams today, summer temperatures often come close to the upper tolerance limits for cold-water species, such as salmon and trout. Thus, anticipated climate change effects may be enough to raise water temperatures above the tolerance limits for salmon and trout in many streams, favoring instead non-native fishes, such as carp and sunfish.[54] Chinook salmon and steelhead, for example, prefer temperatures of less than 20^{o}C in mountain streams, although they may tolerate higher temperatures for short periods.[55]

A water temperature monitoring program is in place at 20 different locations within the Middle Fork American River system. This program includes 12 monitoring locations on the Rubicon River, 7 sites on Long Canyon Creek, and 3 locations on the North Fork American River. During spring and summer storm events, when water spills from the top of reservoirs in the American River watershed, water temperatures have been shown to increase immediately downstream. Water temperatures below powerhouses tend to be cooler while operating. Because of reservoir spilling, water temperatures were coldest in early June and warmest during mid-July at several sites.[56] Maps regarding temperature modeling along the Middle Fork of the American River, completed by PCWA for their FERC relicensing process, are available in a final, and updated, report.[57] The maps completed as part of this data collection and reporting display the changes this hydropower system has had on the Middle Fork in lowering average summer temperatures due to reservoir releases. Reservoir operations can change the habitat suitability for endemic species in the area, and are therefore considered in project management and licensing.

On the South and Middle Yuba Rivers, low flows, high water temperatures, and sediment have contributed to problems for the cold-water adapted aquatic communities.[58,59] Still, the Yuba River has been identified as the best opportunity for the recovery and long-term survival of Central Valley spring-run chinook salmon. Consistent temperature monitoring will help fill critical data gaps and inform management activities around volitional fish passage. Since 2017, The Sierra Fund has collected temperature data at select pools in the upper reaches of the Yuba River to evaluate the presence and location of suitable holding habitat for anadromous fish species. Numerous meadows in the upper reaches of the watersheds in the CABY region are important because they can cool and filter water as well as reduce peak flood flows, much as manmade reservoirs do. The CABY project known as Meadow Enhancement and Restoration in the Yuba, Bear, and American River Watersheds (see Chapter 12, Project Review Process) is designed to

[54] California Department of Water Resources (DWR) (2006). Progress on Incorporating Climate Change into Planning and Management of California's Water Resources; Technical Memorandum Report. Sacramento, CA: DWR

[55] Moyle (2002). Inland fishes of California. Merced, CA: University of California Press

[56] Placer County Water Agency (PCWA) (2006). Draft 2005 water temperature study report (Middle Fork American River). Auburn, CA: PCWA

[57] PCWA 2010b.

[58] Schilling, F. (n.d.). State of the Yuba: an assessment of the Yuba River watershed. Nevada City, CA: University of California

[59] Upper Yuba River Studies Program Study Team, for DWR. (June 2006) Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment

enhance and restore meadow habitats thereby improving water temperature for the benefit of downstream users with the added benefit of enhancing crucial wildlife habitat.

6.3.5 Aquatic Invasive Species

Quagga mussels (*Dreissena bugensis*) and Zebra mussels (*Dreissenid polymorpha*) are a locally concerning Aquatic Invasive Species (AIS).[60] These mussels are prolific invaders that can cause great damage to ecosystems, hydroelectric infrastructure, recreational facilities and boats, and water conveyances. Indigenous to Eurasia, they can clog water intakes and damage equipment by attaching to boat motors and hard surfaces. They have the ability to damage ecosystems by harming fisheries, smothering native mussels and crayfish, and littering beaches with their sharp shells. Zebra mussels occur in many Eastern United States waters and spread primarily by attaching to boat hulls, aquatic plants, nets, fishing equipment, or through water contaminated with their larvae.

Studies completed in the last several years have used water quality parameters to outline Quagga and Zebra mussel invasion risk in watersheds across the country and regionally, including waterbodies within the CABY watersheds. Historically, introduction of AIS was predominantly through shipping and industrial development. In the CABY region, there are persistent threats from recreational boaters, fishermen, and disposal of aquariums and pets into local waterbodies. In the Western United States, Quagga and Zebra Mussel infestations have been restricted to larger reservoirs where boaters visit frequently and move boats from one area to the next.

From an ecological standpoint, both Zebra and Quagga mussels present a risk to food availability for native aquatic species and can alter the water quality of infested reservoirs. As their populations increase, native species cannot compete with densely growing mussel populations and can be displaced. Displacement of native species has cascading impacts to the entire ecosystem within a waterbody and can lead to increases in algae and even facilitate aquatic plant species invasion. Potential water quality parameters that may be influenced if an infestation is established include pH, turbidity, dissolved oxygen, and nutrient availability. By altering the food availability within a reservoir, mussel invasion can lead to decreases in fish populations which in turn will impact the quality of fishing in these reservoirs.

Prevention of AIS, such as Quagga mussels and Asian clam infestation, is a potential water quality concern in the CABY region, although no infestations have been documented to date. AIS are already a serious problem for California[61] as they threaten the diversity and abundance of native species and natural communities; the ecological stability and water quality of infested waters; and the commercial, agricultural, aquacultural, and recreational activities dependent on these waters. The economic consequences of AIS impacts can be substantial, from decreased productivity of commercial fisheries to expenditure of billions of dollars to alleviate AIS impacts in water bodies after they become infected.[62]

6.3.5.1 Studies and Findings on Invasive Species

AIS in the CABY Region: A number of programs are in place in anticipation of AIS infestations. These programs involve thorough inspections and examinations by trained personnel. For example, water purveyors adopted invasive mussel protection plans, and Nevada County Supervisors adopted a resolution petitioning the state for stricter measures to protect against invasive mussels in California waterways. The

[60] Aquatic invasive species include algae, insects, crabs, clams, fish, plants, and other invaders.

[61] California Aquatic Invasive Species Management Plan 2008

[62] Pimentel et al. 2000.

resolution asks the state to implement and fund an inspection program for Quagga and Zebra mussels and other AIS detected in regional waterways.[63] Nevada County is the second county to adopt the measure, following Lake County. Local organizations and agencies will continue to develop water quality monitoring, vulnerability assessment, and prevention plans working with relevant state agencies.

Prevention measures are designed to address prevention and spread of AIS. Prevention measures include inspection, quarantine and decontamination of watercraft; enforcement of legal authority; and strengthening the code of conduct for businesses dealing with aquatic organisms. Inspection and decontamination of recreational equipment such as watercraft (including boats, rafts, kayaks, and float tubes), fishing gear, clothing, waders, rope, cooling tanks, and live wells prevents the spread of many AIS, such as dreissenid mussels, aquatic plants, and other unwanted pests. Preventing the introduction of AIS is far more cost efficient compared to control efforts.

AIS in California and Adjacent Watersheds: The broad-scale introduction of species into California waters most clearly began with the shipment of tens of thousands of barrels of oysters from the East Coast after the establishment of the transcontinental railway.[64] The huge influx of settlers, the establishment of maritime commerce, and a multitude of other human activities through the 1900s contributed to continued invasions. Since then, hundreds of AIS have found their way into California waters, via transoceanic ships, aquaculture, the aquarium trade, the bait industry, recreational activities, biological research, environmental restoration projects, and through freshwater deliveries up and down the state. Nationwide, non-native species have contributed to 68% of the fish extinctions in the past 100 years and the decline of 70% of the fish species listed under the Endangered Species Act.[65]

A local case study involves Lake Tahoe. Beginning in 2009, all boats entering Lake Tahoe were required to have an inspection for AIS. The number of watercraft requiring decontamination has increased annually. In August of 2011, 37 Quagga mussels were found at the Spooner Lake Inspection Site. The boat had arrived from Lake Mead, a water body known to be infected with AIS. In 2010, a boat was found to be infested with New Zealand mud snails (*Potamopyrgus antipodarum*). In 2008, infestations of Asian clam were discovered in Lake Tahoe. Based on the damage caused in the Great Lakes region by Zebra and Quagga mussels, these European freshwater invertebrates could threaten California's entire water delivery system, irrigation network, and freshwater ecosystems, and it is likely that global movements of goods and services will continue to introduce and spread AIS.

6.3.6 Water Quality Monitoring

Current water quality monitoring activities in the CABY region are conducted by local jurisdictions (e.g., water agencies and county environmental health), local watershed groups, conservation groups, and Resource Conservation Districts (RCDs). The purpose and scope of these monitoring activities varies within watersheds and across the region. Governmental agencies are required to collect water quality information associated with a host of operational activities (e.g., raw water, treated water, wastewater discharge, and FERC license requirements). These activities are conducted using strict protocols and incorporate rigorous quality control and quality assurance standards.

[63] The Union 9/28/11

[64] Barrett 1963

[65] Wilcove et al. 1998

Extensive water quality monitoring is currently performed by water purveyors in the CABY region, as required by state and federal law and the FERC relicensing processes. As guided by regulations and permits, source waters, treated water, and areas near land use activities are periodically analyzed for pH, water and air temperature, dissolved oxygen, conductivity, turbidity as well as bacterial constituents, inorganic chemical constituents, general chemical parameters, and organic chemicals, metals, and pesticides. Additionally, water purveyors are required to produce water quality reports to regulatory agencies at regular intervals. This information is available to the public as well as shared with stakeholder groups such as CABY RWMG.

Agricultural stakeholders in the CABY region created watershed water quality coalitions as a response to the Central Valley RWQCB's removal of an exemption for agricultural discharge in 2003. At that time, under the Irrigated Lands Regulatory Program, the Placer/Nevada/South Sutter/North Sacramento (PNSSNS) Water Quality Coalition and the El Dorado County Agriculture Water Management Corporation were formed. These two coalitions have spent over $1.5 million generated by landowner fees to perform monitoring activities and to report the analysis annually to the applicable water quality control board. The Irrigated Lands Regulatory Program requires these agricultural coalitions to monitor discharges for legacy contaminants, metals, pesticides, among many other parameters. Monitoring conducted in 2017 indicates that with few exceptions, there are no major water quality problems with agricultural and managed wetlands discharges in the Sacramento River Basin. The majority of exceedances of adopted numeric objectives consist of specific conductivity, dissolved oxygen, and E. coli. No exceedances were found in the Placer/Nevada/South Sutter/North Sacramento Subwatershed.[66,67]

The State of California encourages and promotes citizen-based water quality monitoring as a means of creating watershed awareness and engaging citizens to enhance watershed health. In the past 10 years, numerous citizen monitoring programs have taken root throughout the CABY region. Most of these groups were aided through past state grants, and some are still active, using grant-funded equipment and approved methodologies. The water quality monitoring parameters and data being collected displays the range of indicators these volunteer groups are experienced in. Citizen monitoring data in the CABY region can be found on the CABY website with links to the various watershed groups and organizations.

Non-regulatory-driven monitoring, such as that performed by citizen-monitoring groups, may be performed for a variety of reasons, including watershed education, stewardship, or baseline data collection activities. While providing useful data for certain purposes, these monitoring efforts may not always employ strict quality control standards. Several citizen water quality monitoring training sessions have become available throughout the region in the past few years. These sessions seek to improve quality control and quality assurance protocols for citizen monitoring groups, as well as creating a standard for regional data collection. The CABY RWMG supports training for quality data collection to bolster the volume of data collected and diversity of sites sampled.

Consistency with regard to collection method, modernity of tools, uniformity of analysis methods, or any number of uncontrollable variables is imperative to establishing a useful scientific database. The CABY region has discussed assembling quality-controlled data sets to create a CABY-wide database that can connect with the pre-existing Sacramento River Watershed Information Module database that can be accessed by CABY stakeholders. Many of the participating organizations, such as El Dorado Irrigation

[66] Source: Sacramento Valley Water Quality Coalition Annual Report 2017

[67] Source: March 21, 2000, Letter from El Dorado County Agriculture Water Management Corporation to the Central Valley RWQCB

District, NID, PCWA, The Sierra Fund, South Yuba River Citizens League, Sierra Streams Institute, and American Rivers, have experience in data collection and management, as well as essential location-specific experience. For further discussion, see Chapter 2, Stakeholder Involvement.

Chapter 7
Water Supply

The quantity, quality, and availability of water resources are vital to natural processes and human activities. Wise and prudent planning combined with management of surface and groundwater resources is fundamental to providing a substantial economic base for the residents of the Cosumnes, American, Bear, and Yuba (CABY) region. This chapter presents a broad water supply and demand forecast for the CABY region. Understanding the magnitude of future water demands, potential changes to existing water demands, and constraints to reservoir storage capacities allows managers to make recommendations that will meet and manage water demands into the future.[1] How growth is accommodated and land use planning decisions are made by cities and counties have important implications for future water use.

7.1 Water Supply Overview

The CABY region encompasses the headwaters and transport reaches of four major Sierra rivers. The water purveyors of the region exercise many senior Area-of-Origin water rights to meet the needs of local citizens. Water from the region also contributes substantial supply to the rest of California and the Delta: approximately 5 million acre-feet (AF) per year, which represents about 30% of the Sacramento River's total supply. Although the region has abundant surface water supplies, some of it is unavailable locally because of prior water rights appropriations for downstream or out-of-basin users.

Water supplies within the CABY region are predominantly local in origin; therefore, the region is dependent on local precipitation patterns. Essentially all local precipitation falls between October and May and must be stored either geographically (meadow storage), geologically (groundwater aquifers), by infrastructure, or as snowpack to provide water supply to the region and the rest of the state during summer and fall. The bedrock of the upland CABY region does not provide reliable aquifers, and importation of water from elsewhere in the state is impeded by elevation (though water is moved between adjacent watersheds in the region). Therefore, the CABY region relies in large part on rain and snowmelt stored in reservoirs and redistributed in time and location to provide reliable public water supply through the dry months. Precipitation amounts can also vary widely from year to year. Storage is necessary to provide reliable supply through dry years to sustain beneficial uses of the water supply. CABY Regional Water Management Group is committed to engaging in ongoing conversation about this complex issue.

[1] CDM 2004

Surface Waters

Supply sources in the region for municipal and domestic use and irrigation generally come from surface waters in the form of watershed runoff, carryover storage in surface reservoirs, and recycled water (treated wastewater to meet standards for irrigation and/or agricultural use). Melting snow from the Sierra Nevada provides a direct water supply source that historically has lasted through June or July, though this pattern is already shifting toward a February through April period with a changing climate.[2] After snowmelt, supplies are provided from surface and groundwater storage throughout the CABY region.

Table 7-1 provides a summary of normal-year and multiple-dry-year (third year) water supplies available to the water agencies from the listed river systems for consumptive and/or irrigation use by right or contract.

Water supply availability shown in Table 7-1 is based on the historical hydrologic record, and could be affected over time due to a reduction in snowpack and as a shifted hydrology evolves in the Sierra Nevada. The table presents data to 2040 planning (except for Georgetown Divide Public Utility District, as information was only available to 2035) as presented in the corresponding 2015 Urban Water Management Plans (UWMPs). Water supply availability in some cases includes new supplies currently being pursued by the agency, as is the case for El Dorado Irrigation District (EID). A comparison of normal-year supply to multiple-dry-year supply illustrates the region's vulnerability to extended drought and climate change. Lack of groundwater for dry-year supplementation is the primary reason for these large fluctuations in water supply reliability. Impacts to water supply are projected to be less significant in terms of meeting projected local demand in the northern parts of the CABY region (the Yuba, Bear, and North and Middle Forks of the American River) than they are in the southern portion of the region. As described in Chapter 10, Resource Management Strategies, the UWMPs for Nevada Irrigation District (NID), Placer County Water Agency (PCWA), Georgetown Divide Public Utility District (GDPUD), and EID, are revised every 5 years based on updated state and federal policies.

Table 7-1
Normal and Multiple-Dry-Year Water Supplies by Agency[1]

Water Agency	2020 Supply (AF)	2020 MDY Supply (AF)	2030 Supply (AF)	2030 MDY Supply (AF)	2035 Supply (AF)	2035 MDY Supply (AF)	2040 Supply (AF)	2040 MDY Supply (AF)	Supply Source
El Dorado Irrigation District	77,490	57,143	107,790	62,443	107,990	62,643	108,190	62,843	South Fork of the American, North Fork of the Cosumnes, Folsom Reservoir, and Echo Lake in the Tahoe Basin

[2] NID 2005

Table 7-1
Normal and Multiple-Dry-Year Water Supplies by Agency[1]

Water Agency	2020 Supply (AF)	2020 MDY Supply (AF)	2030 Supply (AF)	2030 MDY Supply (AF)	2035 Supply (AF)	2035 MDY Supply (AF)	2040 Supply (AF)	2040 MDY Supply (AF)	Supply Source
George-town Divide Public Utility District	12,200	11,060	12,200	11,060	12,200	11,060	n/a	n/a	Middle Fork of the American (Rubicon)
Nevada Irrigation District	360,800	253,185	360,800	253,185	360,800	253,185	360,800	253,185	Yuba and Bear
Placer County Water Agency[2]	233,800	228,500	270,800	233,500	272,800	235,500	273,800	236,500	Yuba, Bear, and Middle Fork of the American

Source: 2015 Urban Water Management Plans
Notes: AF = acre-feet; MDY = multiple-dry-year; n/a = information not available.
[1] For consistency, multiple-dry-year values come from the reported third year.
[2] Assumes new supplies are online in 2030.

Table 7-2 lists the primary reservoirs and corresponding operators that supply the surface water needs both within the region and for export from the region. In addition to the major reservoirs and lakes listed in Table 7-2, several small water agencies in the CABY region have water rights and own and operate small-scale conveyance and storage facilities.

Table 7-2
Major Reservoirs and Lakes in the CABY Region

Reservoir/Lake	Stream/River Outflow	Capacity (acre-feet)	Operator
Bowman Lake	Canyon Creek (Yuba)	68,510	Nevada Irrigation District (NID)
Camp Far West	Bear	104,000	California Department of Water Resources (DWR)
Caples Lake	Silver Fork of the American	22,340	El Dorado Irrigation District (EID)
Collins Lake	Dry Creek	1,600	Browns Valley Irrigation District
Combie Lake	Bear	5,560	NID
Englebright	Yuba	70,000	U.S. Army Corps of Engineers
Faucherie Lake	Canyon Creek (Yuba)	3,980	NID
Fordyce Lake	Fordyce Creek (Yuba)	49,900	Pacific Gas and Electric Company (PG&E)
French Lake	Canyon Creek (Yuba)	13,940	NID
Folsom	American	975,000	U.S. Bureau of Reclamation
French Meadows	Middle Fork of the American	136,400	Placer County Water Agency (PCWA)
Hell Hole	Rubicon	207,600	PCWA

Table 7-2
Major Reservoirs and Lakes in the CABY Region

Reservoir/Lake	Stream/River Outflow	Capacity (acre-feet)	Operator
Ice House	South Fork of Silver Creek (Silver Fork of the American River)	45,960	Sacramento Municipal Utility District (SMUD)
Jackson Lake	Jackson Creek (Yuba)	1,330	NID
Jackson Meadows	Middle Fork of the Yuba	69,210	NID
Jenkinson Lake	Camp Creek	41,000	EID
Lake Aloha	Silver Fork of the American	5,004	EID
Lake Valley Reservoir	North Fork of the American	8,000	PG&E
Loon Lake	Rubicon (Middle Fork of the American)	76,500	SMUD
New Bullards Bar	Canyon Creek (Yuba)	966,103	Yuba County Water Agency
Rollins	Bear	66,000	NID
Sawmill Lake	Silver Fork of the American	3,030	NID
Scotts Flat	Dry Creek	48,550	NID
Silver Lake	Bear	8,640	EID
Slab Creek	Yuba	16,600	SMUD
Spaulding	Canyon Creek (Yuba)	75,000	PG&E
Stumpy Meadows	American	20,000	Georgetown Divide Public Utility District
Union Valley	Middle Fork of the American	277,300	SMUD

Source: Reservoir information obtained from DWR, Division of Flood Management website: http://cdec.water.ca.gov/misc/resinfo.html) and from agency sources.
Note: CABY = Cosumnes, American, Bear, and Yuba.

Recycled Water

The use of recycled water, which involves tertiary treatment of municipal wastewater to meet Title 22 standards, is becoming an increasingly important water supply in the CABY region. Though recycled water is currently used in the region, the increased demand for water is fueling efforts to expand its use. Leading the recycled water use campaign is EID, which has produced recycled water for over 35 years. EID's current recycled water use is about 2,400 AF per year. This use will expand incrementally over time with 3,500 AF of recycled water per year anticipated to be delivered annually by 2040.[3] EID currently provides recycled water for commercial landscape irrigation (including golf courses), residential or multi-family dual-plumbed landscape irrigation, construction water, and recreational impoundments (during certain times of the year). The use of recycled water is impeded in much of the CABY region by high topographic relief and low population densities, which makes centralized wastewater collection, treatment, and redistribution systems uneconomical. In the future, however, the expanded use of recycled water will be a resource to help meet the region's growing water demand where practical.

PCWA is evaluating the use of recycled water within the unincorporated areas of Placer County.

[3] EID 2015 Urban Water Management Plan

Return Flows

Return flows are also an important water-supply component in the CABY region and differ from water recycling in that return flows are not treated or used for primary demands, such as consumptive water rights and in-stream flows. Groundwater, for example, requires a significant supply of water (or recharge) from a variety of sources (e.g., meadows, ponds, irrigation, canals, percolation beds, and wastewater treatment plant discharges). Return flows can recharge groundwater supplies. A specific example of return flows is the mandatory discharge of one million gallons per day at the EID Deer Creek Wastewater Treatment Plant. Because the actual quantity of return flows in the CABY region is not known and difficult to accurately estimate, this water is considered incidental or secondary to other primary demands. A better understanding of the relationship between primary water demands and return flows demands is needed to effectively manage conservation strategies in the CABY region.

Groundwater

In general, groundwater in this area is an inadequate and unreliable water supply for large-scale use. However, many rural homes, farms, and ranches throughout the CABY region rely on groundwater supplies with individual wells. The fractured bedrock formations that constitute much of the Sierra Nevada foothills and western slopes of the mountains are poorly suited to contain large quantities of groundwater. Water cannot penetrate the rocks unless there are fractures, as there is no pore space between the grains of the rock. Where rock fractures are present, small amounts of water can be stored and made available to wells that intersect the fractures. While there can be groundwater resources within meadow complexes in the high valleys throughout the region, these sources are limited in scope; overall, groundwater availability is largely restricted to fractured rock areas.

Accordingly, groundwater makes up a small portion of the water supply in the region, constituting only 10% of the overall water supply in the Mountain Counties Hydrologic Region.[4] However, for many individual home, farm, and ranch operations, groundwater may be the only source available to supply their needs due to limitation in water distribution infrastructure. This resource can be unreliable, especially if additional development occurs in a localized area of short supply or during drought periods. In addition, these groundwater supplies are highly variable in terms of water quality (primarily minerals, but also heavy metals). Because of the variability of groundwater supplies, nearly all of the publicly supplied water in the CABY region is provided by surface waters. The only organizations managing the use of groundwater resources are the cities and counties that issue well-drilling permits and mandate water-quality testing for wells that will be on a small, public water-supply system as well as private wells.

The Sustainable Groundwater Management Act requires the formation of Groundwater Sustainability Agencies and the generation of Groundwater Sustainability Plans for priority basins throughout California. There are not defined groundwater basins in the CABY region; therefore, the Sustainable Groundwater Management Act does not apply to it.

Forest Management to Increase Water Yield

Forest management in the CABY watershed also affects the availability of a reliable water supply. Studies over the past 100 years have found that when the density of forest vegetation is reduced, streamflow

[4] DWR 2005

runoff (i.e., water yield) of a watershed can be increased.[5] Moore and Wondzell provide a good discussion of how forest vegetation management affects snowmelt rates, low flows, and peak flows, as well as identifying future research opportunities.[6]

In 2011, an additional study was completed by the Sierra Nevada Research Institute at the University of California (UC) at Merced, in collaboration with the Center for Information Technology Research in the Interest of Society. This study, "Forests and Water in the Sierra Nevada: Sierra Nevada Watershed Ecosystem Enhancement Project (SWEEP)," proposes testing the hypothesis that forest-management strategies that reduce fire risk and return the historical composition and density of tree species may also result in greater snowpack retention and reduced evapotranspiration, resulting in increased water yield and a shift in timing of runoff to later in the season. The study identifies the American River basin as a viable location for the next phase of these investigations. The project also includes the development of an "Intelligent Water Information System for the American River Basin" that would collect real-time watershed data that could inform more efficient operations of Folsom Reservoir for improved water supply reliability and environmental flows. This study and the initial phase of instrumentation installation have initially been funded by a $2 million National Science Foundation Grant. The California Department of Water Resources (DWR) has approved a small amount of partial funding to expand on the initial work done with National Science Foundation Grant funding, but due to budget limitations, has not yet been made available. Alternative funding for this work is being pursued by some CABY water agencies through the Delta Stewardship Council, impending State Water Bond, and the American River Basin Integrated Regional Water Management Plan (IRWMP). The El Dorado County Water Agency (EDCWA) and UC Merced jointly sponsored an application to the American River Basin Integrated Regional Water Management for a project entitled "An Intelligent Water Infrastructure Information System for the American River Basin;" however, the project was not funded through this effort. UC Merced is still pursuing funding opportunities for this project.

NID is increasing its forest management activities to increase water supply yield in the Yuba and Bear watersheds. These activities include ladder fuel removal and selective thinning to create healthier forest ecosystems that promote long-term water security.

7.1.1 Infrastructure

Some water-supply infrastructure in the region was originally developed to support mining operations and agriculture and to provide hydropower. It was later modified to provide public water supplies for domestic, municipal, industrial, and agricultural use, especially during dry months. Other infrastructure was specifically developed to provide water supply, and other ancillary benefits, such as hydropower and recreation.

The CABY region includes the water infrastructure of several irrigation districts, municipal water agencies, county water agencies, and utility companies. These entities' facilities include an array of canals, flumes, tunnels, ditches, pipelines, penstocks, dams, and powerhouses. The infrastructure provides multiple benefits to the region's residents; the greater Sacramento area; and to a lesser extent, statewide, including treated water, regulated flow for hydropower production, recreational opportunities, environmental benefits, streamflow releases, opportunities for out-of-district sales, aesthetic resources, and agricultural irrigation. The raw-water infrastructure incorporates over 790 miles of canals, 147 dams,

[5] Bosch and Hewlett 1982

[6] Moore and Wondzell 2005

36 powerhouses, and 19 tunnels. The larger dams are operated by water agencies, irrigation districts, public utility districts, the Bureau of Reclamation, the Army Corps of Engineers, Sacramento Municipal Utility District (SMUD), or Pacific Gas and Electric Company (PG&E). Many small dams and/or diversions in the watersheds are owned and operated by smaller entities or private individuals. Overall, the four major rivers of the CABY region contain a significant amount of water-related infrastructure as described in the paragraphs that follow.

The infrastructure in the CABY region is aging, and in many cases, dates back to Gold Rush-era construction and uses. In addition, limitations on reservoir maintenance that are associated with concerns about mercury contamination from the Gold Rush era impact storage capacity sediment accumulation in affected reservoirs. Additional investment in these resources, both from within and outside the region commensurate with benefits received, is essential to continue reliable and cost-effective water supply and wastewater management throughout the region.

In some areas, infrastructure does not currently meet new minimum firefighting requirements. Water agencies are improving their systems to accommodate the new requirements, including increasing emergency storage and pipe sizes. Additional challenges to prioritize improvements related to wildland interface firefighting are being considered by firefighting agencies, local water agencies, and community partners.

Cosumnes River Watershed

The Cosumnes River is managed with numerous diversions, altering its natural flow regime. There are several dams, diversions, and ditches on the three main forks and tributaries that convey water for agricultural, municipal, and other purposes. The most significant dam in the watershed is Sly Park Dam/Jenkinson Lake, originally part of the Central Valley Project, but later transferred to EID's management as part of its irrigation and water storage system. Sly Park Dam/Jenkinson Lake is located in the North Fork Cosumnes watershed and includes Sly Park Dam and Jenkinson Lake on Sly Park Creek, and Camp Creek Diversion Dam on Camp Creek. Jenkinson Lake is the largest reservoir in the Cosumnes watershed, providing 41,000 AF of storage capacity. Several other dams and diversions exist in the Cosumnes watershed, both privately and publicly owned. The many diversions decrease dry season flows and contribute to passage barriers for anadromous fish in the fall.

American River Watershed

The American River and its tributaries are managed for water supply, flood control, hydropower generation, recreation, and environmental benefits. The Middle Fork American River Project (Federal Energy Regulatory Commission [FERC] No. 2079), owned and operated by PCWA, is a major supplier of water and hydropower in the region. The project consists of two main reservoirs (Hell Hole and French Meadows); seven dams (Duncan Creek Diversion, French Meadows Dam, Hell Hole Dam, South Fork Long Canyon Diversion, North Fork Long Canyon Diversion, Interbay Dam, and Ralston Afterbay Dam); and five hydropower plants (French Meadows, Hell Hole, Middle Fork, Ralston, and Oxbow powerhouses).[7]

The Upper American River Project (UARP) (FERC No. 2101), owned and operated by SMUD, is a major supplier of hydropower to Sacramento County and provides storage for a significant amount of the City of Sacramento's water supply. The UARP diverts and regulates water in portions of the Rubicon River, Silver Creek, and South Fork American River watersheds. The project consists of three main reservoirs (Ice

[7] Placer County 2006

house, Loon, and Union Valley), 11 reservoirs (Rubicon, Buck Island, Loon Lake, Gerle Creek, Robs Peak, Union Valley, Ice house, Junction, Camino, Brush Creek, and Slab Creek), and eight powerhouses (Loon Lake, Robs Peak, Jones Fork, Union Valley, Jay Bird, Camino, Slab Creek, and Whiterock); and generates enough electricity to meet about 20% of the SMUD customer demand in Sacramento County. Total gross storage of the project is 400,000 AF, and total installed hydro generation capacity is 688 megawatts. All of the water supply and hydropower benefits from the project are currently exported out of the CABY region to Sacramento County.

On the South Fork of the American River, PG&E owns and operates the Chili Bar Reservoir and powerhouse downstream of the UARP, while EID owns and operates the El Dorado Hydroelectric Project (FERC No. 184) that includes four storage reservoirs (Lake Aloha, Echo Lake, Silver Lake, and Caples Lake), 22 miles of canals, and the El Dorado Powerhouse. On the lower American River, the Bureau of Reclamation operates the Folsom Powerhouse, part of the Central Valley Project (CVP).

Bear River Watershed

The Bear River watershed is extensively managed for water conveyance. Both NID and PG&E utilize the Bear River watershed to convey water supplies to residents, farms, and ranches of Nevada and Placer Counties, as well as to generate hydropower for the California electric grid. Water is imported from the Yuba and American Rivers into this watershed. An estimated 200,000 AF of water is imported annually from the South Yuba River, from Spaulding Lake through the Drum Canal system, and from the North Fork of the North Fork American River through the Lake Valley Canal. Water in the upper Bear watershed is directed into Rollins Reservoir. PG&E's Bear River Canal (below Rollins Reservoir) and the NID's Combie Phase I Canal (below Combie Reservoir), serve as important conveyance systems. Flows in the watershed are managed primarily by NID and PG&E.[8] Dams on the Bear River include Rollins Dam and Camp Far West Dam.

Yuba River Watershed

The resources of the Yuba River are managed for multiple beneficial uses, including water supply, hydropower generation, recreation, flood control, and environmental benefits. Entities with management responsibilities include NID, South Feather Water and Power Authority, PG&E, Yuba County Water Agency (YCWA), and small and individual water rights holders. Water is transported through a system of tunnels and canals to the Feather, Bear, and American Rivers. The New Bullards Bar Dam, which forms New Bullards Bar Reservoir, is located on the North Fork Yuba River and is operated by the YCWA, whose service area is located outside of the CABY region. The Middle Yuba River development includes Jackson Meadows Dam, operated by NID, that stores water that is later transferred to the South Yuba via the Milton-Bowman Conduit and Bowman-Spaulding Canal. Also on the Middle Yuba River is the Our House Dam, located southwest of Camptonville. This dam diverts Middle Yuba River water through a tunnel into Oregon Creek, and then further diverts water into the Lohman Ridge Tunnel and sends it the New Bullards Bar area where it is used to generate hydropower in the Yuba River Development Project (FERC No. 2246). Spaulding Dam on the South Yuba River diverts 66% of flow from the South Yuba River, and Spaulding Lake is the major reservoir for the Drum Spaulding Project (FERC No. 2310), owned and operated by PG&E. The Englebright dam, located on the Yuba River, generates hydropower and provides recreation opportunities.

[8] DWR https://water.ca.gov/Programs/State-Water-Project

Downstream

The rivers and streams in the CABY region provide water for the CALFED Bay-Delta system, the State Water Project (SWP), and the CVP. This water-supply infrastructure depends on a complex system of dams, reservoirs, power plants, pumping plants, and canals to deliver water to users, provide electricity, and for flood control protection. The CALFED Bay-Delta Authority was created in 1995 to address environmental and water management problems associated with the Bay-Delta system, an intricate web of waterways at the junction of the San Francisco Bay and the Sacramento and San Joaquin River Delta. Water flowing out of the CABY region drains to the Sacramento and San Joaquin Rivers and is used in the CALFED Bay-Delta system. The SWP is a water and hydropower development and conveyance system operated by DWR that supplies water to 27 million Californians and 750,000 acres of farmland.[9] There are no SWP-operated dams or reservoirs in the CABY region, although water originating in the region is part of the SWP water supply. Reservoirs in the CABY region not only help prevent flooding in the Central Valley and reduce pressure on the downstream levee system in the valley, they provide regulated water supply for later downstream municipal and industrial and irrigation use outside the CABY region.

The CVP, operated by the Bureau of Reclamation, extends 500 miles southward from the Cascade Mountains and stretches 100 miles from the foothills of the Sierra to the coastal mountain ranges. The CVP includes a network of dams, reservoirs, canals, power plants, and pumping plants. The primary function of the CVP is flood control, although uses also include water storage for irrigation and domestic use and hydropower generation. The Folsom Unit is a CVP unit that is partially in the CABY planning area (the North Fork and South Fork arms of Folsom Reservoir extend into the CABY region). EID and PCWA have CVP Water Service Contracts and/or Warren Act Contracts that allow for diversion of water from Folsom Reservoir. The Sly Park Unit (formerly a part of the CVP, but now an EID operation) is located in the Cosumnes watershed and includes Sly Park Dam and Jenkinson Lake on Sly Park Creek and Camp Creek Diversion Dam on Camp Creek.[10,11] The Folsom Unit is located on the lower American River, near the western boundary of the CABY region. The primary feature of the Folsom Unit is Folsom Dam, which is a key facility for flood control, water supply for irrigation and domestic use, and hydropower generation in the region and the Central Valley.

7.1.2 Interbasin Water Development

One of the features of the CABY region's water development strategy has been to move water from one river basin to another to best serve the public interest. Such water development has been encouraged by California law since the 1850s and is an integral part of meeting the needs of the CABY region and providing water for all beneficial uses. These interbasin water projects are, in some cases, subject to the continuing jurisdiction of the State Water Resources Control Board because the rights involved are post-1914 appropriative rights. Many (if not most) of these projects seek to capture flows during the winter season and use them to meet demand from municipal/industrial users, agricultural users, and the environment for water during the summer. Indeed, even though the primary purpose of most of these projects is to meet consumptive demands for water, without such interbasin projects, many of the rivers in the CABY region would be much less hospitable to fish during the summer months and would provide many fewer opportunities for water-contact recreation.

[9] DWR, 2020

[10] https://www.usbr.gov/projects/index.php?id=246

[11] https://www.usbr.gov/mp/cvp-water/

Six areas within the CABY region involve major interbasin water development: North Yuba to the South Fork Feather (via the Slate Creek Tunnel); Middle Yuba to South Yuba to Bear River; South Yuba to American North Fork of North Fork American to Bear River; Upper Truckee to South Fork American (via the Echo Conduit); and South Fork American to Jenkinson Lake (North Fork Cosumnes watershed).

The movement of water from the North Yuba River to the South Feather River is based on an agreement between the YCWA and the South Feather Water and Power Agency. Water is transported from the North Yuba watershed to the South Fork Feather watershed for use in hydropower generation. Water from Slate Creek, a tributary to the North Yuba, is intercepted by the Slate Creek Diversion Dam, and conveyed via a 2.5-mile tunnel to Sly Creek Reservoir, a tributary to the South Fork Feather River. From 2000 to 2005, an average of 78,000 AF per year of water was transferred.[12]

The movement of water from the Middle Yuba River to the South Yuba River to the Bear River occurs under FERC No. 2266 for NID's Yuba Bear Hydroelectric Project. NID is the licensee, owner, and operator, and NID and PG&E coordinate operations in the project. Under the license, approximately 30,000 AF per year of Middle Yuba water is conveyed via the Milton-Bowman Conduit and Bowman-Spaulding Canal to the South Yuba watershed. From Spaulding Lake in the South Yuba watershed, a portion of the original Middle Yuba water flows into the Drum Canal and eventually the Bear River, and another portion flows into the South Yuba Canal and eventually to Deer Creek (a tributary to the South Yuba). This conveyance of water provides irrigation and domestic water to NID's customers in addition to the hydropower generated.[13]

The movement of water from the South Yuba and North Fork of the North Fork of American River to the Bear River occurs under FERC No. 2310, PG&E's Drum Spaulding Project. PG&E and NID also have separate hydropower generating plants and developed water supply and power purchase agreements within this system.[14] Under this system, North Fork of the North Fork American water is conveyed via the Lake Valley Canal to the Drum Canal, which deposits a portion of its flow into the Bear River. Gage readings (from U.S. Geological Survey Gage 114126190) on Lake Valley Canal indicate that an average of 12,650 AF per year was conveyed from the North Fork American River watershed to the Bear River watershed from 1990 to 1998.[15]

The conveyance of water from Echo Lakes to the South Fork American River is managed by EID. Water is conveyed from the Upper Truckee River watershed at Echo Lakes to the South Fork American River watershed and is counted as part of EID's overall water supply. Up to 1,900 AF of water per year can be conveyed via the Echo Conduit.[16] The water is used for hydropower generation, instream flows for environmental purposes, and raw water deliveries. The amount of water conveyed in any given year is dependent upon water demand and the water year type (i.e., dry, normal, or wet). EID, also on occasion, moves South Fork American River water through the Hazel Creek Tunnel to Jenkinson Lake (Cosumnes River watershed) via the El Dorado Canal to optimize South Fork water supplies.

[12] USGS 2006a

[13] NID 2005

[14] Foothills Water Network 2006

[15] USGS 2006b

[16] DWR 2005

7.1.3 Administration and Management

Urban water supply in the CABY region is administered and managed primarily by five local public agencies for the benefit of local citizens and to comply with pertinent federal and state laws and guidelines. These entities are EID, NID, PCWA, GDPUD, and EDCWA. Other smaller public agencies and private water companies in the region procure, treat, and distribute water at various levels, generally within geographically limited areas.

EID is a water utility serving a population of over 108,000 residents in El Dorado County. EID was formally organized in 1925 under California's Irrigation District Law (California Water Code Section 20500 et seq.). EID provides drinking water for homes, schools, agriculture, and businesses and supplies recycled water to irrigate yards and public landscapes. EID's facilities and delivery infrastructure for drinking water include 1,093 miles of water pipeline, 27 miles of ditches, 5 treatment plants, 36 storage reservoirs, and 38 pumping stations.[17] Additionally, EID owns and operates the El Dorado Hydroelectric (FERC No. 184, described earlier).

NID was formed to provide a reliable, year-round water supply to its local constituents. The District's watershed encompasses 287,000 acres and supplies domestic and municipal water to a population of over 80,000 individuals and agricultural water to over 5,000 agricultural customers. NID produces over 354 Gigawatt hours of electricity annually and provides for public recreation and environmental flows in many streams. A significant component of NID's operations is the Yuba-Bear Hydroelectric Project (FERC No. 2266).

PCWA was created under State legislation entitled, "Placer County Water Agency Act" and adopted in 1957. PCWA carries out a broad range of responsibilities, including water resource planning and management, retail and wholesale supply of irrigation and drinking water, and production of hydropower energy. PCWA provides water to a majority of Placer County residents.[18] PCWA owns and operates the Middle Fork American River Hydroelectric Project (FERC No. 2079) as well as several smaller water rights and a large water purchase contract with PG&E for a substantial quantity of water from the Drum-Spaulding Project (described earlier).

GDPUD was created in 1946 to provide irrigation and domestic water supply to its constituents. The service area is 112 square miles on the ridge separating the Middle Fork American and Rubicon River on the north and the South Fork American on the south. GDPUD provides domestic and irrigation water service to the communities of Georgetown, Buckeye, Garden Valley, Kelsey, Spanish Dry Diggins, Greenwood, Cool, and Pilot Hill. GDPUD owns and operates Stumpy Meadows Reservoir, a 20,000 AF reservoir on Pilot Creek in the Middle Fork American River watershed.

EDCWA was formed by special act of the California State legislature in 1959. Its boundaries are coterminous with those of El Dorado County. Among EDCWA's authorities are the power to contract for water and to finance and construct, operate, and maintain works for the storage and transmission of water. EDCWA may contract for the sale of water to water purveyors, but is not permitted to retail water directly to customers. The Agency has undertaken the role of overall county water planning, and securing new water supply for the county.[19] The majority of residents of El Dorado County purchase their water

[17] EID 2012 Comprehensive Annual Financial Report

[18] PCWA 2006

[19] EDCWA 2003

from one of five water purveyors: EID, GDPUD, Grizzly Flats Community Services District, South Tahoe Public Utility District, and Tahoe City Public Utility District. The latter two agencies serve customers outside the CABY Region. In the southern portion of the CABY region, EDCWA coordinates water resource planning efforts within El Dorado County.

Several Mountain Counties Water Resources Association member agencies are participating in Reclamation's ongoing Sacramento and San Joaquin River Basin Studies to identify imbalances in supply and demand in the watersheds and identify adaptation strategies to address climate change impacts.

7.2 Water Demand

Water demand forecasts take into account many factors to make projections of future water use by a given population. For the CABY region, the water demand forecast is calculated using county estimates of population, land use designations, and agricultural data and multiplied using California Hydrologic Region (Sacramento River and Mountain Counties) parameters. For the Sacramento River Hydrologic Region, this includes irrigated acreage and applied water use; for the Mountain Counties Hydrologic Region, this includes population parameters.

The nine counties that comprise the CABY region are located within the Mountain Counties Area as defined by the California Water Plan Update.[20] El Dorado County comprises the largest area in the CABY region, covering roughly 995,000 acres. Placer and Nevada Counties make up the next largest area, covering approximately 629,000 acres and 511,000 acres, respectively. The remaining counties (Alpine, Amador, Butte, Plumas, Sacramento, Sierra, and Yuba) comprise small portions of the region (see Table 7-3).

Table 7-3
County Acreages in the CABY Region

County	Total County Size (Acres)[1]	Acres of County in CABY Region[2]	% of County in CABY Region	County as % of CABY Region
Alpine	468,849	10,664	2	<1
Amador	381,300	61,273	16	2
Butte	1,072,793	1,150	<1	<1
El Dorado	1,145,027	994,962	87	36
Nevada	625,013	510,513	82	18
Placer	958,339	629,029	66	23
Plumas	1,672,731	17,685	1	<1
Sierra	617,470	306,130	50	11
Yuba	411,699	173,224	42	6
Total:		**2,786,285**		**100**

Notes: CABY = Cosumnes, American, Bear, and Yuba.

1 Acreages derived from CASIL's county shapefile and by CABY Region Boundary provided by CABY participants.

2 Acres of county in CABY derived by clipping counties with CABY Region Boundary shapefile.

[20] DWR 2005

Table 7-4 lists the water demands for multiple-dry-year (third year) scenarios as presented in the UWMPs for the four primary water purveyors in the CABY region.

Table 7-4
Projected Water Demands[1]

Water Purveyor	Projected Water Demands for Multiple-Dry-Year Scenario (acre-feet per year)			
	2020	2030	2035	2040
EID	41,086	47,908	50,206	52,984
GDPUD	7,140	9,748	11,119	n/a
PCWA	142,335	165,272	178,971	200,562
NID	178,919	196,076	203,080	209,521

Notes: EID = El Dorado Irrigation District; GDPUD = Georgetown Divide Public Utility District; PCWA = Placer County Water Agency; NID = Nevada Irrigation District; n/a = information not available.

1 For consistency, multiple-dry year values come from the reported third year.

It should be noted that UWMPs only provide interim demand projections and do not represent the demand that would support full General Plan land use capacity. For instance, EDCWA updated its Water Resources Development and Management Plan in 2007 in an effort to incorporate new land use and associated water need projections of the 2004 General Plan. The planning area includes EID, GDPUD, Grizzly Flats Community Services District, South Tahoe Public Utility District, Tahoe City Public utility District, and other areas in El Dorado County that are not within a water agency's current service boundary. In 2014, EDCWA updated its west slope (within the CABY boundary) demand projections to incorporate state mandated 20% urban water conservation by 2020. The updated demand projections called for upwards of 149,000 AF of urban and agricultural demand to support land use capacity compared to the demand figures in Table 7-4 for EID and GDPUD, which represent a shorter planning horizon and a smaller geographical area.

Forecasting water supplies is challenging due to the influence of many variables, uncertainties, and poorly understood factors, such as the effects of climate change upon surface water supplies and water re-use. Other uncertainties include changes in population and economic growth; changes in water use by households, businesses, and public facilities; agricultural land use and production; the needs for irrigation; and future requirements and public desire for increased environmental benefit and/or economic growth.[21] The water forecast for the CABY region should therefore be viewed as a broad forecast used to determine adequate management practices, and not viewed as an exact future water demand calculation.

7.2.1 Land Use

Although the topic of land use is covered more extensively in Chapters 5, Region Description, and Chapter 8, Water and Land Use, a quick synopsis of predominant land uses and trends is provided here for context in understanding water supply and demand.

Historically, the economies of the mountain and foothill communities of the Sierra Nevada have been tied to the land. Over the last few decades, the CABY region has experienced a shift in land use away from

[21] Groves et al. 2005

traditional rural land uses, such as timber harvesting, livestock grazing, and irrigated agriculture, and toward rural residential developments. This trend has largely been driven by an influx of new residents since the early 1970s.[22] CABY's population is expected to increase by 373,732 between 2000 and 2050.[23] The federal government is the dominant landowner in the CABY region, with most of the higher elevation lands being under the management of the U.S. Forest Service and other federal agencies.

A variety of land uses occur in the CABY region. Most are associated with natural resource uses, as the majority of land cover is coniferous forest managed mainly by the U.S. Forest Service. Agricultural land use is generally confined to the lower elevations.

The amount of land devoted to agriculture (including grazing land) and forestry has decreased from 33% to 10% in Nevada County alone from 1957 to 2001, giving way to residential land uses. Mining and other commercial uses dropped to 2% and timber land uses decreased from 31% to 18% between 1957 and 2001.[24] Agricultural land is used primarily for vineyards, Christmas trees, citrus trees, berries, deciduous orchards, and pasture in El Dorado County; and rice, walnuts, cattle and calves, nursery, and pasture and range in Placer County.[25]

Currently, urban areas only constitute 1.4% of the land cover in the CABY region, but this is expected to change as the region accommodates a large increase in population per projections from Department of Finance/DWR. Growth in the CABY region will affect the extent of open spaces and cause significant impacts on natural resources.[26] At the same time, it brings with it a larger tax base to pay for essential community services that are otherwise limited in rural areas. With the elimination of traditional land uses, such as timber harvesting, farming, and ranching, local rural economies are more dependent on development- and tourism-related revenues.

7.2.2 Current and Future Urban Water Demand

Current projections forecast the population of California to increase 74% from 2009 to 2050, which will substantially increase the statewide urban water uses. The Mountain Counties Hydrologic Region, which includes the CABY planning area, is expected to outpace the state population growth with projected increases of 85% between 2000 and 2050.[27] Most of the population growth in the CABY region, as discussed in the previous section, will be greatest in the foothill urban centers in the western portion of the planning area (e.g., El Dorado Hills, Cameron Park, Auburn, Nevada City, and Grass Valley) (See Table 7-5). Water agencies in the CABY region are actively securing existing supplies, pursuing supply augmentation, and implementing efficiencies in water use and water delivery systems to meet future water needs.

Demand Projections

Urban Water Management Planning water demand forecasts use two variables: population and per capita water use (gallons per capita per day [gpcd]). Population is the primary variable used to calculate future

[22] Wacker et al. 2002

[23] DWR 2009

[24] Walker et al. 2003

[25] Placer County RCD

[26] Sierra Nevada Ecosystem Project 1996

[27] DWR 2009

urban water demand – housing growth, employment growth, and public sector water use are all correlated with population growth.[28] Placer County, El Dorado County, and Nevada County contain the majority of the CABY region's population, accounting for 88% of the 2001 population.[29] Table 7-5 illustrates how under current population growth projections, these three counties alone will be home to 725,141 people by 2050.

Table 7-5
Current Population and Future Estimates per County within the CABY Region

County	County Area (square mile)	Persons per Square Mile	Square Miles of County in CABY Region	2000 County Population in CABY	2013 County Population in CABY	2050 Population Projected (+85%)*
Alpine	738	2	17	28	34	51
Amador	595	64	96	5,663	6,144	10,477
Butte	1,636	134	82	10,183	10,988	18,839
El Dorado	1,708	106	1,555	142,298	164,830	263,251
Nevada	958	103	798	76,662	82,194	141,825
Placer	1,407	248	983	173,008	243,784	320,065
Plumas	2,553	8	28	228	224	423
Sierra	953	3	478	1,783	1,434	3299
Yuba	632	114	314	29,830	35,796	55,186
Total	**11,180**		**4,351**	**439,684**	**545,428**	**813,416**

Sources: 2010 Census information; Department of Finance 2013; 2010 Census information; *DWR 2009.
Note: CABY = Cosumnes, American, Bear, and Yuba.

7.2.3 Conservation

The CABY region has long had a culture of water conservation because it is solely dependent on mountain headwaters with limited options to enhance water supplies. Topography and geography limit the potential to import surface water, and bedrock geology renders groundwater unreliable for public supplies.

Unlike many purveyors in the Sacramento Region Hydrologic Region, the CABY region purveyors have fully metered and billed services, and have long employed best management practices such as tiered, inclining block rate structures on a volumetric basis, residential water audits, dedicated water efficiency staff, and canal lining/piping projects. Conversion of unmetered connections to metered connections with volumetric pricing is the primary tool in promoting water conservation. In fact, the California Urban Water Conservation Council (California Water Efficiency Partnership) estimates in its Utility Operations Program, "Metering with Commodity Rates," a 20% reduction in demand should result from metering and volumetric pricing. This would imply that either metering and volumetric pricing alone could satisfy the 20% conservation requirement of Senate Bill 7X-7 for agencies that currently have unmetered connections, or that CABY agencies already metering and employing volumetric pricing have achieved 20% water conservation. Since traditional water conservation practices have already largely been

[28] Groves et al. 2005
[29] DWR 2005

employed by CABY water purveyors, it will be more difficult and costly to achieve an additional 20% savings.

Additional conservation efforts are underway by all purveyors, at varying levels, to start (or continue) an Agriculture Irrigation Management Service for growers. For example, EID's Agriculture Irrigation Management Service program saved over 2,000 AF annually during the first several years of its deployment. In NID's service area, less than 10% of annual water deliveries are for potable domestic purposes; therefore, most of NID's conservations efforts are focused on raw-water delivery systems. PCWA also operates an extensive water efficiency program.

All water purveyors are continuously increasing efficiency of raw water conveyance systems by lining and piping open canals, automating spillways, and replacing appurtenant structures. One of the projects included for implementation is the Main Ditch Improvement Project, which includes the piping of three miles of open, unlined ditch in EID's service area to save an estimated 1,800 AF of water, on average, currently lost to seepage.[30] Another program aimed at conserving water and meeting future needs is EID's water recycling program. EID has been using recycled water for over 35 years.[31] Such water conservation and efficient use will be a necessary component in meeting future water demand in the CABY region. PCWA is investigating recycled water use in partnership with the cities of Roseville and Lincoln to serve an existing industrial area and future development.

Senate Bill X7-7 was enacted in November 2009, requiring all water suppliers (urban and agricultural) to increase water use efficiency. Urban conservation, as described in this bill, is measured in gpcd and was required to decrease by 20% by the year 2020. Urban per-capita water use includes residential (including landscape), commercial, industrial, and institutional uses of water. Each urban water supplier (providing more than 3,000 AF annually or serving more than 3,000 connections) must report the gpcd for their service area based on calculation methods outlined in the bill, and these must be included in their 5-year updated UWMPs. EID, PCWA, NID, and GDPUD all completed and submitted 2015 UWMPs to DWR, and use projections are based on these numbers. The base year, 2015, and projections are shown in Table 7-6.

Table 7-6
CABY Region Urban Water Suppliers' Conservation Targets Based on Senate Bill X7-7, as Reported in Water Agencies' 2015 UWMPs

Urban Water Supplier	Base Year 2015 (gpcd)	2015 Goal[1]	2020 Goal	Percent Decrease in gpcd Between 2015 and 2020
EID	301	271	241	20
PCWA	322	292	261	19
NID	246	222	197	20
GDPUD	203	185	167	18

Notes: CABY = Cosumnes, American, Bear, and Yuba; UWMP = Urban Water Management Plan; gpcd = gallons per capita per day.
[1] All agencies achieved their goal as described in their UWMPs.

The 20x2020 Water Conservation Plan[32] identifies the statewide and regional baselines for water based on 2005 data. Per capita urban water use for the Sacramento River Hydrologic Region is 253 gpcd. The

[30] EID 2012
[31] EID 2012

2015 target was a 10% reduction of 253 gpcd, or 215 gpcd, and the ultimate 2020 target for the Sacramento River Hydrologic Region was 176 gpcd. For the state, if all urban water suppliers comply with the 20x2020 legislation, gpcd was expected to go down to 154 gpcd by 2020, saving nearly two million AF based on a population of 37 million.[32] Even with decreasing gpcd, overall use may go up with increasing population in the Mountain Counties Region, as discussed in Sections 7.2.1 and 7.2.2.

With the exception of GDPUD, gpcd-related consumption in the CABY region is above the Sacramento River Hydrologic Region baseline and targets. Residents in urban areas with high housing densities typically have no personal landscape space. On the other hand, people in less densely populated areas live in single-family homes with landscaped front and back yards; and in rural areas, typical of a large part of the CABY region, people are watering livestock and irrigating gardens and small orchards, and thus use more water. This type of water use promotes regional sustainability because it is more efficient to grow produce locally, irrigate with gravity-fed water systems rather than with exported water that is pumped and re-pumped, and avoid long-distance produce transport back to these local areas. Current state water policy does not recognize or give rural agencies credit for this water-and-energy-conserving difference between urban and rural water use.

Another issue unique to source-area water supply systems not recognized in state policy is the miles of raw water conveyance systems, typically remnants of the Gold Rush era, that have a great potential for water savings. These systems are characterized by raw-water conveyance, such as earthen ditches and lined canals that typically experience greater water loss than urban potable water systems where water is pumped directly out of the river or ground and injected into the potable water system. Regarding conservation credit toward 20x2020 compliance, current state policy draws an arbitrary line for measuring water conservation just downstream of a municipal water treatment plant. This policy provides no incentive for improvements in raw-water systems where losses are sometimes the greatest; therefore, little advantage in funding for raw-water projects is tied to that policy.

2018 water efficiency legislation (Senate Bill 606 and Assembly Bill 1668) further challenges California water agencies to more aggressively implement conservation best management practices, including using residential indoor and outdoor water budgets, outdoor commercial water budgets, water loss reduction, and water reuse.

7.2.4 Current and Future Agricultural Water Demand

California's agricultural production includes over 350 commodities. Agriculture consumes a large portion of the water supply in the state, exceeding domestic use. Although agriculture is a major economic land use in California, agricultural land has been gradually decreasing statewide. Reductions in crop acreage are due mainly to urban encroachment. From 1990 to 2000, 500,000 acres of agriculture land were converted to urban or nonagricultural purposes.[33]

In the CABY region, agriculture occurs primarily in the lower elevations of the Sierra foothills. The upper elevations are steep and dominated by forested lands that are not suitable for agriculture. For the purposes of the IRWMP, timber harvest and production are not considered agriculture. These activities are covered under land use and management. Thus, the amount of agricultural land in the planning area

[32] DWR et al, 2010

[33] DWR 2005

is small relative to other parts of California. The dominant agricultural use is rangeland and irrigated pasture for cattle production. Crops grown in the area include alfalfa and grass hay, grain, olives, wine grapes, apples, berries, and other deciduous fruits.[34]

Agricultural water use for the planning area is forecasted using irrigated crop area and applied water use. DWR has information on both variables for all of the CABY counties for 2010.[35]

Table 7-7
Agricultural Acreages per County within the CABY Region

County	Total County Size (acres)	Acres of Agriculture per County[1]	Acres of each County in CABY Region	Acres of Agricultural Land per county in CABY Region[1]	Percent of Total County Agriculture in CABY Region
Alpine	475,642	496	12,096	—	—
Amador	387,809	9,792	67,885	3,679	38
Butte	1,073,367	258,671	45,088	1,689	1
El Dorado	1,143,265	5,078	999,871	5,079	100
Nevada	623,232	1,976	511,948	1,963	99
Placer	961,572	47,755	632,205	2,693	6
Plumas	1,672,609	50,223	12,258	—	—
Sierra	615,786	31,944	308,288	23	—
Yuba	412,037	97,648	196,844	1,238	1
Totals:			**2,786,483**	**16,364**	—

Notes: CABY = Cosumnes, American, Bear, and Yuba.

Because the irrigated area totals for each county do not depict their geographic locations, it is difficult to determine the exact irrigated area of the county that falls within the CABY region. This is problematic as the CABY planning area encompasses large portions of some counties and small portions of others. To calculate the acreage of each county's irrigated crop area that is within the planning area, a Geographic Information Systems (GIS) analysis was performed. The GIS analysis used the California Department of Forestry and Fire Protection's Land Cover Mapping and Monitoring Program data (LCMMP) to determine the percent of each county's agricultural land area in the CABY region. This percentage was then multiplied by the DWR's 2010 irrigated crop area per county to determine the possible extent of irrigated agriculture for each county in the planning area. It must be noted that more accurate information is available from county agricultural commissioners and local officials; this method was chosen for plan consistency and ease of comparison.

The LCMMP data (shapefiles) consist of polygons with assigned cover classes (e.g., agriculture, urban, and water) that depict land cover for each county. This data was downloaded and imported into GIS (ArcView). It was then merged and clipped by using the CABY planning area boundaries, producing a land cover dataset for the entire CABY region. The agricultural acreage of each county within the CABY region was derived from this dataset (Table 7-7). The agricultural acreage was divided by the total agricultural acreage per county to derive the percent of agricultural acres per county within the CABY region: Percent of County Agriculture in the CABY region = County Agriculture Acres in the CABY region ÷ County Total Agriculture Acres.

The percentage of County agriculture in the CABY region was then used as a multiplier to determine the number of irrigated acres per county in the CABY region. The DWR (2010) irrigated acres data for each county was multiplied by the percent of agricultural acres per county within the CABY planning area to determine the acres of irrigated crop area per county in the CABY region (Table 7-8).

1 Data for this table came from 'FVEG' dataset, which was revised in 2015, downloaded from https://frap.fire.ca.gov/mapping/gis-data/ on 5/22/2020. More accurate data may be available from local agricultural commissioners.

[34] DWR 2005

[35] DWR 2001

Applied water use, the second variable used to forecast agriculture water demand, is the amount of water needed to grow one acre of a crop. Applied water use, expressed as acre-feet per acre (AF/AC), is variable and influenced by soil characteristics, climate, and irrigation management and efficiency. DWR has information on applied water use per crop by county for 2001.

Table 7-8
Total Agricultural Applied Water Use in the CABY Region

County	Irrigated Acres in County*	Percent of Total County Agriculture in CABY Region	Irrigation Acres in CABY County	Applied Water for Irrigated Agriculture Lands per County (AF/AC)[1]
Alpine	7,130	0	0	4.87
Amador	10,132	37	3,749	2.7
Butte	202,234	0	0	2.77
El Dorado	9,892	100	9,892	2.55
Nevada	7,223	99	7,151	3.4
Placer	30,247	13	3,932	3.61
Plumas	20,229	0	0	1.96
Sierra	6,955	1	70	3.58
Yuba	70,987	1	710	3.44
Total Acres:			**25,504**	**Average = 3.29**

Sources: *2007 Census of Agriculture; DWR 2001.
Notes: CABY = Cosumnes, American, Bear, and Yuba; AF/AC = acre-feet per acre.
Total Applied Water use (AF per year) = (Total irrigated acres) X (Average Applied Water use)
[1] Applied water use per county is derived by averaging the applied water use for all crops grown in the county. Use ranged from 1.96 AF/AC to 4.87 AF/AC for the counties in the planning area, with an average of 3.29 AF/AC (Table 7-8).[36] The CABY region hosts vast differences in soil types and large topographical and cultural practices differences. While a clearer statement of water need would include an evaluation of the amount of water applied versus evapotranspiration rates from all different crops at a variety of elevations in the region, this calculation isn't completed at this time by any entities doing work in the region. Applied water can include water from public sources as well as that from water wells and extracted by riparian right from local streams.

Applied water use in the Sacramento River Hydrologic Region is expected to decrease by 2030 for two of the three scenarios. A decrease of 2% and 4% is projected under the Current Trends and Less Resource Intensive scenarios, respectively. Under the More Resource Intensive scenario, applied water use is projected to increase by 2%.

Regardless of the scenario considered, this methodology does not recognize the efforts of at least some CABY counties to protect agricultural land and promote future growth of agriculture as a means to preserve the rural nature of these counties and promote agricultural tourism. For example, the El Dorado County 2004 General Plan promotes a land use pattern that preserves agriculture to ensure its long-term viability by designating agricultural districts, identifying the principal use of these districts as agriculture, and discouraging incompatible uses, such as high-density residential. Limiting parcel size to 20 acres or more, allowing clustering of residential developments on non-choice soils, and imposing minimum setbacks within agricultural districts are all policies identified in the General Plan that will preserve and encourage agricultural growth in El Dorado County.

[36] DWR 2001

7.2.5 Current and Future Environmental Water Demand

Environmental water use is defined by the DWR as the amount of water purposefully allowed to flow through natural river channels and wetlands that is not diverted or used for urban or agricultural purposes.[37] In other words, environmental waters are waters set aside or managed for environmental purposes that cannot be used for other purposes in the locations where the water has been reserved or otherwise managed.[38] The California Water Plan Update Bulletin 160-198 defines environmental water use as the sum of:

1. Dedicated flows in State and Federal Wild and Scenic Rivers;
2. In-stream flow requirements established by water right permits, Department of Fish Game agreements, court actions, or other administrative documents;
3. Bay-Delta outflows required by State Water Resources Control Board (SWRCB); and
4. Applied water demands of managed freshwater wildlife areas.

There is a growing interest in the CABY region to conserve or restore the ecological health and functioning of rivers and their associated wetlands and riparian systems for the benefit of people and nature. It is recognized that alteration to a river flow regime may change the river ecosystem. Resource management entities need to be able to define the environmental components of a river's flow regime that will support the desired ecosystem and to quantify the ecological impacts of changes to the flow regime caused by artificial influences, such as water withdrawals, dam operations, and water releases for recreational rafting. No simple figure can be given for the environmental flow requirements of river ecosystems. Rivers are complex biological systems, knowledge is limited, and much depends on policies and other factors that determine the desired character of the river ecosystem that is being managed. The challenge for resource managers and scientists is to support decision makers in defining the flow regime that best meets the objectives set, or makes the trade-off that society finds most acceptable.

Various factors determine the health of a river ecosystem. These include flow variation and quantity; the physical structure of the channel and riparian zone; water quality; channel management and resource use, such as dredging and mining; level of utilization (e.g., fishing); and the presence of physical barriers to connectivity (e.g., dams and diversions). Environmental water demand or in-stream flows for rivers is the determination of the quantity or volume, through time, required to maintain river health in a particular condition. This may be predetermined or agreed upon based on a trade-off with other considerations. Initially, environmental flows or in-stream water demand was focused on the concept of a minimum flow level, which considered all river health issues to be related to low flows; as long as the flow was kept at or above a critical minimum level, the river ecosystem was thought to be maintained. However, it is increasingly recognized that all elements of a flow regime, including floods, and medium and low flows are important. Thus, any changes in flow regime will influence the river ecosystem.

To address these challenges, major tributaries of the Yuba, Bear, and American Rivers have undergone FERC relicensing processes during the last decade. More than $100 million dollars in public funds have been invested in environmental studies and public collaboration to establish river flow regimes seeking to balance the beneficial uses of water resources in the affected reaches. These flow regimes and associated environmental parameters are actively monitored and reported to regulatory agencies, such as FERC, California Department of Public Health, and the SWRCB in accordance with FERC licenses.

[37] Groves et al. 2005

[38] DWR 1998

Most watershed resources are managed to some extent for social, environmental, and economic needs. The challenge for scientists and managers is to help decision makers predict the consequences of varying degrees of alteration of the flow regime so that the implications to society are understood; in return, the goals for river management must be clarified so that scientists can determine appropriate flow recommendations. Moving toward restoring flow regimes that mimic natural variability is a goal of some stakeholders. A range of methods now exists to achieve environmental water demand and in-stream flow targets; these methods are being applied through FERC relicensing and SWRCB water rights terms and conditions, although acceptable methods can otherwise vary by stream.

Major tributaries in the American, Bear, and Yuba River watersheds have or are undergoing FERC relicensing proceedings that can affect water allocations. These proceedings are supported by extensive environmental analysis and collaborative effort between regulatory agencies, recreation interests, environmental organizations, and utility providers. Further refinements of the understanding between quantities and timing of flows and environmental effects have been an outcome of these collaborative analyses.

Data from the most recent California Water Action Plan from DWR for the Mountain Counties Hydrologic Region is used to forecast the CABY region's environmental water demand. Much of the dedicated environmental water use in the Mountain Counties area is subsequently diverted and used by downstream users. In addition, the major foothill reservoirs at the western edge of this area contain water dedicated to Bay-Delta outflows. The CABY region provides water to the applied water demands of managed freshwater wildlife areas in California, and managed wetlands occur in the planning area.

In California, flows in Wild and Scenic Rivers constitute the largest environmental water use.[39] The CABY region contains approximately 65.3 miles of Wild and Scenic Rivers and includes 26.3 miles of the North Fork American River from its source to the Iowa Hill Bridge, and 39 miles of the South Yuba from Spaulding Dam to the upper limit of Englebright Reservoir.[40] Designated flows from Wild and Scenic Rivers are available for other uses downstream, but not available in the Wild and Scenic designated areas. For 2001, DWR calculated the environmental water demand for the North Fork American and South Yuba Rivers as 229,590 AF and 83,741 AF, respectively.[41] Rivers identified as Wild and Scenic candidates can be found in Chapter 5.

In-stream flow is the water maintained in a stream or river for beneficial uses, such as fisheries, wildlife, aesthetics, and recreation. In-stream flow is a major factor influencing the productivity and diversity of California's rivers and streams,[42] and flow requirements are established by the SWRCB to protect and maintain aquatic ecosystems. It is difficult to forecast future regulatory actions and agreements that could change existing in-stream flow requirements. Thus, for this environmental water demand forecast, only the projected in-stream flow requirements for the American, Bear, and Yuba Rivers that were calculated by DWR are presented.[43]

[39] DWR 1998
[40] DWR 2002
[41] DWR 2002
[42] DWR 1998
[43] DWR 1998

A complete environmental water demand forecast that analyzes the effect of water rights on water availability and contains a reach-by-reach analysis of in-stream flow requirements is a gap in knowledge in the CABY Region, similar to the rest of the state. DWR estimates for in-stream flow requirements, presented above, based on only the largest downstream requirements and are not cumulative for rivers with multiple in-stream requirements, of which there are many in the planning area.[44] With the implementation of new FERC licenses in the CABY region, environmental water demand was quantified and is being implemented by the licensees.

7.2.6 Water Supply and Climate Change

Climate change will likely alter the timing and amount of water available within the CABY region, and water managers will be challenged to adapt to these changes. As discussed in Chapter 11, Climate Change, climate change is expected to intensify seasonal water shortage (due to less snowpack, earlier snowmelt, and precipitation occurring more often as rain than snow). Although geography and high occurrence of microclimates will influence these changes, higher air temperatures are predicted for the warmer seasons, generally resulting in less available water overall.[45,46,47]

Water delivery managers and purveyors, and hydroelectric generation managers may face more complex hydrologic management system adjustments when accommodating more frequent intense rainfall events and a reduction in late season snowmelt. Uncertainty puts added pressure on managers who are charged with delivering a resource necessary to meet the demands of growing economies, populations, and releases for the environment and recreational purposes.

About 66% of the nation's scarce freshwater resources originate on forested lands. Healthy forests capture and store water, naturally regulate streamflows and water quality, reduce flood and storm damage, control erosion, and replenish groundwater. High-elevation forests in the CABY region protect and enhance water supplies downstream because water supplies are mostly stored as snow cover. It is these critical areas that are particularly vulnerable to climate change and are projected to decline (due to the increased climate-related phenomena of fire, disease, and insect damage) in the next hundred years. Projected earlier spring runoff and reductions in snowpack, coupled with limited storage and compromised forest water retention, will likely reduce water availability downstream, especially during the summer and fall months. Higher water temperatures, flooding, and droughts are likely to affect water quality and exacerbate water pollution.

Each of the four CABY region water agencies has its own model for operational decision-making, and each is prepared to adapt to critical low-flow years and multiple low-flow water years. A regional perspective as climate change models and strategies evolve may be beneficial to those charged with managing resources in the diverse setting of geography, elevation, and storm tracks. However, an overarching climate strategy across the region may not be feasible or appropriate; there are too many variables in geography, elevation, storm track, and values being managed.

7.2.7 Current and Future Native and Cultural Use Demand

Water use is of primary significance to first nation people in the CABY region as regional and downstream demand for water increases in California and the risks to water quality become threatened due to declining forest health, development and climate related stress. Tribes have identified the need to actively

[44] DWR 1998

[45] McKenzie 2004

[46] Miller 1999

[47] Taylor 2009

promote and prioritize clean water by pursuing meadow restoration projects, wetland restorations, cleaning out springs, creeks, etc., and the need for a long-term strategy to create new meadows and natural management of forests. The CABY region needs to start initiatives that address water needs in short term (0 – 50 years) and long term (50 – 100 years) timeframes. In addition to water as a material resource, tribes' cultural use must be recognized and accommodated for in water management planning to ensure there is adequate water available for cultural uses including fishing.

7.3 Future Outlook Considering Water Supplies and Demands

A comparison of the projected region water demands (Table 7-4, Projected Water Demands) with the projected water supplies (Table 7-1, Normal and Multiple-Dry-Year Water Supplies by Agency) suggests that under current conditions, parts of the CABY region have sufficient water to meet future needs in both normal and multiple dry-water years. GDPUD demand outpaces supply by 2035 under a multiple-dry-year scenario, and for EID, new supplies are assumed to be needed before 2045 to meet demands. Statewide and regional efforts as well as climate change impacts could dramatically impact the water supply reliability in the CABY region.

It should also be noted that additional water supply need is projected in areas outside of water agency Service Areas, but within their Spheres of Influence, that may be provided by the agencies in the future. In particular, in El Dorado County, the EDCWA 2014 West Slope Update of the Water Resources Development and Management Plan, identifies urban demand of 10,426 AF per year and 1,086 AF per year that may be provided by EID and GDPUD, respectively. That demand is currently not reflected in the UWMPs for these agencies. Within the NID service area, small water systems interconnections are being investigated to replace diminishing water supplies.

In an effort to meet the projected water demands both inside and outside purveyor service areas, a few of the water purveyors are exploring new water storage opportunities. In El Dorado County, EDCWA continues to pursue a Central Valley Project Water Supply Contract under PL 101-514 (Fazio) and has been successful in negotiating annual storage and delivery of up to 40,000 AF as part of the FERC re-licensing of SMUD's Upper American River Project. In conjunction with the SMUD agreement, EDCWA is pursuing water rights to that water through a petition to the SWRCB for assignment of a state-filed application. EDWPA is currently working with downstream water agencies to develop project elements that would minimize impacts to the lower American River. One of the project elements currently being considered by EDWPA is in-lieu groundwater banking that would provide for EDWPA water to be banked in the Sacramento Groundwater Basin or Sacramento Central Groundwater Basin in wet years for use by Sacramento purveyors in dry years in lieu of surface water from the American River. A new storage reservoir on Alder Creek is also being investigated by EDCWA. Each of these projects are also identified in EID's 2013 Integrate Water Resources Master Plan. In Nevada County, NID is exploring opportunities to construct a water storage reservoir in the Bear River Watershed.

The following issues that face the region can potentially impact water demands and water supplies and are under active investigation:

- Climate change and associated hydrologic impacts
- Changing forest management practices and policies
- Aging infrastructure
- Improved integration of water infrastructure systems
- Urban conversion of current land uses
- Protection of water rights

- Water quality
- Watershed and ecosystem protection
- Integration with statewide water planning efforts
- State policies and regulations
- Surface and groundwater storage opportunities
- Water use efficiencies
- Inter- and intra-regional cooperation
- Conversion of open space to agricultural uses and changes in existing crop mix and patterns

Finally, water demand in the CABY region is met not only by ensuring adequate water supply, but also by ensuring adequate water supply infrastructure to meet storage, treatment, and distribution needs of water users. EDCWA's Water Resources Development and Management Plan and EID's Integrated Resources Master Plan (2013) each identify the need for additional surface water storage to meet the long-term water supply needs in dry years in El Dorado County. NID is embarking on a long-term water planning process to address current and future water supply needs to meet growth and climate change impacts. The IRWMP promotes projects that address specific infrastructure needs as well as overall water reliability for the region. These projects are discussed further in Chapter 12, Project Review Process, and they address water conservation, water recycling, and other water enhancement projects.

Chapter 8
Water and Land Use

A principal intent of the Integrated Regional Water Management (IRWM) process is to ensure the Integrated Regional Water Management Plan (IRWMP) incorporates and is consistent with local water and land use plans. This regional overview and integration does not supersede local planning, but is intended to encourage opportunities both to implement local goals and policies, and to provide better coordination between and among local planners. One of the California Water Plan Update 2009 goals is to make sure that water managers and land use planners make informed, collaborative water management decisions to better assure meeting California's water needs into the future, especially in the face of climate change. Early coordination of water and land use planning decisions is recognized as one of the best methods for meeting that future need; to that end, this chapter highlights opportunities for improved coordination.

As the Cosumnes, American, Bear, and Yuba (CABY) region has grown, competing uses for water have intensified; human needs and environmental demand have required a concerted and sometimes complex balancing act. Each CABY Stakeholder Group (SG) agenda includes an update section during which local representatives can inform CABY members of upcoming plan amendments, revisions, or preparation. In fact, interviews conducted during the 2013 Plan update revealed that many CABY region organizations already coordinate among and between planning entities. Many of these practices could be shared with other organizations because they represent successful lessons learned and could easily be adapted to other processes.

The CABY IRWMP is based on input from city and county land use planners, water agencies, nongovernmental organizations, and land management agencies. This input and information from local plans has been synthesized into this chapter. A review of goals, objectives, and policies of the relevant plans confirmed that the IRWMP reflects, complements, augments, or is consistent with all of the relevant plans (see Appendix E, Land Use Information).

During the 2013 IRWMP Update, the CABY Regional Water Management Group (RWMG) initiated improved integration and coordination by conducting interviews with four water agencies and five land use agencies. These interviews highlighted the need for continued integration between water and land use agencies, especially for interties and sewage infrastructure development. It is the intention of the CABY RWMG to build on the momentum achieved during this early coordination phase.

8.1 Local Planning Relationship to the IRWMP

The IRWMP initially recognized and incorporated local water and land use goals and objectives into the IRWMP, as described above. The water, land use, and IRWMPs seek to address water supply conflicts between users, water efficiency and water supply reliability, and riparian and in-stream environmental needs. (For reference, a matrix of the goals and objectives of the IRWMP and the water and land use plans is included at the conclusion of Chapter 9, Issues and Objectives.)

Projects developed under this IRWMP can then strengthen and manifest those local intentions through implementation and are designed to achieve success on the ground. For example, the recently completed CABY RWMG-sponsored water supply reliability project for Disadvantaged Communities of Locksley and Mount Vernon is designed to improve water use efficiency, which is consistent with the goals and objectives of the Nevada Irrigation District (NID) and Placer County Water Agency (PCWA) Urban Water Management Plans (UWMPs).

Furthermore, mechanisms to build on early momentum from the IRWMP water and land use coordination process offer promise, such as incorporating planning updates into the IRWMP, resolving inconsistencies, and scheduling interactions between and among agencies.

8.1.1 Incorporation of Future Water and Land Use Plan Updates into the IRWMP and Resolving Inconsistencies

Due to the variability of update requirements among plans, as well as the limited capacity of some jurisdictions to fund the required plans, it is not possible to schedule the future updates by year. Therefore, CABY RWMG has adopted an alternative strategy for ensuring that a nexus is created between updates and the IRWM process. Each CABY SG agenda includes an update section during which local representatives can inform CABY RWMG members of upcoming plan amendments, revisions, or preparation. In this way, individual CABY RWMG members are informed of the opportunity to participate in the various planning processes, and the CABY RWMG organization is notified of any plan updates or revisions. Because CABY RWMG is not an advocacy organization, it has not been deemed appropriate for an official CABY RWMG representative to provide input to local planning processes; however, CABY stakeholders often personally participate in these plan updates.

Collaboration could be especially helpful to address the following planning issues:

- Flood management planning (this would likely involve participants from the Central Valley)
- Groundwater recharge and banking opportunities (via interregional coordination)
- Water treatment and conveyance facilities
- Stormwater and runoff management
- Targeted watershed management and restoration, and the identification of open space protection
- Municipal landscaping programs and associated water use efficiency efforts
- Recreational needs, including public access areas
- Long-term planning exercises
- Planning and development review
- Protection and enhancement of working landscapes
- Water quality protection and pollution prevention
- Water management and use
- Public safety and emergency planning

The participation of CABY members in planning processes makes sure that any inconsistency would be identified early in the respective process, and would enable the CABY SG to develop an appropriate response within the IRWM process based on the collective input of CABY SG members.

8.2 Water Planning

Most water planning documents are prepared based on mandatory guidelines and regulations. The overall content and topics addressed are generally similar across the region because surface water derived from snowmelt and/or wet-season precipitation serves the majority of both consumptive and environmental needs. The CABY water-delivery system has been built for over 150 years, and consists largely of upper-elevation storage reservoirs and extensive inter-watershed infrastructure. The water plans all address some component of water storage, distribution, treatment, and land use designations based on environmental and planning principles.

Climate change has the potential to render existing raw water storage and conveyance facilities inadequate for a changing hydrologic regime. All CABY water agencies, large and small, are well aware of the potential consequences of increasing climate variability on their ability to store, treat, deliver, and export water.

8.2.1 Groundwater Management

No groundwater management agencies serve the CABY region; consequently, there are no groundwater management plans, projections, or guidelines. Groundwater resources in the region exist to a limited degree in the fractured bedrock of the region. Much of the interaction between surface and groundwater resources is unknown, though nearly all of the homes not served by a water purveyor are on individual water wells in fractured rock, presenting a possible vulnerability in the face of climate change. This is noted throughout this document as an issue for the CABY region.

The Sustainable Groundwater Management Act (SGMA) was signed into law in California in September 2014. The intent of SGMA is to provide sustainable management of all groundwater basins in California. SGMA requires the formation of Groundwater Sustainability Agencies and the creation of Groundwater Sustainability Plans in groundwater basins designated by the California Department of Water Resources (DWR) as high- and medium-priority.

8.2.2 Urban Water Management

The four largest water agencies in the CABY region—NID, PCWA, Georgetown Divide Public Utilities District, and El Dorado Irrigation District (EID)—are subject to state requirements for urban water planning as set forth in the UWMP Act. State-mandated UWMPs are normally completed at 5-year intervals as part of a master planning process. To date, all four CABY region water agencies have submitted 2015 UWMPs with updated water supply information, reviewed as part of this IRWMP Update. A key provision in Senate Bill (SB) 610 requires that any project subject to the California Environmental Quality Act (CEQA) and supplied with water from a public water system be provided a water supply assessment, except as specified in the law. Previously, the water supply assessments and UWMPs have not been formally presented to the CABY SG meeting or posted on the CABY web portal; however, the CABY SG has determined that links will be provided to each water agency's online library where these documents reside.

A number of other water purveyors with smaller service areas in the region are not subject to the UWMP Act. They include the City of Placerville, City of Auburn, City of Colfax, City of Nevada City, Washington County Water District, and the Grizzly Flats Community Services District. There are also smaller, community-based water systems of between five and 30 connections; these are largely vacation-home communities and not subject to the UWMP Act.

8.2.3 Agricultural Water Management

California Water Code Section 10820(a) requires all agricultural water suppliers that provide water to 10,000 or more irrigated acres to prepare Agricultural Water Management Plans to measure water delivered to customers, adopt pricing based on quantity delivered, and implement water efficiency practices. NID has prepared an Agricultural Water Management Plan that includes information about the agricultural water supplier and service area, inventory of water supplies, water balance, climate change, and efficient water management practices. NID serves about 5,400 agricultural customers with an average total reported irrigated acreage of 29,400 acres. Water uses within NID's service area are domestic, agricultural, environmental, municipal, and recreational.

8.2.4 Water Planning Element Within General Plans

Each city and county in California must prepare a comprehensive, long-term general plan to guide its future with updates every 10 years. To assist local governments in meeting these requirements, the Governor's Office of Planning and Research prepares guidelines for the preparation and content of local plans (General Plan Guidelines 2017) and these guidelines mandate a Land Use Element but they include an Optional Water Planning Element.

All nine counties and many of the cities in the CABY region have updated General Plans. The plans address multiple aspects of water, from supply and water quality maintenance to protection of environmental water needs and conservation. Some plans are more specific about water management; for instance, the City of Colfax included a Water Resources section, and Grass Valley included a Hydrologic Features section. Appendix E, Land Use Information, provides more detailed descriptions of the CABY county General Plans.

The CABY IRWMP integrates with the mandates, standards, and goals of city and county planning in three primary ways:

1. Through direct communication with city and county planners regarding IRWM goals, objectives, and implementation ideas;
2. Through the participation of local planners in the IRWM planning process and in project-specific design; and
3. Through stakeholder formal and informal consultation in local planning processes and project development mandated by local and state ordinances.

By way of example, the CABY IRWMP Water Supply and Water Quality goals/objectives were developed to complement the county General Plan water elements and the goals of the UWMPs compiled in the region. For example, CABY-sponsored projects, such as Improving Water Efficiency and Water Quality; Canal Lining; Gauging Stations/Water Efficiency Education in the American, Bear, and Yuba watersheds; the Grass Valley Drainage System Repairs; and Flood Protection Improvement in the Bear watershed were designed to maximize water-use efficiency and provide reliable sources of drinking water to residents in the region. These projects are not only fully compatible with, but also help facilitate, the water planning

efforts described in the water elements of the corresponding General Plans, UWMPs, and land management plans listed in Appendix E, Land Use Information.

8.2.5 Flood Management

Flooding is not a widespread issue in the CABY region; however, it is of localized importance, such as flooding within the City of Placerville. Placerville experiences serious flooding in the downtown commercial area almost annually as a result of overflow from nearby Hangtown Creek. Flooding from Hangtown Creek regularly disrupts traffic and interferes with economic development and can impact residential areas as well. The City of Placerville Stormwater Management Plan is designed to help restore this drainage and improve the small waterway to avoid flooding. The CABY IRWMP seeks to facilitate the Stormwater Management Plan implementation through CABY RWMG-sponsored projects, such as City of Placerville Water Quality and Habitat Protection: Hangtown Creek Sewer line Replacement.

Moreover, land use and water infrastructure in the CABY region directly and indirectly supports flood-control infrastructure in the Central Valley by attenuating flood flows as local upstream water supply/hydro reservoirs are filling in the winter/spring runoff period. For example, upstream reservoir levels in the American River Basin (Hell Hole, French Meadows, and Union Valley Reservoirs) are integrated into the flood control rule curves used by the U.S. Bureau of Reclamation (USBR) and the U.S. Army Corps of Engineers for flood operations at Folsom Reservoir. These three upstream storage reservoirs, together with numerous other water supply/hydro reservoirs in the CABY region, not only help prevent flooding in the Central Valley and reduce pressure on the downstream levee system in the valley, they also provide regulated water supply for later downstream municipal/industrial and irrigation uses, including within the Central Valley Project and State Water Project. In short, CABY region reservoirs and water infrastructure provide California residents with hydroelectric energy, water supply, and the downstream benefit of flood control. A number of CABY RWMG-sponsored projects, such as the Yuba River Regional Water System Infrastructure Improvement Project and the Combie Reservoir Sediment and Mercury Removal Project, are designed to maintain and improve the reliability of the reservoirs and infrastructure for the protection and benefit of residents far beyond the CABY region boundaries. Many of the CABY water agencies participated in the USBR Sacramento-San Joaquin River Basin Studies, and are currently participating in the USBR American River Basin Study. Both of these studies identify and analyze climate change impacts and adaptation measures and evaluation of storage needs and several new and expanded storage sites in the CABY region.

The CABY region also harbors numerous meadows in the upper reaches of the watersheds that provide flood attenuation and water storage. Montane meadows are important in the context of land use because they can cool and filter water as well as reduce peak flood flows, making downstream water more reliable, much as man-made reservoirs do. Meadows store water which offsets downstream flood events and extends water storage into dry summer months. CABY promotes projects, such as the recently completed Meadow Enhancement and Restoration in the Yuba, Bear, and American River Watersheds to enhance and restore meadow habitats, thereby improving flood management for the benefit of downstream users with the added benefit of enhancing crucial wildlife habitat.

8.2.6 Stormwater Resource Plans

In 2014, SB 985—California Water Code Section 10562—was passed and requires the development of a Stormwater Resource Plan (SWRP) to receive grants for stormwater and dry weather runoff capture projects from a bond act approved by voters after January 1, 2014. The requirement for an SWRP does not apply to Disadvantaged Communities that have a population of 20,000 or less and that are not a co-

permittee for a municipal separate stormwater system national pollutant discharge elimination system permit issued to a municipality with a population greater than 20,000.

Per 2016 DWR IRWM Guidelines, SWRPs developed in the CABY region must be incorporated in the IRWM. As SWRPs are developed in the CABY region, they will be reviewed by the CABY RWMG for incorporated in the IRWMP.

The El Dorado County Water Agency (EDCWA), in collaboration with El Dorado County and the City of Placerville, developed an SWRP for the West Slope of El Dorado County, which was finalized in March 2018. The SWRP is a watershed-based comprehensive strategic document that summarizes a renewed approach to watershed resource planning and stormwater runoff management in West Slope of El Dorado County. The plan incorporates prioritized actions, affordability considerations, and nexus to other related resource planning and implementation efforts to support efficient and responsible implementation. The 2018 West Slope Stormwater Resource Plan for El Dorado County is incorporated into the CABY IRWMP by reference.

8.2.7 Watershed Management

For planning purposes, the CABY region can be divided into two geographic areas: the upper watersheds and the mid-to-lower-elevations. The upper watersheds, from about 3,000 feet elevation and above, are almost uniformly held in public ownership and managed by the U.S. Forest Service. The upper elevations are generally source watersheds with relatively little development pressure. However, the checkerboard private and public land ownership patterns present significant challenges for comprehensive land and watershed management. Representatives from both the Eldorado and Tahoe National Forests are active participants with CABY RWMG and many of the CABY nonprofits are focused on National Forest System lands, so there is a high degree of collaboration about resource management and improvement in these reaches of the watersheds. U.S. Forest Service planning documents provide guidelines and management direction for the upper watersheds. These plans are listed in Appendix E, Land Use Information.

By contrast, the mid-to-lower elevations are largely in private ownership and experience the greatest development pressure, competing interests, and the volatility of local politics. As described in Appendix E, Land Use Information, a number of river management plans, fire plans, and watershed and conservation plans have been developed within the lower elevations of the CABY region.

In addition, a variety of nonprofit organizations across the CABY region focus some or all of their programmatic efforts on a variety of watershed assessment documents, studies, and reports. Some key management plans and studies published by these organizations are:

- The South Yuba River Citizens League authored a critical planning document entitled *The 21st Century Assessment of the Yuba River Watershed* published in June 2010;
- The Sierra Fund has authored planning documents, including *Mining's Toxic Legacy* in 2008 and the *Headwaters Mercury Source Reduction* Strategy in 2018 ;
- The South Fork American River Watershed Group authored the *South Fork American River Watershed Plan* (also begun with a previous watershed coordinator grant), which is largely made up of agency representatives;
- The American River Conservancy authored an *Environmental Assessment and Strategic Plan for Conservation of the Cosumnes River* published in 2001; and

- The Cosumnes Coalition authored the *2016 Cosumnes River Watershed Update and Stewardship Plan.*

These groups were in place as the CABY IRWMP was first being developed in 2006 and 2007, and the CABY SG identified them as an incubation area for project development and prioritization. In this way, CABY RWMG has fully integrated the watershed-level perspective into the planning process.

8.2.8 Multipurpose Program Planning

Multipurpose program planning is another form of watershed planning, and one that may take more activities into account than traditional watershed planning. These may include roads and transportation planning, emergency preparedness planning, and/or low-impact development and stormwater management. While this type of planning is not extensively included in this chapter, representatives from such a variety of management agencies, public interest groups, business interests, and governmental agencies that consider these more diverse forms of planning and management, are present through CABY SG membership and participation, and bring points of interest forward when appropriate. These plans have also served as a basis for identifying issues and projects.

8.3 Land Use Planning

Land use planning is conducted within the region by nine counties, seven cities, a resource conservation district in conjunction with a watershed group, the two National Forests (Eldorado and Tahoe)**,** Bureau of Land Management, and the California Department of Forestry and Fire Protection. Land use planning is inherently political and highly controversial within all counties of the CABY region, often drawing out and increasing the expense of the required 10-year General Plan update process.

Primary land use planning entities involved in this and past IRWMPs have included the following:

- American River Watershed Group
- Bureau of Land Management
- California Department of Forestry and Fire Protection
- City of Auburn
- City of Colfax
- City of Grass Valley
- City of Loomis
- City of Nevada City
- City of Placerville
- City of Plymouth
- El Dorado County
- El Dorado County Resource Conservation District/South Fork Nevada County
- Eldorado National Forest
- Nevada County
- Placer County
- Sierra County
- Tahoe National Forest

Land use planning is conducted by the counties on private unincorporated lands. Much of the public land is planned and administered by the National Forests, leaving cities and counties with responsibility for a large proportion of the planning, but with little jurisdiction in overall land area.

Population trends for the CABY region show that CABY's population is expected to grow at a rapid rate. California Department of Finance projects a population increase in the Mountain Counties, in which all CABY counties are located, of 85 percent between 2010 and 2050. This would be an increase of 373,732 people in the CABY region alone between 2010 and 2050. Most of this growth is anticipated in the lower elevation areas. With this growth will come increasing demand for water – providing further reasons to connect water and land use planning interests.

Water-related supply and treatment issues are included in the Conservation Element of general plans. Policies that must be addressed in the Conservation Element include the following:

- SB 221 prohibits approval of subdivisions consisting of more than 500 dwelling units unless there is verification of sufficient water supplies for the project from the applicable water supplier(s). This requirement also applies to increases of 10 percent or more of service connections for public water systems with less than 500 service connections.
- SB 610 and Assembly Bill 901 make changes to the UWMP Act to require additional information in UWMPs if groundwater is identified as a source available to the supplier. A key provision in SB 610 requires that any project subject to CEQA and supplied with water from a public water system be provided a water supply assessment, except as specified in the law.
- State of California General Plan Guidelines[1] recommends facilitating SB 610 by having strong water elements in local general plans that incorporate coordination between the land use agency and the water supply agency.

Even with these policies in place, efforts to link land use and water management decisions remain challenging.

8.3.1 Climate Change Planning

The Sierra Nevada Climate Action Plan is one of three efforts being led by the Sierra Nevada Conservancy in responding to the direction of its board in the development of the Sierra Nevada Climate Change Initiative. The Sierra Nevada Conservancy Climate Action Plan of the Sierra Nevada addresses potential impacts to water, habitats, endangered species, fire, and recreation resources in the entire Sierra Nevada, including the CABY region.[2] This plan is discussed further in Appendix E, Land Use Information.

Most county planning processes do not include considerations of climate change (adaptability), but most do include consideration of greenhouse gas emissions (mitigation). This is a mandatory measure for consideration in general plans' Housing and Transportation Elements. For example, in El Dorado County in 2008, the El Dorado County Board of Supervisors adopted the "Environmental Vision for El Dorado County" Resolution No. 29-2008, brought forward by the Youth Commission. The resolution sets forth goals and calls for implementation of positive environmental changes to reduce global impact, improve air quality, reduce dependence on landfills, promote alternative energies, increase recycling, and encourage local governments to adopt green and sustainable practices.

[1] Governor's Office of Planning and Research 2003

[2] Sierra Nevada Conservancy Climate Action Plan of the Sierra Nevada 2009

8.3.2 Water Management and Land Use Planning Communication

In spring of 2012, CABY completed a series of interviews with five land use planning entities and four water management agencies, identified in Table 8-1, Agencies Participating in the Water-Land Use Interviews completed in spring 2012. These interviews were conducted to assess the level of coordination and communication between water and land use agencies in the region. The CABY Water and Land Use Technical Advisory Committee aided in the identification of interview questions and candidates. The Technical Advisory Committee's original focus was centered on improving communication, accounting, and coordination. However, the interviews revealed that many CABY region organizations already have exceptional coordination and accounting practices, either within a single agency, or between water and land use entities. In fact, many of these practices could be shared with other organizations because they represent successful lessons learned and could be easily adapted to other processes. The following paragraphs discuss general trends found in the interviews, highlighted successes, and areas where communication and coordination between entities may be improved. One interview focused on the visioning for water and land use coordination, and is summarized at the end of this chapter.

Table 8-1
Agencies Participating in the Water-Land Use Interviews Completed In Spring 2012

Water Agencies	El Dorado Irrigation District (EID)
	El Dorado County Water Agency (EDCWA)
	Nevada Irrigation District (NID)
	Yuba County Water Agency (YCWA)
Land Use Agencies	El Dorado County
	Nevada County
	Yuba County
	Sierra County
	City of Placerville (planning and water supply staff)

8.3.2.1 Interview Findings

In general, the CABY region has relatively well-developed coordination and communication between planning entities, due partly to the forum that CABY RWMG provides. Needed improvements are identified in the paragraphs that follow. Of note is that water is *not* currently the driving force of regional land use planning. Commute distances and the time and costs associated with that travel have a much greater influence on land use planning at present. However, in El Dorado County, additional water supplies are required to meet future projected demand.

Coordination and Communication

Urban water management agencies represent the largest contingent of CABY water management interests. Outside of the CABY SG, NID and PCWA have the most frequent communication in the north CABY region, due largely to proximity and infrastructure sharing. On the south end of the region, EID and EDCWA communicate about water supply and water rights issues, as well as participating in county-level planning meetings. CABY RWMG serves as a hub of information between water agencies and local jurisdictions, as well as a place for nonprofit organizations and community members to contact their water provider.

The land use planning entities in the CABY region convey information to water management agencies as part of the General Plan update processes. Likewise, water agencies in the CABY region share their UWMPs with land use planning entities when they are updated. Each water agency also receives CEQA statutory notification of land use issues, such as General Plan amendments and subdivisions. However, a higher level of communication is lacking a focus on long-term planning. During the interviews, several needs for sustaining or improving coordination were noted:

- Some entities within the CABY region are just beginning to engage in coordination, and others have neglected to practice consistent communication. Both of these group types, in particular, need a consistent forum and may need additional outreach from CABY RWMG.
- The turnover in staff was noted as a key reason for continued coordination. Because there is usually not a policy or protocol guiding communication, it is important to know who to call at the counterpart agency for the variety of issues that may arise. This coordination usually occurs between staff at similar planning levels: technical staff contacts technical staff, management contacts management.
- It is not common for elected boards to contact each other, though it was noted in one interview that having a common elected board made coordination much easier.
- One set of interviewees pointed out that in their jurisdiction it was likely that the relationships made the communication work.
- One entity noted that the biggest challenges in communication come up during long-term developments. Development projects often take up to a decade, and so periodic communication between the developer, the water agency, and the land use entity over time is paramount.
- The point was made that some counties in the CABY region are small enough for every planning and environmental health department employee to know what is going on with groundwater, development pressures, and water availability. However, no maps currently indicate this information, and while maps would be helpful, the planning departments must ensure that the creation of those maps does not affect land values or desirability of specific communities.

Small and Rural Water Systems

Common among all interviewees is the challenge of serving remote communities and homes. Remote communities with independent water systems or individual wells are vulnerable to loss of supply or aging infrastructure. In many cases, water resources are not adequate to serve these areas, and in many cases, the soil is not adequate to support septic systems. Several interviewees acknowledged that these small, rural, remote developments would not occur now because of improved communication between environmental, water, and land use agencies.

When a small system becomes inoperable, pressure is often exerted on a public water supplier to provide service to these areas. This is a challenge on many levels:

1. Cost is the biggest challenge; individuals on small systems often are not able to pay for the very high cost of running water supply infrastructure to remote areas. The water agency bearing that cost must then subsidize the small community.
2. Engineering can also be a challenge; remote areas often remain so because of the difficulty in delivering services across ridges and through valleys.
3. Development pressure may result from water provision in areas not designated as residential in the region’s various general glans.

Water-driven versus Planning-driven Development

In most cases, planned water agency expansion provides backbone infrastructure for development consistent with General Plan land use designations. This infrastructure is paid for through connection fees collected from developers. For the most part, water agencies plan infrastructure expansion consistent with their respective General Plans. However, there are infrequent instances where large-scale land use amendments can mismatch infrastructure capacity and water requirements. In these cases, the burden of increasing capacity or supply is generally borne by the developer. In some cases, these surprises can incur cost to the water purveyor, and additional communication throughout the life of a development project, as mentioned above, would be helpful. In some cases, developers drive the installation of backbone infrastructure, where the project size can support the improvements or where water supply limitations require creative solutions. This was the case with the Serrano Development funding water recycling infrastructure in Cameron Park and El Dorado Hills.

Likewise with General Plan changes, while water agencies often make comments on changes that affect public water service, it was stated that sometimes these comments are too late to have an effect and can result in inefficient water infrastructure.

Water Supply Availability

In one interview, it was stated that the county would not accept a cap on water supply (thereby capping development). The interviewee stated that the county would simply increase that cap and tell the water agency to find the water. In this same interview, the agency stated that it is responsible to find as much water supply as is needed for continued development as projected by the county and cities within the agency's service area.

It was quite evident throughout the interview process that counties having a history of water challenges generally have better water-land use communication protocols than those that historically have not experienced water supply limitations.

Agricultural versus Urban Needs

Several planning units within the CABY region include high levels of agriculture land use. An inherent fear in the agricultural community, especially when agricultural users receive potable water, is that they will be marginalized, or that their supply will be pirated because of a developer's willingness to pay a higher price. Some water agencies plan for agricultural use consistent with General Plan designations while others estimate use based on metered use.

Native and Cultural Use Needs
Alex, add stuff about wetlands and meadow restoration here.

Emergency Planning

Emergency responses to disasters often involve water resource planners both in planning for emergencies and responding to emergencies. The types of emergency situations that can occur in the CABY region include damage to water-related infrastructure by fire or flood, damage to critical infrastructure as a result of operational failures, and/or emergencies that result from weather, such as extended droughts or wind/snow storms in the upper elevations.

The CABY region stakeholders have demonstrated strong coordination skills as needed during emergencies, and several stakeholder entities participate in multi-jurisdictional hazard mitigation planning efforts as well.

8.3.2.2 Successes Identified through the Interview Process

In El Dorado County, historically plagued by supply limitations coupled with development pressures, water-land use coordination has been refined substantially over time. The coordination process evolved as demand approached existing water supplies. This resulted in the land use agency requiring proof of water availability before it would accept an application for, or consider, a land use decision. In the mid-1990s, the El Dorado County Board of Supervisors passed an ordinance requiring proof of meter purchase before the final approval of subdivision maps. Because meters have to be purchased, the associated water use is tracked and set aside, and is not available for sale to others. The El Dorado County Board of Supervisors resolution requires that an annual water supply-and-demand accounting be provided to the county that informs staff and land use decision makers and makes the information public. Tracking is also done at the application stage by EID. EDCWA also periodically prepares a countywide water master plan to accompany the county's General Plan that identifies and makes recommendations regarding the longer-term water supply needs of the county, not only with purveyor service areas, but countywide.

In Nevada County, all land use planning efforts are managed under the one roof of a Community Development Agency (though the major water supplier in that county is not included in this agency). In that way, issues of well water safety, transportation planning, lot size and use zoning, and many other considerations may be dealt with as a team. This limits the silo effect of having various departments review and approve. The planning team discusses each proposed project on at least two occasions, (1) a pre-application meeting including the developer/applicant, and (2) a staff meeting to discuss project findings. The designation of the planner as the project manager for each project, and a review file and routing sheet that follows the project to each reviewer for a sign-off, facilitates integrated review. An even more successful strategy may be to include the water purveyor at a designated step in the process.

In Sierra County, an ordinance was passed banning the sale of water outside the county. This was done largely because of a single project: developers purchased land on the county's eastern border with the State of Nevada, and were planning on sending the water over state lines. Yuba County has a similar ban on pumping groundwater for export out of county, though the export of surface water is allowed.

Follow-up Interviews

Follow-up interviews served as a mechanism to more fully integrate water and land use planning, and they identified activities that could enhance on-the-ground collaboration between land use and water management entities. The interviews also identified recommendations and successes that could be replicated elsewhere in the region.

Nevada County and NID: Staff members of the NID and Nevada County Planning and Environmental Health Department met on January 10, 2013, to discuss some of the topics noted above. Participants noted that even though there are state-mandated coordination efforts with which both entities must comply, these are often not adequate for implementation-level water planning and long-range (General Plan-level) planning. In addition to general coordination, the prospect of climate change indicates additional future challenges for which the water district and the planning agency would be better prepared if working together; the consensus was that the agencies could "combine resources to make a stronger regional position from an economic, quality of life, and many other standpoints."

Both entities agreed that coordination should continue, at least twice a year, if not quarterly. Staff time is always a challenge, but they both stated that the benefits from this collaboration would be fully worth the required staff time. Topics for future conversations include coordinated planning for areas currently without infrastructure; a discussion of the 20x2020 legislation requiring the county to participate in landscape water conservation efforts; a discussion and identification of previous successes regarding groundwater availability and infrastructure extensions to development areas; better coordination on well decommissioning when infrastructure is extended; and how to avoid miscommunication with the county's Environmental Health Department regarding the placement of wells and septic systems. Groundwater conversation is significant because of the frequency this challenge was mentioned in the initial interview process.

Both agencies committed to involving the other earlier in the high-level planning processes; NID will more fully include the county in its master planning process, and the county will better inform and involve NID in its general planning process. There was mention of a development review committee, as is used in El Dorado County, to serve as a possible structure for the effort. This will be pursued in future meetings. Nevada County agreed to take responsibility for holding the next collaborative meeting. Both agencies are bringing on new staff in significant managerial positions, and will be better able to integrate these efforts with the additional staff. They agreed to report outcomes to CABY RWMG on a regular basis as meetings occur.

Placer County and PCWA: Staff members of PCWA and Placer County Planning and Environmental Health Department met by conference call on March 31, 2013, to discuss the integration of land use and water planning. Based on the interview, these two agencies appear to be working closely together and there are no major issues or concerns. PCWA currently has the capacity to serve water to maximum build-out of the General Plan, even during multiple dry years. Both agencies are closely involved with implementing the Placer County Conservation Plan, an amendment to the General Plan that identifies those areas available for development within the county. PCWA is responsible to ensure that they have the ability to serve surface water to areas targeted for development and for compliance with the Endangered Species Act. PCWA is a critical stakeholder in the development and implementation of the Placer County Conservation Plan.

On a routine basis, when Placer County or municipalities within the county have a development project submitted to their planning departments, a notice is sent to PCWA requesting their comments. These notices are sent to PCWA almost daily. Typically, an Environmental Specialist at PCWA receives and reviews these notices and prepares a response.

Current Regulatory and Policy Developments: Placer County is developing several policies to address water development in coordination with PCWA. Staff is also considering developing a Countywide Water Master Plan that focuses on rural, underserved areas. Placer County includes over 100 small water systems distributed throughout the county and recently has been working with County Environmental Health to better understand these systems. The goal is to make sure that all county residents have access to a reliable supply of safe drinking water.

8.4 Recommendation and Future Actions to Improve Coordination

- In building on the successful coordination efforts noted above, the CABY RWMG is interested in evaluating ways to encourage more diverse communication between water and land use

managers in the CABY region. Ideas include an annual water-land use summit; planning-themed CABY SG meetings; and watershed-specific meetings between water and land use professionals on a more targeted basis. These concepts will become more developed with time, but the CABY SG views the water-land use connection as a priority for the region.

- Growth in this largely rural region may occur outside the purview of SB 610; in other words, cumulative effects of smaller subdivisions that do not have to provide (i.e., can avoid) water supply assessments might have greater impacts than well-planned larger subdivisions. Land use planning entities may want to consider requiring demonstration of adequate supply and infrastructure for smaller projects. This effort could include consideration and quantification of cumulative effects of land use on water supply by working with El Dorado County's example.
- One county has maintained agricultural parcel size at 160 acres, minimum. This parcel designation has helped in preserving the groundwater availability in those parts of the county and has guided development into the community cores. A CABY RWMG-facilitated conversation about the pros and cons of this approach for interested counties, and an examination of the successful political strategy used, would extend and coordinate lessons learned.
- One of the interviews evolved into an informal vision session for the ideal situation for communication/coordination between water managers and land use planners; In Placer County, land use planners, including middle-management and/or department heads from each entity, could meet with water managers as often as quarterly (depending on the pace of development). The discussion could include projected growth areas, large project tracking, infrastructure development and project review, both future and current planning efforts, and strategic issues for both entities. The meetings would be organized as needed by the affected parties, and occur with the intent of resolving regional planning issues. Note: NID and PCWA meet quarterly for a similar purpose on a water agency-to-water agency level. These meetings have proven to be invaluable to the two agencies as they identify and solve issues of mutual concern and import. If this model is successful, it is expected that, with CABY RWMG support, similar initiatives could occur in other counties in the CABY region.

Chapter 9
Issues and Objectives

The purpose of this chapter is to present the process by which Cosumnes, American, Bear, and Yuba (CABY) members and stakeholders developed Integrated Regional Water Management Plan (IRWMP) goals and objectives, and the consistency of those objectives with mandatory state plans and water code requirements. In addition, this chapter identifies the measurement metrics that the CABY Regional Water Management Group (RWMG) established to create accountability within the system and to make sure that implementation projects serve to meet the identified objectives.

The goals and objectives presented in this chapter were developed by assessing the issues, conflicts, and resource management strategies identified within the CABY region and formulating actions to address each of them. The CABY Stakeholder Group (SG) specifically designed the planning effort to provide a direct connection between the identified region-specific issues and conflicts, the State Water Plan Resource Management Strategy, the development of measurable objectives, and creation of implementation projects that serve to meet the specified outcomes/measurable objectives. Furthermore, the CABY SG directed that issues and objectives be presented in the same chapter as water-related conflicts to make sure that these concepts were dealt with in a comprehensive and coherent manner.

9.1 Use of Working Groups

Working Groups (WGs) are established by the CABY RWMG to prepare recommendations for the CABY RWMG and CABY SG's consideration on a specific topic or action. WGs are convened on an as-needed basis for plan updates, grant proposals, project selection and other final products, and remain active until product completion. During the initial development of this IRWMP, the CABY SG identified three WGs to support preparation of the Issues and Objectives Chapter: Issues WG, Objectives WG, and Water WG. The activities of these committees were coordinated so that each WG both informed and was informed by the activities of the others. CABY RWMG has a strong history of collaboration, and it is not uncommon for the same CABY RWMG member to be on multiple WGs. This was the case with these three committees, and the overlap in participation further serves to ensure cross-pollination between the work efforts.

9.1.1 Issues Work Group

The Issues WG organized the issues list into the five programmatic areas. They also developed a structure of primary and secondary issues, as displayed in Table 9-2. The primary issues identified categories of issue, while the secondary issues clarified when a primary issue had multiple components or aspects of concern. It was noted during this process that some issues were relevant to more than one programmatic area. In these cases, the most relevant programmatic area was chosen to minimize confusion and to ensure consistency throughout the list.

9.1.2 Objectives Work Group

The Objectives WG met specifically to discuss prioritization and to develop a format to display the objectives. The WG also developed objectives for the secondary issues. For example, in cases such as Governance, where a primary issue was assigned multiple secondary issues (e.g., Political, Legislative, and Regulatory), the objectives were compiled for all three secondary issues, but not for the primary issue.

The CABY SG was very clear in its direction that the objectives needed to include actual implementation targets rather than a simple list of the types of measures that could be used to assess implementation. For example, in the case of the objective to enhance meadows, the actual number of five meadow projects and a specific implementation target date were specified. This makes sure that a certain number of meadow projects will be implemented before the objective is considered attained.

9.1.3 CABY Water Work Group

The CABY Water WG was created to address technical water management issues throughout the CABY region. Because the CABY SG outreach and coordination of interested parties was so successful, it resulted in a diverse array of participants with different perspectives on water and watershed management. Detailed and technical conversations were not always appropriate or productive within the larger CABY SG meetings, so water purveyors and others assembled a smaller technical group to advance projects and ideas specifically on the topic of water supply, delivery, and management.

9.1.4 Chapter Update

As part of the 2021 IRWMP update, the CABY RWMG met to review and update the issues and objectives found in Tables 9-2 and Table 9-4 to capture changed conditions and emerging trends within the CABY region.

9.2 Programmatic Goals

A framework of programs was identified by the CABY SG to aid in the development of specific objectives. This list of programmatic areas includes Water Supply, Water Quality, Environment and Habitat, Climate Change, and Human-Landscape Interaction. The Objectives WG, in consultation with other issue-specific WGs, developed goals for each recommended program. Table 9-1 identifies the goals that were developed by the WG effort and ultimately approved and adopted by the CABY SG. These goals then became the organizing principle for the objectives.

Table 9-1
Program Goals

Programmatic Area	Goal
Water Supply	Ensure adequate and reliable water supply that can be adapted to climate change and can meet the needs of the region.
Water Quality	Ensure sufficient water quality to support healthy ecosystems and dependent organisms.
Environment and Habitat	Preserve and restore watershed health.
Climate Change	Anticipate climate change needs and be prepared to respond adaptively to human and ecosystem needs.
Human-Landscape Interaction	Maintain and enhance functioning landscapes that provide sustainable services for humans.

Table 9-2 illustrates each programmatic area, the primary issues associated with that program, and the secondary issues that were identified to support development of more specific objectives and targeted outcomes.

Table 9-2
CABY Issues Organization

Programmatic Area	Primary Issue	Secondary Issue
Water Supply	Conservation	Policy and Education
	Infrastructure	Aging Infrastructure
		Interties
	Water Storage	Reservoir Sedimentation and Green Infrastructure
		Shifting Hydrology
		Forest Management
	Water Management Operations	Drought
		Recycled Water
	Water Transfers	Financing Mechanism for Headwater Management and Restoration
	Groundwater	Recharge and Contamination
Water Quality	Contamination	Legacy Mining Toxics
		Urban/Abandoned Mine Land Runoff
	Sediment Management	Mercury Contaminated Sediment and Debris Control Dams
		Erosion and Sediment Control Associated With Roads
	Wastewater Management	None
	Headwaters Protection	None
	Temperature	None
Environment and Habitat	Fisheries	Volitional Fish Passage
	Aquatic Biota	None
	Instream Flow	None
	Meadows	None
	Fire and Fuels	Prioritizing Fuels Treatment in the Wildland Urban Interface
	Invasive Species	Aquatic Invasive Species
		Terrestrial Invasive Species
Climate Change	Greenhouse Gas Emissions	Carbon Sequestration
		Fuels Management
Human-Landscape Interaction	Habitat Alteration	None
	Native American Uses	Traditional Ecological Knowledge
	Flooding	Environmental Flows
	Open Space	Brownfield Properties
	Environmental Flow Hydrograph	None

Table 9-2 CABY Issues Organization		
Programmatic Area	**Primary Issue**	**Secondary Issue**
	Disadvantaged Communities	Access to Water
	Recreation	None
	Hydropower	None
	Agriculture	Agricultural Land Conservation
	Sustainable Economy/Self Sufficient Communities	None
	Governance	Political
		Legislative
		Regulatory
Other	**Topic**	
Over-arching Issues/Objectives	Education and Outreach	
	Financial Feasibility and Sustainability	
	Capacity Building	
	Data Analysis and Monitoring	
	Regional Planning and Land Use	
	Fire Resiliency	
Conflicts	Growth and Land Use	
	Dams	
	Agriculture Sustainability	

9.3 Prioritization of Objectives

Since 2006, the CABY SG has consistently rejected the idea of prioritizing issues or objectives within the IRWMP. Many stakeholders have expressed the view that this practice would not only result in unneeded conflict between member entities, but that prioritizing objectives would be similar to comparing apples and oranges; that is, each objective is so different from the next that they cannot be ranked effectively.

9.4 Final Objectives and Measurable Objectives

Through the CABY IRWMP 2021 Update process, the CABY SG increased the number of objectives from 41 to 54. The final list is included at the end of this chapter in Table 9-4. Additionally, these objectives are described in more depth in Appendix F, Background Information, that supports identification of objectives. As discussed earlier, each objective includes the specific quantitative or qualitative target outcomes by which overall success will be measured. Every objective has the target outcome that is directly associated with the objective, as well as performance measures that will be used to further assess the outcomes of all projects associated with meeting a particular objective. This structure was chosen because the CABY stakeholders wanted to intentionally hold the IRWMP to a high standard. It was determined that matching the targeted outcomes (with specific measures of accountability) with each objective would increase the probability that the identified objective would be achieved.

CABY stakeholders reached consensus early in IRWMP development that the group did not want to use generic forms of measurement, but instead wanted to establish firm and identified targeted outcomes

concurrent with development of individual objectives. For example, rather than gauge success by an unspecified number of acres restored after the IRWMP is implemented, CABY stakeholders chose to indicate the actual number of acres to be restored and by what date, in order for the IRWMP to claim full implementation of that objective. The group wanted to establish a performance bar that would drive project development, pursuit of funding, and partnership opportunities, and ensure a focus on specific outcomes.

9.5 Overarching Objectives

The overarching objectives are planning elements that CABY stakeholders hold as essential to all project activities, and are considered key concepts at the implementation level. These are deemed to be intrinsic components of every implementation project pursued through the IRWMP. As a result, these overarching objectives are more particularly focused on implementation and project development than on being separate IRWMP objectives. In other words, rather than judge the IRWMP by reaching these objectives, individual projects will be assessed against these objectives, which will be included in project-specific, performance-review criteria.

9.5.1 Education and Outreach

CABY SG considers education and outreach essential to building and maintaining the agency and public support necessary to continue support for sustainable, collaborative approaches to managing CABY's resources. As a result, stakeholders have prioritized the creation of educational materials, delivering of workshops and presentations, production of project-related informational brochures, delivering systematic public education activities, and other similar project components, as essential to making the CABY IRWMP and process relevant to regional stakeholders who are not directly involved in CABY IRWMP activities or individual project implementation.

9.5.2 Data Analysis and Monitoring

One of the benefits of the IRWMP process is the sharing of data and findings between organizations and entities. In order to preserve and enhance this benefit, stakeholders have identified the sharing of data and continual development of the Sacramento Watershed Information Module (SWIM) website and the CABY webpage as an integral component to IRWMP preparation and update, as well as project implementation. Furthermore, the ongoing monitoring associated with project implementation will be critical information for other stakeholders both in and out of region to assist in the progressive refinement of project development strategies and identification of appropriate project-specific performance measures. Finally, the data collection and monitoring will support the assessment of IRWMP performance as required by the CABY SG and California Department of Water Resources. As a result, all CABY SG implementation projects are expected to upload their data to the SWIM website, create and provide content to populate project-specific webpages, upload all relevant data to appropriate state databases, and consider their education and outreach activities as integrally associated with the data analysis and monitoring work.

9.6 Conflicts

This section presents an overview of the water resource management conflicts that have the most significance within the CABY region. For purposes of this section, issues are defined as problems facing the watershed that have been identified by stakeholders or the project team preparing this IRWMP; conflicts involve prolonged and seemingly irreconcilable approaches to resolving an issue.

9.6.1 Issues vs. Conflicts

An issue becomes a conflict only if there is seemingly irresolvable and prolonged dispute about the issue's resolution. Differing opinions, interpretations of available data, and perspectives on the significance of an issue does not intrinsically make an issue a conflict. CABY RWMG has taken the proactive step of identifying objectives that would assist in resolving these differences. In some cases, CABY RWMG members have joined together to develop specific projects that would solve divergent interpretations or lack of available data.

The communication that the CABY SG, CABY RWMG, WGs, and collaborative project-integration activities have fostered has contributed significantly to the ability of the group to identify strategies to avoid conflicts through expending hard work on addressing issues. There also appears to be a greater willingness on the part of CABY RWMG members and stakeholders to attempt to resolve differences though negotiation and collaborative processes provided by the IRWM venue. In terms of individual implementation projects, CABY RWMG has established a conflict-resolution process (see Chapter 4, Governance). In spite of these efforts, one lingering conflict remains (Construction of New Surface Water Storage Facilities), as discussed in Section 9.6.2.

9.6.2 Conflicts Identified in the Previous IRWMP

The major conflicts identified in the previous IRWMP were growth and land development, new dam construction, and Federal Energy Regularity Commission (FERC) relicensing.

Over the passage of time, it has become clear that, while there are differences in opinion, position, and/or values held by the various stakeholders, there are appropriate venues to deal with both the land use and FERC-related issues.

Land Use: In the case of land use and growth, the conversations and outcomes of the work associated with water and land use (see Chapter 8, Water and Land Use) made it clear that the CABY water and land use decision makers have a high degree of coordination. Some recommendations to improve the existing communication and collaboration were identified and are included in the section. Furthermore, it has become clear that the process used to update the general plan and local rezoning are the more appropriate venues for these discussions. CABY RWMG has no ability to directly impact these processes. Instead, CABY RWMG members are responsible for advocating specific policies or decisions as representatives of their respective groups. Finally, the IRWMP addresses stakeholder-identified, growth-related issues through projects and programs that make more efficient use of existing water supplies, and links the consequences of land-use decisions, water management, and the environment. CABY stakeholders continue to recruit participation of additional land use agencies in the decision-making process. Sensitive issues that the group has identified as associated with land use decision making (via general plan adoption) include fragmentation and/or loss of open space and biodiversity, depletion of water resources, degradation of air quality, degradation of water quality, increased generation of waste, and use of raw water versus tertiary-treated water.

FERC: The hydropower dams on the Yuba, Bear, and American Rivers were first licensed by FERC almost 50 years ago, and most have undergone relicensing in the past decade. The dams owned and operated by the Yuba County Water Agency are currently being relicensed. The hydropower relicensing process addresses different interests of power generation, ecosystem health, water reliability, and recreational opportunities in river stretches impacted by hydropower facilities.

In the CABY region, Pacific Gas & Electric, El Dorado Irrigation District, Sacramento Municipal Utilities District Upper American River Hydroelectric Project, Placer County Water Agency, Pacific Gas & Electric (Drum-Spaulding Project), Nevada Irrigation District (Yuba-Bear Project), and Yuba County Water Agency (Bullard's Bar Project) have all obtained their FERC licenses. These relicensing processes direct the operating conditions of these hydropower facilities and the health of the river ecosystems for the life of their licenses, which can extend from 20 to 50 years.

A wide variety of interests advance objectives in relicensing negotiations, including hydropower licensees, regulatory agencies, Tribes, recreation interests, and nongovernmental organizations. Particularly sensitive issues include minimum instream flows, flow variability and temperature, recreational flows, and maintenance of National Forest lands where much of the hydropower facilities are situated.

Similar to the land use issue, the established regulatory process provides targeted and meaningful opportunities for CABY members to advocate for their own positions and perspectives. This renders CABY a useful place to engage in discussions concerning the topics raised in the FERC process, but does not require the group to serve as a conflict-resolution body for the members.

9.6.3 Construction of New Surface Water Storage Facilities

A remaining regional conflict is the potential for additional water storage facility construction. As climate change and population growth continue, the demand for new supplies and more reliability is requiring water agencies to evaluate all water supply options. This includes water recycling, water use efficiency, conjunctive use, transfers, and new storage.

One group of CABY stakeholders strongly believe that surface water storage is essential to the future security of water supply, not only for the region but also for downstream users and cold water fisheries. Another group of CABY members and stakeholders feel that additional surface water storage should only be considered after all other conservation measures are exhausted, and the need for the facility (and its cost-benefit) can be conclusively documented. This second group is particularly concerned about the effects of additional storage on environmental systems and functions and impacts on First Nations' cultural resources. That being said, all CABY stakeholders support reasonable operational and/or demand management changes, increased use of recycled water where economically feasible, improved water use efficiency appropriate to the CABY region, and other measures that reduce the need for new surface water storage.

The CABY SG has engaged in several discussions about impoundments/reservoirs in general and has engaged in limited and focused discussions about the Alder Creek facility feasibility study. It is clear from these discussions that entrenched divergence of opinion exists about use of the surface storage strategy. With the introduction of Nevada Irrigation District's proposed Centennial Dam and Reservoir on the Bear River and state and federal interest in new storage in the Sacramento/San Joaquin River Watershed, these ongoing discussions will continue but may not serve to resolve this conflict to the full satisfaction of either group.

9.7 Mandatory Plans and Other Considerations

9.7.1 Interface of State Documents and CABY RWMG Goals and Objectives

9.7.1.1 RWQCB Water Quality Control Plan Objectives

As listed in Chapter 6, Water Quality (Table 6-1), there are 42 water bodies in the region that are listed on the state's 303(d) list. The listing reasons include exotic species, mercury, bacteria, chromium, iron, dissolved oxygen, chlorpyrifos, fecal coliform, pH, copper, sediment/siltation, zinc, and arsenic. Sources include land disposal, agricultural practices, urban runoff and storm sewers, recreational activities (non-boating), legacy mining, and resource extraction. CABY RWMG's suite of objectives address these water-quality challenges through the following issues and objectives (the WQ numbering corresponds to the organization in Table 9-4):

- Contamination: Legacy Mine Toxins
  - *WQ-1: Remediate abandoned mines and mine features*
  - *WQ-2: Remove legacy mining contaminants from region*
- Contamination: Urban Runoff and Abandoned Mine Land Runoff
  - *WQ-3: Increase the number of water bodies that can achieve water-quality objectives*
- Erosion and Sedimentation Management
  - *WQ-4: Enhance the natural sediment transport regime*
- Headwaters Protection
  - *WQ-8: Improve watershed's most critical major urban areas' water supply*
  - *WQ-9: Maintain watershed resilience*
  - *WQ-10: Evaluate feasibility of a watershed and water quality credit trading program*

9.7.1.2 20x2020 Water Conservation Legislation

All urban water agencies in California are now responsible for contributing to California's statewide goal of 20% of water conserved based on a variable combined-year use level by 2020 (see California Water Code [CWC] Section 10608). It is the CABY SG's intent to encourage these activities through the sharing of regional expertise and a regular check-in regarding water conservation activities of member agencies. The CABY SG views conserving water not only as stretching the current supply, but also as aiding in the conservation of electricity and wastewater treatment activities, thereby mitigating greenhouse gas emissions—it is a climate change response as much as it is a response to shortage and state mandates. The IRWMP objectives answer this important part of the CWC through the following (the WS numbering corresponds to the organization in Table 9-4):

- Conservation
  - *WS-1: Implement urban water conservation programs*
- Infrastructure: Aging Infrastructure
  - *WS-2: Upgrade aging infrastructure*
- Water Storage
  - *WS-4: Assess the need and economic and environmental feasibility of new storage facilities*
  - *WS-5 : Reservoir Maintenance*
- Water Management Operations: Drought
  - *WS-7: Adopt local drought and emergency preparedness*

- Water Management Operations: Recycled Water
  - *WS-8: Development of additional recycled water infrastructure*
- Water Transfers
  - *WS-9: Convene meetings that discuss water transfers in and out of the region*

9.7.1.3 California Water Code, Section 10540(c)

The CWC explicitly sets forth expectations for IRWM documents and groups, including considerations of the makeup of the group, what it can and cannot do, the relative authority of the IRWMP, and more. Section 10540(c) states that the low bar of what IRWMPs should address/include consideration of includes agricultural and urban water conservation and reliability, drinking water quality, consistency with the applicable basin plan, groundwater overdraft threats, watershed stewardship, groundwater quality threats, and disadvantaged community needs. The exact text of the CWC section is included in the left column in Table 9-3; the right column includes the location in this chapter and throughout the document where the particular topic is addressed.

Table 9-3
CWC Section 10540(c) Requirements and Where They are Answered Within the CABY IRWMP

At a minimum, all plans shall address all of the following:	Location of standard in CABY IRWMP
(1) Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water-use efficiency strategies	Chapter 9, Issues and Objectives Chapter 7, Water Supply Chapter 12, Project Review Process
(2) Identification and consideration of the drinking water quality of communities within the area of the IRWMP	Chapter 9, Issues and Objectives Chapter 6, Water Quality (Section 6.2.1, CABY Region Drinking Water Quality)
(3) Protection and improvement of water quality within the area of the IRWMP, consistent with the relevant basin plan	Chapter 9, Issues and Objectives Chapter 6, Water Quality
(4) Identification of any significant threats to groundwater resources from over-drafting	Chapter 9, Issues and Objectives Chapter 7, Water Supply (Section 7.1, Water Supply Overview)
(5) Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region	Chapter 9, Issues and Objectives (Section 9.2, Programmatic Goals) Chapter 12, Project Review Process
(6) Protection of groundwater resources from contamination	Chapter 9, Issues and Objectives Chapter 6, Water Quality (Section 6.1, Regulatory Overview for Water Quality)
(7) Identification and consideration of the water-related needs of disadvantaged communities in the area within the boundaries of the IRWMP	Chapter 9, Issues and Objectives Chapter 2, Stakeholder Involvement (Sections 2.3, Definition of Disadvantaged Communities) Chapter 12, Project Review Process

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Programmatic Area: Water Supply (WQ)			
GOAL: Ensure adequate and reliable water supply that can be adapted to climate change and can meet the needs of the region			
Primary Issue: Conservation			
Policy and Education	*WS-1:* ***Implement urban water conservation plans***	• Implement Urban Water Conservation Plans in at least five additional communities by 2020 • Include conveyance and delivery system leak detection and control in each plan	• Acre-feet per annum (AFA) of water supply conserved or enhanced (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM) by treating less water • Number of communities implementing new (since 2012) urban water conservation plans and/or leak detection plans
Primary Issue: Infrastructure			
Aging Infrastructure	*WS-2:* ***Upgrade aging infrastructure***	• Implementation of at least five site-specific projects and lining or piping of at least 10 miles by 2020 • Projects can be associated with urban, rural, and agricultural water supply treatment and delivery of canals/ditches • Address community-identified infrastructure issues including upgrading treatment systems, fixing leaks in water transport, storm water collection under-capacity and drainage maintenance	• AFA of water supply conserved or enhanced (SNC-PM) • Miles of lined canals/ditches • Number of projects implemented to upgrade or improve aging infrastructure
Interties	*WS-3:* ***Complete major strategic interties between regional water agencies***	• Complete three major strategic interties by 2020 • Choose and design interties that allow for connectivity within and between delivery systems in the case of a catastrophic infrastructure failure, to allow for a backup supply and/or conduit to provide water for water treatment plants, urban and municipal drinking water supplies, and/or irrigation and agricultural water	• AFA of water supply conserved or enhanced (SNC-PM) • Number of interties installed

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Water Storage			
Shifting Hydrology	*WS-4:* ***Assess the need and economic and environmental feasibility of new storage facilities***	• By 2020, facilitate discussion with at least one agency to assess the need and determine the economic and environmental feasibility of a new storage facility and alternatives accomplishing multiple benefits	• Number of collaboratively developed plans and assessments (SNC-PM)
Reservoir Sedimentation and Green Infrastructure	*WS-5:* ***Reservoir Maintenance***	• Remove sediment that abate mercury transport and methylation and reduce reservoir capacity	• Fish tissue mercury levels • Storage volume recovered
Forest Management	*WS-6:* ***Healthy forests managed to reduce wildfire risk while sustaining high quality habitat and optimizing water supply yield***	• Achieve expansion of CABY member efforts to treat and improve forest health by reducing loads and stand density • Increase use of TEK methods in forest management, including fire	• Annual reporting of forested areas treated.
Primary Issue: Water Management Operations			
Drought	*WS-7:* ***Adopt local drought and regional drought and emergency management preparedness plans***	• Specific plans for every local water delivery service area by 2020 • Interregional, coordinated drought and emergency management plans by 2020	• Number of collaboratively developed plans and assessments (SNC-PM) • Number of water agencies collaborating in the development of an interregional drought response
Recycled Water	*WS-8:* ***Development of additional recycled water infrastructure***	• Identify at least one site for recycled water infrastructure development and/or expansion by 2020 • Include consideration of gray water systems • Consider entire CABY region, including import or export to others regions through collaborative planning	• AFA of water supply conserved or enhanced (SNC-PM) • Site identified for recycled water infrastructure development/expansion
Primary Issue: Water Transfers			
Financing Mechanism for Headwater Management and Restoration	*WS-9:* ***Convene meetings discussing water transfers in and out of the region***	• Transfer water supply which can be deemed to be in surplus of demand on an annual or other frequency basis on a case-by-case basis. Convene project-specific meetings of interested parties • Ensure Tribal water rights are represented with specific targets for cultural water us	• Number of collaboratively developed plans and assessments (SNC-PM)

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Groundwater			
Recharge and Contamination	*WS-10:* ***Prepare summary of requirements for approving development relying exclusively on groundwater***	• Summarize the requirements for three major planning jurisdictions in the CABY region for approving developments that rely exclusively on groundwater wells as a source of water	• Number of county-level approval processes for groundwater-dependent community plans that are assessed and summarized • Number of identified at-risk subdivisions • Outlined improved approval processes
	WS-11: ***Catalogue major subdivision permit denials due to possibility of unavoidable impacts due to reliance on groundwater***	• Determine if there have been any denials of major subdivisions since 2010 • Using this information, identify at-risk subdivisions and summarize the planning oversight process and where process could be improved	• Performance measures are currently being defined.
Programmatic Area: Water Quality			
GOAL: Ensure sufficient water quality to support healthy ecosystems and dependent organisms			
Primary Issue: Contamination			
Legacy Mining Toxics	*WQ-1:* ***Remediate abandoned mines and mine features***	• Prioritize abandoned mine land sites for remediation, develop necessary plans, and obtain permits and funding to ensure implementation	• Number of improved or restored abandoned mine land features
	WQ-2: ***Remove legacy mining contaminants from region***	• Remove legacy mining contaminants • Work with stakeholders to collaborate with the land owner/land manager to develop/implement/ fund remediation of the site	• Mass of pollutant reduced per year (SNC-PM)
Urban Runoff and Abandoned Mine Land Runoff	*WQ-3:* ***Increase the number of water bodies that can achieve water quality objectives***	• Implement at least five projects by 2030 • Work with affected parties to restore a natural balance to identified river systems	• Linear feet of protected or restored stream bank (SNC-PM) • Mass of pollutant reduced per year (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain • Measurable improvement in water quality

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Sedimentation Management			
	WQ-4: ***Enhance the natural sediment transport regime***	• In at least three river reaches by 2025 • Monitor and publicize the work being done and encourage the implementation of projects designed to restore natural sediment transport	• Acres of protected or restored riparian habitat and/or floodplain • Linear feet of protected or restored stream bank (SNC-PM) • Miles of stream where natural sediment transport regime is enhanced/restored
Mercury Contaminated Sediment and Debris Control Dams	*WQ-5:* ***Map and prioritize debris control dams on national forest lands for remediation***	• Prioritized list and schedule for remediation efforts	• Implementation of remediation plan
Erosion and Sediment Control Associated with Roads	*WQ-6:* ***Complete unpaved roads assessment and prioritize watersheds for remediation***	• Prioritized list and schedule for high priority roads to mitigate erosion	• Implementation of remediation plan
Primary Issue: Wastewater Management			
	WQ-7: ***Assess the level of preparedness and prevention measures in place for wastewater spills***	• Convene regional discussions on the topic with regional agencies that provide wastewater services (including small systems)	• Number of meetings convened
Primary Issue: Headwaters Protection			
	WQ-8: ***Improve watersheds critical to major in-region urban areas' water supply***	• Implement at least two collaborative projects • Work with stakeholders to identify the major threats to those important watersheds (including wildland fire, development, insects and disease, climate change, or other threats) • Focus on watersheds that are the most critical for production of surface drinking water for the major urban areas in the CABY region • Consultation with tribes and DACs to improve watersheds	• Number of collaboratively developed projects and assessments (SNC-PM) • Number of identified critical surface drinking-water watersheds • Number of major threats described

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
	WQ-9: ***Maintain watershed resilience***	• Work with stakeholders in the affected areas to identify threats to watershed resilience • Develop strategies and plans that make the forests in these important watersheds more resilient to the identified threats (including forest and fuels treatment, eradication of non-native invasive plants, decommission unneeded roads, revegetate steam banks, and/or improve the water-holding capacity of wetlands/riparian areas/meadows)	• Number of projects addressing threats to source water areas and increased resiliency of those watersheds • Acres of improved or restored land (SNC-PM)
	WQ-10: ***Evaluate feasibility of a watershed and water quality credit trading program***	• Discuss with CABY stakeholders a watershed and water quality credit trading program • Enable land managers and owners who discharge effluents into the same watershed and who must comply with regulatory requirements to purchase credits and trade them • Take advantage of the most economically efficient activities to facilitate compliance with water quality standards	• Identified water quality credit trading opportunities
Primary Issue: Temperature			
	WQ-11: ***Improve habitat for aquatic biota***	• Improve habitat on at least 10 miles of streams by 2020 by providing appropriate water temperatures	• Linear feet of protected or restored stream bank (SNC-PM) • AFA of improved streamflow (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Programmatic Area: Environment and Habitat (EH)			
GOAL: Preserve and restore watershed health			
Primary Issue: Fisheries			
Volitional Fish Passage	*EH-1:* ***Improving and protect suitable spawning habitat for anadromous and resident fish populations***	• Make 15 additional miles of spawning habitat available by 2030 • Work with interested and affected stakeholders to identify spawning habitat potentially accessible to anadromous fish • Improve and protect habitat for spawning and rearing • Address First Nations' access to fishing for cultural purposes to improve access and improve fish flows	• CFS per annum of targeted streamflow improved (SNC-PM) • Linear feet of protected or restored stream bank (SNC-PM) • Number of removed anadromous and resident fish migration barriers • Miles of additional created and/or improved spawning habitat
Primary Issue: Aquatic Biota			
	EH-2: ***Improve aquatic and riparian habitat***	• For Sierra Nevada yellow-legged frogs (*Rana sierrae*) and foothill yellow-legged frogs (*Rana boylii*), remove trout and bullfrogs in 18 acres of high mountain lakes at locations where these frogs can recolonize • For California red-legged frogs (*Rana draytonii*), create one acre of pond habitat by 2025 where existing California red-legged frogs reside downstream and have the potential to colonize the new pond habitat • Improve 4 miles of stream through various measures of enhancement and restoration by 2025	• Linear feet of protected or restored stream bank (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain • Improved AFA of streamflow (SNC-PM)
Primary Issue: Instream Flow			
	EH-3: ***Quantify and/or secure habitat on rivers or tributaries with barrier-free ocean access***	• CABY stakeholders work to quantify and secure the amount of water and habitat necessary to allow for anadromy on the Cosumnes River (and/or major tributaries) within the CABY region that have barrier-free access to the Pacific Ocean	• Improved CFS per annum streamflow (SNC-PM) • Acres of protected riparian habitat

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Meadows			
	EH-4: ***Enhance meadow-complex function***	• Support stakeholders in the annual development, implementation, and/or funding of five projects to maintain or enhance meadow function	• Number of developed, funded, and/or implemented meadow restoration or enhancement projects • Acres of improved or restored land (SNC-PM)
Primary Issue: Fire and Fuels			
Prioritizing Fuels Treatment in the Wildland Urban Interface	*EH-5:* ***Increase fuel load management***	• By 2025, conduct fuels management on at least 10,000 acres • Reduce risk of environmental and property damage by working with regional agencies to address loss/impacts from catastrophic fire through management actions • Develop access to financial programs for DAC communities to mitigate burden/risk	• Acres of improved or restored land (SNC-PM) • Tons of avoided carbon sequestered or emissions (SNC-PM)
Primary Issue: Invasive Species			
Aquatic Invasive Species	*EH-6:* ***Implement an Aquatic Invasive Species (AIS) Program***	• Collaboratively work with the State of California and others to implement an AIS prevention program, detection program, and closure of infested water bodies program • Annually develop and distribute prevention information to users at a minimum of 20 launch sites, survey at least 10 water bodies, and collaborate with regulatory groups to rapidly close infested water bodies until the AIS are eliminated	• Number of collaboratively developed plans and assessments (SNC-PM) • Number of launch sites where AIS information was distributed (annually) • Number of sites surveyed for AIS (annually) • Number of identified AIS-infested water bodies (annually) • Number of closed AIS-infested water bodies (annually)

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Terrestrial Invasive Species	*EH-7:* ***Implement coordinated non-native invasive plant education, prevention, and control actions***	• Work with affected regional organizations • Implement coordinated non-native invasive plant education, prevention, and control actions to specifically treat 50 acres • Provide at least one annual training • Survey a minimum of 50 acres annually, supporting prevention through rapid detection and treatment	• Number of collaboratively developed plans and assessments (SNC- PM) • Acres of improved or restored land (SNC-PM) • Number of trainings conducted per year • Number of acres surveyed for terrestrial invasive species • Number of acres treated for terrestrial invasive species
Programmatic Area: Climate Change			
GOAL: Anticipate climate change needs and be prepared to respond adaptively to human and ecosystem needs			
Primary Issue: Greenhouse Gas Emissions			
	CC-1: ***Implement climate change adaptive management strategies***	• By 2025, implement (or encourage the implementation of, as appropriate) three adaptive strategies identified in the 2021 IRWMP update to make the CABY region more climate resilient	• Number of adaptive strategies implemented in the CABY region • Kilowatts of renewable energy production capacity created (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM) • Number of collaboratively developed plans and assessments (SNC-PM)
	CC-2: ***Increase alternative energy and energy efficiency***	• Work with interested parties/agencies • By 2025, implement at least alternative energy or energy efficiency projects • Focus on increasing alternative energy and energy efficiency by including small-scale hydropower, biomass, solar power, wind energy, and other clean energy options	• Number of Energy Action Plans adopted by CABY-region local governments • Number of alternative energy projects
Carbon Sequestration	*CC-3:* ***Improve forest health to promote increased carbon sequestration and healthy forest communities***	• Reduce forest stand density to promote increased forest sequestration rates	• Annually quantify acres of selectively thinned forest within the CABY region

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Fuels Management	*CC-4:* ***Treat forest communities to shift wildfire patters from catastrophic to low intensity burn potential within the wild land/urban interface***	• Reduce ladder and fire fuels to strategically reduce wildfire severity	• Annually quantify acres of treated forested areas within the wildland/urban interface
Programmatic Area: Human-Landscape Interaction (HL)			
GOAL: Maintain and enhance functioning landscapes that provide sustainable services for humans			
Primary Issue: Habitat Alteration			
	HL-1: ***Provide conservation stewardship for core and connected habitat***	• Collaborate with conservation groups, local land use authorities, and property owners to identify priority lands/parcels • By 2025, protect 25,000 acres of core and connective habitat by bringing identified lands under permanent conservation stewardship	• Number of locations identified as integral to maintaining habitat connectivity throughout the CABY region • Acres of conserved land (SNC-PM) • Acres of improved or restored land (SNC-PM)
Primary Issue: Native American Uses			
Traditional Ecological Knowledge	*HL-2:* ***Increase involvement of Tribal entities in CABY SG activities***	• Develop sustained outreach and involvement through the Tribal WG participants • Build capacity of nonprofits run by Tribes to implement projects	• Number and diversity of people reached (SNC-PM)
Primary Issue: Flooding			
Environmental Flows	*HL-3:* ***Implement flood risk reduction projects***	• Remove flood risk from at least 50% of the current FEMA inundation zone in Placerville, Nevada City, and Grass Valley • Work with affected areas to implement flood management and/or reduction projects	• Linear feet of protected or restored stream bank (SNC-PM) • Number of protected significant sites (SNC-PM) • Decrease in the number of acres covered by the FEMA inundation zone

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Open Space			
	HL-4: ***Provide for permanent protection of open space***	• By 2030, bring at least 30,000 acres of open space under permanent protection • Collaborate with conservation groups, local land use authorities, and property owners to preserve rural open space and the character of the CABY region	• Acres of conserved land (SNC-PM)
Primary Issue: Disadvantaged Communities			
Access to Water	*HL-5:* ***Support DAC project development activities***	• CABY member groups and other stakeholders support and work with disadvantaged communities (DACs) to develop high-scoring projects	• DAC projects make up at least 30% of the total infrastructure funding request of the CABY IRWMP on an annual basis, including all grant and loan requests to all potential funders
Primary Issue: Recreation			
	HL-6: ***Increase recreational opportunities***	• Implement at least six multipurpose projects by 2025 that include recreation as a consideration • Develop projects to maintain and enhance the recreational experience in the CABY region by working with interested agencies	• Number of new recreation access points (SNC-PM) • Feet of constructed or improved trail/path (SNC-PM) • Acres of improved or restored land (SNC-PM)
Primary Issue: Hydropower			
	HL-7: **I*****ncrease alternative energy generation***	• Implement at least two alternative energy generation projects by 2025 • Work with interested agencies to increase alternative energy generation, including small-scale hydropower projects and existing hydropower plant efficiency improvements	• Kilowatts of maintained or created renewable energy production capacity (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM)

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Primary Issue: Agriculture			
Agricultural Land Conservation	*HL-8:* ***Advocate for regulations that support continued agricultural operations viability***	• Advocate for reasonable, area-specific regulations that will preserve the viability of continued agricultural operations in the region	• Number and diversity of CABY region agricultural stakeholders active in the development of and lobbying for revised ILRP regulations for the Sierra • Number and value of new, improved, or preserved economic activities (SNC-PM) • Number of collaboratively developed plans and assessments (SNC-PM)
	HL-9: ***Permanently protect agricultural lands***	• By 2030, bring at least 30,000 acres of agricultural land under permanent protection (the purchase of development rights or another similar approach) • Identify acreage that will sustain the local economic base, rural open space, and agricultural production • Collaborate with conservation, local land use authorities, and property owners	• Acres of conserved land (SNC-PM)
Primary Issue: Sustainable Economy/Self- sufficient Communities			
	HL-10: ***Create a Sustainability Revolving Fund***	• Create a Sustainability Revolving Fund of a minimum $350,000-$500,000 • Configure fund to support projects, industries, and economic pursuits that are sustained by the ambient natural resource base, including timber management, agriculture, recreation, and energy production	• Number and types of jobs created (SNC-PM) • Number and value of new, improved, or preserved economic activities (SNC-PM) • A developed Sustainability Revolving Fund
Primary Issues: Governance			
Political	*HL-11:* ***Continue to expand CABY members' presence in the region***	• Ensure that all CABY member organizations understand the current status of the CABY IRWMP and the potential benefits received to support their own organizations' mandates • Annually: Have the CABY executive director (or designated alternate) present CABY to the elected boards of all CABY member agencies	• Continued increase in CABY membership/CABY IRWMP adoptees • Number of presentations to CABY member organizations per annum • Number and diversity of people reached (SNC-PM)

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Legislative	*HL-12:* ***Enhance legislators' understanding of the Sierra Region***	• CABY stakeholders will participate in at least one Sierra Lobby Day at the Capitol each year • Efforts will focus on furthering support for the IRWMP objectives and enhance legislators' understanding of the Sierra Region • Host legislative tours of CABY projects	• Number of stakeholders participating in Sierra Lobby Day • Number of outreach opportunities taken with state government officials to advocate for source water IRWM regions
Regulatory	*HL-13:* ***Monitor regulatory processes with the potential to affect water resources in the region***	• The CABY organization, with the help of member groups, will monitor regulatory processes that have the potential to affect water resources in the region • Activities may include regular presentations by member groups and/or outside entities seeking to inform and/or recruit CABY's support	• Performance measures are currently being defined
Regulatory	*HL-14:* ***Identify persistent conflicting regulations that hinder implementation of the CABY IRWMP***	• Identify persistent conflicting regulations that hinder implementation of the CABY IRWMP	• Commenting on pending regulatory processes
Primary Issues: Other (OV)			
Education and Outreach	*OV-1:* ***Integrate education into all CABY projects and programs***	• Where possible, outreach and education will be integrated into all CABY projects and programs • This will include both school education and public and community outreach	• Measurable changes in knowledge or behavior (SNC-PM) • Number and diversity of people reached (SNC-PM)
Financial Feasibility	*No objective developed – will be included in the finance chapter*	–	–
Capacity Building	*OV-2:* ***Improve CABY member capacity to identify and develop solutions for critical issues***	• Increase participation and collaboration in CABY Stakeholder Group	• Attendance at Stakeholder Group meetings and sustained participation in RWMG

Table 9-4
CABY Goals, Objectives, Target Outcomes, and Performance Measures

Issue(s)	Objective	Target Outcomes*	Performance Measures
Data Analysis and Monitoring	*OV-3:* ***Maintain the Data Management System***	• The CABY website will link to appropriate state databases for data management both during plan preparation and implementation • Assure best management and coordination throughout the region over time	• CABY documents are annually updated in the SWIM data management system
Regional Planning and Land use	*OV-4:* ***Coordination of planning activities across the region***	• Encourage that all planning in the region be completed in a coordinated fashion • Ensure communication and shared solutions for the benefit of the region • Emphasize school and community education regarding stormwater runoff and the positive effects of low-impact design	• Land use planners are active in the CABY SG
Fire Resiliency	*OV-5:* ***Prepare for catastrophic fire and protect water infrastructure against wildfire damage***	• Expand fire vegetation management activities to protect water system infrastructure with the wildland/urban interface	• Annual reporting of fire resiliency activities associated with water system infrastructure

* NOTE: To ensure consistency with California Department of Water Resources guidelines, ease of comprehension for performance reviews, and to more closely match other IRWMP chapters – the Consulting Team has shortened each objective, included the exact measurable outcome language developed by the WG in the column headed "Target Outcomes," and inserted performance measures from Chapter 13, Plan Performance and Monitoring.

Chapter 10
Resource Management Strategies

This chapter addresses the Resource Management Strategies (RMS) listed in the California Water Plan Update 2013,[1] with the addition of one region-specific strategy identified by the Cosumnes, American, Bear, and Yuba (CABY) Stakeholder Group (SG). The intention of the RMS is to encourage diverse approaches to solve water management issues as a means to "mitigate for uncertain future circumstances" and comply with California Water Code Section 10541(e)(1).[2]

The chapter describes which RMS are considered applicable to the region, how the RMS were used in updating the Integrated Regional Water Management Plan (IRWMP) document (e.g., applicability to issues identified in the Region Description, development of measurable objectives, assessment of adaptive management strategies for climate change, project review and integration, and IRWMP implementation), how future data management activities will inform RMS updates, and how climate change considerations affected and were integrated into the RMS framework.

The RMS structure will be used by the governing body into the future to support IRWMP updates in response to ongoing and new studies, development of new data and as new issues emerge. Future IRWMP updates will consider whether strategies identified as Not Applicable in the 2018 IRWMP Update may become applicable in response to changing conditions in the watershed.

10.1 Applicable CABY RMS

The Proposition 1 Guidelines[3] describe 32 RMS, based on the California Water Plan Update 2013. As described in Section 10.2, the RMS Work Group (WG) and the CABY SG identified 26 RMS deemed relevant to the IRWMP process and one additional region-specific strategy felt to be essential for full implementation of this IRWMP.

To achieve the CABY IRWMP goals and objectives articulated in Chapter 9, Issues and Objectives, a wide range of RMS were considered by the CABY SG, WGs, and CABY Regional Water Management Group (RWMG). Table 10-1 identifies the RMS that were identified as applicable to the region. A rationale for each RMS determined as "not relevant to the region" is included in the table. The mix of RMS displayed in Table 10-1 demonstrates the breadth of potential water management tools available to CABY stakeholders. As described in the following sections, the future effects of climate change relative to applicable RMS were taken into consideration during RMS selection.

[1] CWP 2013
[2] DWR (2016). Integrated Regional Water Management Grant Program Guidelines
[3] DWR, July 2016

Table 10-1
RMS Determination of Regional Relevance with Rationale for Determination

State Resource Management Strategies (RMS)[1] (DWR 2016 Guidelines)	RMS Addressed in Plan	Rationale for Determination
Reduce Water Demand		
1. Agricultural Water Use Efficiency	Yes	Already being practiced by major water purveyors in region.
2. Urban Water Use Efficiency	Yes	Already in practice: all urban water purveyors in the Cosumnes, American, Bear, and Yuba (CABY) region have estimated and are on track to comply with their 2020 targets outlined in their Urban Water Management Plans and required by legislation. Additionally, many CABY disadvantaged communities (DACs) have elected to employ practices consistent with the 20x2020 targets, even though they are not technically subject to the legislation.
Improve Operational Efficiency and Transfers		
3. Conveyance – Delta	Yes	During discussions of the Climate Technical Advisory Committee, it was decided that activities in the Bay-Delta may be of significant impact to the CABY region. This perspective has been enhanced by the recent release by the state of the planning on the Delta which shows that North State's reservoirs will reach Dead Pool once every 10 years.
4. Conveyance – Regional/ local	Yes	Local water conveyance relies heavily on ditches, canals, and aging infrastructure. Improvements to local infrastructure provide ample opportunities for projects.
5. System Reoperation	Yes	The number of Federal Energy Regulatory Commission licensed facilities in the region will require ongoing consideration of this issue, as will climate change-related, water-adaptive management.
6. Water Transfers	Yes	A key consideration in context of regional drought preparedness plans for coordinated regional response to both short-term and climate change-related supply issues.
Increase Water Supply		
7. Conjunctive Management and Groundwater Storage	Yes	Regional reliance on groundwater for rural residences and options for using conjunctive use as a climate change mitigation are key consideration.
Desalination	Not applicable	Not applicable because of distance from coastal zone.
Precipitation Enhancement	Not applicable	PG&E and Sacramento Municipal Utility District (SMUD) have conducted documented cloud seeding operations within the CABY region. While CABY stakeholders and Integrated Regional Water Management Plan (IRWMP) adoptees may not currently engage in or unilaterally support cloud seeding, such activities may be undertaken in the area.
8. Recycled Municipal Water	Yes	One of the major water purveyors in region already uses this strategy and is considering expansion of facilities, while other purveyors are considering assessing potential benefits of beginning program. Some agencies are evaluating options for out-of-region partners.

Table 10-1
RMS Determination of Regional Relevance with Rationale for Determination

State Resource Management Strategies (RMS)[1] (DWR 2016 Guidelines)	RMS Addressed in Plan	Rationale for Determination
Surface Storage – CALFED	Not applicable	There are no CALFED storage plans for this region.
9. Surface Storage – Regional/local	Yes	Various constituencies within the region are in favor of surface storage, while others are not. Ongoing dialogue and feasibility studies will be needed. Surface storage in Green Infrastructure, such as restored meadows, will also be part of ongoing discussions and considerations.
Improve Water Quality		
10. Drinking Water Treatment and Distribution	Yes	Evolving water quality standards will keep this strategy relevant, as will ability of regional DACs to meet these standards. Distribution system efficiencies and upgrades are a key concern.
Groundwater Remediation/ Aquifer Remediation	Not applicable	The fractured bedrock geology in the region challenges management for substantive aquifer recharge or remediation. There are localized projects (such as meadow restoration, canal lining, and creek restoration) that can yield benefits to groundwater management in the immediate vicinity; regional groundwater is not characterized by large aquifers.
11. Matching Quality to Use	Yes	CABY purveyors have developed infrastructure to allow use of recycled water, have developed substantive integrated projects to support in-stream and ecosystem water quality and removal of legacy mining contaminants, and are addressing water quality in conveyance systems through both lining and education programs.
12. Pollution Prevention	Yes	Contamination from legacy mining, sedimentation from post-fire events, and ongoing monitoring are all issues that are an active focus of CABY members and stakeholders. Grazing Management is another consideration.
Salt and Salinity Management	Not applicable	No documented impacts of salt or salinity.
13. Urban Runoff Management	Yes	A variety of CABY members are already actively investigating options and developing pilot projects for locally applicable low-impact design (LID) and green infrastructure to mitigate need for large-scale infrastructure upgrades and repairs. Some regional water agencies have created Stormwater Resource Plans that also include strategies to address urban runoff.
Improve Flood Management		
14. Flood Risk Management	Yes	Location of wastewater treatment facilities in areas of flood risk/flood plain, as well as canyon-bottom residential areas are key focus.
Practice Resources Stewardship		
15. Agricultural Lands Stewardship	Yes	Both the irrigated agricultural and grazing/pasture operations and lands in the region are key to the local economy and open space values. CABY members are investigating on-farm BMPs, potential for carbon sequestration on pasture lands, and working to identify crops that are appropriate to climate change considerations.

Table 10-1
RMS Determination of Regional Relevance with Rationale for Determination

State Resource Management Strategies (RMS)[1] (DWR 2016 Guidelines)	RMS Addressed in Plan	Rationale for Determination
16. Ecosystem Restoration	Yes	A wide variety of CABY non-profit organization members have a core mission that focusses on restoration of ecosystems. The major water agencies also have a vested interest in and commitment to stewardship of the watershed environments that enable the region to sustain quality water and sufficient supply.
17. Forest Management	Yes	Much of the region is in federally owned or privately managed forest use. Study of the impacts of a variety of management strategies and pilot projects is already ongoing and will continue. A key evaluation of climate change focused on the impacts of catastrophic wildfire. Remediation of legacy mines and special considerations associated with forest management in mining impacted landscapes (erosion potential) should be integrated with forest management.
18. Land Use Planning and Management	Yes	CABY members and participating agencies already collaborate closely and non-profit entities are investigating options to include LID/green infrastructure in ongoing policy updates to local plans.
19. Recharge Area Protection	Yes	Groundwater recharge attributes of the region are poorly understood. Activities focus on determining the characteristics of local and out-of-region recharge dynamics.
20. Sediment Management	Yes	Sedimentation, particularly as a result of historic mining activity, has significant negative impacts on the region. Restoration of the natural sediment transport regime is a primary objective for the CABY region.
21. Watershed Management	Yes	Stewardship of watershed lands is of primary concern to all CABY stakeholders and members.
People and Water		
22. Economic incentives (Loans, Grants, and Water Pricing)	Yes	Water-pricing incentives are already in use in the region and will continue to play a role, particularly in response to impacts of supply due to climate change. Local entities could pursue loans and grants to support conservation and stewardship.
23. Outreach and Engagement	Yes	This is a key component of CABY project development and its governance process. This includes use of the CABY web portal to make information available, individual CABY members provide education material in Spanish, as necessary, and provision of materials and pilot projects for local schools.

Table 10-1
RMS Determination of Regional Relevance with Rationale for Determination

State Resource Management Strategies (RMS)[1] (DWR 2016 Guidelines)	RMS Addressed in Plan	Rationale for Determination
24. Water and Culture	Yes	The CABY region is home to many California Native Peoples whose spirituality, ceremony, recreation, subsistence resources, and life fabric involve and depend upon water and taking care of waterways. Incorporating Cultural Resources into regional resource management means engaging with Native peoples and incorporating resource management strategies that address those values. Traditional Native practices for land stewardship consider the need for sustainability and regeneration for future generations, which will positively inform CABY's water management, while preserving cultural resources. Agriculture is a significant and valued component of local communities, representing the character and landscape of the region. Farm-to-Fork, Ranch Marketing, and Agricultural Tourism are evolving major economic drivers and water users in the CABY region, and an important part of the region's culture.
25. Water-Dependent Recreation	Yes	A water-dependent recreation is an important way people connect with wildlands and nature. The CABY region is home to public lands and stunning waterways that attract a myriad of people seeking relief from urbanization, or an opportunity to spiritually connect with nature. It is also a primary economic driver for the region. Determining methods to adapt to climate change and human-related impacts to these resources will be fundamental to the region's quality of life, quality of the water resources, and economic well-being
Other Strategies		
Crop Idling for Water Transfers	Not applicable	The cropping profile render this strategy of minimal value to the region.
Irrigated Land Retirement	Not applicable	The cropping profile render this strategy of minimal value to the region.
Not Addressed by Current State RMS List		
26. Inter-IRWMP Coordination	Yes	CABY RWMG works with adjacent IRWM regions and Mountain Counties Funding Area to discuss options for joint project development, issue identification and resolution, and other options for collaboration.

Note:
[1] Applicable RMS are numbered.

10.2 Integration of RMS with CABY Governance and Decision Making

CABY RWMG began the RMS review process with a systematic evaluation of each RMS to determine its applicability to the CABY region. The evaluation was conducted using a WG established for that purpose and attended by a variety of CABY stakeholders and members. The WG product was then reviewed by the CABY SG. Other CABY WGs (Water, Issues and Conflicts, Objectives, and the Climate Change Technical Advisory Committee) then utilized this information to inform their deliberations.

The CABY governing body will continue to oversee the integration of RMS into IRWMP-related activities and make sure that all future IRWMP updates (especially those for goals/objectives and project development) also include consideration of both updating and continued integration of RMS. Ongoing monitoring of RMS consistency will be required as new projects continue to be identified and existing projects are refined in response to emerging issues, data gleaned from performance measures tracking, and evolving local conditions.

10.3 Integration of RMS into Development of IRWMP Goals and Objectives

The CABY Goals and Objectives WG spent considerable time evaluating regionally appropriate RMS as determined by the CABY SG, as shown in Table 10-1. The WG then evaluated all suggested objectives to assure consistency with the RMS. As a result of this effort, each of the 26 RMS identified as relevant to the IRWMP has at least one corollary objective with the majority meeting at least four and in some cases as many as 20 RMS (See Table 10-2 for the RMS addressed by each objective).

10.4 Integration of RMS with CABY Project Development and Implementation

The CABY group spends considerable time developing projects aimed toward fully implementing the IRWMP objectives and goals, as described above. In turn, The RMS framework is used extensively during the project development activities to ensure a linkage between issues, RMS, goals and objectives, and the development of individual projects.

The CABY RWMG intentionally provides participants with the opportunity to develop multi-stakeholder, multi-objective projects that utilize multiple RMS. CABY's mercury contamination projects offer a good example of the potential benefits of the integration process. Mercury in sediment affects water supply (through the inability to remove accumulated sediment in area reservoirs, thus lowering storage capacity), and has a considerable effect on the quality of habitat for native species. These water quality issues were identified through the planning and implementation of the CABY Regional Mercury Abatement Initiative. Mercury abatement projects integrate components of multiple water management strategies, such as Pollution Prevention, Ecosystem Restoration, Recharge Area Protections, and Outreach and Engagement.

10.4.1 Overview of Existing or Proposed Activities in the Region Already In Alignment with the RMS

10.4.1.1 Agricultural Water Use Efficiency

In the late 1970s and early 1980s, the El Dorado Irrigation District (EID) developed the Irrigation Management System to reduce water demand by local farmers. Its immediate success made it a popular strategy within the CABY region and it is now utilized by the Nevada Irrigation District (NID) and Placer County Water Agency (PCWA), as well. Irrigation Management System is a program building on California Irrigation Management Information System data, soil moisture sensors, and crop water use patterns to

help farmers better understand their crops' water needs. In its first decade of use, the Irrigation Management System is estimated to have saved EID over 2,000 acre-feet of water. This system will be important to growers and to water agencies as climate change alters the region's hydrology because (1) it will allow water users to maintain and increase efficiencies; and (2) it will help growers to track plant water to ensure a healthy crop, even in times of low precipitation.

PCWA has a limited program, called the Growers Irrigation Management System, and a rebate program for rural residential and agricultural customers funded by grants through February 2019.

10.4.1.2 Urban Water Use Efficiency

Both EID and PCWA are active members of the California Urban Water Conservation Council. NID makes use of the State's Demand Management Measures and has a strategy, documented in its Assembly Bill 1420 tables, for compliance with these practices. All water purveyors in the CABY region have estimated and are on track to comply with their 2020 targets outlined in their Urban Water Management Plans and required by legislation. In addition, many of the Disadvantaged Communities (DAC) water purveyors in the region have voluntarily adopted management measures and operational strategies to attempt to meet these goals, despite the fact that they are not under obligation to demonstrate such activities.

In May 2018, two new water conservation bills were passed, Assembly Bill 1668 and Senate Bill 606, to enact long-term improvements in water conservation and drought planning. Senate Bill 606 and Assembly Bill 1668 establish guidelines for efficient water use and a framework for the implementation and oversight of the new standards. The bills call for the creation of new urban efficiency standards for indoor use, outdoor use, and water lost to leaks. The State Water Resources Control Board must adopt these standards by June 30, 2022. Beginning in November 2023, and in accordance with these standards, each urban retail water agency will calculate its own annual objective and must meet that objective, subject to enforcement by the Water Board.

Water use efficiency reduces energy consumption by decreasing the volume of water that must be treated, transported, and heated, all of which require energy. Efforts across the CABY region to increase urban water use efficiency therefore reduce greenhouse gas emissions and have a positive impact on climate change.

10.4.1.3 Conveyance – Regional/Local

Conveyance in the CABY region consists of streams, rivers, diversion structures, canals, flumes, pump stations, pipelines, and distribution systems. Portions of these systems date back to the Gold Rush Era. Opportunities are sought to improve conservation, increase conveyance capacity and storage, and incorporate improvements that increase operational efficiency and flexibility. The region has installed numerous interties and has relieved conveyance bottlenecks in recent years to support this strategy. Recent replacement of aging pipes and piping of canals and/or flumes have also improved water quality by eliminating sources of pollution. Improvement projects in the region seek to comply with regulatory processes and California Environmental Quality Act and/or National Environmental Policy Act evaluation and disclosure requirements.

Climate change is predicted to impact the amount, intensity, timing, and quality and variability of runoff and recharge. These changes will impact the operation of regional and local conveyance. Ongoing efforts to improve conservation, conveyance capacity and storage, and operational efficiency and flexibility will all become increasingly important as the effects of climate change are born out. At the same time,

population expansion into the wildland-urban interface, where conveyance facilities are located, adds additional complexity to the successful operation of conveyance facilities.

10.4.1.4 System Reoperation

System reoperation means changing *existing* operation and management procedures for *existing* reservoirs and conveyance facilities to reallocate supply to water-related benefits from these facilities. System reoperation may improve the efficiency of existing water uses or it may increase the emphasis of one use over another. Physical modifications to existing facilities may be needed in some cases to expand the reoperation capability. Water management agencies in the region maintain the option for system reoperation within existing regulatory constraints. System reoperation can provide energy use benefits, reducing greenhouse gas emissions and positively impacting climate change. At the same time, reoperation can increase operational flexibility and allow the system to respond as the effects of climate change are realized.

10.4.1.5 Water Transfers

Water purveyors in the CABY region with water supply that can be deemed to be in surplus of demand on an annual basis can and do export water out of the region through water transfers.

10.4.1.6 Conjunctive Management and Groundwater Storage

Participation in conjunctive use and groundwater storage are being explored by CABY members.

- There is both surface and groundwater use in the region. Surface water is the primary supply for the region serviced by water agencies and irrigation districts. Many rural residents use individual groundwater wells. However, the individual groundwater resources in the region are unpredictable and often unreliable in terms of both quantity and quality, especially during dry times (and likely in the face of climate change). Water agencies in the CABY region continue to prepare for incidents or extended periods when individual groundwater wells run dry and residents need local water agency assistance.
- Some of the water purveyors in the CABY region, especially those sharing Folsom Reservoir as a common resource, have the option to participate in water banking with the Sacramento Valley. The theory behind CABY region agencies banking groundwater is that excess water would be stored in times of great yield (wet years), and then traded with agencies that could use the groundwater in place of surface water during dry years. The surface water would then be available to the CABY agencies and others through the Folsom Reservoir.

Conjunctive use and groundwater storage provide important pathways for water agencies to respond to changes in water availability and quality associated with climate change. Preparing for the foreseeable needs of individual groundwater users and developing strategies for groundwater banking will allow local agencies to respond strategically to climate change impacts.

10.4.1.7 Recycled Municipal Wastewater

EID has successfully made use of recycled wastewater; their recycled water service currently represents less than 10% of the respective total annual deliveries. EID has studied the expansion of this service with storage reservoirs that would extend the water supply by capturing winter flows of recycled water; however, EID has determined this to be unfeasible at this time.

As climate change alters regional hydrology, alternate sources of water, such as recycled water, will become more valuable. Agencies identifying current options for future implementation will be more prepared to deal with these needs.

10.4.1.8 Surface Storage – Regional/Local

At this time, there are three new on-stream storage facilities being considered within the CABY IRWMP area—Alder Reservoir by EID and El Dorado County Water Agency, Centennial Reservoir by NID, and Garden Bar by South Sutter Water District. In the recent past, water supply efforts focused on demand management and increasing operational efficiencies. However, with climate change projections including reduced snowpack throughout the Sierra Nevada, storage options are being reconsidered. At the largest scale, the potential to leverage green water storage infrastructure in the form of healthy/restored meadows should be considered.

CABY stakeholders support consideration of operational and/or demand management changes, increased use of recycled water, increased conservation, and other no-regrets strategies for increasing efficiency of water usage.

The CABY SG has engaged in discussions about new reservoirs and substantive divergence of opinion exists. Ongoing discussions and public review processes will continue to shed light on the nature of the subject and inform the wide-ranging perspectives of the various stakeholders.

10.4.1.9 Drinking Water Treatment and Distribution

Any ongoing refinement and promulgation of water quality standards could impact CABY water purveyors directly. For larger districts, these ongoing regulatory standards will create a need to upgrade, redesign, and in some cases replace existing treatment facilities. For all water agencies and the smaller DACs in the region, this process can be impacted by the lack of available expertise, staff, and funds to accomplish needed repairs or replacements. The DACs Needs Assessment in the Mountain Counties Funding Area (MCFA) identified infrastructure improvement needs in the CABY region. Examples include:

- Canals and very old pipes need major maintenance or replacing because leaks are a major issue and soils are porous. Some water lines are 2-inch electrical pipes (Colfax, Alta, Dutch Flats).
- Some areas still have wooden flumes to convey water that can burn and interrupt water supply (PCWA).
- Applegate community relies on bottled water for drinking and cooking and uses raw water for everything else. New wells are not possible because parcels are very small, forcing wells to be placed too close to septic leach fields. Residents can't sell their property. (Midway Heights).
- Baker Ranch has water quality issues.
- Although these water quality parameters are discussed in the CABY IRWM plan, the small water providers in the CABY region are very concerned with the impact of legacy mining toxins to customers and the costs to treat these contaminants. Todd Valley / Forest Hill – drains into the American River.
- Disinfection by-products resulting from chlorination of organics is a problem from Dutch Flats to Auburn especially given that the source water is of good quality.
- Wells went dry during drought (Todd Valley / Forest Hill).
- New code requires water sprinklers in homes to use 1-1/2" – 2" pipes. If used, depletes the water pressure and domestic water supply.

- Attracting and paying for qualified staff is an overarching problem in the rural areas of the Sierra region. Meeting administrative, operational or regulatory requirements is challenging for many small water purveyors. Operational training is expensive and burdensome for the small water purveyors. Many have to travel extensive distances to receive training with little to no money budgeted for this effort. In addition, there is no capacity currently to coordinate training region wide. Small water providers need retention and succession planning.
- Colfax Wastewater System currently has 1,110 connections and can't process all incoming water in the winter.
- No sewer system, septic only in Iowa Hills, Applegate, Heather Glen area.
- Insufficient fire suppression water storage. Iowa Hill has 4 tanks for fire suppression. Tanks are within a 1/8th of a mile from each other but the community covers 5 sq. miles. The communities of Sugar Pine View, Alta / Dutch Flat / Monte Vista, Moody Ridge / Cape Horn / Alpine Meadows need tanks.
- Can't definitively locate asbestos-lined pipes used for irrigation water. Ground-penetrating radar can't locate (Midway).

Many of the communities in the region suffer from aging and substandard water distribution infrastructure, experience wide fluctuations in system pressure, considerable water waste through undetected or unrepaired leaks, and are vulnerable to failures of canals and pipes as a result of aging infrastructure or weather-related disruptions. Much of the project proposals within the region are focused on remedying these issues and will continue to focus on this strategy for the foreseeable future.

All of the water purveyors in the region will be vulnerable to changes in water supply relating to climate change. However, less commonly considered aspects of climate change on drinking water treatment and distribution may include impacts on system maintenance and operation, such as increased sedimentation (from increases in catastrophic fire and resulting erosion), fluctuations in peak storm events with associated flow surges and localized flooding, effects of erosion on stability of existing canals, and raw water distribution systems.

10.4.1.10 Match Quality to Use

Many of the CABY region's water systems are designed to match water quality to the appropriate type of use. For example, in general it is inefficient to use the more expensive treated water for irrigation purposes. Recycled water and untreated (raw) water are better options for irrigation and landscaping. Matching water quality to use reduces energy consumption by allowing for the use of water that has not been treated to potable standards. Water treatment is energy intensive, so increasing the use of recycled and raw water decreases the overall energy use of the water system, reducing the associated greenhouse gas emissions and positively impacting climate change.

Matching Water Quality to Agricultural/Landscape Uses

Recycled Water Programs: A number of water purveyors in the CABY region are developing recycled water supplies, which are treated to Title 22 standards. The use of recycled water serves as a source of water that offsets the demand for potable water. For example, EID uses recycled wastewater in the El Dorado Hills and Cameron Park areas for irrigation. This is considered a better match of water quality to the type of water usage.

Matching Water Quality to In-stream and Ecosystem Use

Promoting In-stream Uses:
Ambient, in-stream water must be suitable to support a wide range of aquatic habitats and conditions. Water quality for in-stream uses must meet physical, chemical, and biological objectives specific to the habitat and in-stream needs. The seven integrated projects of the CABY Mercury Initiative provide a good example of CABY RWMG's efforts to improve water quality for in-stream and ecosystem use. The projects are designed to address the region's oldest and longest neglected water quality impacts: mercury and sediment drainage from abandoned mines.

Matching Water Quality to Drinking Water Use

Protect Public Health:
To minimize the cost of enhanced treatment, and to provide multiple barriers of protection for public health, it is best that drinking water supplies start with the highest quality source water available. There are several ongoing projects by water purveyors across the region that address this issue.

10.4.1.11 Pollution Prevention

CABY stakeholders have determined that ongoing water quality monitoring is a key priority for inclusion in this strategy. Monitoring allows information to be systematically and reliably shared to enhance organizations' capacity to manage adaptively and track implementation project success. Monitoring can also contribute to early warnings of polluting events or actions. Monitoring-based early warning enables a quick response from the affected agency, thus minimizing potential damage to ecosystems or municipal water sources. The ability to monitor and respond to unexpected events will likely prove to be valuable as climate change alters regional hydrology and the effects of contamination events become more difficult to predict. Additional factors relevant to pollution prevention include the following:

- There are legally required water quality monitoring programs in place throughout the CABY region. This monitoring assists water managers and stakeholders in the region to identify when the quality of a particular water body is threatened and aid in the identification of the source.
- The Clean Water Act Section 303(d) has promulgated listings of impaired water bodies throughout the CABY region. The CABY region has 42 listed water bodies due to mercury, arsenic, copper, iron, chromium, fecal coliform, E. coli, DDE, indicator bacteria, dissolved oxygen, zinc, chlorpyrifos, water temperature, sediment/siltation, and/or pH.
- Legacy mining effects are ubiquitous throughout the CABY region. This contamination, primarily the result of heavy metals, can affect animal and plant species. The metals—usually mercury—accumulate in upper-level trophic species and can affect humans consuming contaminated fish and water plants, as well as entering the area food chain and causing problems for area animals, fish, amphibians, and biota.
- According to the U.S. Environmental Protection Agency, sedimentation is the number-one cause of water pollution in the United States. Erosion and sedimentation are natural processes in mountainous watersheds, such as those of the CABY region. However, water contamination can be caused by extraordinary erosion and sedimentation resulting from high intensity wildfire or inadequate or poorly implemented land use management practices. While there are best management practice (BMP) systems in place to manage these variables, sedimentation continues to be a management issue for the CABY region.

- Waste contamination can occur due to the proximity of animal or human waste areas to waterways, as well as being residential or recreation related. The work of Resource Conservation Districts and counties help control this on private lands, and U.S. Forest Service and county processes and permits help control this pollution on public lands. The various Departments of Environmental Health monitor and have regulatory control over private septic systems.
- Illegal cannabis cultivation can have runoff impacts from fertilizer, rodenticides, and herbicides.

10.4.1.12 Urban Runoff Management

Contaminated urban runoff can be a problem when there is a concentration of development. While this cannot be avoided entirely, it tends to be more of an issue in communities with higher population densities in the CABY region. There is a significant opportunity for technical design innovation, including low impact and green infrastructure designs for urban runoff, because of the rural character of the region and population growth.

10.4.1.13 Flood Risk Management

The CABY region does not contain floodplains, such as those in the Central Valley or other mountainous regions of the state. Instead, the region is characterized by relatively steep canyons with a sharply confined area subject to inundation, or more gently incised creeks in the lower elevation that again constrain the extent of the area subject to flooding.

Traditional floodplain management is not necessary within the mountainous canyon terrain of the CABY region. However, there are localized flood risks that could affect water, wastewater, and hydroelectric power generation infrastructure, as well as portions of developed cities and unincorporated areas. Climate change is predicted to increase runoff variability and increase the likelihood of flooding. Flood management needs to take a different approach in the CABY region, and CABY stakeholders continue to identify affected areas, using Federal Emergency Management Agency maps, city and county planning documents, and local community knowledge to create the most appropriate management strategies. These strategies must take into consideration the future impacts of climate change to successfully prepare the region for future flood potential. As with urban runoff management, flood management in the CABY region may present an opportunity to employ green infrastructure and low impact design elements to manage and mitigate flood flows.

10.4.1.14 Agricultural Lands Stewardship

As with many of the RMS, there are several ways this strategy can and is being applied within the CABY region. As well as developing objectives and projects to address this issue, CABY has identified the following additional options to use this strategy:

- Comply with the requirements of the Regional Board's Irrigated Land Regulatory Program, and implement a program that promotes and rewards good management practices at the individual ranch and farm level;
- Work with the U.S. Department of Agriculture Natural Resources Conservation Service to improve on-farm BMP implementation, such as animal and/or crop rotation and grazing management practices;
- Research the potential of carbon sequestration in pasture lands, and possibly employ this as a mitigation strategy for other actions; and

- Identify crops that may be more adapted to an environment altered by climate change, such as requiring less water, being more heat-tolerant and/or fire adapted, or having growth characteristics that are appropriate to emerging climatic conditions.

10.4.1.15 Ecosystem Restoration

Intact watersheds provide a wide variety of quantifiable and qualitative ecosystem services, including, but not limited to, climate moderation, carbon and nutrient storage, water purification and supply, recreation, habitat, forest products, and diverse aquatic and terrestrial species. While the CABY region watersheds are generally intact, there are definite threats, including high intensity wildfire, legacy mining effects, and degraded mountain soils and meadows, all of which are compounded by the predicted impacts of climate change. These threats must be addressed to minimize impacts to the CABY region and to benefit downstream use. Healthy ecosystems are more resilient and more able to adapt to impacts caused by climate change. In addition, ecosystem restoration can provide carbon sequestration benefits and therefore positively contribute to slowing climate change.

10.4.1.16 Forest Management

This RMS is particularly applicable to CABY, as management of forest resources to reduce the risk of high intensity wildfire is imperative to sustaining the healthy watersheds upon which the region depends. The sheer number of abandoned mines in the region points to special considerations for preventing erosion, which often involves mercury-contaminated sediment. This includes prioritizing forested areas with a high density of hydraulic mines and mine features for treatment, preventing additional erosion during and after fuels reduction activities, and stabilizing these landscapes following wildfire as a first priority. High intensity fires arguably pose the greatest natural threat to the people and resources of the CABY region and may increase in both frequency and intensity due to climate change. CABY members continue to initiate studies, pilot projects, and evaluation to determine the most effective way to implement this RMS.

Properly managed multi-species, multi-aged forests provide for better water yield, improved carbon sequestration, improved habitat and recreational opportunities. As demands on water supplies for all beneficial uses in California become affected by increasing population, economic and environmental needs, and climate change, optimization of watershed conditions and water management strategies will become ever more critical. CABY stakeholders continue (through establishment of objectives and development of projects) to address forest management on public and private lands across the region.

10.4.1.17 Land Use Planning and Management

In CABY's 2007 IRWMP, land use was listed as an issue of conflict, and as such, one that would not be brought to the group for active discussion – largely to preserve the emerging stakeholder group's capacity to develop trust and an effective working, collaborative environment. However, by the publication of 2009 Water Plan RMS and the updated 2012 California Department of Water Resources (DWR) Guidelines, the nexus between water management and land use decision-making was noted by many stakeholders as important to the region. As a result, the IRWMP Update includes a substantive outreach strategy aimed at identifying the nexus between land use and water management and also identification of existing policies and procedures to support increased collaboration. CABY RWMG's efforts in this IRWMP Update have demonstrated stakeholders' interest in and capacity for effective and productive discussions. Plans for implementing the outcomes of the evaluation (characterized by substantive interviews with local water agencies and their corresponding land use decision-makers) are part of the CABY's RMS for integrating land use and water management.

Additionally, several CABY objectives, including *OV-4: Coordination of planning activities across the region*, will guide actions in the next several years, and as CABY members track organizational performance, it may be changed, emphasized, or otherwise altered to best respond to current needs.

10.4.1.18 Recharge Area Protection

The CABY region is a surface water source area for the Sacramento Valley, as well as for state and federal water projects. In addition, the region provides recharge to both Sierra and valley groundwater sources. This recharge connection has been learned through general research; however, the specifics about where the recharge areas are located or how they function (including transport time) are poorly understood. CABY stakeholders continue (through suggested projects and inter-agency collaboration) to seek a greater understanding of how these underground systems work, and how the CABY region is connected to the groundwater resources throughout the Central Valley.

10.4.1.19 Sediment Management

Erosion and sedimentation are important issues in the CABY region. A history of mining has left a legacy of sediment ponds, tailing piles, and open scars that contribute significant quantities of sediment to waterways. Toxic substances associated with mining, in particular mercury, are transmitted with those sediments and cause additional harm to water quality and ecosystem health. Fires, floods, grazing, timber harvest, recreation, and road construction all contribute to sedimentation issues in the CABY region.

Sediment accumulation behind dams reduces reservoir storage capacity, clogs infrastructure necessary for dam operation and water transport, and can increase water treatment costs. Over time, sediment accumulates in reservoirs behind these dams causing impacts to reservoir operations and storage capacity as well as depriving downstream reaches of sediments that are essential for maintaining healthy riparian and aquatic ecosystems and channel form.

For example:

- Humbug Creek in the Yuba watershed is listed on the Clean Water Act Section 303 (d) list for impairment due to sediment/siltation. Sedimentation impairs fisheries by destroying spawning habitat, smothering eggs, and filling in foraging pools. Compounds that bind to soil particles are spread throughout aquatic habitats circulating toxic substances and delivery excessive nutrients that can cause algae blooms.
- Rollins Reservoir has lost an estimated 12,000 acre-feet of reservoir storage capacity, or 18%, due to sedimentation since its construction in 1965. For additional discussion on the impacts of sedimentation to the CABY Region, see Section 6.3.1, Sedimentation and Erosion.

Given that climate change is anticipated to increase sedimentation as the prevalence of wildfires and flood frequency increase, CABY members must address this issue now to help mitigate negative impacts.

10.4.1.20 Watershed Management

Stewardship of the watersheds of the plan area by local agencies, organizations, and entities supports long-term health and productivity for quality, quantity, and timing of water runoff, as well as other ecological and recreational values. Management of watersheds by federal, state, and local agencies and entities to reduce the risk of high intensity wildfire is critical to sustaining healthy watersheds. High intensity fires have and, without adequate management, can denude forest soils, reducing hydraulic conductivity, thus increasing erosion and sedimentation and removing the medium for tree growth. This

compounds the impacts of legacy mines, many of which are denuded and erosion prone landscapes laced with mercury. The potential for high-intensity wildfire may increase with climate change and, therefore, watershed stewardship has risen in regional importance. The CABY region also is served by nongovernmental organizations (NGOs) that have a wide-ranging focus on watershed and/or resource management, including mountain meadow, wetland, restoration and enhancement; water quality monitoring; citizen education and stewardship; and scientific monitoring and evaluation of riparian and fish, groundwater, forest health and maintenance, endangered species, and other similar issues. Both public agencies and NGOs will be critical partners in this RMS.

10.4.1.21 Economic Incentives (Loans, Grants, and Water Pricing)

The use of economic incentives is a common strategy for water purveyors in the CABY region. Water purveyors in the CABY region engaged in the stakeholder process to provide support and guidance to DWR and the State Water Resources Control Board as they develop the water budget framework for Executive Order B-37-16, Making Water Conservation a Way of Life. Water purveyors in the CABY region follow the State's Demand Management Measures, and comply with pricing requirements through those. Research into the potential for loans and grants for project implementation, as well as potential for partnership with NGOs are an important aspect of the CABY work effort. CABY members frequently collaborate to seek public and/or private funding for integrated multi-stakeholder, multi-objective projects.

10.4.1.22 Outreach and Engagement

This strategy was included in the previous CABY IRWMP as Education and Outreach, a strategy developed by the CABY RWMG before Outreach and Engagement was included as an RMS in the California Water Plan. Education is a central component of this strategy, and although the title has been changed to align with the California Water Plan RMS, application in the CABY region is still focused on education. This strategy focuses on two separate components, (1) integration of resource education into the design of all CABY implementation projects, and (2) education and outreach to the general public.

It is important that the general public understand the value of regional, integrated, watershed-level management. Therefore, ongoing outreach to the public will continue and be augmented by using the same methods described for stakeholder recruitment. There is an important initiative by some CABY members to reach out to organizations and entities to increase participation from Spanish-speaking individuals. This initiative has an emphasis on Latino health and community organizations and on the publication and distribution of educational materials in Spanish.
Agencies, organizations, and entities currently participating in the CABY SG are actively engaged. However, representatives (whether newly elected or appointed board members, paid staff and/or volunteers) from those organizations will undoubtedly change with time. Therefore, ensuring that new representatives of established member entities are fully oriented will be important to ensuring continuity of participation and collaborative activities.

In recognition of the importance of project and issue-related education, CABY developed an IRWMP objective specifically focused on education and outreach as a component of each CABY project and program. It is part of CABY's overarching objectives: *OV-1: Integrate outreach and education into all CABY projects and programs* (see Chapter 9 for more information).

10.4.1.23 Water and Culture

Agriculture

Agriculture is a significant and valued component of local communities, representing the character and landscape of the region. Farm-to-Fork, Ranch Marketing, and Agricultural Tourism are evolving major economic drivers and water users in the CABY region, and an important part of the region's culture.

Native American Lifeways

The CABY region recognizes the importance of considering Native American cultural practices when making decisions regarding water resource management. The CABY region is home to many California Native People whose spirituality, ceremony, recreation, subsistence resources, and life fabric involve and depend upon water and taking care of waterways/watersheds. Incorporating Cultural Resource Values into regional resource management means engaging with Native peoples and incorporating RMS that address those values. Traditional Native practices for land stewardship consider the need for sustainability and regeneration for future generations, which will positively inform CABY's water management, while preserving cultural resources.

The following sections identify some activities and places in the CABY region related to water resource management that are influenced by cultural values and practices.

- **Subsistence activities**: Watersheds throughout the CABY region are used by Native People for fishing, hunting, collecting plants for cultural items, food sources, medicinal properties, and raw materials. Water flows and water quality are critical aspects of supporting water-dependent subsistence activities. Public health risks can occur if food sources are obtained from contaminated water bodies.
- **Spiritual activities**: CABY region water sources, such as springs, seeps, rivers, confluences, deep pools, waterfalls, and lakes are some of the places of reverence, spiritual ceremonies and gatherings for Native People of the past as well as today. Water is essential to life, and Native practices emphasize the obligation to take care of the land, the water, and the creatures as part of a spiritual commitment made by the people.
- **Historic Preservation**: Regional cultural resources provide a key linkage to the heritage and historic lifeways of Native Peoples. The value of these resources is immeasurable, and cannot be replaced once they are destroyed. There are many laws and policies in place that speak to the government to government consultation required when a project is contemplated that may lead to disturbance or discovery of cultural resources or human remains
- **Public Art**: Clearly the waterways that flow through the CABY region are the source and inspiration of many public art forms. From a Native perspective, there are many traditional stories associated with significant places, types of places, and landmarks within the watershed. There are traditional dances, songs, and many beautiful ceremonies that are practiced for specific purpose of place. Many art pieces are a direct result of human interaction in these waterways, and many photos, paintings, sculptures, poems, and books are written about the places within the CABY territories.
- **Lifeways**: Native People hold many social and spiritual gatherings at sites throughout the region– often close to rivers and streams. An important aspect of these gatherings has to do with taking care, as Creator intended. For example, Native People within the Cosumnes River Watershed participate in seasonal Salmon Ceremonies, marking the importance of work to restore fall flows for salmon passage. Work is also done to clean and restore the rivers, and to gather plants near the rivers for medicine and basketry.

Climate change may fundamentally change the ways in which water exists in and moves through the region. These changes will affect cultural activities, cultural resources, and the ecosystems on which they depend. Mitigation and adaptation to climate change should consider and be responsive to culture and cultural resources in the region. Maintain clean water through meadow restoration, wetland restoration, cleaning out of springs and creeks, and a long-term strategy for the creation of new meadows and natural management of forests. Need processes to maintain watersheds that create new meadows for 0-50 years and 50-100 years.

The first step in incorporating Native American cultural practices is to engage with tribal entities. Below is a list of tribal entities in the region. It is important to note that the entities present and their contact information may change over time; further research may be needed to connect with appropriate tribal representatives.

10.4.1.24 Water-Dependent Recreation

Water-dependent recreation activities are a primary economic stimulus in the region, and are an important part of the regional culture. These activities include pursuits such as backcountry use dependent on snowpack, as well as agro tourism and whitewater rafting in summer. These activities could see the effects of climate change before urban areas, due to their dependence on a specific weather pattern. More information on this topic can be found in Chapter 11, Climate Change.

10.4.2 RMS not Included in DWR Update 2013 but Identified by CABY Stakeholders

10.4.2.1 Inter-IRWMP Coordination

CABY values the opportunity to collaborate and engage in project and issue-specific conversations with adjacent IRWM regions, and has been a long-term organizer of meetings with all IRWM entities within the MCFA.

Issues such as wildfire, mercury and heavy metal contamination, climate change-related impacts to water supply timing and availability, migration corridor connectivity, removal of barriers to anadromous fish spawning, forest land management, air and water quality impacts associated with wildfire, and other similar topics do not stop at county or IRWM regional lines. In recognition of this, CABY members remain committed to ongoing outreach to neighboring IRWMs and IRWMs within the MCFA aimed at fostering conversations, collaboration, and project development for projects of mutual benefit, and ongoing coordination of large-landscape strategies and programs.

10.5 Integration between Data Management Activities and RMS Updates

CABY has already established a Data Management System that makes sure that all CABY members and the general public have access to the technical data which supports the IRWMP and its RMS (see Chapter 15, Technical Analysis). Additionally, there are IRWMP procedures proposed to ensure that the RMS chapter will be revisited and revised as necessary in response to the availability of new or updated technical data and emerging issues. The RMS chapter will be subjected to this review and will be updated as required. The RMS review will include four components: (1) review of RMS that were previously deemed Not Applicable to ensure that changing conditions are reflected in the ongoing integration of management strategies; (2) review of updates to RMS in the California Water Plan to ensure that any newly identified RMS are included in the IRWMP; (3) reviews of both IRWMP and project performance to

determine if individual RMS need to be reconsidered and/or how objectives and strategies may be impacted by new information and lessons learned from project implementation; and (4) impacts to chapter content resulting from the emergence of new data, findings, and issues

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
Programmatic Area: Water Supply		
GOAL: Ensure adequate and reliable water supply that can be adapted to climate change and meet the needs of the region.		
Primary Issue: Conservation	**Applicable Resource Management Strategies (RMS)**	
Policy and Education	• Agricultural Water Use Efficiency • Urban Water Use Efficiency • Conveyance – Regional/Local	• Economic Incentives • Urban Run-off Management • Outreach and Engagement
Primary Issue: Infrastructure	**Applicable RMS**	
Aging Infrastructure	• Agricultural Water Use Efficiency • Urban Water Use Efficiency • Conveyance – Regional/Local	• Drinking Water Treatment and Distribution • Pollution Prevention
Interties	• Conveyance – Regional/Local • System Reoperation	• Drinking Water Treatment and Distribution • Water Transfers
Primary Issue: Water Storage	**Applicable RMS**	
	• Recycled Water • Surface Storage – Regional/Local • Drinking Water Treatment and Distribution • Water-Dependent Recreation	• Outreach and Engagement • IRWMP Coordination • Sediment Management
Reservoir Sedimentation and Green Infrastructure	*RMS are currently being developed by the CABY RWMG*	
Shifting Hydrology	*RMS are currently being developed by the CABY RWMG*	
Forest Management	*RMS are currently being developed by the CABY RWMG*	
Primary Issue: Water Management Operations	**Applicable RMS**	
Drought	• Agricultural Water Use Efficiency • Urban Water Use Efficiency • System Reoperation • Agricultural Stewardship	• Recycled Water • Outreach and Engagement • IRWMP Coordination • Economic Incentives
Recycled Water	• Economic Incentives • Recycled Municipal Water • Surface Storage – Regional/Local	• Matching Quality to Use • Outreach and Engagement

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
Primary Issue: Water Transfers	**Applicable RMS**	
Financing Mechanism for Headwater Management and Restoration	• Local Conveyance • Water Transfers	• Conjunctive Management • Outreach and Engagement
Primary Issue: Groundwater	**Applicable RMS**	
Recharge and Contamination	• Conjunctive Management and Groundwater Storage • Groundwater Remediation	• Outreach and Engagement • Land-use Planning and Management
Programmatic Area: Water Quality		
GOAL: Ensure sufficient water quality to support healthy ecosystems and dependent organisms.		
Primary Issue: Contamination	**Applicable RMS**	
Legacy Mining Toxics	• Pollution Prevention • Ecosystem Restoration • Recharge Area Protection • Water-Dependent Recreation	• Watershed Restoration • Drinking Water • Outreach and Engagement • IRWMP Coordination • Sediment Management
Urban Run-off and Abandoned Mine Land Run-off	• Pollution Prevention • Ecosystem Restoration • Forest Management • Urban Run-off Management • Water-Dependent Recreation	• Watershed Management • Drinking Water • Outreach and Engagement • IRWMP Coordination • Sediment Management
Primary Issue: Sedimentation Management	**Applicable RMS**	
	• Pollution Prevention • Urban Runoff Management • Ecological Restoration • Forest Management	• Land-use Planning and Management • Water-Dependent Recreation • Watershed Restoration • Outreach and Engagement • Sediment Management
Mercury Contaminated Sediment and Debris Control Dams	• Pollution Prevention • Ecological Restoration • Forest Management	• Water-Dependent Recreation • Watershed Restoration • Outreach and Engagement • Sediment Management

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
Erosion and Sediment Control Associated With Roads	• Pollution Prevention • Urban Runoff Management • Ecological Restoration • Forest Management • Land-use Planning and Management	• Water-Dependent Recreation • Watershed Restoration • Outreach and Engagement • Sediment Management
Primary Issue: Wastewater Management	**Applicable RMS**	
	• Pollution Prevention	• Flood Risk Management
Primary Issue: Headwaters Protection	**Applicable RMS**	
	• Ecosystem Restoration • Forest Management • Recharge Area Protection • Water-Dependent Recreation • Ecosystem Restoration • Flood Risk Management	• Sediment Management • Drinking Water • Pollution Prevention • Economic incentives (Loans, Grants, and Water Pricing) • Outreach and Engagement • IRWMP Coordination
Primary Issue: Temperature	**Applicable RMS**	
	• Ecosystem Restoration • Forest Management • Recharge Area Protection	• Watershed Restoration • Groundwater Remediation • Sediment Management
Programmatic Area: Environment and Habitat		
GOAL: Preserve and restore watershed health.		
Primary Issue: Fisheries	**Applicable RMS**	
Volitional Fish Passage	• Ecosystem Restoration	• Watershed Management
Primary Issue: Aquatic Biota	**Applicable RMS**	
	• Ecosystem Restoration • Watershed Restoration • Water-Dependent Recreation	• Outreach and Engagement • IRWMP Coordination • Sediment Management

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
Primary Issue: Instream Flow	**Applicable RMS**	
	• Ecosystem Restoration • Forest Management • Recharge Area Protection • Water-Dependent Recreation • Watershed Restoration	• Economic incentives • Outreach and Engagement • IRWMP Coordination • Water Quality
Primary Issue: Meadows	**Applicable RMS**	
	• Ecosystem Restoration • Forest Management • Recharge Area Protection • Economic Incentives	• Drinking Water • Outreach and Engagement • IRWMP Coordination
Primary Issue: Fire and Fuels	**Applicable RMS**	
Prioritizing Fuels Treatment in the Wildland Urban Interface.	• Ecosystem Restoration • Forest Management • Recharge Area Protection	• Watershed Management • Outreach and Engagement
Primary Issue: Invasive Species	**Applicable RMS**	
Aquatic Invasive Species	• Ecosystem Restoration • Water-Dependent Recreation	• Outreach and Engagement • IRWMP Coordination
Terrestrial Invasive Species	• Ecosystem Restoration • Forest Management	• Watershed Management • Outreach and Engagement
Programmatic Area: Climate Change		
GOAL: Anticipate climate change needs and be prepared to respond adaptively to human and ecosystem needs.		
Greenhouse Gas Emissions	**Applicable RMS**	
	• Agricultural Water-use Efficiency • Urban Water-use Efficiency • System Reoperation • Water Transfers • Flood Risk Management • Agricultural Stewardship • Conjunctive Management	• Forest Management • Recharge Area Protection • Watershed Management • Economic incentives (Loans, Grants, and Water Pricing) • Land use Planning and Management • Urban Run-off Management • Water-Dependent Recreation

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
	• Recycled Water • Surface Storage – Regional/Local • Ecosystem Restoration	• Sediment Management • Outreach and Engagement • IRWMP Coordination
Carbon Sequestration	• Forest Management • Outreach and Engagement	• Ecosystem Restoration • Economic Incentives
Fuels Management	• Ecosystem Restoration • Forest Management • Recharge Area Protection	• Watershed Management • Outreach and Engagement
Programmatic Area: Human-Landscape Interaction		
GOAL: Maintain and enhance functioning landscapes that provide sustainable services for humans.		
Primary Issue: Habitat Alteration	**Applicable RMS**	
	• Agricultural Stewardship • Economic Incentives • Ecosystem Restoration • Forest Management • Recharge Area Protection • Sediment Management	• Land use Planning and Management • Pollution Prevention • Water-Dependent Recreation • Watershed Management • Outreach and Engagement
Primary Issue: Native American Uses	**Applicable RMS**	
Traditional Ecological Knowledge	• Flood Risk Management • Economic Incentives • Ecosystem Restoration • Land use Planning and Management	• Urban Run-off Management • Watershed Management • Outreach and Engagement • IRWMP Coordination
Primary Issue: Flooding	**Applicable RMS**	
Environmental Flows	• Sediment Management	
Primary Issue: Open Space	**Applicable RMS**	
Brownfield Properties	• Agricultural Stewardship • Economic Incentives • Ecosystem Restoration • Forest Management • Recharge Area Protection	• Land use Planning and Management • Pollution Prevention • Water-Dependent Restoration • Outreach and Engagement

Table 10-2 CABY Objectives and RMS Addressed – An Overview		
Primary Issue: Environmental Flow Hydrograph	**Applicable RMS**	
	• Ecosystem Restoration • Water-Dependent Recreation • Water Supply	• Watershed Management • Outreach and Engagement
Primary Issue: Disadvantaged Communities	**Applicable RMS**	
Access to Water	• Economic Incentives • Drinking Water	• IRWMP Coordination
Primary Issue: Recreation	**Applicable RMS**	
	• Economic Incentives	• Water-Dependent Recreation
Primary Issue: Hydropower	**Applicable RMS**	
	• Local Conveyance • Economic Incentives	• Outreach and Engagement
Primary Issue: Agriculture	**Applicable RMS**	
Agricultural Land Conservation	• Agricultural Stewardship • Economic Incentives • Ecosystem Restoration • Forest Management • Recharge Area Protection	• Land use Planning and Management • Pollution Prevention • Water-Dependent Recreation • Watershed Management • Outreach and Engagement
Primary Issue: Sustainable Economy/Self-sufficient Communities	**Applicable RMS**	
	• Economic Incentives	
Primary Issue: Governance	**Applicable RMS**	
Political	• Outreach and Engagement	• IRWMP Coordination
Legislative	• Outreach and Engagement	• IRWMP Coordination
Regulatory	• Outreach and Engagement	• IRWMP Coordination

Table 10-2 **CABY Objectives and RMS Addressed – An Overview**	
Overarching Objectives: Overarching objectives are topics that have been raised with every discussion of specific issue-based objectives. These components of the CABY planning process will be considered for every program implemented and for inclusion in each project concept.	
Education and Outreach	• Outreach and Engagement
Financial Feasibility and Sustainability	*No objective developed – will be included in the finance chapter*
Data Analysis and Monitoring	• Outreach and Engagement
Regional Planning and Land use	• Land use Planning and Management • Outreach and Engagement • IRWMP Coordination

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Chapter 11
Climate Change

The purpose of this chapter is to (1) discuss relevant research that illustrates the region's climate setting and vulnerabilities; (2) describe the actions that the Cosumnes, American, Bear, and Yuba (CABY) members took in developing this chapter; (3) discuss CABY member stakeholders' participation in state and federal efforts to prepare for and mitigate climate change impacts; (4) offer adaptation strategies that CABY can undertake for an integrated, region-wide effort to respond to variations in climate and the associated impacts; (5) offer potential actions to minimize greenhouse gases (GHGs) generated within the region; and (6) array future plans for addressing climate within the CABY Integrated Regional Water Management (IRWM) process. Table 11-4, Climate Change Discussion throughout the CABY Integrated Regional Water Management Plan (IRWMP), located in Section 11.10, illustrates the guideline-required consideration of climate change in other IRWMP chapters.

11.1 Process for Preparing the Updated Climate Change Chapter

CABY Stakeholder Group (SG) and member engagement on the issue of climate change has been consistent and reliable. The CABY Climate Change Working Group (WG) was established in January 2012 to allow for member-based, technical input to the project team about how climate change should be considered within the CABY IRWMP. Participation recruitment for the WG occurred at the November 2011 CABY SG meeting, and the first WG meeting was held in January 2012. The Regional Water Management Group (RWMG) met in 2018 to review the current climate change chapter. The RWMG confirmed this chapter is current and exhaustive.

While an expanded list of individuals who received meeting information, active participants (those attending WG meetings and submitting comments on materials) included representatives of Cosumnes Culture and Waterways, American River Conservancy (ARC), The Sierra Fund, South Yuba River Citizen's League, El Dorado Trout Unlimited, El Dorado Irrigation District (EID), El Dorado County Water Agency (EDCWA), Nevada Irrigation District (NID), and Placer County Water Agency (PCWA) Representatives brought to the table organizational interests as well as individual qualifications ranging from biological and geological expertise to in-depth knowledge of the CABY region watershed and water system management. Each meeting of the Climate Change WG was open to the public and often accommodated call-in participants. New members were regularly invited to attend, and the Mountain Counties Funding Area disadvantaged community (DAC) outreach program is underway.

This chapter was updated in 2021 by the RWMG, including representatives of Cosumnes Coalition, ARC, The Sierra Fund, South Yuba River Citizen's League, El Dorado Trout Unlimited, EID, EDCWA, NID, and PCWA.

11.2 Climate Change Evaluation Overview

11.2.1 CABY Region – Climate Change Considerations in a Source Area

This chapter discusses the influence of a changing climate on the CABY region, and specifically on the quantity, quality, and timing of water resources available to support the needs of humans and natural systems. The Sierra Nevada forests and meadows are California's most robust carbon storage infrastructure. Climate change and related drought conditions are increasingly at the forefront of water resource management decisions around the state and throughout the CABY region. Water supply and demand, ecological processes, and fire are CABY's core issues, and it is likely that management of these issues under the projected impacts of climate change will intensify.

The historic hydrologic regime can be described as follows: During winter, snow falls high in the mountains and runs off as winter transitions to spring and summer. This runoff fills rivers, streams, reservoirs, and canals, and supports critical ecosystems, agriculture, recreation, and a vast array of other human and wildlife systems. Folsom Reservoir, a major federal reservoir that plays an integral part in Delta health and serving statewide water needs, was created by damming one of the four rivers for which the CABY region is named (American River). Three of the four primary waterways in the region flow directly into the Sacramento River (American, Bear, and Yuba Rivers), and the fourth, the Cosumnes, flows into the San Francisco Bay-Delta system. Thus, projected effects that climate may have on managing the region's water storage, flood risk, recreational and economic benefits, and watershed health are of utmost interest for both the region and the state as a whole.

The CABY region is entirely within the Sierra Nevada range, which is the source for the majority of the state's fresh water. As such, its water is under complex management by multiple agencies, and of considerable and competing value to out-of-region interests. Some CABY stakeholders maintain that policies adopted by state agencies beyond the purview of the region, (e.g., to address Sacramento Delta supply and ecological concerns in response to climate change) could have as much effect on the region's water supply and management as direct climate impacts. This situation suggests to CABY stakeholders that the best defense will be to enter into robust conversations on how the region's water systems are being affected, develop an effective communication strategy, and place it at the table in decision-making processes. Some key documents and stakeholder entities addressing climate change policy and adaptation are listed and described in the relevant sections of this chapter.

Furthermore, given constrained funding for projects and the uncertainty of how specific climate effects might manifest at the greatest cost/damage, no-regrets strategies—strategies that can be employed without foreclosing future opportunities or committing stakeholders to a single course of action—are at the forefront of consideration.

11.2.2 Current Status of CABY's Climate Change Preparedness – Trends and Projections

From the outset of the CABY IRWM planning effort in 2006, stakeholders have worked to incorporate CABY-based climate planning and projections with other regional planning. In 2007 and 2008, CABY members worked with EID to expand the Water Evaluation and Planning System (WEAP) modeling effort throughout the CABY region. Effort was also put into incorporating the findings of the El Dorado County Western Slope Drought Analysis—a planning and assessment process completed in spring 2007 with the goal of preparing South Fork American River water users for extreme drought. Currently, staff from each member water agency work within their respective systems to project the effects of drought and climate change on specific service area infrastructure and water demand patterns. The four major water providers

in the CABY region—EID, PCWA, Georgetown Divide Public Utility District, and NID—all have different modeling frameworks for operations. These models have been used for variable periods of time between the agencies, but all represent significant financial commitment in terms of purchasing the software and getting individual systems described in the respective model. None of these operational models are capable of predicting the effects of future climate scenarios; instead, they indicate how water delivery (operational) systems might work under differing climate scenarios. As such, the models could help the region identify infrastructure-related vulnerabilities and/or preparedness for climate change.

Moreover, many members of the non-profit community are highly invested in conservation, restoration, and other activities directly aimed at mitigating projected climate change impacts. As a consequence, a substantial regional body of research on climate-change projections, effects, mitigation, and adaptation has been completed by a variety of public agencies, universities, and organizations. This research has contributed greatly to the understanding of climate change displayed in this chapter.

11.2.3 Vulnerabilities/Adaptive Management Strategies

While climate models developed by national and international organizations vary on the *amount* of warming that will occur in various regions, they agree that this region will warm by 2°F to 4°F in the winter and 4°F to 8°F in the summer by the end of the century.[1] Precipitation is less predictable, especially within the regions microclimates, but the increase in temperature is projected to bring about a higher level of evapotranspiration, potentially less available moisture overall, even in areas that experience increased precipitation.

Spring thaw in the central Sierra occurred 5 to 30 days earlier in 2019 than it did in 1948.[2] Along with rising temperatures, more precipitation now falls as rain than snow. This has serious implications for a region where snowpack has historically served as a reservoir, a reliable slow-melting source of water for the rest of California. As snow melts sooner and faster and combines with precipitation increasingly falling as rain rather than snow, uncertainty in water storage and release will confront water managers and hydropower producers. Flooding impacts increase with storm intensity and higher winter precipitation events, while summer stream flows are expected to diminish over the season, potentially affecting domestic and environmental water supply and quality and engendering tough choices for water managers and policy makers.

The CABY region has been plagued with detrimental forest fires in recent years. PCWA, in collaboration with other local agencies, is implementing a forest management project of French Meadows that involves clearing underbrush; thinning smaller trees; removing biomass to renewable energy facilities; reforestation; restoring meadows; and initiating prescribed fires to promote forest resilience to stressors such as wildfire, insect and disease outbreaks, and climate change, as well as to protect and restore habitat for fish and wildlife and to safeguard water supply and resources. CABY water agencies have been incorporating operational and other modeling into their respective management projections for some years now, and have been responding to those projections with adaptive conservation and operational strategies as well as infrastructure upgrades and new facilities. Federal, state, local agencies, and nongovernmental organizations (NGOs) have responded as well, with innovative responses to create

[1] Safford, H.D., M. North, and M.D. Meyer. *Chapter 3: Climate Change and the Relevance of Historical Forest Conditions*, *Managing Sierra Nevada Forests.* Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Stations. **Date:** Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf

[2] Stewart, I.T.; Cayan, D.R.; Dettinger, M.D. 2005. Changes toward earlier streamflow timing across western North America. Journal of Climate. 18: 1136-1155.

climate resiliency on the ground—forest-management strategies that account for the upslope movement of species and create more fire-resilient forests, restoration of mountain meadows to enhance the slow releases from the region's watershed, and use of alternative energy production (see Table 11-2, Feasibility of Addressing Priority Climate Change Vulnerabilities, for a display of the region's vulnerabilities and suggested adaptive strategies).

CABY groups suffer from a lack of common knowledge about vulnerabilities as they manifest in underserved disadvantaged communities. These DACs will bear a disproportionate impact of the impact of climate change as the triple impact of increased fire vulnerability, aging infrastructure, and changed precipitation threaten their water security. In addition, there is concern that state policies may become at odds with facets of water rights that were developed more than a century ago. Furthermore, a lack of funds to implement projects and mitigations to climate change may limit the ability to respond to evolving understanding of the problems.

11.2.4 Long-term Climate Change Program

The Climate Change WG, with the endorsement of the RWMG, formulated recommendations for a long-term climate change program to help assure climate resiliency for the region. The program focuses on ways to mitigate climate change effects on the region, as well as identifying the contributing factors within and outside of the region (including potential state policy and regulation) that exacerbate the impacts of climate change.

The program seeks to provide the means, under an altered climate future, for the region to continue to produce high quality water, provide reliable water supply and carbon-free hydroelectric generation, support sustained healthy and diverse ecosystems, and reduce socioeconomic impacts under an altered climate future. The CABY stakeholders were uniform in their support in having IRWM be the organizing venue for both developing and implementing this recommended program.

The Climate Change WG, after considerable reflection and with the intent of fully implementing resource management strategies and IRWMP goals and objectives, formulated a climate change program to consist of eight components: involvement in developing state policies and programs, increased knowledge sharing, increased coordination and collaboration, securing funding, monitoring the implementation of adaptive management strategies, reducing GHGs, data gathering, and investment in infrastructure and monitoring (see Section, 11.9, CABY Climate Change Program: Implementation of Adaptive Management).

11.3 State Climate Strategies

In preparation for evaluating potential vulnerabilities and adaptive management strategies for the CABY region, the Climate Change WG reviewed the four primary source documents identified by the California Department of Water Resources in the 2016 IRWM Guidelines. The results of this review informed both the process and the content of the CABY climate change evaluation. These documents and their influence are listed in Table 11-1, Influence of State Plans on the Climate Change Analysis, and include the following:

- Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water
- 2009 California Climate Adaptation Strategy
- Climate Change Scoping Plan
- Climate Change Handbook for Regional Water Planning

Table 11-1
Influence of State Plans on the Climate Change Analysis

Plan	Requirements/Focus	Impact of State Plans on the CABY Climate Change Analysis
Climate Change Scoping Plan	Recommends specific strategies with a goal of cutting 15% from today's greenhouse gas (GHG) emission levels	Two of the 18 Emissions Reduction Measures were identified to have the highest degree of relevance to the CABY IRWMP, including No. 16, (sustainable forests) and No. 17, (water). Agricultural reduction measures will have a modest degree of relevance. • The forest management component includes strategies that reduce the risk of catastrophic wildfire and the avoidance of land use changes that reduce carbon storage. See Appendix G: Fire and Fuels - A CABY Climate Change Case Study. • Four of the six water-related strategies are being implemented in the CABY region. See Table 11-3, California Climate Change Scoping Plan Recommendations for Water Management Being Implemented in the CABY Region. These strategies are also being considered by CABY Governance members and other stakeholders as part of issue identification, evaluation of applicable resource management strategies, development of goals and objectives, and project development and integration process. • Agricultural strategies will have minor influences on fuel efficiency of on-farm equipment, water-use efficiency, and carbon sequestration from restoration of riparian and forested areas.
Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water	Presents 10 strategies for adaptation measures	CABY has embraced 3 of the 10 strategies presented in the report: • Strategy 1: *Provide Sustainable Funding for Statewide and Integrated Regional Water Management:* In the past, four CABY region water agencies have stepped up to fund the ongoing efforts of the CABY SG and the CABY RWMG. Beyond this, members are strategizing for the future, as they are interested in seeing CABY persist as an active entity. The RWMG has specifically identified enhancing funding streams and identifying new funding as an adaptive management strategy. • Strategy 2: *Fully Develop the Potential of Integrated Regional Water Management*: CABY represents the first IRWM model the state had in 2007-2008 for full and consistent member inclusion without requiring dues or other form of payment. This IRWMP goes on to specifically develop adaptation strategies that would help realize IRWM potential. • Strategy 3: *Aggressively Increase Water Use Efficiency:* Four of the CABY regions water agencies' 2015 Urban Water Management Plans have Water Use Efficiency as an element.
2009 California Climate Adaptation Strategy	Discusses how to assess vulnerabilities and outlines adaptation strategies	The document is guided by a set of principles, including the identification of specific and cross-sector strategies, the development of a method for and list of prioritized strategies, and the need for additional education of the public regarding climate change risks and how adaptation can positively affect those risks. Members of CABY RWMG share these principles and values, and have incorporated much of the same ethic throughout both the implementation work done in the region and the IRWMP.
Climate Change Handbook for Regional Water Planning	Offers an outline for how to assess vulnerabilities and adaptation strategies	The CABY RWMG specifically identified vulnerabilities by using the questions in the Handbook's Appendix B - Vulnerability Assessment Checklist, as a primary resource. Guidance was also taken from suggested adaptation strategies having relevance in the region. See Appendix H for the Technical Advisory Committee analysis.

11.4 Current Climate Trends

The region's climate is characterized by mild, wet winters and hot, dry summers, but varies greatly by topography and elevation. Precipitation generally increases with elevation in the CABY region and average annual precipitation ranges from 22.5 inches in the lowest, most western elevations of the planning region to 85 inches in the highest elevations. Snow levels are generally near 3,500 feet in the winter and rarely reach as low as the valley floor. Average temperatures generally decrease from west to east with elevation; in the summer months, temperatures tend to be warmer in the lower elevations (70°F to 85°F) and cooler at the higher elevations (60°F to 70°F). The winter months are mild at the lower elevations (45°F to 60°F), and cooler at the higher elevations (30°F to 40°F). A wide variety of microclimatic variations also exist due to local topography and air flow.

Alongside east-west gradient of precipitation, the northern portion of the CABY region receives proportionally more precipitation than the southern portion. Much of the precipitation in the higher elevations is in the form of snow. Runoff from precipitation released from the reservoirs of snow, forest soils, and constructed lakes provides a major source of water for the region and for the state during the dry summer months. A majority of the rainfall occurs between November and April.

Models project varying patterns of precipitation and warming within the CABY region, including more or less precipitation and varying degrees of warming. This is, in part, because the area exists between grid squares on several major climate models and the resolution of the models is presently too coarse to be predictive for the region. The central expectation of these models, though, is that winter precipitation in the region will increasingly arrive in the form of rain instead of snow. Earlier snowmelt is also occurring and projected to increase. Both increased rain versus snow and earlier snowmelt have significant implications for seasonal water supply and storage as well as forest health and wildfire.

Streamflow trend projections on portions of the North Yuba show significant decreases that may imply significant adaptations for supply and hydropower generation starting in about 2025.[3]

The effects of climate change are already manifesting in the CABY region, suggesting the need to identify vulnerabilities and related impacts to public safety, natural systems, water supplies, power generation, and recreation. The CABY region has experienced many climate-related or enhanced disasters since the previous IRWMP update. Devastating effects from the numerous wildfires and lingering drought are felt throughout the region, including the deadly Camp Fire of winter 2018 that blazed just beyond CABY's boarders. Since any climate effects are potentially exacerbated or diminished by population trends, the following discussion is provided.

Population trends, as discussed in Chapter 5, Region Description (Section 5.3.2, Economic Conditions and Trends), suggest that the growing metropolitan population in the Sacramento area is spreading into the CABY region, fueling demand for water and other natural resources. Population centers are mostly in the foothills of the Sierra Nevada and along the major Sierra highways (Highways 50 and 80), and regional growth trends over recent decades indicate increased population growth into the future. Thus, any of the trends and vulnerabilities, discussed in the sections that follow, could be affected to a greater or lesser degree when correlated with overall population growth and specific patterns of growth.

[3] Freeman, Gary J. 2010. *Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff.* Paper presented at the Western Snow Conference 2010.

11.4.1 Regional Climatic Projections

Increased Air Temperature

Higher air temperatures are predicted for warmer seasons, generally resulting in less available water overall.[4,5,6] In the Sierra, average temperature is predicted to increase by 2°F to 4°F in the winter and 4°F to 8°F in the summer by the end of the century.[7]

Earlier Spring Melt

Across the larger Sierra Nevada and Intermountain West, regional models predict a 30% to 70% decrease in spring snowpack by 2100 under moderate climate change scenarios.[8] These impacts are already being felt; the start of the spring snowmelt recession in the northern and central Sierra Nevada occurs one to three weeks earlier than in it did 60 years ago,[9] largely due to warming air temperatures.[10,11]

The Sierra Nevada is considered one of the most vulnerable regions to climate variability in the continental U.S. due to its relatively warm snowpack. The Sierra snowpack acts as an enormous natural water storage system, accumulating precipitation over the winter and slowly releasing it in spring and early summer. The 1,000-plus dams in the Sierra were designed to take advantage of this predictable and manageable inflow of water to ultimately provide over 60% of California's water supply.[12] However, several observers have documented that the Sierra precipitation is arriving ever more often as rain rather than snow, especially at lower elevations. Moser et al.[13] documented a 23% decrease in the April–July annual runoff within the Sacramento basin within the recent past. Pacific Gas and Electric Company's (PG&E's) water management team has documented a "*…significant reduction in the low- to mid-elevation April 1 snowpack during the second half of the 20th century. This appears to be most noticeable within the PG&E headwater drainage from the Yuba River in the central Sierra north into the McCloud and Pit Rivers in the southern Cascades. This downward shift appears balanced among increased frequency of both precipitation occurring as rainfall and earlier snowmelt. The effect has been an overall shift in runoff timing and quantity from the spring into the winter period.*"[14] Freeman points out that the lower-elevation snow

[4] McKenzie 2004

[5] Miller 1999

[6] Taylor 2009

[7] Safford, H.D., M. North and M.D. Meyer. Chapter 3: Climate Change and the Relevance of Historical Forest Conditions, Managing Sierra Nevada Forests. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Stations. No date. Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf

[8] Hayhoe et al. 2004

[9] Peterson et al. 2008

[10] Miller 2009

[11] Taylor 2009

[12] Rothert, S. 2008. Sierra Meadows and Climate Change. Tree Rings, Journal of the Yuba Watershed Institute. 21:18-19. Available from: http://www.yubawatershedinstitute.org/documents/treerings21.pdf

[13] Moser, S., G. Franco, S. Pittiglio, W. Chou, D. Cayan. 2009. The future is now: An update on climate change science impacts and response options for California. California Climate Change Center Report CEC-500-2008-071, May 2009. California Energy Commission, Sacramento, CA.

[14] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G.Clmate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf

zone (below 6,000 feet[15]) is the most sensitive to early melt and lack of seasonal accumulation in recent years.

Runoff

Along with the early melt, the increased rainfall produces runoff at an accelerated rate compared to snowmelt, and has increased the frequency and amount of winter (as opposed to spring) runoff periods. The shift from spring to winter (November through February) runoff periods has implications for water use and management, both within the watershed and for those downstream.

Flooding

Peak natural flows have increased on many of the state's rivers during the past 50 years. For instance, the five highest floods of record on the American River have occurred since 1950.[16]

Increased flood potential is projected under many climate scenarios because higher temperatures cause earlier snowmelt and an increase in the ratio of precipitation arriving in the form of rainfall versus snow. Peak daily flows in winter are expected to increase even under scenarios with reduced precipitation overall.[17] Under the wettest scenarios modeled by Miller et al., highest flow volumes would increase by more than double in many Sierra Nevada rivers, resulting in greater flood risk in flood-prone areas.[17] Miller et al. conclude that greater flood risk is likely because temperature (not precipitation) is the primary driver of peak runoff. Flooding may be further exacerbated by more extreme precipitation events, another projected outcome of climate variability. However higher-elevation snow levels may reduce the potential for winter floods because less snowpack may fall that can be mobilized. Additionally, floodplain restoration addresses the vulnerabilities of flood risk and evapotranspiration while increasing ground water storage. Considering natural mitigation techniques for their effective multi-benefit solutions is one of the tools CABY uses to combat climate change.

Flood intensity in the Sierra Nevada is projected to increase due to increases in heavy precipitation amounts, storm frequency, and precipitation falling increasingly as rain rather than snow. An investigation into the annual maximum three-day flood magnitude projected larger-than–historical floods across the Sierra Nevada by the end of the 21st Century[18]. The investigation also looked into the frequency of floods and found that two climate scenarios predicted increased flood frequency, while a third, which included an overall drying trend, projected frequency to remain constant or even decline slightly.

The entire CABY region lies outside of the part of California that has been mandated to plan for a 200-year flood. CABY is in need of a clearer definition of the flooding risk to all areas within Federal Emergency

[15] Freeman, G. J. 2008. Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation - a mountain hydroelectric system perspective. Western Snow Conference 76:23-34. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2008/Freeman.RunoffImpactsOfClimateChangeOnNorthernCalifornia'sWatersheds.pdf

[16] California Department of Water Resources. Managing An Uncertain Future: Climate change adaptation strategies for California's water. Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[17] Miller, N.L.; Bashford, K.E.; Strem, E. 2003. Potential impacts of climate change on California hydrology. Journal of the American Water Resources Association. 39:771-784.

[18] Das, T., Dettinger, M.D., Cayan, D.R. et al. Climatic Change (2011) 109(Suppl 1): 71. https://doi.org/10.1007/s10584-011-0298-z

Management Administration (FEMA) mapping zones. This includes portions of most major, and many minor, cities and communities in the CABY region, including Nevada City, Auburn, and Placerville.

Storm Intensity

Along with reductions in snowpack and accelerated snowmelt, greater storm intensity and weather extremes have been documented elsewhere in California.[19] Records show there have been 69 severe weather incidents affecting Nevada County in the period from 1960 to 2000: 28 incidents were related to high wind; 8 to freeze or extreme cold; 5 to lightning; 21 as heavy rain; and 24 to winter storm or snow.[20] Some included more than one cited cause. Several of the counties now have Hazard Mitigation Plans that chronicle extreme events and estimate their costs to taxpayers.

Streamflow

In 2007, EDCWA and EID worked with a large public stakeholder group to complete a Drought Preparedness Plan. In the introductory section on climate change, that Plan states: "[*l*]*ate season runoff constituted 44 percent of total runoff in the early 1900s, decreasing to 33 percent by the early 2000s. Melted Sierra Nevada mountain snowpack is the source for the majority of late season runoff for EID.*"

Mehta et al.[21] used an integrated river basin management model for the CABY region (Water Evaluation and Planning System [WEAP] model) to find that under climate warming scenarios, all four watersheds responded with "*increases in wet season flows, decreases in dry season flows, and a net annual decrease [in flows]*."

In a 2012 study, PG&E examined possible side effects of climate change on runoff by comparing two consecutive 35-year periods (1942-1976 and 1977-2011).[22] The company maintains daily runoff records for 100+ locations in the Sierra, southern Cascade, and Coastal Ranges of California. This study showed that out of the 13 rivers studied, the Yuba River at Smartville has experienced the third highest reduction in unimpaired runoff between these two periods (-3.4%), behind only the Klamath River at Orleans (-10.6%) and the Feather River at Oroville Dam (-4.5%). [Note that this recent study is only one snapshot in time and may be more a recent analysis than those used in regional operational models. Also note that the author intends to update this trend analysis frequently where trends indicate the greatest decreases in streamflows.]

When comparing the two 35-year periods, PG&E also found that the standard deviation in runoff (higher variability in flow) on the Yuba River changed by 30% for the unimpaired water year during the second period. While it is fairly normal for rivers flowing over exposed granite (such as the Yuba) to have a large

[19] California Department of Water Resources. Managing An Uncertain Future: Climate change adaptation strategies for California's water. Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[20] Nevada County. Local Hazard Mitigation Plan for Nevada County. Nevada County, CA. 2011. Available from: http://www.mynevadacounty.com/nc/igs/oes/docs/Multi%20Jurisdiction,%20Multi-Hazard%20Mitigation%20Plan%20for%20Nevada%20County/2011%20Local%20Hazard%20Mitigation%20Plan%20DraftRev8.pdf.

[21] Mehta, V.K.; D. E. Rheinheiimer; D.Y. Yates; D.R. Purkey; J.H. Viers, C.A. Young; and J.F. Mount. 2011. Potential impacts on hydrology and hydropower production under climate warming of the Sierra Nevada. Journal of Water and Climate Change. 02.1 2011.

[22] Freeman, G. J. Analyzing the Impact of Climate Change on Monthly River Flows in California's Sierra Nevada and Southern Cascade Mountain Ranges. Western Snow Conference 2012. Available from: http://www.westernsnowconference.org/sites/westernsnowconference.org/PDFs/2012Freeman.pdf

variance in flows, what was observed during this comparison was that an even greater standard deviation occurred over the second period. Furthermore, it was found that a large portion of the April through June runoff has shifted into the March and even February period, corroborating the studies mentioned above. By percentage shift, the Yuba is second only to the Feather River (of the 13 regional rivers studied) in this trend.

PG&E has been a leader in analyzing trends in runoff for the Sierra Nevada because this region feeds nearly 100 reservoirs that the company manages for hydropower generation, and because it has recognized a relatively rapid change in runoff within the region since 1970. The company is also keenly aware that Sierra drainages differ greatly in topography, geology, soil porosity, aquifer storage, runoff recovery efficiency, as well as other parameters. For purposes of understanding runoff trends, a simplified trends forecast has been designed for relatively small subbasins, including the North and South Yuba and subbasins of the American. The tool is based on past trends extrapolated into the future, rather than downscaled climate models. PG&E's previous and current trend analyses indicate that the Feather and Yuba river basins are experiencing the highest end of timing changes in runoff and loss of low elevation snowpack from climate change.[23]

Starting with the year 1964, a 30-year moving average in runoff was applied to subbasins. Projections made from these trends were divided into three categories that indicate runoff losses between April and June: green (<20%), amber (20% to 40%), and red (>40%). In 2009, spring runoff in the North Yuba at Slate Creek had already diminished by 28% over the previous 30-year average. By 2025, five of seven tributaries analyzed are in the amber to red runoff-loss categories, and Slate Creek is projected to go dry during this period by 2075.

The South Yuba and Bear subbasins are projected to fare better. Two of four tracked water bodies in those drainages are projected to be in the amber loss categories—Lake Spaulding at a 38% loss, and the Bear River at Rollins at a 24% loss by 2100. The American and Rubicon are projected to increase in flow at French Meadows, 13% by 2100, but to drop into the amber category with a decrease in flow by 25% at Hell Hole.

PG&E intends to re-examine these trend analyses annually, focusing on subbasins most likely to approach the red (40% loss) category. Therefore, following these annual analyses will be valuable for regional water planning purposes.

Of additional note, most modeling shows sustained increases in the rain-to-snow ratio (rain:snow), with decreased snowpack (up to 50% by 2100) and earlier runoff dates.[24] PG&E suggests that at the current rate of decline, low-elevation subbasins, such as the Feather and Yuba, may lose virtually all their snowpack except at their highest elevations by century's end.[25] Elevation and aspect play a substantive role in this differing characteristic in snowpack; from the Yuba River north, the Sierra is lower in elevation and less steep.

[23] Freeman, Gary J. 2010. Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff. Paper presented at the Western Snow Conference 2010.

[24] Moser, S.; Franco, G.; Pittiglio, S.; Chou, W.; Cayan, D. 2009 The future is now: an update on climate change science impacts and response options for California. California Climate change Center Report CEC-500-2008-071. Sacramento, CA: California Energy Commission.

[25] Freeman, Gary J. 2012. Ibid.

Groundwater

Establishing an *annual* tie between groundwater elevations and climate in the CABY watershed is difficult because of localized factors of drawdown, geology/recharge, and tapping into groundwater subbasins by others beyond the watershed. However, PG&E's long-term studies of streamflow fed by underground aquifers have indicated a correlation between long-term drought and decreased groundwater elevations.

Water Quality

Chapter 6, Water Quality, addresses specific water-quality concerns within the watershed; this climate section addresses only those concerns that may be exacerbated by climate variability. However, earlier snowmelt coupled with rain-on-snow events that accelerate runoff may increase erosion and raise turbidity (and resulting sedimentation), as documented elsewhere in California.[26] Higher water temperatures also have accelerated some biological and chemical processes, such as increased methylation of mercury, increasing growth of algae and microorganisms, the depletion of dissolved oxygen, and produced impacts to water treatment processes. As climate-change-induced hydrograph variability continues to manifest, the period of seasonal low flows may be extended. Low flows reduce the assimilative abilities (dilution capability) of streams, thus reducing water quality.

More Extreme Precipitation and Other Weather Events

Nineteen severe winter storms or extreme weather events (freezes or droughts) have been documented in the Yuba County *Multi-Jurisdictional Multi-Hazard Mitigation Plan* since 1982, which describes these events as an "*inordinate number of natural disasters*." (Disasters also include fires.) Again, comparing these statistics with future documented events should help indicate trends in extreme precipitation events.

Intensified Wildfire Severity and Sierra Nevada Tree Mortality

A recent analysis of a daily climate data in the western United States found that fire extent and severity are greater during droughts as compared to before or after drought.[27] In addition, Sierra Nevada tree mortality was found to be greatest in drought cores immediately following droughts. Given the predicted increase in extreme temperatures and precipitation under climate change, droughts and the related effects on wildfire intensity and tree mortality are anticipated to increase in the CABY region.

Tree mortality, increased area burned, and tree regeneration failure due to increased dryness are all projected to decrease the forested area of the Sierra Nevada, which will significantly reduce the carbon carrying capacity of the region.[28]

11.5 Vulnerabilities and Adaptive Management Strategies

CABY affiliates and stakeholders have gained a fundamental understanding of climate vulnerabilities, both from the conduct of their operational management of respective resources, as well as from the process

[2618] California Department of Water Resources. Managing An Uncertain Future: Climate change adaptation strategies for California's water. Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[27] Crockett, J.L. and A.L. Westerling, 2018: Greater Temperature and Precipitation Extremes Intensify Western U.S. Droughts, Wildfire Severity, and Sierra Nevada Tree Mortality. J. Climate, 31, 341–354, https://doi.org/10.1175/JCLI-D-17-0254.1

[28] Liang, Shuang, Hurteau, Matthew D., Westerling, Anthony LeRoy. 2017. Potential decline in carbon carrying capacity under projected climate-wildfire interactions in the Sierra Nevada. Scientific Reports volume 7, Article number: 2420 (2017)

that they underwent to prepare this section. As demonstrated below, water agencies, NGOs, and public land management entities have formulated and are conducting adaptive strategies to bolster the region's climate resiliency. The relative sophistication and capacity of entities in the region has developed over time to deal with historic and existing natural resource challenges.

For many, restoring an ecosystem that has experienced 150 years of intensive resource extraction, including mining and timber harvest, should be a primary component of climate resiliency. In the opinion of others, restoration in the region may not provide sufficient resources to ensure the region's ability to provide for all consumptive and non-consumptive uses.

In addition, some view human and political responses to climate change as the greatest vulnerability of the region. For instance, changes in state policies to solve the Sacramento Delta water quantity and quality problems could affect everything from the region's water systems management and facilities construction, to water rights that have been developed over the last century.

A further vulnerability identified during the IRWMP process is the lack of funding to conduct climate resiliency projects, even after identification and prioritization. Identification of new funding sources, creative use of sources, and cost-effective responses may, at this point, be one of the most-needed adaptive strategies to climate change.

11.5.1 Process for Identification of Vulnerabilities

As discussed above, the Climate Change WG began its process to identify vulnerabilities and adaptive strategies with a review of the four documents listed in Table 11-1. These documents identified topics for further research and consideration by the Climate Change WG. At the direction of the Climate Change WG, the project team then conducted an extensive literature and data search into climate trends, vulnerabilities, and adaptive strategies, guided by the four state primary documents. The Climate Change WG expected that this data/literature evaluation would provide an historical climate trend description and offer qualitative climate projections, as well as a preliminary indication of regional vulnerabilities and adaptation strategies.

The most useful information was regionally or issue-specific, such as the California Energy Commission-funded study identifying fire danger for the central Sierra. Additional resources available and consulted by the Climate Change WG include the Sacramento-San Joaquin River Basin Study, the American River Basin Study, and the Truckee Basin Study.

Participants also expressed an interest in knowing what data and/or modeling was available specific to the region. The project team brought before the Climate Change WG several potential models for consideration, including WEAP and the Soil Water Assessment Tool. The Soil Water Assessment Tool model was developed to predict the effects of management decisions and includes consideration of hydrology, weather, sedimentation, soil temperature, crop growth, nutrients, pesticides, and agricultural management, all in the context of climate change.[29] After consideration, no single model was identified to satisfy all of CABY's needs. The Climate Change WG discussed technical merits of available models; the use of models specifically for the CABY IRWM region; and alternative bases for making climate-change-related, water-management decisions. The MC1 vegetation model, discussed in Section 11.7, Fire and

[29] Arnold 2005

Fuels – A CABY Case Study, was chosen to display potential climate effects to the region's plant communities. No other modeling was agreed upon for use at this time.

A vulnerability identified during the process was the region's air quality. Air quality affects the rate and health of forest growth, the health of regional residents, and the quality of life of both residents and visitors to the region. It can also affect water quality. CABY will continue to work with city and county planning entities to ensure that planning and travel management minimizes emissions, where possible; however, the CABY SG decided against putting significant effort into describing and identifying vulnerabilities and adaptation strategies for this issue because it was judged to be outside the sphere of the CABY SG.

Going forward with regional climate trends in mind, the Climate Change WG conducted a vulnerability assessment as outlined in the Climate Change Handbook for regional Water Planning, Appendix B. An extensive list of vulnerabilities was then assembled with a corollary list of adaptation strategies (see Table 11-2). This included substantive measures that regional public agencies and NGOs are already implementing.

11.5.2 Prioritization of Vulnerabilities

During the synthesis of the data search and ensuing vulnerability exercise with guidance from the Climate Handbook, the Climate Change WG agreed that three key categories of vulnerability rose to the top as highest priority: water supply, water quality, and environment and habitat, each of which has a wide variety of sub-vulnerabilities. These vulnerabilities are considered equal in importance to the Climate Change WG as a whole, although individual entities within the Climate Change WG and across the region would assign higher or lower priority depending on interests and perspective. All other identified vulnerabilities were considered to be of secondary import, either because of the nature or scope of their impact. The Regional Drought Contingency and Water Reliability Plan assisted in adaptation strategies; however, both out-of-region demands, particularly water supply for the Delta, and a lack of funding for adaptive strategies to address vulnerabilities exacerbate issues across the board.

CABY will address these prioritized vulnerabilities through the implementation of resource management strategies, as discussed in Chapter 10. In addition, projects selected for implementation funding in the CABY region must demonstrate their contribution to mitigating the effects of climate change.

Further detail on the highest priority vulnerabilities and the feasibility of addressing these vulnerabilities is included in Table 11-2. The table includes mitigation actions to dampen the effects of climate change. Additional detail on the identified climate change vulnerabilities is included in Appendix H, Climate TAC Identification of Vulnerabilities and Adaptive Strategies.

Table 11-2
Feasibility of Addressing Priority Climate Change Vulnerabilities

Vulnerability	Feasibility to Address
Water Supply	
• Less snowmelt to recharge streams and maintain a reliable water supply for people and wildlife through late summer and autumn • Timing of water availability may threaten life cycles that have evolved in concert with the natural timing of snowmelt recession. • Climate change modeling indicates scenarios in which EID is unable to meet demand or instream flow obligations. • A multi-year drought, especially one lasting more than 2 years, could create problems in carryover storage capacity. • Conditions in some parts of the CABY region may be such that even in-region quantities are threatened.	• Urban Water Use Efficiency and Agricultural Water Use Efficiency are being implemented across the region. • Improvements to local and regional conveyance, which relies heavily on ditches, canals, and aging infrastructure, will decrease loses. • Recycled Water is being produced and used in the region and there are opportunities to expand both. • Additional Surface Storage may be applicable, though there is not region-wide consensus on its appropriateness. • Agencies have drought plans and drought rates in place to stretch supply, and generally manage a 2-year supply to accommodate short drought periods. However, some smaller agencies have limited or no carryover storage and must curtail demand even during mild drought periods. • Area of Origin water rights are an important supply cornerstone for CABY stakeholders and will be important as the region looks at climate change effects throughout the state.
Water Quality	
• Altered regional hydrology may make meeting beneficial uses more difficult. • All reservoirs are in forested areas that are susceptible to fire and the resulting increased sedimentation. • Water quality shifts occur during extreme storm events and can affect treatment facility operation. • Both sediment and increased acid mine pollutant release can be challenging pollutants for treatment facilities. • Low flows' effect on diluting pollutants (assimilative capacity) is difficult to measure. • Increased water temperatures could increase levels of mercury methylation. • Eutrophication can increase in summer, especially if exacerbated by low flows and higher water temperature.	• An increased focus on pollution prevention can help offset the reduced assimilative capacity of waterways. • The CABY region has developed integrated projects to support in-stream and ecosystem water quality and removal of legacy mining contaminants. • Lining and education programs are addressing water quality in conveyance systems. • Contamination from legacy mining, sedimentation from post-fire events, and ongoing monitoring are all issues that are an active focus of CABY members and stakeholders. • CABY members are actively investigating options and developing pilot projects for locally applicable low-impact design (LID) and green infrastructure. • Restoration of the natural sediment transport regime is a primary objective for the CABY region. • Study of the impacts of a variety of forest management strategies and pilot projects is ongoing and will continue.

Table 11-2
Feasibility of Addressing Priority Climate Change Vulnerabilities

Vulnerability	Feasibility to Address
Environment and Habitat	
• The region is particularly vulnerable to climate change, and represents a significant bio-region for plant and animal species survival. • Frog and fish reproductive cycles and habitat availability could be effected by increased sedimentation. • Imperiled species, some of which only exist locally, could be affected by climate change. • Extreme, long-term drought could persist in lowering instream flows past the mandated flow levels. • Riparian and wetland communities, seeps, and springs are often dependent upon groundwater resources. • Increased distribution of bark beetle, and increased occurrences of *Phytophthora ramorum*, canker diseases, dwarf mistletoe, and root diseases could increase fire risk.	• A wide variety of CABY non-profit organization members have a core mission that focusses on restoration of ecosystems. The major water agencies also have a vested interest in and commitment to stewardship of the watershed environments that enable the region to sustain quality water and sufficient supply. • Groundwater recharge attributes of the region are poorly understood. Activities are focused on determining the characteristics of local and out-of-region recharge dynamics • Restoration of the natural sediment transport regime is a primary objective for the CABY region. • Study of the impacts of a variety of forest management strategies and pilot projects is ongoing and will continue.

After careful consideration, the CABY RWMG would support research and participate in fire danger, forest management, and meadow restoration as a major topic (sub-vulnerability of environment and habitat) for in-depth research, as appropriate. The RWMG decided to complete a case study of fire and fuels now and include research on the other issues, as funds become available (see Section 11.7).

11.6 Adaptive Management Strategies

Following identification and prioritization of regional vulnerabilities, the Climate Change WG identified and evaluated adaptive management strategies. Adaptive management strategies were identified without consideration to cost, feasibility, or impact of implementation (see Table 11-5, Climate Vulnerabilities and Strategies to Increase Climate Resiliency).

The Climate Change WG investigated three primary sources/bodies of work to address adaptation approaches for the CABY region: (1) existing strategies employed by entities, agencies, and NGOs; (2) state-generated adaptation strategies that help fulfill water planning goals and mandates; and (3) strategies identified during the extensive literature and data search.

CABY stakeholders are already implementing many of the strategies identified in Table 11-2. For example, the U.S. Forest Service is giving significant effort through its Institute of Forest Genetics in Placerville, California, to preserving biodiversity and minimizing the effects of invasive species, as well as the functioning and modeling of ecosystem response to changes in temperature, precipitation, and historic land use practices. The El Dorado National Forest has completed a program to identify areas that are at risk of mass slumping and to remediate those through reforestation and other stabilization techniques, and ARC has made it a practice to identify imperiled habitats and prioritize those areas for conservation. Partnerships in the region have developed to address climate change impacts in headwaters forests. For example, the French Meadows Project (PCWA, ARC, The Nature Conservancy, Tahoe National Forest, et.al.) seeks to restore fire resiliency to high-elevation forests in the North and Middle Forks of the

American River, with the additional goals of reducing the risk of catastrophic wildfire and increasing the carbon-storing capacity of these forest ecosystems.

Another example includes the Caples Creek Watershed Ecological Restoration Project (EID, U.S. Forest Service, and Sierra Nevada Conservancy) which seeks to reintroduce prescribed fire for forest health and fire resiliency benefits, restore meadow habitats to promote watershed health within the Caples Creek watershed, and help protect water quality in an area that provides an important portion of EID's water supply.

Water agencies have conducted climate projections and incorporated findings into their respective plans, incorporated water-efficiency measures into system operations, installed solar panels at facilities, and promote conservation measures among employees. EDCWA began to pursue additional water rights in 2009 for the west slope of El Dorado County. This water rights application leans heavily on the county's need as identified in EDCWA and EID documents and the El Dorado County's General Plan. It also is an application based on the Area of Origin rights statutes.[30] It also is the first water rights application in the state that will test the California Water Code's Area of Origin rights statute.

Suggested strategies identified in the reference documents within the guidelines (see Table 11-1) confirmed strategies that the region is already using and provided additional guidance and specific approaches not previously considered. The extensive literature search served the same purpose of confirming and informing stakeholders about adaptive strategies. Use of a wide variety of source documents ensured that the Climate Change WG was fully informed by the most current applicable thinking. Effort was made to identify at least one adaptation strategy for each identified vulnerability.

Because the CABY region's water delivery system is so complex and intertied, variable, and in some cases, fixed, limited capacity exists for adaptive management strategies to address projected climate change impacts. Adaptive management usually requires flexible infrastructure and flexible management policies and approaches. There are fewer barriers to the adaptive management strategies of green infrastructure—such as wetland restoration and forest management—that could provide opportunities for adaptive management strategies.

11.6.1 Integrated Adaptive Strategies

In addition to the adaptive management strategies developed for specific topics, the Climate Change WG developed several integrative strategies:

- Integrate terrestrial and aquatic objectives and urban-area objectives to better develop (and then address) opportunities for multi-benefit solutions, as suggested by Reiman, 2010;
- Diversify and examine/analyze finance options for funding watershed programs and projects that implement adaptive strategies; and
- Recognize that water management is only part of a comprehensive response to climate change and implement Integrated Resource Management by integrating land use, transportation, human health, forest management, education, environmental, and economic-focused interests into CABY more fully, perhaps at an annual forum.

[30] Area-of-Origin water rights are rights to the amount of water a county will need in the future as it grows. There are a number of statutes that, individually and collectively, protect those rights from infringement by projects exporting water from the watershed.

11.7 Fire and Fuels – A CABY Case Study

The Climate Change WG identified fire and fuels as a topic for further study, as it touches on issues of water quality, carbon sequestration, biomass preservation, land use and recreation activities, and habitat connectivity (a core concern of the CABY SG), among other concerns. Its social and economic costs have also become increasingly evident in recent years as California's fire season extends at each end. While water supply may have been the obvious choice, the Climate Change WG confirmed that water management agencies were already far along in their water assessments/planning, had consulted or generated much of the existing hydrologic information, and were already enacting adaptive management. The linkage of this issue to the rest of California cannot be overstated: the quality of recreation space, water and air quality, and overall water supply for the state are all dependent upon the ecological health and robust and resilient nature of the Sierra Nevada watersheds. Moreover, participants felt that the variability projected with all climate change assessments in the Sierra indicated that a no-regrets strategy was necessary for habitat protection and connectivity, and reducing stressors to endangered species. Managing wildfire risk will be important to the CABY region no matter what the future climate brings, so identifying management strategies, adaptation measures, and mitigation actions are all value-added. As identified in the California Air Resources Board's Climate Change Scoping Plan, watershed investment would be an excellent use of state investment for addressing climate change effects in California.

To pursue its in-depth analysis of this topic, a more rigorous document review was performed. This work resulted in a list of articles dealing with topics ranging from the occurrence and severity of fires in the central Sierra to nutrient cycling and habitat refugia. Members of the Climate Change WG made a special request that the analysis look further into the issue of carbon sequestration and fuels management. This topic is sometimes controversial and there are benefits and detriments to both main types of management. Current debates question if more greenhouse gas emissions occur with the occurrence of a catastrophic wildfire or if the mechanized harvest, transport, and (often) burning results in greater emissions. Research in the Klamath region is demonstrating that forested lands devastated by wildfire may not grow back as forests but as shrub lands. Alternatively, proper management of forests allow remaining trees to prosper, resulting in greater carbon sequestration over time. Coinciding with the climate, forest maintenance techniques continue to change in order to provide the most optimal outcome for both humans and the natural environment. Research continues to surface about mitigation and wildfire effects on forests, and more information on this topic can be found in the Fire and Fuels Study in Appendix G.

The document review was then supplemented by a vegetation modeling exercise to help determine how vegetation might respond to climate alteration. The Climate Change WG chose the Forest Service's MC1 model for two main reasons, (1) it would build on information already collected regarding fire occurrence and vegetation change within the CABY region, and (2) large-scale vegetation change can be analyzed from a general perspective, allowing diverse stakeholders to talk about overarching management and adaptation strategies. The MC1 model also created a clear nexus with the Climate Change WG's priority of understanding how biomass and fuel loading might be modified by climate.

The future scenarios modeled for the Climate Change WG showed an increase in and general upslope movement of the warm temperate/subtropical mixed forest (regional examples include Douglas Fir-Tanoak forest, Ponderosa Pine-Black Oak forest, and Tanoak-Madrone-Oak forest). This is largely displacing the boreal conifer forest, less tolerant of heat and drought. The temperate-mixed xeromorphic woodland moved upslope from the foothills just outside of the western edge of the CABY region, further into the region (displacing the warm temperate/subtropical mixed forest upslope). The vegetation

communities at the highest elevations in the region became more complex and varied, and generally drier, moving to temperate arid and/or Mediterranean shrubland, expanded xeromorphic woodland, and grasslands.[31] All future scenarios projected an increase in the number and severity of fires, but the change became more significant toward the end of the century.[32] See Appendix G for further discussion of the MC1 modeling.

Extensive and very specific (and sometimes conflicting) vulnerabilities were documented along with adaptive management strategies for managing fire and fuels and the secondary consequences of fire. This effort was updated as part of the 2019 IRWMP Update Process. A synopsis is displayed in Table 11-2, while full results of the case study are contained in Appendix H.

11.8 Climate Change Mitigation/Greenhouse Gas Reduction

The CABY region does not host major industrial facilities (e.g., power plants) that typically produce substantial, single-source greenhouse gas (GHG) emissions. Instead, The CABY region has significant hydroelectric capacity, developed many decades ago, that is a very low carbon source of electric generation. The three primary sources of regional GHG production are related to residential and commercial development (building lighting, heating, and cooling), transportation, and wildfires.

Counties are the relevant entities to address GHG reduction in relation to regional development and transportation, and their efforts in this regard are discussed below. Regional water agencies have also recognized their role in reducing GHGs and have undertaken substantive efforts to limit production of GHG emissions.

Research on fire and fuels conducted for this IRWMP showed that greater occurrence of fires feeds a negative feedback loop, putting greater amounts of carbon and particulates into the atmosphere.[33] By way of example, the *Sacramento Bee* reported that the 2008 Moonlight fire, that burned across Plumas County north of Quincy, pumped an estimated 5 million tons of carbon dioxide into the air, equivalent to the annual emissions of 970,000 vehicles, or one coal-fired power plant.[34] Therefore, management of sustainable forests and curtailment of catastrophic fire may offer the greatest opportunities for GHG reductions by the CABY SG and other regional stakeholders (see Section 11.6, Adaptive Management Strategies).

11.8.1 Mitigation Strategies

Governor Schwarzenegger's Executive Order (EO) S-3-05 established GHG emissions reduction goals for the State of California. The final target of 80% below 1990 levels is in line with the international reductions target essential to address long-term climate stabilization. These concepts were considered in the development of CABY's objectives (see Chapter 9, Issues and Objectives). As such, they are integrated into project conceptualization, development, and implementation. Furthermore, as directed by Senate Bill 97,

[31] Perennial grasses can be classified as either C3 or C4 plants. These terms refer to the different pathways that plants use to capture carbon dioxide during photosynthesis. These differences are important because the two pathways are also associated with different growth requirements: C3 plants are adapted to cool season establishment and growth in either wet or dry environments, and C4 plants are more adapted to warm or hot seasonal conditions under moist or dry environments. C3 species also tend to generate less bulk than C4 species, but the C3 feed quality is often higher.

[32] Lenihan 2008

[33] Westerling 2006

[34] Sierra Nevada Conservancy. 2009. The Climate Action Plan of the Sierra Nevada: A Regional Approach to Address Climate Change. Version 1.0. December 2009. Available from: www.sierranevada.ca.gov

CNRA adopted Amendments to the CEQA Guidelines for greenhouse gas emissions, effective on March 18, 2010. These called for lead agencies to determine baseline conditions and levels of significance and to evaluate mitigation measures. As the guidelines do not identify a threshold of significance or prescribe methodologies for doing this, lead agencies need to establish these levels of significance.

Accordingly, climate mitigation strategies and GHG reduction methods are also required as part of an IRWMP. California has developed a wide body of work looking at the possible sources of greenhouse gases, effects of those gases in the atmosphere, and of a warming climate on a variety of state resources. The primary document addressing GHGs was AB 32, passed in 2006. This legislation mandated a reduction in overall GHG emissions, and required CARB to develop a Climate Change Scoping Plan (December 2012) for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions by 2020 (California Health and Safety Code Section 38561). The scoping plan provides for actions to reduce GHGs in California and indicates how these emission reductions will be achieved via regulations, market mechanisms, and voluntary measures.

The CARB recommended actions relating to sustainable forests, water supply, and agriculture may hold the most promise locally and are embodied in the objectives of this IRWMP. CARB's proposed sustainable forest actions most applicable to the region are carbon sequestration through sustainable forestry practices and prevention of widespread and intense forest fires. Forestry and fuels management projects and restoration that stabilizes mountain meadows and forest ecosystems help address maintenance of California as a carbon sink, meaning that more carbon is removed from the atmosphere in California at present than is generated from processes, such as wildfires and forest land conversion. Fuels reduction projects, such as selective cutting, also help assure that frequent widespread fires do not shift this carbon sink balance. Biomass processing from forest residue also has been a potential project suggested under this IRWMP. For reference, planting trees now will result in a maximum sequestration capacity in 20 to 50 years. Near-term investments in activities like these will play a role in reaching California's 2050 goals. Suggested and implemented adaptive strategies for forest health address both carbon sequestration and sustainable forestry.

Improvements in water delivery, treatment, and use are another area of regional relevance addressed under the CARB strategies. IRWM Guidelines state that GHG emissions are associated with all aspects of water management, including habitat management; recreation; domestic, municipal, industrial, and agricultural water supply; hydroelectric power production; and flood control. Since activities related to water management result in significant amounts of GHG emissions (on a statewide average, 19% of the electricity and 30% of the non-power-plant natural gas of the state's energy consumption are spent on water-related activities, although a disproportionate amount occurs outside the CABY region), several state mandates and strategies are aimed at reducing GHG contributions from this sector of energy use.

The Scoping Plan recommends six actions that, if implemented throughout the state, could reduce GHGs (in CO_2 equivalent) by almost 5 million metric tons. CABY water management agencies are already implementing five of these actions, and the specific details of this are described in Table 11-3.

Table 11-3
California Climate Change Scoping Plan Recommendations for Water Management Being Implemented in the CABY Region

Climate Change Scoping Plan Actions	Nevada Irrigation District	Placer County Water Agency	El Dorado Irrigation District
W-1: Water Use Efficiency	Complying fully with California's 20x2020 mandate (see 2010 Urban Water Management Plan).	Complying fully with California's 20x2020 mandate (see 2010 Urban Water Management Plan).	Complying fully with California's 20x2020 mandate (see 2010 Urban Water Management Plan).
W-2: Water Recycling	Investigating efforts to reuse treated effluent for agricultural uses.		Recycled water delivery currently makes up 9% of total water deliveries.
W-3: Water System Energy Efficiency	Delivers raw water to users wherever feasible and appropriate, saving energy in the treatment process and chemical production. Replacing pumps as appropriate with energy efficient models. Use built-in system gravity feed effectively.	Delivers raw water to users wherever feasible and appropriate, saving energy in the treatment process and chemical production. Replacing pumps as appropriate with energy efficient models. Use built-in system gravity feed effectively.	Replacing pumps as appropriate with energy efficient models. Use built-in system gravity feed effectively. Employs electrical load management by shifting loads to off-peak schedules.
W-4: Reuse Urban Runoff	Reducing urban runoff is a component of the agency's 20x2020 compliance; reuse is not currently a strategy.	Reducing urban runoff is a component of the agency's 20x2020 compliance; reuse is not currently a strategy.	–
W-5: Increase Renewable Energy Production	Looking for ways to incorporate in-pipe and in-system micro-hydro facilities. Improving efficiency of existing low-carbon hydroelectric power generation, system modernization, and expansion.	Looking for ways to incorporate in-pipe and in-system micro-hydro facilities. Improving efficiency of existing low-carbon hydroelectric power generation. Installed solar panels at several PCWA facilities.	Constructed a 484 kW in conduit hydroelectric station and is considering other similar projects. Installed a one-megawatt solar plant to aid in powering a wastewater treatment plant, pursuing additional solar plant options at its treatment plants. Improving efficiency of existing low-carbon hydroelectric power generation.
W-6: Public Goods Charge	Not implementable on an individual-agency basis.	–	Not implementable on an individual-agency basis.

The Scoping Plan also includes strategies that would influence water management on a secondary basis, including fuel economy standards, efficiency regulations for light-duty and heavy-duty vehicles and equipment, a green building strategy, and suggestions for recycling and waste management such as mandatory commercial recycling. The agency also has established a conservation awareness program and installed solar panels to help reduce electrical use at a few of its facilities.

CARB strategies associated with agriculture typical of this region include improving fuel efficiency of on-farm equipment, water-use efficiency, and carbon sequestration from restoration of riparian and forested areas. Objectives in this Plan address the latter two actions; the IRWMP can address improving on-farm fuel efficiency via future objectives to develop and share best management practices and through stewardship outreach with local watershed groups.

The CABY area partners have also played a substantive role in stabilizing regional ecosystems that help capture carbon and thus reduce GHGs.

11.8.2 Further Opportunities for Greenhouse Gas Reduction

While CABY agencies and NGOs have come a long way in addressing GHG reduction, stakeholders recognize the urgency of this issue and anticipate emerging technologies that may aid in further regional GHG mitigations. Stakeholders identified some of those future opportunities, detailed below.

Opportunities for Carbon Sequestration

Two categories of forest management can help decrease the amount of carbon in the atmosphere:

- Carbon sequestration through reforestation and restoration of degraded lands, improved silvicultural techniques to increase growth rates, and implementation of agroforestry practices
- Carbon conservation, including utilization of woody biomass to reduce surface erosion and conserve soil carbon in existing forests, improved harvesting practices, and fire protection.

Both of these practices have been recognized in public management of forests in the CABY region and coordination with private forestry interests over these issues has been suggested as an adaptation strategy that could help reduce carbon emissions. Portions of the CABY region are serving as pilot study areas for the Sierra Nevada Watershed Ecosystem Enhancement Project (SWEEP) to determine the potential for sequestration within the forest resulting from diverse management strategies. Dr. Roger Bales at University of California at Merced has determined through SWEEP studies that forest management still allows for carbon sequestration while promoting watershed health and increased water availability.[35] Outreach to the private forest industry to assess current management practices supporting carbon sequestration has been identified as a priority by CABY.

Actions Proposed or Underway by Counties

In keeping with the integrated, regional approach embodied in this IRWMP, it is important to recognize the role counties and others will play in reducing GHGs, in concert with the CABY RWMG. While none of the counties has adopted a Climate Action Plan (CAP), plans are beginning to be drafted. It is expected that consideration of land use patterns to encourage energy efficiencies, community incentives for conservation, and altered design standards may all be part of the counties' CAP mix that will help reduce GHGs.

GHG Reduction Considerations for Project Design

At a minimum, the project team will determine a project's ability to help the CABY IRWM region reduce GHG emissions as new projects are implemented over a 20-year planning horizon. The project team will

[35] Bales, Roger C., et. al. 2011. Forests and Water in the Sierra Nevada: Sierra Nevada Watershed Ecosystem Enhancement Project. Sierra Nevada Research Institute report 11.1. https://eng.ucmerced.edu/people/rbales/americanriver/SWEEP_111116_final

also consider energy efficiency and reduction of GHG emissions when choosing between project alternatives.

Environmental Compliance

Through its project review process, CABY will document that (1) emissions from a proposed project have been determined, (2) GHG mitigations have been incorporated into the project, (3) the project may help in adapting to climate change over the 20-year planning horizon, and (4) a determination of significance has been made.

11.9 CABY Climate Change Program: Implementation of Adaptive Management

The purpose of the CABY climate program is to begin a systematic and purposeful response to assist the region in its ability to adapt to climate change. The program attempts to mitigate climate change effects on the region, as well as the contributing factors within and outside of the region (including potential State policy and regulation) that exacerbate the impacts of climate change.

The program seeks to assure, under an altered climate future, that the region continues to produce high quality water, reliable water supply and hydroelectric (clean energy) generation, sustained healthy and diverse ecosystems, and reduces socioeconomic impacts under an altered climate future. The CABY stakeholders were uniform in their support in having IRWM be the organizing venue for both developing and implementing this program.

After considerable reflection and with the intent of fully implementing resource management strategies and IRWMP goals and objectives, CABY formulated a climate change program to consist of eight components. These program components are (1) involvement in developing state policies and programs, (2) increased knowledge sharing, (3) increased coordination and collaboration, (4) securing funding, (5) monitoring the implementation of adaptive management strategies, (6) reducing GHGs, (7) data gathering, and (8) investment in monitoring. These programmatic focus areas follow and, when taken together, constitute CABY's climate change program for the future. CABY will determine the measures and outcomes for these programmatic elements, as they are implemented and mature.

Involvement in Developing State Policies and Programs

CABY stakeholders are engaged in local, regional, state, and federal water and environmental policy and program development. To affect these and other policies to the benefit of the region, CABY has determined it needs to be actively involved in State-level and interregional IRWM discussions, using IRWM as an organizing principle. It needs to continue to participate in the Mountain Counties Funding Area discussions. Therefore, involvement with state water policy will be part of CABY's future climate program.

Increase Knowledge Sharing

CABY members have a sophisticated understanding of climate change due to their joint and individual efforts to understand the issue and its effects on both water supply and watershed health. As a result, they have experience with evaluating and interpreting a wide variety of climate-related information. With this in mind, the Knowledge Sharing component is specifically aimed at ensuring that the newest and most relevant information is available to CABY members.

The Knowledge Sharing element focuses on several specific activities: use of the CABY web portal and the Sacramento River Watershed Information Module (SWIM) website to post and store relevant information (as directed by the Climate Change WG), use of two regular CABY meetings to ensure that new information (data, reports, modeling outcomes, trends analyses, results of project, and program-level monitoring) that is germane to the region will be brought forward and discussed, attendance by various CABY members at conferences and workshops focused on climate change with reports to the Climate Change WG as an outcome, and creation on the CABY website of a set of links to various climate-change-relevant state and federal agency websites to facilitate access by both the Climate Change WG and stakeholders.

Increased Coordination and Collaboration

Many of the management strategies and objectives identified in this document suggest increased communication and coordination with outside and partner organizations. CABY already provides a venue for members to engage in formal and facilitated climate-related discussions, as does the Climate Change WG and the various CABY WGs. In addition, CABY members collaborate frequently in the course of project development and integration activities.

This component of the program seeks to provide better tracking of these internal CABY coordination discussions and activities as they relate to climate change.

Additionally, several CABY members have indicated the need to work with adjacent IRWM regions (most notably though the Sierra Nevada Conservancy, Sierra Water Work Group, Mountain Counties Water Resources Association, Sierra Nevada Alliance, and Sierra Business Council) to ensure that issues of common concern with the larger Mountain Counties region (as defined in the 2013 Water Plan) are identified and the groups are actively engaged in discussion about emerging trends and available adaptive management strategies.

CABY water agencies, through decades of experience dealing with climactic and weather variations, as well as regulatory and State policy initiatives, have instituted ongoing programs to increase system efficiency, decrease water wastage and increase operational flexibility, and are engaging in de facto climate change adaptation. Likewise, the CABY region non-profit community and federal agencies are focusing on implementing projects that address watershed resiliency and sustainability. However, taken together, these efforts may not be sufficient to ameliorate the worst of the predicted impacts of climate change and variability.

CABY creates a venue where most of the key stakeholders with interest in the effects of and adaptive management for climate change can meet on a regular basis and advance both discussions of the issues and collaborative opportunities to address these issues.

Securing Funding

In many ways, the greatest challenge associated with climate change is developing funding to support the ongoing studies, support for small hydropower and other infrastructure that increase feasibility for using renewable resources and flexibility for managing water resources in response to changing climatic conditions, evaluation of adaptive management strategies and projects, development of regional and collaboratively developed mitigations, and devising ways to increase inter-agency opportunities for water system efficiency and redundancy in the face of persistent drought.

Additionally, the ability of disadvantaged communities and less affluent water agencies and non-profits to take part in developing knowledge, collaborating regularly, understanding the strategies most appropriate to their issue, and to be included in regional strategies is very limited. Some communities rely exclusively on groundwater, and the potential impacts of climate change on these resources are very poorly understood. However, experience in previous drought years suggests that there will be an increasing number of groundwater-dependent residences and small communities that will also need to be included in any regionally oriented solutions, yet there is no real process for funding these small-scale efforts.

Use of grants to support these myriad efforts will not be sufficient, neither is it possible to keep raising water cost to fund such activities. Therefore, the identification of suitable and sustainable funding sources will be a key focus of implementing this program component.

Monitoring the Implementation of Adaptive Management Strategies

CABY will specifically monitor the Plan's climate goals and objectives, and implementation of projects to assure adaptive management strategies, at a minimum during the IRWMP's scheduled performance reviews. Furthermore, CABY will serve as a think tank for identification of new and emerging adaptive strategies to address climate and assure they are incorporated into IRWMP updates.

Reducing GHGs

CABY will help assess and develop a project review process that incorporates mitigation and reduction of GHGs into project design. It will monitor the outcomes of project implementation to determine if adaptive management strategies and mitigations appear effective, based on technical input from project sponsors, and if the list of project mitigations can be supplemented as guidance for project development, CABY will work with entities to develop a regionally consistent level of significance for GHG emissions.

The goal of reducing GHGs will be further targeted by supporting opportunities to employ non-carbon-based energy sources.

Data Gathering

The CABY data-gathering effort focuses on two types of data: existing material and data that is developed over time. For existing data, the current Data Management System (DMS) (i.e., the CABY web portal) is a searchable database that contains all relevant climate change data for the region, cataloged by topic. The DMS is available to all CABY members and is maintained regularly. As new data emerges (in the form of in-region monitoring results, technical and/or scientific papers or articles, modeling by or for the region, information developed within the IRWM community) this information will be added to the database. The CABY webpage will have a Climate tab that will link to this portion of the CABY DMS and will support program component #2, Knowledge Sharing.

Investment in Monitoring

Stakeholders have determined that investment in monitoring (e.g., water quality, macro benthic invertebrates) is needed to substantially affect resources management and programs in the CABY region. Monitoring will facilitate more robust science-based adaptive management and assist in detecting change in climate and hydrologic effects on the ecosystem and the human population.

Many volunteer organizations demonstrate effective support for monitoring activities of all kinds, but seed funding is often needed for lead staff and/or materials. Monitoring is rarely funded as a component of the IRWM program, yet it could save considerable time and effort spent on ineffective methods if property deployed. CABY will continue to make a case for funding of monitoring with public agencies and engaged private organizations.

Moreover, monitoring is going on throughout the region that needs only to be shared for greater impact. CABY represents an ideal forum for publicizing monitoring information through the use and application of the SWIM tool, thereby creating the synergies that are essential in further assessing and understanding data's various components. Increased diligence will be made to assure monitoring data is posted on the SWIM site.

11.10 Climate Change Discussion Elsewhere in the IRWMP

Climate is addressed in several other sections of the IRWMP, as appropriate. References to those sections are listed in Table 11-4.

Table 11-4
Climate Change Discussion throughout the CABY IRWMP

Item	Description	Chapter
Region Description	Regional vulnerabilities from the effects of climate change are discussed in general in this section.	5
Plan Objectives	Objectives and goals address climate change. Climate change is cited throughout the descriptive text for many of the objectives.	9
Resource Management Strategies	Climate change is built into the consideration of each resource management strategy, as discussed in the description below each strategy.	10
Project Review Process	Climate change adaptation and mitigation was a major component of identifying project readiness to proceed in the Tier 1 project suite.	12
Local Water Planning	Climate change is part of most water management agencies' planning processes.	8
Local Land Use Planning	Climate change is identified by several county general plans as a specific point of coordination with local water management institutions.	8
Plan Performance and Monitoring	Many performance measures address increasing system resiliency and flexibility, as well as measures to address mitigation efforts. Utilize consistent metrics, data collection and analysis so that defensible and comparable data is generated.	13
Coordination	Coordination with federal, state, and local agencies about climate change is addressed in chapters covering Coordination and Plan Performance and Monitoring.	3

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentially Affected Natural Resources				
Forest and Rangeland Vegetation	-Future vegetation-modeled scenarios show an increase in and general upslope movement of warm temperate/subtropical mixed forest, largely displacing boreal conifer forest, less tolerant of heat and drought. Vegetation communities at the highest elevations in the region become more complex in variety and generally more drought tolerant. An increase in future biomass is also projected. -Increased fire severity and intensity is predicted for the Sierra Nevada by the latter part of the century, with more frequent fires and more area consumed by fires (Lenihan 2008; Westerling 2008). Catastrophic wildfire in particular is projected to become more frequent and more severe in the coming decades.	-Poor habitat condition of some forest habitat and areas of rangeland in the watershed make them more susceptible to increased fire risk under potentially hotter and drier climate conditions, and make habitat less resilient in supporting native wildlife species. -Increased fire severity will both amplify and accelerate the ecological impacts of climatic change (Flannigan 2000). -Decreased species variability within natural systems could result in degraded habitat for native species and economic losses for agricultural producers and recreation-related businesses. -Invasive species expansion often results in a higher, more flammable fuel load (Brooks, 2004) and often more shallow-rooted and quick lived, a contributing factor to mass wasting events and excessive sedimentation in general (TetraTech EC, Inc. 2007).	-Enact strategic forest management: It increases resiliency to longer fire seasons and bark beetle outbreaks (Flannigan 2000). In stand improvement projects and revegetation efforts, Tahoe National Forest (TNF) considers favoring or planting different species and species mixes. Where appropriate and based on anticipated changes, white fir could be favored over red fir, pines would be preferentially harvested at high elevations over fir, and species would be shifted upslope. -TNF is strategically managing for process rather than structure or composition in proposed projects (e.g., those involving succession after fires, where novel mixes of species and spacing may reflect natural dynamic processes of adaptation). -Implement fuels management/ reduction in watersheds where a high vulnerability exists to critical water sources. Where possible, mix selective harvest and prescribed fire to best mimic natural forest management (Schwilk 2009).	-Coordinate between and within management agencies to better address clear management goals (Reiman 2010). Steps to more successfully integrate the management of forests, fires, watersheds, and native fishes into regional and project-scale planning should include communication among disciplinary scientists with a clear definition of management goals. -Strategies implemented to reduce fuels and minimize chances of catastrophic fires are increasing the adaptability and resilience of the Tahoe National Forest (TNF). For example, the Western Nevada County Community Defense Project is strategically located on the landscape near Grass Valley, Nevada City, and other small communities to reduce small-diameter fuels and surface fuels that will decrease the impacts from wildfire. The second project phase would treat fuels over a broader geographical area.

Table 11-5
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Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
	-Future regional climate is likely to favor certain invasive species, such as cheat grass. Additional invasive species act as stressors on native species that, when combined with lower flows, or erratic flow regimes more likely with greater climate variability, can cause decreased viability for desired species.		-Maintaining a forest at full ecological function recharges groundwater and provides for more resiliencies region-wide. -Use integrated pest management on terrestrial noxious weed species, including prioritization of most effective strategies; mechanical, chemical, and grazing treatments; revegetation; and monitoring to improve water quality and habitat condition. -Participate in statewide pest detection programs. The region is close to the state border and hosts two major national freeways going east-west across the Sierra Nevada.	
Species and Habitat	-The Sierra Nevada is identified in its entirety as an important climate refugia by the Endangered Species Coalition. The region is particularly vulnerable to climate change, and represents a significant bio-region for plant and animal species survival.	-Sedimentation associated with higher potential for intense storms could affect aquatic species' reproductive cycles and habitat quality. This sediment would involve particulate-bound mercury, further decreasing water quality. -More mercury in the system coupled with warm-tolerant, upper-trophic species like bass leads to more mercury-contaminated fish. Imperiled species confronted by other stressors could be particularly affected by climate change.	-Maintain/enhance species and structural diversity and the redundancy of ecosystem types across a landscape. -Maintain/create refugia for at-risk populations or unique sites. -Reduce existing stressors (e.g., unhealthy levels of sedimentation or invasive species).	-Create a list of all climate-sensitive populations of flora and fauna in the CABY region and identify potential adaptation strategies that stakeholders could help to implement; assess those strategies for cost, risk, and benefit and prioritize based on the outcome.

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	-The region is also host to myriad species of special concern that may be climate-sensitive (e.g., are wetland-dependent, or occupy elevation niches projected to be affected). Climate-sensitive populations of flora and fauna in the region include whitebark pine, vernal-pool-dependent rare plant populations, and wetlands or small ponds (such as the Pierce Wetland Area on the Tahoe National Forest) and pika, alpine chipmunks, Lahontan cutthroat trout. Habitat is currently fragmented in lower elevations by roads and urban development, and in the higher elevations primarily by Highways 80 and 50.	-While quantified environmental surface flows exist throughout the region, extreme drought could negatively affect riparian habitats, species viability, and increase conflicts between human and environmental needs. -Drought and/or growing demand coupled with climate variation could dry up or fragment these biologically productive wetland habitats. -Increased nighttime and winter temperatures are expected to increase the population and distribution of bark beetle, canker diseases, dwarf mistletoe, and root diseases (Kliejunas 2011). It is likely that this will also have a negative effect on regional fire cycles by increasing the fuel load from dead trees. -The timing of water availability will threaten life cycles that have evolved with the natural timing of snowmelt recession (Yarnell et al. 2010). -Climate-induced changes in fire behavior and frequency will affect species distribution, migration, and extinction (Flannigan 2000).	-Sustain and promote fundamental ecological forest functions/services (e.g., soil quality and nutrient cycling, hydrologic cycling, and riparian zones). -Identify and prioritize habitat corridors essential to wildlife migration. -Prioritize needs for aquatic habitat connectivity; provide in-steam barriers to invasive species, where appropriate; prioritize wetland, vernal pool, and riparian restoration; maintain healthy aquatic systems or create water developments to support key species; promote activities that increase stream shading and flow attenuation, such as meadow restoration; adopt best management practices that reduce channel alteration and sedimentation; and determine where infrastructure replacements can be most meaningful (e.g., culvert and bridge projects that increase connectivity and reduce barriers). -Enhance genetic diversity, potentially including introduction or enhancement of genotypes better adapted to future conditions (such as trees with higher levels of oleoresin).	-Restore wet meadow and/or spring habitats to improve shallow groundwater storage, increase summer base flows, improve in-stream-habitat diversity, and create a vegetation community within the meadow dominated by species adapted to moist soil conditions. -Monitor spring melt dates, bud burst dates, and pollinator availability. -Monitor and quantify the rate of mercury methylation. - Protect important watershed lands in the region that conserve important climate refugia, riparian habitats, and habitat for at-risk species or ecosystems. - Monitor water quality across the region.

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		-Animals and plants dependent upon boreal forests will likely become more vulnerable because the warming trend will force them higher in elevation where habitat may be less suitable. -The region may offer refugia for wildlife if other suitable habitat is lost to sea-level rise.	-Work with major transportation providers throughout the region to ensure adequate ecosystem permeability and wildlife passage of major roadways – particularly four-lane roadways.	
Potentially Affected Communities				
Flooding	-Increased flood potential is projected under many climate scenarios because higher temperatures cause earlier snowmelt and an increase in the ratio of precipitation arriving in the form of rainfall versus snow. However, higher-elevation snow levels may reduce the potential for winter floods because less snowpack may fall that can be mobilized. Peak daily flows are expected to increase even under scenarios with reduced precipitation overall.	-A lack of coordinated approach to flooding management and response may compound flood impacts and increase risk to public safety. -Need exists for a clearer definition of flooding risk to all areas within FEMA mapping zones. -Extreme flood events could have substantial negative effects on aging infrastructure, including water supply, transportation, hydropower, and water treatment facilities. -Increased risk of wildfires could result in mass wasting events (connected with flood events) similar to the massive landslide that closed Highway 50 for four weeks in 1997.	-Prepare and coordinate management response for extreme weather events at greater frequency. -Work within the CABY region membership as well as with relevant state agencies to identify better flood management practices, including data tracking and communication and updated land use policies (development patterns, attenuation, and infiltration). -Identify risk areas for mass slumping and target fuels management efforts. -Update flood maps for communities in the region as updated information becomes available.	-Improve the reliability and accessibility of gauging and telemetry on streams and rivers upstream from flood-prone areas during flood events. -Implement low-impact design principles to reduce flooding within proposed development.

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Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		-More reliable gauging and telemetry on streams is needed to provide advance notice to developed areas in flood-prone zones.	-Increase infiltration rates in urban areas to combat localized flooding and Improve or decommission roads to reduce flooding impacts.	
Water Demand	-Projected population growth, especially in the foothills of the Sierra Nevada and along the major Sierra highways (Highways 50 and 80) exceeds average growth rates for the Bay Area and California as a whole, fueling demand for water and other natural resources. Vulnerabilities could be affected to a greater or lesser degree when correlated with overall population growth, and specific patterns of growth. -Regional groundwater supplies represent a significant resource used by individuals outside water service areas for residential potable water use. -Agricultural water demands are expected to increase overall with gradual warming, increased evapotranspiration, and decreased soil moisture.	-Major industries and institutions requiring heating and cooling could be affected as average temperatures increase, both economically and by potential losses of power. -As California's 20x2020 demand reduction targets are achieved, water use curtailment will be more difficult, especially in areas that have already installed meters and implemented tiered commodity rate structures. -In-stream flow requirements could be affected, especially where FERC relicensing processes didn't account for the effects of climate change. -Naturally flowing streams (without in-stream flow reservations) may be even more vulnerable to drawdown during low flows. -Regional groundwater levels may decrease with warming and drying conditions. -Agricultural use could increase due to increasing temperatures and lower summer precipitation.	-Examine environmental needs in the face of a changed hydrologic regime. -Pursue sharing supplies across the CABY region. -Identify opportunities for conjunctive use. -Identify opportunities to sell water in or outside the CABY region in years where local supply exceeds local demand for additional funds to be used within the CABY region. -Identify alternative crops that will grow well in a changed hydrologic cycle and temperature regime; consider use of drip irrigation and recycled water. -Invest in upgrading infrastructure to maximize efficiency and flexibility and to reduce waste. -Locate water service stations in areas where residential wells are likely to go dry.	-Peak use can be lowered by using pricing strategies – this has been successful for water purveyors throughout the CABY region using a conservative baseline for indoor use and ascending block rates for outdoor use. -Invest in distribution system interties and replacement of aged pipelines to maximize efficiency and reduce waste. -Water agencies provide efficiency services to domestic, municipal, and agricultural customers. -Resource Conservation District programs to upgrade efficiency of irrigation systems.

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Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		-Groundwater is used for potable supply outside water service areas. Local fractured geology makes groundwater resources particularly vulnerable to drying/drought.		
Water Supply	-Warming temperatures, earlier snowmelt, greater rain:snow ratio, relatively stable projected regional precipitation, and more intense storm events could affect surface water supply. -Establishing an *annual* tie between groundwater elevations and climate in the region is difficult because of localized factors of drawdown, geology/recharge, and tapping into groundwater subbasins by others beyond the watershed. However, PG&E's and PCWA's long-term studies of streamflow fed by underground aquifers have indicated a correlation between long-term drought and decreased groundwater elevations.	-Reduced reliable water supply for people and wildlife through late summer and autumn, especially in areas of projected population growth. -Potential inability for water agencies to meet in-stream flow obligations. -Potential for reduced carryover storage capacity, especially during multi-year drought. Some smaller water agencies have limited or no carryover storage and must curtail demand even during mild drought periods. -The CABY region is a contributor to Delta flows with no reciprocal access to Delta supplies. The negotiated outcome of Delta sustainability and management may have an effect on the way water is managed and may reduce supply in the CABY region. -Area-of-Origin water rights are an important supply cornerstone for CABY stakeholders and will be important as the region looks at climate change effects throughout the state.	-Recruit more complete information on snowpack and hydrology, including real-time data tracking. -Examine forest management strategies to increase snowpack/water retention -Increase the capacity of the landscape to retain water, replacing, in part, a decreased snowpack (e.g., meadow restoration and soil conservation). -Diversify storage opportunities to add system flexibility – think of storage as a network including snowpack, forest soils, and constructed infrastructure. -Continue to explore opportunities to enhance storage. -Conduct leak detection, pipeline repair/ replacement and meter calibration.	-Where not already implemented, provide fee incentives for customers who meet residential conservation objectives. -Implement groundwater management plan objectives. -Consider changes in reservoir operations. -Add capacity to existing dams. -Invest with partner interests in improved hydrologic and meteorological monitoring of CABY watersheds. -Educate small water-rights holders on potential effects of climate change and how the region might collaboratively respond.

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Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		-Reduced growing-season irrigation supplies for area agriculture.	-Many CABY water agencies are participating in the USBR Sacramento-San Joaquin River Basin studies to evaluate storage needs and sites in the region, based on climate. -Pursue additional water rights. -Explore and support opportunities for conjunctive use. -Invest in improved efficiency of water conveyance and distribution systems. -Increase levels of water conservation among customers and the general public. -Continue to monitor water systems for aquatic invasive species (AIS).	
Water Quality	-Reductions in flow, timing and intensity of runoff, and heating of air temperatures associated with climate change could affect water quality. -Three main water quality concerns exist in the region: 1) increases in water temperature, 2) the potential for increased organics content in municipal water sources due to vegetation, and	-Beneficial uses designated in the CABY region could be more difficult to meet. -Water quality shifts occur during extreme storm events can affect treatment facility operation, as in the case of Grass Valley. -Increased water temperature could affect aesthetics of municipal water supply. -Sediment can negatively affect treatment facilities. Low flows may hinder dilution of pollutants.	-Increase the capacity of the landscape to absorb and filter water. -Preserve and/or restore, where appropriate, riparian vegetation to control water temperature for aquatic biota. -Identify 303(d)-listed waters that may become more challenging to manage under future climate scenarios, and work with agencies to develop management strategies and projects/actions that address impacts.	-Implement a more intensive network of real-time water quality and water level tracking to identify when storm flows may be testing water treatment capacity and/or infrastructure. -Implement regional stormwater control infrastructure. - Monitor water quality (various parameters) across the region.

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
	3) how increased water temperatures might affect the rate of mercury methylation.	-Increased water temperatures could increase levels of mercury methylation throughout the CABY region. This has been identified by the CABY SG as an issue for further investigation and potential modeling. -Stream temperature has shown to be moderately affected increased fire activity; this may particularly affect aquatic species because of their inability to monitor body temperature, and confined, easily fragmented habitat (Isaak 2010). -Eutrophication can increase in summer, especially if exacerbated by low flows and higher water temperature.	-Identify places where the assimilative (dilution of contaminants) capacity of streams and rivers may be at risk and monitor those areas.	
Infrastructure	-Hydrologic changes are projected to include altered flows, changes in seasonal flows (e.g., earlier runoff), and greater extremes in storm events. Some extreme events in the past have tested the capacity of regional infrastructure (such as near overtopping events in the floods of 1997), and it is likely that these extreme events will occur more often.	-Historic water Infrastructure design and management coupled with rules in place for reservoir and other infrastructure operations may not adequately respond to altered flows and intense flow events. -Planning for longer-term drought is limited to historic extreme events. Extended duration of extremes due to climate is difficult to account for, which could compromise delivery capacity, customer capacity, and financial stability of water purveyors.	-Locate system interties where small systems and disadvantaged communities can more easily hook into a larger system's supply. -Locate water service stations in areas where residential wells are likely to go dry. -Expand treated and raw water infrastructure to underserved areas. -Add infrastructure to facilitate conjunctive use.	-Upgrade aged infrastructure to improve efficiency. -Add infrastructure to augment distribution and conveyance system efficiency and flexibility. -Increase existing water storage facility size. -Research and implement strategies to manage increased sedimentation rates in reservoirs. -Implement regional stormwater control infrastructure.

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
	-Much of the region's infrastructure is either antiquated, in poor repair, or in the case of water delivery and storage and flood flows, designed for historic flow regimes.	-Aquatic invasive species could become an issue as climate change alters the region's water temperature and chemistry (pH and TDS), and thus clog or damage facilities. -All reservoirs are in forested areas susceptible to fire, and therefore at risk of damage and increased sedimentation load in the event of intense post-fire precipitation. -Hydropower facilities could be challenged by increased sediment loads/decreased reservoir capacity and increased levels of wear on equipment.	-Invest in upgrading infrastructure to maximize efficiency and reduce waste.	-Invest in distribution system interties and replacement of aged pipelines to maximize efficiency and reduce waste.
Potentially Affected Economic Interests				
Hydropower Generation	-Hydropower represents a significant source of electricity in the CABY region. Continued change from snowfall to rainfall is anticipated to have a cumulative effect on hydroelectric production by about 2020 to 2025.	-With less predictable runoff periods and potentially more intensive storm events, hydroelectric generation may become less reliable, and management will be more challenging and may involve competing with other storage needs, such as flood control and natural system needs.	-Identify opportunities for development of solar and wind energy projects to ensure multiple benefits to the region, and benefit habitat, wildlife, and agricultural uses (grazing opportunities). -Increase the diversity of hydropower projects (e.g., micro-hydro, small hydro, or pumped storage), particularly those with little or no negative in-stream impacts.	-Explore and fund small hydropower generation opportunities in existing water and wastewater conveyance systems. -Investing in continued efficiencies in hydropower generation by upgrading equipment and operations.

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

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	-Energy needs have decreased on a per capita basis over the last several decades due to increases in the efficiencies of appliances and conservation. However, an increasing population indicates that energy use will grow in the future.	-The results of a WEAP modeling warming scenario suggested that a low degree of warming is sufficient to significantly alter historical inflows into regional reservoirs, with a concomitant reduction in hydropower generation – between 5% and 20% losses, depending on the degree of warming – by the end of this century (Mehta et al. 2011).	-Hydro generation managers may increase storage in the winter in anticipation of critical summer needs and subsequently with the need to spill in order to accommodate wet winter or intensive storm flows.	
Wood Products Industry	-Potential climatic changes are expected to shift forest types and species mixtures within the watershed.	-The changing conditions may continue to render forests susceptible to insect invasion and fire, which may in turn create a greater need for thinning.	-Support and develop projects to provide timber, wood or biomass in partnership with existing and emerging facilities to achieve ecologic objectives, hydrologic benefits, and economic viability.	-Continue to explore environmentally acceptable and economically feasible ways of producing and using power from biomass.
Local Communities	-The amount of burned property (in total area and in monetary value) in Northern California increases substantially under global climate models' high-emissions scenarios due to greater fire risk. This is highly evident in Placer County (Westerling 2008). -Sea-level rise is not a direct issue for the CABY region, but does pose potential indirect effects on communities.	-Costs for increases in fire occurrence and severity will need to be paid for, either through landscape-level forest/fuels management, or through fire-fighting activities. -Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects on local economies.	-Enact strategic forest management: It increases resiliency to longer fire seasons and bark beetle outbreaks (Flannigan 2000). -Implement fuels management/reduction in watersheds where a high vulnerability exists to critical water sources. Where possible, mix selective harvest and prescribed fire to best mimic natural forest management (Schwilk 2009).	-Support and develop local and regional projects to increase community safety and security with respect to wild fire risk and long-term water supply.

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		-Incorporated communities have sufficient infrastructure and capacity to fight fires, while rural communities typically have very limited resources. Catastrophic wildfires have the potential to surround, encroach into, or overwhelm all local communities. -Population influx from coastal areas affected by sea level rise could impact regional land use patterns and water demand and supply. -The impact of sea level rise on the Delta is forcing the state to look upstream for solutions to water-producing regions, including CABY. This could lead to potential changes to infrastructure, operations, and water rights in the CABY region because of the Delta's vulnerability to environmental change and water transfer capability.	-Maintaining a forest at full ecological function recharges groundwater and provides for more resiliencies region wide. -Use integrated pest management on terrestrial noxious weed species, grazing treatments; revegetation; and monitoring to improve water quality and habitat. -Monitor changes in development patterns and water use from areas affected by sea level rise to prepare for potential impacts to the region over time. -Actively participate in regional discussions focused on modifications of source-water systems that may be proposed to protect the Delta from the impacts of sea-level rise.	
Agriculture	-More frequent drought, the drying effects at upper elevations from earlier snowmelt, potential variation in storm events, greater variability in temperatures, and more intense storm events could potentially affect agriculture.	-Peaches, grapes, cherries, mandarin oranges, and berries are heat-sensitive crops that can also be susceptible to unseasonable precipitation. -Non-irrigated agriculture – grazing and dryland hay – may be the most vulnerable to projected climate changes.	-Protect the agricultural land base and designate a portion of the water supply to agriculture to provide farmers with the assurance they need. -Work with University of California Extension, local agricultural commissions, and farm bureaus to identify potential changes in crop	-Water agencies provide efficiency services to domestic, municipal, and agricultural customers. -Identify alternative crops that will grow well in a changed hydrologic cycle and temperature regime, consider use of drip irrigation and recycled water.

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Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		- More frost-free and growing-degree days could benefit some crop production and local agricultural profits, and could affect the current crop mix. -Reduced flows and groundwater recharge alongside increased demand in a warming climate could negatively affect agricultural water supply (Mehta et al. 2011; Regional Water Management Agency 2013). -Irrigation inefficiencies reduce overall water supply, both for agriculture and other beneficial uses.	patterns to adapt to potential changes in climate. -Increase efficiency of irrigation practices and systems. -Explore opportunities for conjunctive use of water supplies.	-Resource Conservation District programs to upgrade efficiency of irrigation systems.
Recreation	-Climate projections of potential greater storm intensity and variability may impact recreational infrastructure and fish and game species.	-Most rafting flows have been set by FERC licenses, but projected low flows may not be sufficient to sustain current-day recreational pursuits/timing. -Insufficient flows for boating and whitewater rafting due to climatic shifts could have negative financial effects on regional businesses and local economies. -Forest infrastructure such as bridges, culverts, campgrounds, and roads may be damaged by increased variation in flows, while recreational game fish species may be negatively affected by diminished water quality.	-Identify opportunities to adjust to changing hydrology, if necessary, to maintain recreational opportunities. -Identify and develop recreation enhancement plans responsive to changing conditions. -Assess public agency road inventories for hot spots of sediment delivery and correct; conduct bridge and culvert inventory to replace undersized or failing infrastructure; reassess flood risk and establish recreational facilities out of potentially elevated peak flows.	-Augment water storage infrastructure to provide recreational values while meeting other beneficial uses. -Use improved modeling, forecasting and communication tools to facilitate recreational use of water resources.

Table 11-5
Climate Vulnerabilities and Strategies to Increase Climate Resiliency

Summary of Modeling Results and Relevant Studies		Vulnerabilities Identified by Stakeholder Group	Existing and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
		-Forage for big game species may be affected by increased invasive species, but these species may benefit from milder winter temperatures and increased localized forage.		

Chapter 12
Project Review Process

This chapter describes the processes by which projects implementing this Integrated Regional Water Management Plan (IRWMP) are identified, developed, integrated, reviewed, and selected for funding. The intent of this planning element is to (1) create an adaptive model for project development that assures actions will be taken to implement the IRWMP's goals and objectives, and (2) provide an inclusive, effective, and impactful approach to Integrated Regional Water Management (IRWM) project planning and implementation in the Cosumnes, American, Bear, and Yuba (CABY) region.

12.1 Introduction — Investing in Source Water Areas of the Sierra Nevada

Throughout the lifespan of the CABY IRWMP, the CABY Regional Water Management Group (RWMG) and CABY Stakeholder Group (SG) members have submitted projects with an associated cost of more than $500 million. While the total costs for these projects equals far more than what is available to the region through the California Department of Water Resources (DWR) grant implementation programs, CABY members have emphasized that the projects represented herein only reflect a fraction of the total investment needed for water infrastructure and watershed management in the CABY region.
However, CABY stakeholders continually underline the need for greater state investment in source water areas such as the CABY Region. CABY's planning area is entirely in the Sierra Nevada, which provides benefits of a large magnitude to the state by:

- Providing a high-quality water supply,
- Contributing significantly to the state's energy supply through hydropower,
- Sustaining valuable and endemic habitat and species in a biodiversity hotspot,
- Providing climate refugia amidst climate uncertainty, and
- Offering spectacular recreational and scenic areas of state and national importance.

The Sierra Nevada Ecosystem Project found that Sierra waters are valued at $1.3 billion per year and are essential for the health and welfare of California.[1] However, there have been disproportionately low state funds dedicated to headwaters resources. In 2016, the State of California passed Assembly Bill 2480, which includes source watersheds as part of California's water supply infrastructure. Historically, the distribution of funding for projects to ensure a more reliable water supply has been linked to population and has not adequately supported the watershed protection, restoration, and infrastructural improvements to the less populated areas of the state that are the source areas of California's water supply.[2]

[1] "People and Resources." *Sierra Nevada Ecosystem Project, Final Report to Congress (SNEP).* Vol. I Assessment Summaries and Management Strategies. Davis: University of California, Center for Water and Wildland Resources, 1996. Pg. 29-30.
[2] Sierra Nevada Alliance. *Investing in California's Headwaters: The Sierra Nevada*. 2009. Pg. 5.

Under climate change projections, investment in source water areas has become even more pressing. California's water supply system has been built on snow pack dependence, and with potentially significant reductions in snow pack, investing in greater headwaters resiliency in the face of climate change is of essential importance. Furthermore, reducing fuel loads in the CABY region and throughout IRWM regions in critical fire hazard areas in upper watersheds will have a mitigating effect against the dire impacts and astronomical costs associated with catastrophic fire events and optimizing water supply yields (see Chapter 11, Climate Change).

Even in an environment of limited funding resources, CABY's diverse stakeholders have collaborated to develop projects within all programmatic areas that embrace the principles of integrated regional water management. Projects address the region's most immediate threats to those that are far-reaching, from aging infrastructure, renewable energy, water storage and water use efficiency to legacy mining contamination, meadows restoration and forest health improvements. In all, these projects effectively meet the State IRWMP Standards and are in close alignment with CABY's IRWMP objectives.

12.2 Programmatic Structure and Project Development

In 2009, the CABY SG developed a program and initiative structure as an update to the original 2007 IRWMP. The program and initiative structure were developed as a tool to organize projects, to rank projects with a specific focus, and to identify gaps in project development. In 2011- 2012, the CABY SG established programmatic areas with broad goals and objectives to function as an organizational framework (see goals and issues in Table 12-1). CABY's programmatic areas are aligned with the IRWMP expectations outlined by the California Water Code (discussed in Chapter 9, Issues and Objectives). The programmatic structure has proven useful in guiding stakeholders in the development of projects that address regional issues of concern and meet regional goals and statewide priorities.

Table 12-1
Programmatic Area Goals and Primary and Secondary Issues

Programmatic Areas and Goals	Primary Issues	Secondary Issues (where relevant)
Water Supply *GOAL: Ensure adequate and reliable supply that can be adapted to climate change and can meet the needs of the region.*	Conservation	Policy and Education
	Infrastructure	Aging Infrastructure
		Interties
	Water Storage	Reservoir Sedimentation and Green Infrastructure
		Shifting Hydrology
		Forest Management
	Water Management Operations	Drought
		Recycled Water
	Water Transfers	Financing Mechanism for Headwater Management and Restoration
	Groundwater	Recharge and Contamination

Table 12-1
Programmatic Area Goals and Primary and Secondary Issues

Programmatic Areas and Goals	Primary Issues	Secondary Issues (where relevant)
Water Quality *GOAL: Ensure sufficient water quality to support healthy ecosystems and dependent organisms.*	Contamination	Legacy Mining Toxins
		Urban Runoff and Abandoned Mine Land Runoff
	Sediment Management	Mercury Contaminated Sediment and Debris Control Dams
		Erosion and Sediment Control Associated With Roads
	Wastewater Management	–
	Headwaters Protection	–
	Temperature	–
Environment and Habitat *GOAL: Preserve and restore watershed health.*	Fisheries	Volitional Fish Passage
	Aquatic Biota	–
	Instream Flow	–
	Meadows	–
	Fire and Fuels	Prioritizing Fuels Treatment in the Wildland Urban Interface
	Invasive Species	Aquatic Invasive Species
		Terrestrial Invasive Species
Climate Change *GOAL: Anticipate climate change needs and be prepared to respond adaptively to human and ecosystem needs.*	Greenhouse Gas (GHG) Emissions	Carbon Sequestration
		Fuels Management
Human-Landscape Interaction *GOAL: Maintain and enhance functioning landscapes that provide sustainable services for humans.*	Habitat Alteration	–
	Native American Uses	Traditional Ecological Knowledge
	Flooding	Environmental Flows
	Open Space	Brownfield Properties
	Environmental Flow Hydrograph	–
	Disadvantaged Communities	Access to Water
	Recreation	–
	Hydropower	–
	Agriculture	Agricultural Land Conservation
	Sustainable Economy/Self Sufficient Communities	–
	Governance	Political
		Legislative
		Regulatory

12.2.1 Measuring Project Outcomes

CABY's programmatic structure helps to ensure that project implementation meets the goals and objectives identified in the IRWMP. For each programmatic area, an explicit relationship exists between and among the goals, issues, objectives, and performance measures, as illustrated in Chapter 9, Table 9-4, Goals, Objectives, Target Outcomes, and Performance Measures. Therefore, by aligning project development with the programmatic structure, the CABY RWMG has created a standardized approach for measuring and reporting project outcomes. This is further discussed in Chapter 13, Plan Performance and Monitoring.

12.2.2 Overarching Project Elements

The five programmatic areas listed above in Table 12-1 (Water Supply, Water Quality, Environment and Habitat, Climate Change, and Human-Landscape Interaction) comprise the highest level of CABY's programmatic structure. For all of the five programmatic areas, the CABY SG identified "Overarching Project Elements" as broad priorities to be considered in the development and review of projects. These elements are intended to be integral components of CABY projects whenever possible. The Overarching Project Elements include:

- Education and outreach, with disadvantaged community (DAC), Tribal and environmental justice (EJ) considerations,
- Financial feasibility and sustainability,
- Data analysis and monitoring,
- Regional planning and land use,
- Benefits to DAC water supply and water quality issues, EJ-related issues and climate change adaptation,
- Reduction of greenhouse gas (GHG) emissions in comparison to project alternatives
- Technical feasibility, and
- Project costs, availability of financing, and overall economic feasibility.

12.2.3 Relationship between Resource Management Strategies and Project Development

Regionally applicable Resource Management Strategies (RMS), including the state-developed strategies and an additional strategy developed by the CABY SG, are described in Chapter 10. The CABY project development process incorporates these strategies into the programmatic project structure described above.

Based on the CABY RWMG's experience with approximately 170 projects submitted during the 2013 project development process, most CABY projects address more than one RMS because they are designed as multi-stakeholder, multi-benefit projects. The diverse CABY SG membership embraces this multi-stakeholder, multi-benefit approach, acknowledging that an integrated approach to management of water resources will not only help the individual stakeholders achieve their respective missions but will also better contribute to the CABY Region as a whole.

12.3 Stakeholder Outreach for Project Identification

The CABY region comprises a large land area at the upper elevations of four watersheds, covering nearly 2.8 million acres and all or part of nine counties. Since its inception in 2006, the CABY RWMG has encouraged participation from stakeholders as diverse and far-reaching as the land itself. The CABY SG membership comprises representation from all sectors engaging in water and watershed management across the region, including small and large water agencies, municipal and county governments, state and federal natural resources managers, Tribes, and nongovernmental environmental organizations (see Chapter 2, Table 2-1, CABY SG Members/2013 IRWMP Adoptees).

In 2011-2012, CABY members assembled a project team to conduct the formal IRWMP update process. Initially, given the expansive geographic scope and the great number of stakeholders in the region, CABY members approached stakeholders and project recruitment on a watershed scale. Where possible, and in coordination with the CABY SG and CABY RWMG, CABY partnered with existing organizations and coalitions (e.g., the Yuba Bear Watershed Council, the Sierra County Fire Safe and Watershed Council, and others) to assist in ensuring inclusive and equitable stakeholder outreach and project recruitment across the region (as further discussed in Chapter 2, Stakeholder Involvement). In 2019 and 2020, the CABY SG and CABY RWMG to conducted outreach and solicited new projects.

Since the last plan update in 2014, CABY recognized that most project proposals were still coming principally from the organizations that were already represented in the CABY SG and CABY RWMG and that other community participation is generally lacking in the project submissions. Attempts have been made to expand the membership of the SG beyond the traditional actors by outreach and encouragement of participation from communities that haven't been involved previously with a focus on small water providers.

12.3.1 Project Identification and Recruitment

The CABY SG solicits for new projects through individualized outreach emails to stakeholders who have previously submitted projects, global emails to all stakeholders, and follow-up phone calls to specific stakeholders who had previously expressed interest in submitting projects. The CABY SG participates in the Mountain Counties DAC involvement, which is working to solicit participation by DACs and identify their water access and water quality needs. The DAC involvement process provided an opportunity to invite a wider representation of the communities in the CABY Region to identify water and wastewater needs in their communities and to discuss their capacity to meet these water needs. During these meetings, the workshop facilitators explained the purpose of Proposition 1 funding to address water infrastructure projects and encouraged communities to submit projects. Many of the communities require technical assistance to prepare project proposals. The Mountain Counties Funding Area has committed funding to provide technical assistance.

This attempt to initiate a more inclusive project development process has required stewarding existing CABY projects while at the same time incorporating new projects that address the full range of issues, goals, and objectives identified in the region.

12.3.2 Existing Projects from Previous IRWMP Updates

CABY members recognize the importance of updating projects that appeared in previous IRWMP updates. Some projects have been funded in venues outside of the IRWM program, some have been withdrawn, and others have been combined with larger regional efforts. During this most recent IRWMP update

process, as has been done for past updates, the existing project list was reviewed, and projects that were no longer relevant were removed or updated. CABY RWMG members reached out to each project sponsor individually to update the project list. Existing projects from previous CABY IRWMP updates will continue to be incorporated as CABY projects, if that is the desire of the project sponsor.

12.3.3 DAC/Tribal/EJ Project Development Considerations

CABY RWMG conducted outreach to rural and urban DACs across the region and has sought to provide individualized attention and assistance to these communities throughout the project development process. The effectiveness of the CABY IRWMP requires broad and active participation of all the stakeholders in the region. By considering the barriers faced by DACs, Tribes and other underserved stakeholders, and by committing to address them (see Chapter 2), CABY RWMG will increase its capacity to implement the IRWMP equitably throughout the region.

CABY has solicited and received input from Native American Tribal communities using a variety of methods. CABY invited and engaged tribal participation in the process of plan development. For example, CABY's representative to the state-mandated tribal needs assessment process represents the traditional tribal people from the Nevada City region. The Mountain County Funding Area outreach process to Native American Tribal communities was significantly shaped by this participation, including the development of a Tribal Members only consultation process.

Tribal input resulted in significant additions to the 2021 CABY plan. This includes new language in almost every chapter from Resource Management Strategies (Chapter 10) to Project Review (Chapter 12) and Issues and Objectives (Chapter 9) recognizing the importance of Tribal community participation in achieving the goals of this Plan. To improve CABY's capacity to work with Tribal communities, activities funded by DWR through Prop 1 included efforts to attract Tribal interest in participating by working to better understand how CABY can best meet the needs of these tribal communities. This includes:

- Development of cultural consultation protocols by representatives of the Foothills Nisenan Tribe for project development that includes an oral and PowerPoint presentation and materials available on the CABY website (to be posted soon).
- Meetings with the federally recognized United Auburn Indian Community that serves as the Tribal Information Protection Office for all cultural resources in the region that overlaps significantly with the CABY region. This Tribe has a Tribal Engagement Committee that works with other tribes in the region on a wide range of projects.
- Individual meetings with every other identifiable Tribal community group in the region (traditional tribes and non-profit organizations that are Tribal-led) to discuss potential water issues and needs
- Working with these processes CABY has developed and included several Tribal-led restoration projects in the plan.

12.4 Project Application Process

The CABY IRWMP project application process is intended to encourage diversity in projects and stakeholder benefits. The CABY RWMG acknowledges that multi-stakeholder, multi-benefit projects will not only help the individual stakeholders achieve their respective missions but will also better contribute to the entire CABY Region.

The project list is available on the CABY website (https://cabyregion.org/), and presents a list of projects that have been submitted and acknowledged by the RWMG as meeting IRWMP goals and objectives.

The RWMG performs two separate review processes for project applications:

1. Acceptance for inclusion in the CABY IRWMP project list, and
2. Prioritization of listed projects for specific funding opportunities.

Procedures for project submission by SG Members for inclusion on the CABY IRWM project list are described below in Section 12.4. Procedures for prioritization of listed projects with respect to specific funding opportunities are described in Section 12.5.

12.4.1 Project Application

Members of the CABY Stakeholder Group (stakeholders) may submit new or revised project applications at any time. The application is available on the CABY website (https://cabyregion.org/). The RWMG will announce interim deadlines for project applications based on specific funding opportunities. In order for a project to be eligible for consideration under a specific funding opportunity, the project application must be submitted by the interim deadline announced by the RWMG for that specific funding opportunity. Contact information is provided on the CABY website (https://cabyregion.org/) for inquiries regarding the project list and interim deadlines.

Project applications, if accepted, will be added to the CABY IRWMP project list but will not replace projects that were previously listed. Project applications may be fully-developed and ready-to-proceed, or they may be partially-developed and conceptual in nature. The listing of partially-developed and conceptual projects is intended to foster collaboration between stakeholders to identify linkages and integration opportunities. The listing of conceptual projects is also intended to reduce duplicative independent efforts when there is an opportunity for collaboration in application development.

Project sponsors must be a members of the CABY Stakeholder Group, and as required for SG Group membership, must adopt the CABY IRWMP. The following minimum information is required for project applications. Summary information is acceptable, as projects may be submitted at a conceptual level during their development.

1. Descriptive Project Name
2. Project Sponsor Agency/Organization
3. Primary Contact Name, Phone Number, Email
4. Project Type (Environmental/Restoration, Water Quality, Recreation, Land Conservation/ Stewardship, Infrastructure, Water Supply, Education/Outreach, Planning)
5. Programmatic Area (Chapter 9)
6. Resource Management Strategies addressed (Chapter 10)
7. Project Description (what, where, when, how; 750 character limit)
8. List of Collaborators/Partners
9. Assessment of Technical Feasibility
10. List of Background Documents
11. Direct Water-Related benefits to a DAC/EDA/SDAC (Y/N, Details)
12. Benefits Related to Identified Environmental Justice Issues (Y/N, Details)
13. Benefits Related to CABY Region Climate Change Adaptation (Y/N, Details)
14. Benefits Related to Reduction of GHG Emissions (Y/N, Details)
15. Sponsorship by a Native American Tribal Community (Y/N, Details)

16. Benefits to a Critical Water Issue of a Native American Tribal Community (Y/N, Details)
17. Design Status (Conceptual, Partially-Developed, Complete)
18. Engineering Status (Conceptual, Partially-Developed, Complete)
19. CEQA/NEPA Status
20. List of Performance Standards (If Identified)
21. Status of Monitoring Plan (Conceptual, Partially-Developed, Complete)
22. Study/Assessment
23. Land Tenure/Site Control
24. List of Permits Required (If Known)
25. Total Project Budget (If Known)
26. Percent Funding Match Available (If Known, Indicate Source and Certainty)
27. Project Location (Latitude and Longitude in Decimal Degrees)
28. Eligibility Status for Consideration as Part of Current Funding Round (Requires CEQA to be Complete; Proposal Must be Aligned with the Current Solicitation)

The application is available on the CABY website (https://cabyregion.org/). Additional information specific to the 2019 DWR Solicitation is provided at the link below:

https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-1/Implementation-Grants)

CABY stakeholders submitted more than 100 projects for listing during the most recent IRWMP update, spanning from October 2018 through August 2020

12.4.2 RWMG Project Application Review for Project Listing

The CABY RWMG typically performs project application review for listing under the CABY IRWMP on a quarterly basis. Project application review considers the alignment of the proposed project with the objectives of the IRWMP. To qualify for project listing, a project must be located within the CABY Region and must fall within the scope of the CABY IRWMP, as described below. The CABY IRWMP is a living document, and the addition or removal of a project from the Plan's online list of projects does not require the IRWM Plan to be amended or re-adopted.

Pursuant to CWC Section 10540(b), a RWMG may address or incorporate all or part of any of the following actions into an IRWMP:

1. Groundwater management planning,
2. Urban water management planning,
3. The preparation of a water supply assessment,
4. Agricultural water management planning,
5. City and county general planning,
6. Stormwater resource planning, and
7. Other water resource management planning, including flood protection, watershed management planning, and multipurpose program planning.

As described in this Plan, the CABY IRWMP focuses primarily on water management planning, watershed management planning and multipurpose program planning.

Pursuant to CWC Section 10540(c), all plans must address:

1. Protection and improvement of water supply reliability, including water use efficiency,
2. Identification and consideration of the drinking water quality,
3. Protection and improvement of water quality,
4. Identification of significant threats to groundwater resources from overdrafting,
5. Protection, restoration, and improvement of stewardship of aquatic, riparian and watershed resources,
6. Protection of groundwater resources from contamination, and
7. Identification and consideration of the water-related needs of disadvantaged communities.

This Plan addresses the topics listed above and identifies specific needs in the CABY Region related to items 1, 3, 5 and 7: protection of water supply reliability, protection and improvement of water quality, stewardship of water-related resources and needs of disadvantaged communities.

The CABY RWMG may determine that a project application meets one or more Plan objectives and is therefore eligible for inclusion on the project list, but the RWMG was not able to come to consensus in project support. Project applications that are listed but are not accepted by RWMG consensus are qualified as "non-consensus" projects. The project list will contain a column immediately following the project name designating "consensus" or "non-consensus." These non-consensus projects may be reconsidered by the RWMG during subsequent project application reviews.

12.5 RWMG Project Prioritization for Funding

The CABY RWMG performs review and prioritization of listed projects upon each funding cycle. The general process is outlined below:

1. The RWMG issues a Call for Projects in writing to the Stakeholder Group for each funding cycle. The Call for Projects:
   a. References the eligibility criteria set forth by the funding agency,
   b. Establishes the relative importance of each project review element listed in Table 12-2 (i.e., the percentage that each element contributes to the overall project ranking), and
   c. Sets a deadline for project applications.
2. Project applications are eligible for prioritization as part of the funding cycle if the applications:
   a. Is performed in accordance with the applications process outlined above in Section 12.4,
   b. Is received by the RWMG by the deadline established in the Call for Projects,
   c. Meets the eligibility criteria set forth by the funding agency for the specific grant cycle, and
   d. Is approved by the RWMG for listing as described above in Section 12.4.
3. The RWMG may hold a public workshop during the applications period to provide a public forum for discussion and information sharing, encourage project integration, and solicit stakeholder input regarding project prioritization.
4. Upon project listing and strategic integration, the RWMG will prioritize projects for funding considering stakeholder input and the numerical ranking system described below in Section 12.5.
5. The RWMG will conduct interviews with the sponsors of the highest-ranked projects to collect additional information to be used in the selection process. The same question set and interview duration is to be used for all interviews. RWMG members are not allowed to participate as interviewees if they are project sponsors.

6. The RWMG will make project selections based on numerical ranking, which may be revised based on information gathered during the interviews. A formal vote of the RWMG is required to recommend the package of projects for inclusion in an IRWM grant application.
7. The RWMG will post the prioritized project list and numerical ranking values for review by the stakeholders. Stakeholders may respond in writing to the RWMG, and the RWMG will review the comments at the next regularly scheduled public meeting of the RWMG.
8. The sponsoring water agency board of directors vote to approve the grant application, including the package of projects.

CWC Section 10541(e) requires that an IRWMP include measurable regional objectives and criteria for developing project priorities. The Act sets forth several objectives, which include but are not limited to:

1. The Resource Management Strategies identified in the California Water Plan,
2. The Basin Plan objectives for water quality,
3. An integrated, collaborative, multi-benefit approach to selection and design of projects,
4. Consideration of the water-related needs of disadvantaged communities.
5. The inclusion of performance measures and monitoring programs,
6. A plan for project implementation and financing,
7. Consideration of project greenhouse gas emissions,
8. Evaluation of the adaptability to climate change,
9. Documentation of project data and technical analysis,
10. A process for dissemination of data and information, and
11. Coordination of projects to avoid conflicts and take advantage of efficiencies.

Not all projects are ranked for a specific funding opportunity. Rather, only eligible projects (as defined at the beginning of Section 12.5 above) will be reviewed. Projects will be ranked within each programmatic initiative (also referred to as primary issues), which is intended to facilitate the matching of projects with a funding program's priorities and preferences.

In 2011–2012, the project development process resulted in the integration of ready-to-proceed projects. In many programmatic areas, one highly-integrated, multi-stakeholder, multi-objective project was selected for funding. For example, in Programmatic Area 3 (Habitat and Environment, within primary issue 3.4, Meadows), several individual projects were integrated into one regional meadows project on several meadow sites throughout the CABY Region. By aligning their goals, objectives, and RMS, and by integrating their outcomes and performance measures, the project sponsors created an efficient, streamlined meadows project elevated well beyond its separate, individual project applications.

By maintaining a list of ready-to-proceed projects, the CABY RWMG is able to leverage investment from other funding programs in addition to DWR initiatives.

12.5.1 Guiding Principles for Project Prioritization

The CABY SG established these guiding principles for project prioritization:

1. **Intent of sponsor**: Is the project sponsor actively seeking funding through the specific grant program in question?

2. **Alignment with funding opportunity**: Is the project consistent with the requirements and schedule of DWR's specific grant program guidelines?
3. **Alignment with IRWMP programmatic goals**: Is the project consistent with the goals of the CABY Plan as discussed in Section 12.2 and as summarized in Table 12-1?
4. **Integration**: Does the project offer an integrated approach, considering the factors discussed in Section 12.6?
5. **GHG Emissions and Climate Change**: Does the project adequately address GHG emissions and climate change, as outlined below in Section 12.7?

Elements to be considered during project review are summarized below in Table 12-2. The relative importance of each element (i.e., the percentage that each element contributes to the overall project ranking) is determined by the RWMG for each specific funding opportunity and is announced in each Call for Projects.

Table 12-2
Project Review Elements

Criterion	Reference	Percentage Contribution[1]
Alignment with Funding Opportunity		
Compliance with requirements	Specific Grant Program Guidelines	TBD
Compliance with schedule	Specific Grant Program Guidelines	TBD
Alignment with IRWMP Goals and Objectives		
Water Supply	IRWMP Chapters 7, 10	TBD
Water Quality	IRWMP Chapters 6, 10	TBD
Environment and Habitat	IRWMP Chapters 5, 10	TBD
Climate Change	IRWMP Section 12.7, Chapters 10, 11	TBD
Human-Landscape Interactions	IRWMP Chapters 8, 10	TBD
Integration		
Project Integration	IRWMP Section 12.6	TBD
Water Resources Integration	IRWMP Section 12.6	TBD
Geographic Integration	IRWMP Section 12.6	TBD
Stakeholder Integration	IRWMP Section 12.6, Chapter 8	TBD
Measurement Integration	IRWMP Section 12.1, 12.2, 12.6, Chapters 13, 15	TBD
Community Integration	IRWMP Sections 12.1, 12.2, 12.6	TBD
Other		
Comparison of Costs and Benefits	IRWMP Chapter 14, 16	TBD
Technical Feasibility	TBD	TBD
Benefits to DAC Water Issues	IRWMP Chapters 2, 14	TBD
Benefits to Tribal Water Issues	IRWMP Chapters 2, 14	TBD
Environmental Justice Benefits	IRWMP Chapters 2, 14	TBD
Additional Review Elements	TBD	TBD

[1] Percentage contribution of each review element to the overall project ranking is to be determined (TBD) by the RWMG based on the requirements of and compatibility with the specific funding opportunity.

12.5.2 Project Selection

As described in Section 4.5, the CABY RWMG is intended to be a consensus-based group. Project review and selection for funding is to be performed by consensus whenever possible. If consensus cannot be reached regarding the ranking or selection of a project for funding, the RWMG will make a decision based on the support of a majority of the CABY RWMG, as defined below.

- Support of both a majority of the RWMG agency members and also a majority of the RWMG non-agency members is required.

As discussed in Section 4.5, because the RWMG does not have a fixed composition, the actual number of agency and non-agency RWMG members required for a decision will vary with the RWMG composition.

If the RWMG does not select a project by consensus or by the decision-making process set forth in Chapter 4 and summarized above, then if requested by the project proponent the RWMG will provide a written response summarizing the decision-making process and stating the reason that the project was not selected.

12.6 Integration

The CABY RWMG developed the procedures listed in this section to promote integration. In its broadest sense, integration is the combining of separate pieces into an efficiently functioning unit. Integration is encouraged by the RWMG on many levels:

1. **Project Integration**: The development of multi-purpose, multi-benefit projects that address several Plan objectives.
2. **Water Resources Integration**: The synergy of management strategies within and across watersheds for multiple beneficial uses.
3. **Geographic Integration**: Integration within a hydrologic system and/or across watersheds.
4. **Stakeholder Integration**: The development of partnerships and collaborative working relationships between stakeholders.
5. **Measurement Integration**: Compatibility of monitoring and measurement systems for all projects and programs under the CABY IRWMP.
6. **Community Integration**: The solicitation of public input and dissemination of information to foster community involvement with protection and improvement of water resources.

RWMGs are encouraged to incorporate the Ahwahnee Water Principles into their IRWMPs. The 2016 IRWM Program Guidelines state that “an IRWMP must contain structures and processes that provide opportunities to develop and foster integration.” The Ahwahnee Water Principles identify the following five Implementation Principles that have formed the basis for CABY’s approach and commitment to project integration throughout the planning process:

1. Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics, and growth projections.
2. City and county officials, the watershed council, local agency formation commissions, special districts, and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
3. The best, multi-benefit, and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.

4. From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information. The participatory process should focus on ensuring that all residents have access to clean, reliable, and affordable water for drinking and recreation.
5. Plans, programs, projects, and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

This Plan addresses the five principles as follows:

- The first principle, early agency involvement, is further discussed in Chapter 8, Water and Land Use.
- Principles two and three, collaboration and integration, encapsulate the core tenets of the Plan's project development strategy, embracing multi-agency collaboration, stakeholder involvement and integrated, regional approaches to water management.
- Principles four and five emphasize community engagement and information sharing, and these have been identified as overarching priorities within CABY's RMS and Programmatic Structure (see Sections 12.2.1 and 12.2.2), which require that all CABY projects include education and outreach, as well as monitoring, data analysis, and measuring and reporting outcomes to improve future practices.

12.6.1 Linkages and Strategic Partnerships

As projects are developed, the CABY RWMG and CABY SG consistently identify opportunities to create linkages where project synergies exist and to facilitate appropriate collaboration and formation of partnerships. CABY SG meetings provide venues to facilitate the development of strategic partnerships in pursuit of multi-benefit, multi-objective, multi-agency, watershed-scale and/or regional projects.

The CABY RWMG encourages the building of relationships between stakeholder entities with varying degrees of organizational capacity. The development of these strategic partnerships enables DACs, as well as small rural water districts, to participate in project development and to achieve their objectives as part of a larger collaborative process. Integration is intended to benefit smaller agencies and groups with limited capacity by promoting collaboration rather than competition with larger, better-resourced stakeholder groups. This integrative approach to project development allows stakeholder groups to achieve their individual objectives while also promoting the objectives of other stakeholders and improving the CABY Region as a whole.

12.6.2 Monitoring and Measurement

During project prioritization and review, the CABY RWMG evaluates the level of project integration using the following criteria:

1. **Project Integration**: Project meets multiple CABY priorities (goals, issues, and objectives) and provides multiple benefits.
2. **Water Resources Integration**: Project integration within and across similar projects employing key resource management strategies.
3. **Geographic Integration**: Project integration within a hydrologic system and across watersheds, as further described below.

4. **Stakeholder Integration**: Project partnerships are collaborative in design and implementation, including representation by federal, state and local government, nongovernmental organizations and private sectors.
5. **Measurement Integration**: Project monitoring and measurement is compatible with the Plan objectives and performance measures for similar projects in the CABY Region.
6. **Community Integration**: Project includes the solicitation of public input and dissemination of information to foster community involvement with protection and improvement of water resources.

Geographic Integration may include integration along the CABY Region's east/west axis and integration along the Region's north/south axis for projects with exportability to other regions:

- **East to West (Crest to Valley):** CABY IRWMP projects begin at the 4,500-foot elevation and end at the 400-foot elevation. The RWMG encourages representation from all elevations in the CABY Region.
- **North to South (Plumas to Mariposa):** Mindful of its location within the Western Sierra Region, CABY has purposefully set out to provide projects that are exportable to other Sierra IWRM regions. The RWMG encourages stakeholders to develop methodologies, models, databases and innovative project technologies that are exportable to the larger region, thereby establishing a reservoir of new approaches to water management that can be utilized for adjacent IRWMPs.

12.7 GHG Emissions and Climate Change

GHG emissions reduction and climate change adaptation are discussed in Chapter 11, Sections 11.6 (Adaptive Management Strategies), 11.8.2 (Further Opportunities for GHG Reduction), and 11.9 (CABY Climate Change Program: Implementation of Adaptive Management Strategies). These guidelines are used during project development, prioritization and review.

The CABY RWMG and stakeholders, in response to the efforts of the Climate Change Work Group and development of Chapter 11, consider as key project development concepts the response to climate change and reduction of GHG emissions. The CABY RWMG and stakeholders acknowledge their need to reduce GHG emissions associated with their projects, with regard to existing activities and facilities as well as future construction and operation.

12.7.1 GHG Emissions Reduction

This Plan considers greenhouse gas (GHG) emissions of identified projects and programs pursuant to CWC 10541(e)(9), including:

1. Project-related GHG emissions,
2. Potential reductions in GHG emissions in comparison to project alternatives over the 20-year planning horizon, and
3. Potential reductions in energy consumption, particularly related to water use, and associated reductions in GHG emissions.

Mitigation of GHG emissions is discussed in Chapter 11. Project-related GHG emissions, as well as potential reductions in GHG emissions and energy consumption in comparison to project alternatives, are evaluated by the RWMG as part of project prioritization and review. Reduction of GHG emissions is both a guiding principle and a Plan objective, as discussed in Section 12.5.1.

12.7.2 Climate Change Adaptation

This Plan considers the adaptability to climate change of water management systems in the CABY Region pursuant to CWC 10541(e)(10), including:

1. Potential effects of climate change, identification of water system vulnerabilities, and associated adaptation requirements for the CABY Region.
2. Anticipated changes in the amount, intensity, timing, quality and variability of runoff and recharge.
3. Project contributions to climate change adaptation.

Climate change trends, projections, vulnerabilities and adaptation strategies are described in Chapter 11. Project-related adaptations are evaluated by the RWMG as part of project prioritization and review. Climate change adaptation is both a guiding principle and a Plan objective, as discussed in Section 12.5.1.

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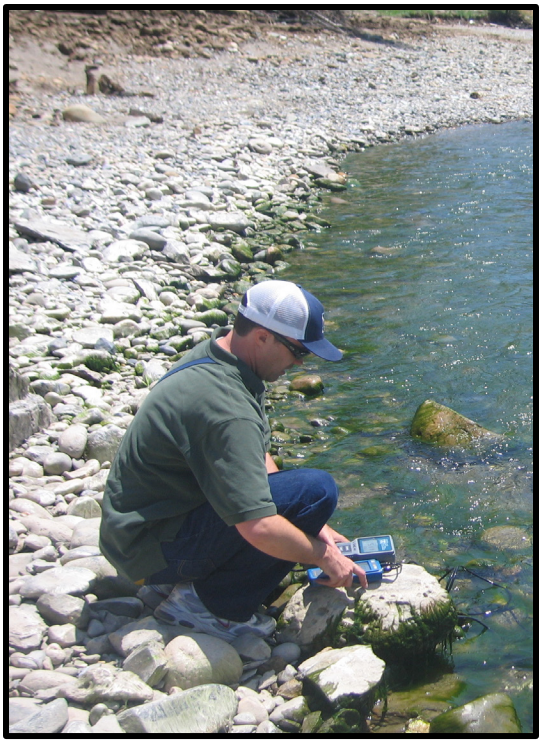
Chapter 13
Plan Performance and Monitoring



Performance measures and monitoring will gauge the success of Integrated Regional Water Management Plan (IRWMP) implementation. IRWMP performance and monitoring generally falls into two categories, (1) evaluation and measurement of the IRWMP's performance (progress toward accomplishing goals and objectives), and (2) monitoring and evaluating individual projects against their respective measures and outcomes.

This chapter presents the IRWMP and project performance measures the Cosumnes, American, Bear, and Yuba (CABY) Regional Water Management Group (RWMG) will use to monitor its performance in implementing the IRWMP objectives and to assure that projects meet measurable outcomes appropriately. It sets forth the respective roles of project sponsors and the CABY RWMG for monitoring and measuring, and any adaptive management that might take place to assure desired progress.

13.1 Performance Measures Development

In recognition of the importance of both organizational self-assessment and project-level monitoring, the CABY RWMG began evaluation early in IRWMP development process of both the appropriate and quantifiable performance measures, and design of a process to ensure those measures are accurately reported. The CABY RWMG discussed the importance of performance measures, stating that they "…are central to gauging regional progress toward collaboratively defined accomplishments and objectives."

The California Department of Water Resources (DWR) mandates a process of identifying and addressing the issue of IRWMP performance: "[The Plan] shall include performance measures and monitoring to document progress toward meeting plan objectives." Notwithstanding the guidelines requirement, the longstanding commitment of CABY members to the organization, and their desire to have the collective investment in the IRWM process be value-added, has driven the development of both IRWMP and project-related performance evaluation.

13.1.1 IRWMP-Level Performance Measures Identification

The CABY RWMG determined that the factors that could be used to evaluate the performance of the IRWMP fell into two general categories: (1) qualitative measures associated with the governance of the group and (2) qualitative measures that related directly to whether the IRWMP was being fully implemented (as judged by meeting objective targets and in numbers of funded implementation projects). The qualitative performance measures associated with IRWMP governance of the group has not yet been developed, but could include the following:

- The number of attendees and range of attendees targeted by the CABY SG
- The amount of additional funding for projects identified in the IRWMP
- Reduction of conflicts identified in the IRWMP, as measured by implementing systems for greater collaboration, and by qualitative perceptions of stakeholder participants
- The participation of DAC members
- The participation of Tribes including federally and state recognized tribes as well as traditional tribal organizations

Performance measures tied to objectives will indicate progress toward the accomplishment of objectives targets. The assessment of funding success will be judged by both DWR/Bond-funded awards and other funding. Projects included in this IRWMP and implemented, regardless of funding source, will be counted as contributing to objectives/outcomes.

13.1.2 Project-Level Performance Measures Identification

The CABY RWMG prioritized minimizing duplication of effort by the various entities throughout the region that have mandated collection of performance and monitoring data. The CABY RWMG also determined that this could be done best by utilizing measures already in place, wherever possible. After research, targeted interviews, and discussion, the CABY RWMG identified the Sierra Nevada Conservancy (SNC) suite of comprehensive performance measures as a starting point for developing the CABY measures.

13.1.2.1 Rationale for Basing Performance Measures on SNC Measures

The SNC was created with the understanding that the environmental, economic, and social well-being of the Sierra Nevada and its communities are closely linked and that the Sierra-wide region and the State of California would benefit from an agency providing a strategic direction. The organization is an effective advocate for the Sierra Nevada on issues such as bioenergy, healthy forests, water supply, and climate change, all of which benefit from a regional focus. The SNC awards grants on a semi-annual basis to projects improving economic, recreational, agricultural, and environmental aspects of the region. Accordingly, the SNC has developed performance measures to track project goals, as well as track individual project contributions to larger SNC programmatic goals.

The CABY RWMG decided to make use of these goals for several reasons, including the following:

1. To increase the efficiency of reporting for CABY members
2. To enhance the ties between CABY RWMG and the SNC and to support the SNC's efforts
3. To better understand how the CABY region's efforts fit into the larger Sierra Nevada

The SNC measures, given the focus and scale that they address, are not always directly relevant to specific CABY projects. In these cases, more refined and specific measures were identified. A review of the draft performance measures submitted by project proponents in 2013, as part of the project development process, affirmed that this approach would standardize tracking on a regional basis, and would also simplify the process for individual project proponents.

13.2 Monitoring CABY's Success on an IRWMP Level

13.2.1 Evaluation Process and Responsibility

The CABY SG and RWMG identified the CABY RWMG as having final responsibility for ensuring that tracking IRWMP-level performance is completed. The CABY RWMG will discuss IRWMP implementation at least once annually, and more often if needed to enhance chances for project funding, for incorporation of updates to regulations, for opportunities to improve the IRWMP, and/or recognize and document circumstances in the region that substantively affect the IRWMP. The schedule for evaluation will be set forth when the CABY SG adopts the IRWMP.

As part of its adaptive management strategy to stay current and revise the IRWMP, the CABY RWMG will compare implemented projects and their outcomes against objective metrics to determine progress toward achieving the IRWMP's goals and objectives. New scientific data, regional conditions, or natural resource events could substantively alter the understanding of issues or solutions within the watershed. CABY understands that the IRWMP will require adjustments as more effects of climate change manifest, new tools are developed, and new information becomes available. Potential alterations to the IRWMP goals and/or objectives will necessarily need to consider and address changes in water demand, water supply, water quality, and effects on communities and natural resources. For guidance on amendments to the IRWMP, see Chapter 4, CABY Governance.

The CABY RWMG will determine if updates that materially affect the IRWMP need to be appended, and whether objectives and their metrics continue to be relevant and appropriate. For instance, some objectives may be met, either by a change in circumstance, regulation, or implementation of projects. Objective metrics might need to be changed at that point, or a timeframe added to the metric to give it additional timeliness or urgency. New strategies and adaptations or mitigation may also emerge that warrant a change in an objective or metric. The feedback loop provided by a consistently applied performance and monitoring program will ensure that CABY RWMG can revise objectives (either in language and/or measures of quantification) to be responsive to ongoing data collection and evaluation; evaluate the success of different projects and project types in achieving the IRWMP objectives; revise quantification measures stated in the objectives in response to meeting the stated criteria; assess the reasons for project-related and IRWMP-related successes and failures and revise portions of the document in response; and perform critical system analyses in response to documented outcomes.

Significant changes that affect aspects of the IRWMP may promulgate more frequently than annual IRWMP evaluations, and/or IRWMP re-adoption. Re-adoption will occur at the discretion of the CABY RWMG, but could be triggered by significant changes in governance structure, catastrophic changes to natural resources, or significant changes in regulations. Re-adoption will occur at least every 5 years to assure widespread buy-in by area stakeholders, and account for climate and infrastructure changes within the region.

IRWM Guidelines encourage RWMGs to stay involved with the California Natural Resource Agency's California Adaptation Strategy process and to consider joining the Climate Registry at: https://www.theclimateregistry.org/.

The ability of the CABY RWMG and regional stakeholders to exhibit adaptive management to outcomes of the performance monitoring will be a key factor in ensuring that the IRWMP is being implemented successfully and remains relevant to water management across the CABY region. See Table 9-4, CABY

Goals, Objectives, Target Outcomes, and Performance Measures, located in Chapter 9, Issues and Objectives, for a description of the target outcomes and performance measures that will be used to assess the success of both project and IRWMP implementation.

13.3 Project-Specific Monitoring

13.3.1 Responsible Parties and Timing

Individual project sponsors are responsible for reporting compliance with CABY performance measures as well as the associated monitoring of their own projects. However, individual implementation projects may be funded by a variety of sources with different reporting and outcome monitoring requirements and timelines. Reporting to funders, especially if project match is provided via additional grants from non-DWR sources, can become an onerous process, greatly increasing the administrative costs of project implementation. In recognition of this, the reporting process will be developed on a project-by-project basis (where necessary) to avoid requiring project sponsors having to create multiple reports for a single project. This process, designed on a case-by-case basis, will ensure that measures identified in the CABY project are specifically tracked to support annual IRWMP and project performance review criteria and process.

A project sponsor agreement is administered to track progress, monitor performance, and report resulting information to CABY as projects are implemented. As the process currently stands, project proponents will provide project-related data for inclusion in the CABY Data Management System. It is expected that, if there are multiple project participants, the project lead would be responsible for reporting.

13.3.2 Typical Project Monitoring Requirements

Individual project monitoring requirements have been and would continue to be established as the projects are developed. As with tracking and reporting, monitoring of individual projects would be the responsibility of individual project sponsors, and in the case of a group of project participants, the responsibility of the lead sponsor.

Many projects included in this CABY IRWMP have fully developed monitoring protocols and are ready for implementation, but they have not yet been submitted for funding. As a result, specific monitoring protocols for individual projects may change or be augmented, based on the requirements of diverse funding agencies. Project data that is relevant to state databases will always be collected compliant with these databases' needs and structure. Mandatory and permitting-level monitoring will be administered in compliance with the laws and regulations outlining those requirements.

A typical monitoring plan for projects in the CABY IRWMP would include the following:

1. A brief description of the project and GPS-based location of either the project center if it is a large project, or the actual project location if it's location-specific
2. A description of the proposed monitoring (both of performance measures and post-project results) for the project and the specific, GPS-based location of that monitoring. See Table 13-1, Potential Monitoring Activities Based on Project Type, for a list of possible monitoring activities based on project type
3. The protocols and frequency of the monitoring; if it is to be done in compliance with an established regulatory framework, that framework is referenced

4. The individual and/or entity responsible for monitoring is identified and a contingency plan described in the case that the individual or entity is unable to complete the responsibility
5. As appropriate, project proponents will establish a plan for tracking the data and how it will be used, how the data will be made public, how the public will benefit from the information made available, and whether any interpretation will be necessary to communicate findings to the public
6. This would include reference to both CABY's data management system for performance measures monitoring as well as to applicable state databases and tracking tools; if a state database is referenced, the CABY Protocols for State Database Reporting should be referenced and any additional contact/coordination completed
7. A description of the funding and/or volunteer coordination efforts needed to complete the monitoring task and how, if applicable, the work will be funded if scheduled to be complete after grant funds expire or are used in full on project implementation

The basic monitoring plan structure for CABY projects is expected to be developed as the project is accepted into CABY's project list. These preliminary plans will be made available via the CABY website, along with all other project materials. Making these plans publicly available increases CABY organizational capacity by creating a pool of monitoring resources available to all CABY members and the general public. In this way, regional project monitoring expertise and consistency is elevated.

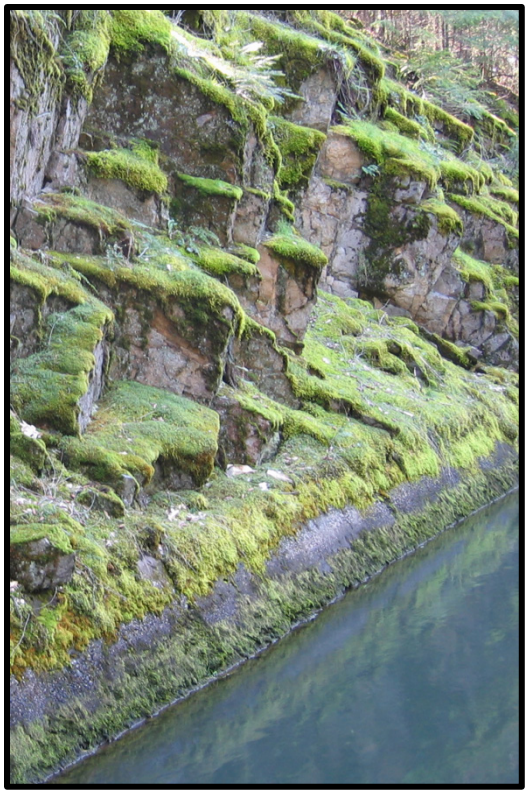
Table 13-1
Potential Monitoring Activities Based on Project Type

Project Type	Potential Project-level Monitoring Activities
Environmental Work/Restoration	a. Number of fish successfully migrating b. Extent of flooding c. Linear feet of channel bottom and bank erosion repair d. Linear feet of vegetated swale created e. Miles of riparian corridor restored f. Stabilization of severe bank erosion g. Number and distribution of native species h. Number and diversity of waterfowl populations i. Development of a low-flow threshold for population j. Development of method to distinguish and characterize at-risk populations for the purpose of targeting risk-reduction and impact-mitigation efforts k. Number of fish passage barriers removed l. Distribution of non-native species m. Re-grading of channel complete
Water Quality	a. Number of certified water testers b. Number of homes sampled/tested c. Number of reservoirs re-operated to provide temperature-appropriate flows d. Quality of on-site stormwater runoff e. State or federal protocols or standards for water quality testing or measurements f. Salinity, organic carbon, turbidity, nutrients, and pathogens in local or regional discharges and runoff g. Reduced inflow of contaminants to treatment plant h. Removal of water body from 303(d) list i. TMDL created

Table 13-1
Potential Monitoring Activities Based on Project Type

Project Type	Potential Project-level Monitoring Activities
Recreation	a. Square miles of watershed access b. Number of access points to river c. Linear feet of new trails
Land Conservation and Stewardship	a. Number of environmentally important acres of forest protected b. Cost per acre of environmentally important forest protected c. Amount of voluntary land conservation d. Acres of land assisted with protection e. Linear feet of fire road stabilized f. Sediment delivery to adjacent creek channels g. Quality of water in adjacent creeks
Infrastructure Projects	a. Quality of on-site stormwater runoff b. Flow rate/capacity c. Percent of CIP implemented d. Frequency of infrastructure issues/problems e. Stabilization of the dam, canal, intertie, etc. f. Capacity of existing plant g. Stormwater infiltration area established h. Number of active monitoring wells
Water Supply	a. New wells drilled b. Number of years of supply projected c. Quantity of recycled water produced d. Cost per household of supply augmentation (can be used for both supply- and demand-side management)
Education and Outreach	a. Number of individuals educated b. Decrease in the amount of pesticides/herbicides applied on residential properties c. Number of viewing platforms erected d. Decrease in per-capita water demand e. Number of participants in region-wide technical committees for discussing data collection, management, disbursement, coding, presentation techniques f. Removal of properties from Federal Emergency Management Agency (FEMA) flood insurance rates g. Development of a manual/guidebook h. Number of signs placed
Planning	a. Development of a comprehensive Agricultural Areas Management Plan b. Model completed c. Vulnerabilities assessed d. Development of feasibility assessment e. Development of methods for identifying contaminants f. Percent of stakeholder/public input considered and/or included in the project implementation design

Chapter 14
Impacts and Benefits



Implementation of this Plan will potentially generate a range of benefits and impacts, at both the Integrated Regional Water Management Plan (IRWMP) and project-specific levels, and within and potentially outside the Cosumnes, American, Bear, and Yuba (CABY) region. The intent of this chapter is to describe, at a screening level, the impacts and benefits associated with implementation of this IRWMP and whether those potential impacts or benefits might have an interregional effect. The effects of IRWMP implementation on disadvantaged communities (DACs), Tribal communities, and environmental justice-related concerns are also discussed.

Prior to implementation of individual projects, a project-specific impact analysis will occur, associated with any applicable environmental compliance evaluations (e.g., California Environmental Quality Act [CEQA] and National Environmental Policy Act [NEPA]).

Table 14-1 describes and summarizes the potential CABY IRWMP implementation impacts and benefits, both within and outside of the region. These impacts and benefits are organized by programmatic area and are assessed based on performance measures that are described in Chapter 13, Plan Performance and Monitoring.

14.1 Programmatic-Level Impacts and Benefits

The IRWMP implementation will potentially entail pursuit of grant and other funding sources; multiple forms of interpersonal contact involving stakeholder time commitment; project development, implementation, and monitoring; and plan performance monitoring and potential update. Side effects of this work may include ongoing refinement and identification of conflicts and purposeful pursuit of their resolution. For DAC and Tribal stakeholders, dedication of funding and staff time to this effort may prove particularly difficult.

The benefits of programmatic-level implementation are wide-ranging, and include the following:

- A potential reduction of identified regional water-related issues by meeting objectives through IRWMP implementation
- Increased understanding and information sharing between area stakeholders and interregional interests
- Opportunities for collaboration on project development
- Resolving regional and interregional conflicts and addressing emerging issues
- Potential identification of a more diverse set of funding sources to increase project-related investment in the region

- Opportunities for cost savings and creating an economy of scale, particularly from project integration
- Can be used as a venue to address policy and regulatory issues facing the region

Please see Table 14-1 for a comparison of impacts and benefits by programmatic area that are attributable to implementation of the CABY IRWMP.

The advantages of the regional approach also include increased opportunities to identify issues best addressed on a regional basis (e.g., climate change, legacy mine issues, and cross-watershed collaborations on fish passage), and ability to work on point and non-point source pollution strategies (as pollutants do not respect political boundaries).

The requirements of IRWMP preparation have mandated a level of increased regional understanding that did not exist prior to the formation of CABY. The ongoing dialogues, regular meetings, creation of work groups, and implementation of joint planning have resulted in the ability of organizations to realize an economy of scale, ability of agency and nonprofit boards to engage in policy-level collaboration, the fostering of support and empowerment amongst small grassroots organizations, and the realization that implemented projects can and do provide benefits that extend beyond the needs of the region.

If IRWMP implementation is broadly realized, it will be vital to include outreach to underrepresented groups (e.g., DACs and Tribal entities), as outlined in the IRWMP, so that benefits such as increased collaboration, development of joint projects, and cost savings manifest for those communities.

Additional benefits from the IRWMP include the development and integration of projects from a diverse group of project sponsors, substantive collaboration on project integration, and maintenance of a website to communicate CABY water management issues and activities. The website provides an access point for data and information transfer to assist water and resource managers in their activities, as well as informing the general public. If maintained as planned, the website will continue to provide a primary data and information source for water/watershed planning and management for the region.

Finally, a number of CABY projects have the potential to serve as demonstration projects to illustrate the economic viability and technical merit of innovative approaches that can then be applied throughout the region, and potentially, the state.

14.1.1 Fostering Understanding and Information Sharing and Resolving Conflict

One of the strengths of this IRWMP and the CABY Stakeholder Group is to improve the understanding of the diverse points of view among stakeholders and interregional partners, and to achieve balance where possible. Planning within a regional (or sometimes interregional) framework allows stakeholders to evaluate whether it is best to respond more broadly to an issue, to share knowledge and resources, and to minimize inter-entity conflict. Conflicts in the region over adaptation strategies to climate change will likely intensify as the precipitation regime changes. Therefore, a collaborative venue for information sharing and conflict resolution is invaluable.

14.1.2 Opportunities to Collaborate on Project Development and Cost-saving

The IRWMP provides a vehicle for local entities to collaborate and develop joint projects of multiple benefits and to identify and problem-solve on issues for which no projects are currently proposed.

CABY Working Groups are a powerful venue for project development and integration and have enabled stakeholders to collaboratively review the outcomes of both individual projects and those projects' relationship to IRWMP implementation. This allows for a more comprehensive overview of and feedback on the methodologies used, and cumulative magnitude and benefit of projects that can be implemented or developed in the future. It can also provide for a greater cost-effective project design alongside potentially improved technical project design. Coordination also helps eliminate redundancy of project development and provides for integration of project suites that potentially allow for shared equipment, technical expertise, and personnel.

CABY members will seek project funding from a variety of sources, including Integrated Regional Water Management (IRWM) Implementation Grants. In the past, project sponsors have broadened their understanding of project benefits for the good of the region's water resources. Project sponsors continue to assist one another in developing project materials and funding applications.

14.1.3 Identification of Diverse Funding Sources

As identified elsewhere in this IRWMP, the historic lack of funding sources relative to the water-management-related needs of the region is, in and of itself, a regional vulnerability. As a headwaters region, the newly available funding sources may be important in addressing our resources needs. The CABY forum provides strength in numbers to take this issue to the interregional and state level where appropriate actions may help address this problem. A united front also bolsters the importance of funding, not only for the CABY region, but also for the benefits of CABY's resources to other California regions.

The IRWMP also increases the potential for investment in the region because funding entities often require a proposed project to be a component of a larger, deliberate process to achieve stated outcomes. They anticipate greater benefit from the cumulative project (watershed-wide) implementation than from standalone projects, and often require demonstrated collaboration, technical data sharing, and opportunities for cost savings among stakeholders. Collaboratively developed projects, included in a deliberate local process and adopted by local entities, improve chances for individual projects or project suites to be funded by a variety of sources.

14.2 Project-Level Impacts and Benefits

Project-associated benefits to the region far outweigh impacts, particularly since each project will necessarily undergo environmental review to identify measures to minimize project-specific impacts. This project review process will include assessing viable project alternatives and developing mitigations to reduce negative impacts prior to project implementation.

Impacts from project implementation are primarily related to potential environmental or social disturbance. An important aspect of project inclusion in the IRWMP is the requirement that disturbance to the landscape, or construction-related project activities, will undergo evaluation for mitigation and environmental compliance evaluation under CEQA or NEPA prior to implementation. In many cases, projects, such as feasibility studies, public education and outreach, and/or best management practices implementation, would not result in direct physical environmental impacts. Additionally, small habitat restoration projects (under 5 acres with some provisions) are exempt from CEQA review.

Most proposed projects would result in localized and temporary environmental impacts. These impacts could include, for example, disruption in traffic and noise from infrastructure improvements, temporary

increases in sediment from stream restoration, and short-term decreases in air quality from prescribed burns. Social impacts could result from rate increases or changes in review policies.

Projects in the CABY region often have multiple benefits at local, regional, and state-wide levels. Benefits from project implementation include improved forest health to reduce wildfire risk, ecosystem resiliency, and improve water supply; invigoration of the local economy resulting from project-related employment; and long-term benefits from improvements to natural resources and habitat that support hunting, fishing, other recreational pursuits, and tourism. Energy conservation would result primarily from irrigation efficiency projects and improvements in municipal water delivery. Individual assessments of reductions in greenhouse gas emissions will be conducted as part of project evaluations with associated mitigations. Localized biomass and other alternative energy projects could conserve energy, employ construction workers, and potentially improve air quality. Adaptive strategies suggested to maintain the watershed's resilience under climate change would also reduce the region's vulnerability to drought, flooding, wildfire, and other climate-related phenomena.

14.2.1 Impacts from Failure to Implement the IRWMP

Over the course of generating this IRWMP, regional stakeholders have dedicated thousands of hours and considerable staff costs to planning efforts. CABY's longevity and past successes, as well as previous watershed assessments and implemented projects, display a commitment to watershed stewardship and cohesive regional water management. If the IRWMP were not implemented, it would be a disservice to these involved and committed stakeholders, as well as a lost opportunity to achieve watershed health, integrated water management, and a more resilient region.

The nature of some of the CABY region watershed's problems is critical: Some natural resource problems threaten human health and/or the survival of natural communities and species. In some cases, failure to implement may, at best, cause problems to deteriorate, and at worst, hasten irreparable damage.

As projects are developed for inclusion in this IRWMP, funding match is often identified and committed, often with associated time limitations. Failure to implement the IRWMP could result in loss of substantial match and investment in the region. In-kind contributions of volunteers and landowners would also be lost, cumulatively adding up to a substantial forfeiture of investment to the region.

14.2.2 Impacts and Benefits – Assessing Progress

The implementation of this IRWMP will help to achieve the objectives of standards and goals set by the State of California, including the Forest Carbon Plan and the State Water Plan.

Funded projects will report out on progress against performance measures, applicable impacts, and benefits. Project progress will be shared with CABY members to inform evaluation of IRWMP implementation. This section will be reviewed and updated as part of the normal plan management activities.

14.3 Impacts and Benefits to DACs, Native American Tribes, and Environmental Justice

CABY members have been actively participating in the California Department of Water Resources (DWR)-mandated assessment of DAC and Tribal needs with the goal of updating this IRWMP to better reflect the needs of these communities. As discussed in Chapter 5, Region Description, the CABY region includes

many communities identified as disadvantaged under the DWR definition (a Median Household Income of 80% or less of the statewide average Median Household Income). Additionally, recognizing the special status of Native American populations, CABY groups continue to work to develop productive and inclusive relationships with regional Tribal organizations. As a result of the Department of Water Resources required disadvantaged community needs identification and assessment, the CABY RWMG has directed the development of a Tribal Consultation Protocol targeting water agencies and other interested parties. This protocol goes beyond the consultation requirements of AB 52 to include guidelines for working with tribes that are not federally recognized, including "traditional" tribes that often work with non-profit organizations supporting their cultural revival.

Implementation of this IRWMP will have significant benefits to DACs and local Tribes. As discussed in Chapter 2, Stakeholder Involvement, and Chapter 3, Coordination, the CABY stakeholder outreach efforts and governance structure will allow representatives to actively participate in the development and implementation of the IRWMP. Through this open process, potential for grant funding, partnership, and matching funds will be available to communities previously overlooked by many regional planning efforts.

If the IRWMP is not implemented, there is the potential for the deepening of conflicts with DACs if water shortages remain unaddressed, public health hazards continue, and water and recreational standards decline within the region. CABY stakeholders seek to address these potential issues through the implementation of this IRWMP.

14.4 Interregional Benefits and Impacts

As part of its IRWMP preparation process, CABY has purposefully interacted with adjacent IRWMPs. It became obvious early in CABY's history that, while the CABY region supplies water to much of the state, its infrastructure for water delivery is primarily local, far-reaching, and rural in nature. The region can be characterized as having high fire risk that threatens the source of this water. Frequently, projects improving water conveyance, local habitat, and water quality result in increased benefits to downstream users outside of the CABY region. The benefits of alternative energy and forest health projects help the entire state to meet Assembly Bill 32 greenhouse gas emissions goals. The benefits of CABY project implementation extend far beyond IRWMP-specific boundaries and serve to enhance and emphasize the CABY region's status as a source water area.

Interregional benefits from this IRWMP will impact interconnected but out-of-region water bodies, such as the Sacramento River, and could also produce habitat improvements that will affect migratory species and their well-being, such as waterfowl and recovery efforts for imperiled fish and wildlife. Benefits to other regions could also occur from clarification and amendment of state policy or regulations, such as Delta water policy that will affect source-water regions.

Regional management of forest health will reduce fuel loads and reduce the potential for widespread, intense fires. Overgrown forests also reduce the potential for CABY watersheds to sequester carbon, supply water, and support habitat for species.

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Water Supply					
Conservation	• Acre-feet per annum (AFY) of conserved or enhanced water supply (Sierra Nevada Conservancy Performance Measure [SNC-PM]) • Tons of carbon sequestered or emissions avoided (SNC-PM) • Number of communities implementing new (since 2012) urban water conservation plans and/or leak detection plans	→ Could be detrimental to water recycling efforts	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality	None	→ Increased in-stream flow → Improved in-stream water quality
Infrastructure	• AFY of conserved or enhanced water supply (SNC-PM) • Miles of lined canal/ditch • Number of projects implemented to upgrade or improve aging infrastructure • Number of installed interties	→ Water quality degradation → Habitat/species removal → Construction-related impacts → Potential effects on disadvantaged communities (DACs)/environmental justice (EJ) effects	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Increased recreational opportunities → Increased system redundancy	→ Habitat/ species removal → Potential effects on DACs/EJ effects	→ Increased in-stream flow → Improved in-stream water quality → Increased recreational opportunities

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Water Storage	• Number of collaboratively developed plans and assessments (SNC- PM)	→ Reduced in-stream flow → Water quality degradation → Habitat/species removal → Construction-related impacts	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Increased recreational opportunities → Decreased reliance on imported water → Improved preparation for an altered hydrology	→ Reduced in-stream flow → Water quality degradation → Habitat/ species removal	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Increased recreational opportunities
Water Management Operations	• Number of collaboratively developed plans and assessments (SNC-PM) • Number of water agencies collaborating in the development of an interregional drought response • AFY of conserved or enhanced water supply (SNC-PM) • Site identified for recycled water infrastructure development/expansion	→ Reduced in-stream flow (if greater reliance on recycled water) → Water quality degradation → Habitat/species removal → Potential effects on DACs/EJ effects	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Improved habitat/species conditions → Decreased operations costs → Saving construction of additional storage	None	→ Increased in-stream flow → Improved in-stream water quality → Improved habitat/ species conditions

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Water Transfers	• Number of collaboratively developed plans and assessments (SNC-PM)	→ Reduced in-stream flow → Water quality degradation → Habitat/species removal → Potential effects on DACs/EJ effects	→ Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Improved habitat/species conditions → Increased recreational opportunities	None	→ Increased in-stream flow → More water available on a statewide level, adding flexibility to the system
Groundwater	• Number of assessed and summarized county-level approval processes for groundwater-dependent community plans • Number of identified at-risk subdivisions and outlined improved approval processes	→ Potential effects on DACs/EJ effects	→ Potential effects on DACs/EJ effects → Reduced groundwater overdraft/overuse	None	None
Water Quality					
Contamination	• Number of improved or restored abandoned mine land sites • Mass of pollutant reduced per year (SNC-PM) • Linear feet of protected or restored stream bank (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain • Measurable improvement in water quality	→ Temporary, site-specific construction impacts → Additional contamination sites discovered	→ Increased available water supply → Decreased treatment costs → Decreased number of health advisories → Decrease in bioaccumulation of heavy metals	None	→ Decrease in bioaccumulation of heavy metals → Better Delta water quality due to treatment at the source

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Sediment Management	• Acres of protected or restored riparian habitat and/or floodplain • Linear feet of protected or restored stream bank (SNC-PM) • Miles of stream where natural sediment transport regime is restored	→ Temporary, site-specific construction impacts → Negative feedback from recreation groups	→ Decreased treatment costs → Increase substrate available for species/ habitat use → Increased populations of threatened/endangered species	None	→ Increased populations of threatened/ endangered species
Waste Water Management	• Number of collaboratively developed plans and assessments (SNC-PM) • White paper developed identifying major regional issues and strategies	None	→ Decreased spill violations	None	→ Increased downstream water quality
Headwaters Protection	• Number of collaboratively developed plans and assessments (SNC-PM) • Number of identified critical-surface drinking-water watersheds and major threats described • Number of projects addressing threats to source water areas and increased resiliency of those watersheds • Water quality credit trading opportunities identified • Acres of improved or restored land (SNC-PM)	→ Temporary, site-specific construction impacts → Competition between user groups and interests	→ Improved species habitat and populations → Increased water retention in headwaters → Improved recreation opportunities → Decreased treatment costs → Increased watershed resiliency → Increased water supply → More stable temperature and base flow	None	→ Improved species habitat and populations → Increased water retention in headwaters → Improved recreation opportunities → Increased watershed resiliency → Increased water supply → More stable temperature and base flow

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Temperature	• Linear feet of protected or restored stream bank (SNC-PM) • AFY of improved streamflow (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain	→ Temporary, site-specific construction impacts	→ Improved species habitat and populations → Improved species makeup and diversity	None	→ Improved species habitat and populations → Improved species makeup and diversity
Fisheries	• AFY improved streamflow (SNC-PM) • Linear feet of protected or restored stream bank (SNC-PM) • Number of removed anadromous fish migration barriers • Miles of additional spawning habitat created	→ Temporary, site-specific construction impacts → Increased mandatory compliance measures to avoid species impacts	→ Increased coordination between water users and environmental groups → Improved species habitat and population → Return of previously extirpated species	None	→ Improved species habitat and population → Return of previously extirpated species – more robust statewide populations
Environment and Habitat					
Aquatic Biota	• Linear feet of protected or restored stream bank (SNC-PM) • Acres of protected or restored riparian habitat and/or floodplain • AFY of improved streamflow (SNC-PM)	→ Temporary, site-specific construction impacts	→ Increased species diversity and makeup → A more robust, healthier ecosystem	None	→ Increased species diversity and makeup → A more robust, healthier ecosystem
Instream Flow	• AFY improved streamflow (SNC-PM)	→ Water not otherwise available for municipal and industrial use	→ Increased species diversity and makeup → A more robust, healthier ecosystem → A more natural flow regime and temperature	None	→ More water available for downstream users → Increased species diversity and makeup → A more robust, healthier ecosystem

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Meadows	• Number of developed, funded, and/or implemented meadow restoration or enhancement projects • Acres of improved or restored land (SNC-PM)	→ Temporary, site-specific construction impacts	→ Reduced surface water contamination → Greater landscape water holding capacity → Increased summer base flow → Decreased temperatures → Improved habitat	None	→ Greater landscape water holding capacity → Improved habitat conditions
Fire and Fuels	• Acres of improved or restored land (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM)	→ Temporary, site-specific construction impacts → Increased emissions from fuels management activities	→ Decreased emissions from catastrophic fire → Improved habitat conditions → Greater landscape water holding capacity → Improvement in landscape-level response to climate change	→ Increased emissions from fuels management activities	→ Decreased emissions from catastrophic fire → Improved habitat conditions → Greater landscape water holding capacity → Improvement in landscape-level response to climate change
Invasive Species	• Number of collaboratively developed plans and assessments (SNC-PM) • Number of launch sites where aquatic invasive species (AIS) information was distributed (annually) • Number of sites surveyed for AIS (annually)	→ Temporary site disturbance	→ Improved habitat for native plants and animals → Improved public education → Decreased chance of AIS transmittance between water bodies	None	→ Greater control over invasive species spread → Interregional coordination on education/ outreach efforts

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
	• Number of identified AIS-infested water bodies (annually) • Number of closed AIS-infested water bodies (annually) • Acres of improved or restored land (SNC-PM) • Number of trainings conducted per year • Number of acres surveyed for terrestrial invasive species • Number of acres treated for terrestrial invasive species		→ Cost savings due to avoided contamination problems		
Climate Change					
None	• Number of adaptive strategies implemented in the CABY region • Kilowatts of renewable energy production capacity created (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM) • Number of collaboratively developed plans and assessments (SNC-PM)	→ Temporary site disturbance → Habitat loss due to infrastructure placement → Harm to bird species by wind power infrastructure	→ Increased regional adaptation and mitigation to projected climate effects → Increased production of clean power → Increased number of green jobs in region	→ Habitat loss due to infrastructure placement → Harm to bird species by wind power infra-structure	→ Greater contributions to Assembly Bill 32 compliance for clean energy
Human-Landscape Interaction					
Habitat Alteration	• Number of locations identified as integral to maintaining habitat connectivity throughout the CABY region • Acres of conserved land (SNC-PM) • Acres of improved or restored land (SNC-PM)	→ Short-term site disturbance due to construction → Reduced acres available for economic use (agriculture or silviculture)	→ Enhanced species habitat and populations → Increased ability of species to migrate cross-region for annual or climactic reasons	None	→ Maintains species diversity on a state level

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Native American Uses	• Number and diversity of people reached (SNC- PM)	None	→ Increase in Native American representation in water management discussions → Increased regional awareness of Tribal presence and history → Increased protection of resources important to the Native American way of life	None	→ Increased interest in CABY region Tribes and collaboration efforts
Flooding	• Linear feet of protected or restored stream bank (SNC-PM) • Number of protected significant sites (SNC-PM) • Decrease in the number of acres covered by the Federal Emergency Management Agency (FEMA) inundation zone	→ Short-term, site-specific impacts due to construction → Land use restrictions → Economic effects (insurance requirements for homeowners)	→ Increase in riparian habitat (with green infrastructure) → Low-maintenance flood infrastructure → Reduced risk to life and property → Avoided loss costs → Decreased insurance costs → Increased groundwater recharge	None	→ Decrease in flood impacts
Open Space	• Acres of conserved land (SNC- PM)	→ Short-term site disturbance due to construction → Reduced acres available for economic use (agriculture or silviculture)	→ Enhanced species habitat and populations → Increased recreation opportunities → Increased/preserved regional aesthetics	None	→ Maintains species diversity on a state level → Increased recreation opportunities and regional aesthetics

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Disadvantaged Communities	• DAC projects make up at least 30% of the total infrastructure funding request of the CABY Integrated Water Management Plan (IRWMP) on an annual basis, including all grant and loan requests to all potential funders	→ Funds do not go to other agencies/ organizations	→ DACs get needed funding for important projects → DACs remain a viable part of CABY and active in the process → Cultural diversity is preserved in the preservation of small, remote communities	None	None
Recreation	• Number of new recreation access points (SNC-PM) • Feet of constructed or improved trail/path (SNC-PM) • Acres of improved or restored land (SNC-PM)	→ Increased impacts to water quality and surrounding habitat and species	→ Increased social consciousness regarding the environment → Increased health of people using the recreation options → Opportunities for environmental education	→ Species and habitat influences can be felt down stream	→ Recreation opportunities can be used by all
Hydropower	• Kilowatts of renewable energy production capacity maintained or created (SNC-PM) • Tons of carbon sequestered or emissions avoided (SNC-PM)	→ Negative effects on species and habitats (if traditional, in-stream projects)	→ No effects on species and habitats (micro- and small-hydro in conveyance lines) → Increased regional adaptation and mitigation to projected climate effects → Increased production of clean power → Increased number of green jobs in region	→ Species and habitat influences can be felt down stream	→ Increased availability of clean power to the state and the grid

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Agriculture	• Number and diversity of CABY region agricultural stakeholders active in the development of and lobbying for revised ILRP regulations for the Sierra • Acres of conserved land (SNC-PM) • Number and value of new, improved, or preserved economic activities • (SNC-PM) • Number of collaboratively developed plans and assessments (SNC-PM)	None	→ Increased value of agricultural activities in the CABY region → Inclusion of agricultural interests in the CABY process → Preserved economic options for regional residents → Increased availability of agro-tourism options	None	None
Sustainable Economy/Self-Sufficient Communities	• Number and types of jobs created (SNC-PM) • Number and value of new, improved, or preserved economic activities • (SNC-PM) • Development of Sustainability Revolving Fund	→ Political decisions regarding funding choices → Requires a formal, long-term structure for funding and follow-up (staff and funding requirements)	→ Increase in the number of small natural-resource-dependent businesses → Increased viability of small natural-resource-dependent businesses → Increased investment in CABY region stakeholders	None	None

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Governance	• Increase in CABY membership/ CABY IRWMP adoptees • Number of presentations to CABY member organizations per annum • Number and diversity of people reached (SNC-PM) • Number of stakeholders participating in Sierra Lobby Day • Number of outreach opportunities taken with State government officials to advocate for source water IRWM regions	→ Political discussions/ decisions regarding CABY positions → Requirement for additional stakeholder time and resources	→ Political discussions/ decisions regarding CABY positions → Increased regional cohesiveness → Increased awareness on a state level of the Sierra and the resources it provides → Increased investment in CABY and the Sierra	None	→ Helps with Sierra Water Work Group and Mountain Counties goals
Overarching Objectives					
Education and Outreach	• Measurable changes in knowledge or behavior (SNC-PM) • Number and diversity of people reached (SNC-PM) • Number and types of jobs created (SNC-PM)	None	→ Synergies with K-12 curriculum → Increased level of investment of regional residents in CABY watersheds → Increased number of people reached in non-traditional cultural groups	None	→ Sharing regional curriculum saves money → Education of recreational visitors can help improve stewardship in other regions

Table 14-1
Impacts and Benefits

CABY Issue	Relevant Performance Measures	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Financial Feasibility and Sustainability	• *None identified*	→ Resources do not go toward other programs and projects	→ Increased regional collaboration and cooperation → Reliability on CABY as an organization → Preserves regional self-determination and responsibility	None	→ Preserves regional self-determination and responsibility
Data Analysis and Monitoring	• CABY documents are annually updated in the Sacramento Watershed Information Module data management system	→ Inadvertently sharing sensitive data	→ Increased regional awareness of project implementation and data availability → Regional synergies from the awareness of potential project partners	None	Similar to regional benefits
Regional Planning and Land Use	• Land use planners are active in the CABY RWMG • Number of collaboratively developed plans and assessments (SNC-PM) • Percent of pre-project and planning efforts resulting in project implementation (SNC-PM)	→ Political sensitivity to the issue → Staff time	→ Efficient use of time and resources for planning → Cost effective infrastructure planning and development → Collaborative mandate compliance	None	→ Can create a more comprehensive regional approach and ethic with regard to resource and development planning

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Chapter 15
Technical Analysis

This chapter describes the (1) breadth of data and information used to prepare this Integrated Regional Water Management Plan (IRWMP), (2) analyses of that data and information, (3) data collection and management procedures, and (4) how stakeholders contributed to and have access to this water-management-related information. The IRWMP is intended to have a 20-year planning horizon; therefore, information was gathered and analyzed to illustrate water management needs over that time period, when possible.

This section also identifies data needs in the region and describes how updates of data and documents will be shared. Online programs, such as California Environmental Data Exchange Network and the Cosumnes, American, Bear, and Yuba (CABY) website, both expand the CABY region's capacity for data management and accessibility.

15.1 Technical Information

15.1.1 Background

Over the course of IRWMP preparation and revision, extensive data gathering was conducted by numerous individuals, including the Regional Water Management Group (RWMG), Technical Advisory Committees (TACs), Work Groups, and the CABY Stakeholder Group (SG). Data gathered includes maps, reports, time series data, and other information used to identify problems and opportunities and to characterize conditions in the CABY region. Extensive information on climate change and attendant information on fire and fuels was gathered and analyzed to characterize vulnerabilities and adaptation to climate change. These documents, in addition to several updated and/or new planning documents produced over the course of CABY's history, have contributed data updates, priorities, projected scenarios, and have identified issues and data gaps. Table 15-1, A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP, lists the primary sources of data used; see the Bibliography for a full listing of references.

15.1.2 Analysis

Specific methodologies explaining how CABY does each respective analysis are contained in respective chapters and appendices. However, four areas of inquiry deserve special mention because the CABY SG and/or its committee delved into the following topics to a greater degree, and then used the available information to better understand water management needs and strategies relative to these topics during IRWMP preparation.

15.1.2.1 Western Placer Creeks Fish

The region offers important habitat for restoring historical runs of native anadromous fish. The CABY SG's decision to focus on fish access below regional dams came out of the examination of several documents as well as expert opinion. The Lower Yuba River Accord, a process and suite of documents completed in 2008, was headed by the Yuba County Water Agency and included topics of fish habitat, passage, species diversity, and the seasonality of essential streamflow patterns. These documents were created by a group of diverse stakeholders, and are based on federal, state, and peer-reviewed scientific data. As a complement to the Lower Yuba River Accord work, the National Marine Fisheries Service Biological Opinion[1] on the presence of anadromous fish in the Sacramento Valley contributed to these discussions. This information provided a foundation on which the Western Placer Creek Work Group could focus its issues and objectives development for habitat restoration and fish recovery.

15.1.2.2 Climate Change Assessment

The climate change assessment conducted by the CABY TAC represents a significant number of primary data and analyses, including the MC1 vegetation modeling described in Appendix G, Fire and Fuels. As discussed in Chapter 11, Climate Change, the CABY TAC identified early on that creating a foundational review of literature relevant to climate change in the CABY region would be essential to enhancing regional understanding of on-the-ground climate change effects. The documents identified in this analysis consisted of approximately 80% peer-reviewed journal articles and 20% federal, state, and locally produced documents. Each item considered for use in the literature assessment was reviewed for quality within the TAC, and became part of the IRWMP bibliography. In this way, the determinations of vulnerability, and therefore adaptation strategies and priorities, were based on a foundation of material assessed for quality in an outside arena, such as academia and/or the public sector. Information was used to identify regional issues, vulnerabilities and adaptation strategies, and objectives.

15.1.2.3 FERC Data Management to Aid Data Analysis

The CABY region includes five major hydropower operations, most of which have completed relicensing over the last decade, for which vast amounts of data have been generated. Implementation of relicensing processes often results in additional data collection and analysis as well; such documents will be a source of updated information for the region.

The CABY membership identified the Federal Energy Regulatory Commission (FERC) documents as adequate for developing the IRWMP because the collection of information represents the current conditions in a fair, relevant, and balanced way. Represented in the source materials are documents from the U.S. Forest Service and other federal agencies; the member water agencies; various environmental advocacy groups in the region; and internationally known, peer-reviewed scientific journals. In addition, members are confident in the scope of the suite of documents. Document recruitment was announced during early CABY SG meetings, and calls were made to each member organization to query additional and/or updated documents.

FERC relicensing data and technical analyses provided background for several chapters of this IRWMP and helped the CABY SG and its committees to identify issues, objectives, and implementation projects.

[1] National Marine Fisheries Service Biological Opinion 2009

15.1.2.4 Greenhouse Gas Analyses

Greenhouse gas (GHG) analyses are calculated for Tier 1 projects in this IRWMP to compare project alternatives and mitigate emissions under project design. To determine the average annual total GHG emissions, short-term construction emissions are divided over the life of the project. The total construction activity emissions are the sum of the emissions from the following:

- construction equipment
- transportation of construction workforce
- transportation of construction materials
- construction electricity emissions

Construction Equipment Emissions

Emissions from construction equipment are calculated by evaluating each equipment type. The maximum number of a specific equipment types per day is multiplied by the total operation days of that equipment to find the total operation hours. The fuel consumption per hour is determined either by a table from the California Air Resource Board, or by the sponsor of the project if they are familiar with the equipment. The total fuel consumption is calculated by the product of the total operation hours and fuel consumption per hour. Finally, the total carbon dioxide (CO_2) equivalent emissions are determined in metric tons by multiplying the total fuel consumption by the CO_2 emissions per gallon diesel, which is 0.010 (from the World Resources Institute-Mobile combustion CO_2 emissions tool).[2] This process is repeated for each equipment type. The sum of these numbers is the total CO_2 equivalent emissions for the construction equipment.

Construction Workforce Transportation Emissions

The emissions from transportation of construction workforce are calculated next. The total miles traveled are determined by the product of the average number of workers per day, the total number of workdays, and average distance traveled (round trip). The total fuel consumption in gallons of gasoline is determined by dividing the total miles traveled by the average passenger vehicle fuel efficiency, which is provided by the U.S. Environmental Protection Agency. This number is multiplied by the CO_2 emissions per gallon gasoline (0.009) to obtain the total CO_2 equivalent emissions in metric tons for the transportation of construction workforce.

Construction Materials Transportation Emissions

The emissions from transportation of construction materials are subsequently calculated. There are two trip types: delivery and spoils. The total emissions are calculated the same way for both. The total miles traveled are determined by the product of the total number of trips and average trip distance. This number is then divided by the average semi-truck fuel efficiency to find the total fuel consumption, and then multiplied by the CO_2 emissions per gallon diesel to find the total CO_2 equivalent emissions in metric tons. The sum of this number for the two trip types is the total emissions from the transportation of construction materials.

Construction Electricity Emissions

The construction electricity emissions are calculated simply by multiplying the amount of electricity needed in mega-watt hours by the amount of CO_2 per mega-watt hour, which is 0.310 (provided by eGRID2010[3]).

[2] World Resources Institute. 2006. The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool. June 2006. Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf

[3] U.S. Environmental Protection Agency. 2010. The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document. Prepared by: E.H. Pechan & Associates, Inc. December 2010.

The total construction activity emissions are the sum of the total of emissions from construction equipment, transportation of construction workers and materials, and construction electricity. The average annual total GHG emissions are finally determined by the quotient of the total construction activity emissions and estimated project useful life in years.

15.2 Data Management

15.2.1 CABY Data Collection Policies and Procedures

It is CABY's policy that the person or entity responsible for data collection and project implementation funded by California Department of Water Resources RWMG grants is also responsible for reporting the obtained data. However CABY's policy is also to offer all members assistance, if needed, in implementing a project or in addressing a state mandate. This is available through CABY staff or a member organization.

Every project funded through CABY has participated in uploading their information to various websites, including the CABY website. The website has been designed for easy use and accessibility to these data sets.

One challenge with historical data is its format—much of it exists in hardcopy that does not readily allow for comparison, analysis, and distribution. Furthermore, much of the available digital information (e.g., soils, topography, streamflow, and rainfall time series data) from local, state, and federal sources is widely distributed throughout multiple databases and is not in compatible formats that can be easily integrated and analyzed. One of the principles CABY members have identified going forward is that historic information, while important, will not be updated to be compliant with current database standards and/or formats. This would be an expensive effort and CABY members would rather focus on future data points.

Long-term goals of regional data management are as follows:

- Increase the staff efficiency and effectiveness
- Reduce the cost of long-term information management
- Provide a one-stop shop for basin-wide water-related data
- Provide the highest level of support to member entities

The functionality of the CABY website to serve as a data and communications portal was enhanced as part of this IRWM planning process and state support.

15.2.2 How Stakeholders Contribute and Share Data

Stakeholders are able to submit information to data management systems by uploading project-related data (with CABY SG permission) to the CABY website (www.cabyregion.org/). The process of contributing data to the CABY website is simple and straightforward.

Part of the IRWMP update process includes training project sponsors and interested CABY members to use the CABY website. This makes sure that stakeholders will be able to use the tool and populate it with information. Training stakeholders to use the tool also increases regional capacity to complete maps for grant applications and planning purposes, and allows all stakeholders to view data relevant to the watershed. The tool covers the entire CABY region, creating the opportunity to research projects and programs completed or in process throughout neighboring IRWM regions.

15.2.3 Responsibility for Maintaining Data

Relevant information must be uploaded by stakeholders. It is expected that the CABY RWMG will keep the website current for matters pertaining to CABY events and planning, and all project sponsors will add the information relevant to their particular projects.

15.3 Data Needs and Gaps

In the process of identifying data and documents, the CABY SG noted two major gaps in regional knowledge, (1) the region's groundwater resources and how/whether the fractured rock aquifers are connected and might respond to climate change, and (2) the occurrence, behavior, risk, and future costs to the region of catastrophic fire.

15.3.1 Groundwater

One important and persistent gap in the CABY region is the understanding of groundwater. Underlying the entire CABY region is a complicated network of granite rock with fissures that hold water; this is called a fractured rock aquifer. No water purveyor in the region uses groundwater as a source for public supply, but there are many private residents who rely upon groundwater as their only water source. Fractured rock is known to be unpredictable in terms of where water might be found (including both well depth as well as surface placement) in addition to how it moves through the fissures. Extended drought has caused problems in the past with regard to supplying water to households whose wells run dry for a period of time.

15.3.2 Climatic Effects on Catastrophic Fire

CABY members identified the need to better understand the future of fire behavior and risk throughout the region, especially under a changing climate regime. It projected that both the occurrence and severity of fire will increase (see Chapter 11, Climate Change), but not well known is how the hydrology of the region's forestland will respond. To address part of this data gap, CABY's Climate Change TAC conducted an extensive literature review as part of its vulnerability analysis. This review was updated in 2018 to integrate additional information.

The effects of fire on the ecosystems and hydrologic cycle in the CABY region is something that will be taken into account as CABY continues both its climate change work and coordination with land use planning entities. The Tahoe Central Sierra Initiative, a collaborative of state, federal, and nonprofit agencies, is modeling forest health and fire behavior in the CABY region that could be used for our planning purposes.

15.3.3 CABY's Federal Energy Regulatory Commission Information

While FERC relicensing processes generated substantive data relative to this IRWMP, new FERC data will need to be managed for accessibility to CABY and surrounding watersheds. CABY has identified a need for a data management system that would allow for shared access in a categorized way to the wide array of FERC maps and data. Within the CABY region, this data and a well-designed system will provide long-term value because they will accomplish the following:

- Improve the understanding of the conditions
- Support public education and generate public awareness and support for proposed projects and programs
- Reduce risk and uncertainty in decision making by land use and water agencies

- Facilitate sharing of data between local, state, and federal agencies
- Increase the cost-effectiveness and utility of the data collection and management efforts

15.4 Quality Assurance of Datasets and Information

Technical information and datasets were assessed initially for validity. Generally, if the data or documents were accepted by an outside agency or other entity as being satisfactory, for instance peer-reviewed studies and planning documents having undergone public review, the items were judged of adequate quality for use in the CABY IRWMP.

Some of the more scientifically based analysis methods for the key documents used in the IRWMP may be found in Table 15-1, in addition to a description of how they have aided the CABY SG in understanding the water management picture through the planning horizon. The CABY IRWMP was first written in 2007 and updated in 2013 and 2021. Each update continues to build on the original significant reference library.

Table 15-1
A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP

Name of Study/Data Set	Use in the IRWM Plan	Other (e.g., status of data, certainty of data/analysis, relevance to other sections)
Water Quality		
California Environmental Protection Agency State Water Resources Control Board. *2014 and 2016 California Integrated Report (Clean Water Act Section 303(d) List and 305(b) Report)*; 303(d) list – Excel file (includes potential sources).	These analyses were used to characterize the nature and status of water body impairment for stream reaches. Used in Chapter 6, Water Quality.	Updated 2019 Monitor for updates
Placer County Water Agency (PCWA) Federal Energy Regulatory Commission (FERC) data and studies	Important water quality information, especially used to enhance understanding of mercury methylation the region.	Includes a variety of statistical, biological/scientific, economic, hydrological modeling; and physical monitoring; frequency and occurrence of threatened or endangered species; and occurrence of special-status plants in the region.
Water Demand		
Population estimates as described in the Region Description (from the California Department of Finance) Water use as estimated at purveyors' treatment plants	These data points were used to estimate water demand and to project demand with future population estimates.	These data should be reviewed periodically and as implementation projects are completed.
Urban Water Agency, updated 2015 Urban Water Management Plans (UWMPs) for El Dorado Irrigation District (EID), Georgetown Divide Public Utility District (GDPUD), PCWA, and Nevada Irrigation District (NID)	Used to project water needs in the CABY region.	Current and future water use by urban water agencies in the region; monitor for updates.
Water Supply		
Urban Water Agency, updated 2015 UWMPs for EID, GDPUD, PCWA, and NID	Used to assess/understand the state of water supply for the larger retail water purveyors in the CABY region.	Used by urban water agencies in the region; monitor for updates.
Flooding		
FEMA 2005. Zone A – Areas subject to inundation maps.	These data were used to understand both infrastructure and climate vulnerabilities and to determine data gaps for flooding.	–

Table 15-1
A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP

Name of Study/Data Set	Use in the IRWM Plan	Other (e.g., status of data, certainty of data/analysis, relevance to other sections)
Natural Resources		
California Department of Fish and Wildlife, Biogeographic Data Branch. *California Natural Diversity Database*. Sacramento, CA. May 2019. Available from: https://wildlife.ca.gov/Data/CNDDB	These data were used to identify species of special concern as identified by the state.	Monitor for updates
U.S. Fish and Wildlife Service. *Critical Habitat Portal*. Washington, D.C. May 2019. Available from: http://criticalhabitat.fws.gov/crithab/	These data were used to identify areas of critical habitat as identified by the U.S. Fish and Wildlife Service.	Monitor for updates.
National Marine Fisheries Service. Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project (June 4, 2009) Available from: https://www.fisheries.noaa.gov/resource/document/biological-opinion-and-conference-opinion-long-term-operations-central-valley	Results directly relevant to the CABY region include the identification of the Western Placer Creeks as suitable habitat for anadromous migration and spawning.	–
California Fish Advisory Map California Gov. Office of Environmental Health Hazard Assessment.	Data used to identify Fish Advisory, species, and pollutant information for impaired bodies of water in the region. Used in Chapter 6, Water Quality.	Updated 2019 Monitor for updates
Population		
California Department of Finance. *Population Projections by Race/Ethnicity for California and Its Counties 2000–2050.* Sacramento, CA. May 2012. Available from: http://www.dof.ca.gov/research/demographic/reports/projections/	These statistical analyses were used to project future population and demographics, and subsequently, water demand and potential land use changes.	Monitor for updates
U.S. Census Bureau. *Census 2010.* Washington, D.C. 2011. 15 August 2011. Available from: https://www.census.gov/programs-surveys/decennial-census/decade.html	Statistical analyses were used to project population and demographics, and subsequently, water demand and potential land use changes.	Monitor for updates

Table 15-1
A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP

Name of Study/Data Set	Use in the IRWM Plan	Other (e.g., status of data, certainty of data/analysis, relevance to other sections)
Socioeconomic		
PCWA FERC data and studies	Used to enhance CABY members' understanding of the region and to update the region description in the IRWMP.	Includes a variety of statistical, biological/scientific, economic, hydrological modeling; and physical monitoring; frequency and occurrence of threatened or endangered species; important water quality information (especially regarding effects on mercury methylation); and occurrence of special-status plants in the region.
Wild and Scenic Rivers Status studies from Tahoe and El Dorado National Forests	List of streams and rivers recommended for federal wild and scenic status, used in Chapter 5, Region Description.	Scientific, botanical, biological, and other analyses to determine suitability of protection
Land Use		
General Plans for Amador, El Dorado, Placer, Nevada, and Butte Counties	Used for population estimates, development projections, goals and objectives review, and planning priorities.	Monitor General plans for updates
City Plans for Placerville, Auburn, Grass Valley, Nevada City, and Colfax	Used for development projections, goals and objectives review, and planning priorities.	Monitor City plans for updates
Sierra Nevada Forest Plan Amendment	Used for goals and objectives review and planning priorities.	Monitor Forest plans for updates
Land and Resource Management Plans for the El Dorado and Tahoe National Forests	Used to evaluate development projections, goals and objectives review, and planning priorities.	Monitor Forest plans for updates
Climate		
The Natural Resources Agency, Department of Water Resources, Division of Integrated Regional Water Management. *2019 Integrated Regional Water Management Guidelines.* Sacramento, CA; State of California. December 2019. Available from: https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-1/Implementation-Grants	Guidance for the IRWMP on aspects of climate to be discussed, strategies to be considered, and assessment of GHG emissions.	Guidance for all Plan sections

Table 15-1
A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP

Name of Study/Data Set	Use in the IRWM Plan	Other (e.g., status of data, certainty of data/analysis, relevance to other sections)
Climate Change Scoping Plan: A framework for change. December 2008. Prepared by the California Air Resources Board for the State of California, Sacramento, CA. Available from: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf	Was most relevant when considering adaptive resource management strategies and GHG reduction associated with project development.	–
California Department of Water Resources. *Managing An Uncertain Future: Climate change adaptation strategies for California's water.* Sacramento, CA, State of California. October 2008. Available from: https://www.amwa.net/galleries/climate-change/CaliforniaWhitePaper-Oct08.pdf	Provided a profile of the observed climate phenomena at the state level that have bearing on the region.	–
California Natural Resources Agency. (2009). 2009 California Climate Adaptation Strategy. Retrieved from CAKE: https://www.cakex.org/documents/2009-california-climate-adaptation-strategy	Proposes a set of recommendations for policy development to protect the state from the effects of climate change and generally focuses on GHG reduction strategies that may be relevant. Used in Chapter 11, Climate Change.	–
Westerling, A.L. & Bryant, B.P. (2008). Climate change and wildfire in California. Climatic Change, 87 (Suppl 1), S231- S249	Key study indicating continued and increasing risk of fire in the CABY region under all climate change scenarios; used to assess regional vulnerabilities.	Statistical, using projected climate change scenarios
Safford, H.D., M. North and M.D. Meyer. *Chapter 3: Climate Change and the Relevance of Historical Forest Conditions*, *Managing Sierra Nevada Forests.* Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Stations. No date. Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf	Broad application of data from this study helped define regional climate trends and vulnerabilities/strategies.	–
Freeman, G. J. 2010. Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff. Western Snow Conference 78:107:118. Available from: https://westernsnowconference.org/sites/westernsnowconference.org/PDFs/2010Freeman.pdf	Used to examine the influences of and correlation between topography and rain shadow effect on climate impacts to reduced snowmelt, spring runoff, and sometimes total runoff for the water year.	–

Table 15-1
A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP

Name of Study/Data Set	Use in the IRWM Plan	Other (e.g., status of data, certainty of data/analysis, relevance to other sections)
Lenihan, J.M., et al. 2008. The response of vegetation distribution, ecosystem productivity, and fire in California to future climate scenarios simulated by the MC1 dynamic vegetation model. Climate Change 87 (Suppl 1): S215-S230. Output of potential natural vegetation for California (model simulations). Available from: https://www.fs.fed.us/pnw/pubs/journals/pnw_2008_lenihan002.pdf	Analysis of vegetation and effects on vegetation from climate change using modeled data. Used to help inform the climate vulnerability analysis about changing vegetation patterns and related habitat.	Less certain because modeled data were used.
Greenhouse Gas Calculations		
World Resources Institute. 2006. The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool. June 2006. Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf	Provided the formulae used to calculate GHG emissions from projects.	–
U.S. Environmental Protection Agency. 2010. *The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document*. Prepared by: E.H. Pechan & Associates, Inc. December 2010.	Used to calculate construction-related electric energy use emissions.	–

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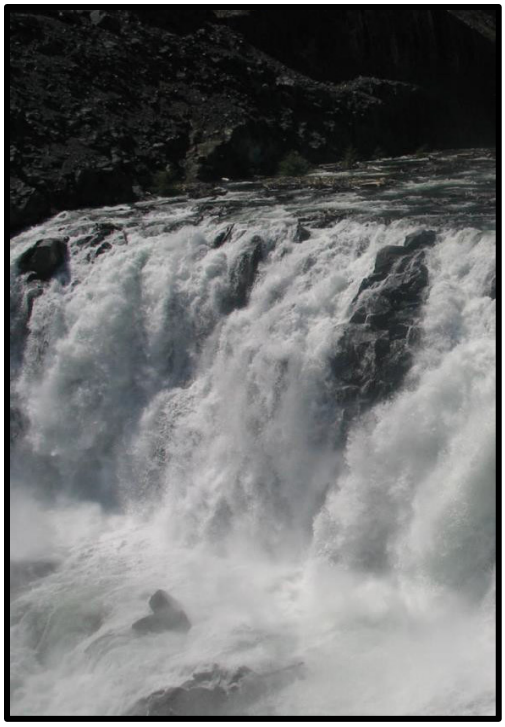
Chapter 16
Finance



This chapter helps ensure that financing of the Integrated Regional Water Management Plan (IRWMP) has been considered at a programmatic level by the Cosumnes, American, Bear, and Yuba (CABY) Regional Water Management Group (RWMG), and that a strategy for financing the ongoing work of the CABY RWMG, implementation of the IRWMP, and providing support for project development and implementation is presented and understood by stakeholders. Funding and financing to support identified projects and programs, as well as project-level operations and maintenance (O&M), is also considered in this chapter.

16.1 Background

Throughout the years, CABY member agencies and organizations have provided thousands of dollars and have committed thousands of match hours to keep the organization functioning and to support project development, IRWMP amendment, grant proposal development, and other key activities. CABY stakeholders and the RWMG members recognize that there is a need to commit both staff and financial resources to sustain the momentum of the group, and that planning and implementation grants can be critical in completing specific tasks and priority projects that have been identified in the IRWMP.

16.2 Fundraising for CABY Organizational Support

CABY depends on the organizational and administrative support of the RWMG to identify and secure funding and other forms of support to ensure that CABY is sustained. Working collaboratively, the RWMG members identify annual budgets, work plans, and priority tasks (e.g., updating the CABY IRWMP to meet the 2016 California Department of Water Resources [DWR] Guidelines), and then a strategy to accomplish this work. Often, this process includes selection of a fiscal sponsor and/or contracting entity that can execute agreements, and receive and expend funding. Contractors have effectively supported the CABY RWMG members that are staff of local nonprofit and water agency organizations. By basing the CABY RWMG on staff participation, the institutional capacity and support of each organization does not become part of the CABY workload or budget. Funding may include state or federal grants, private foundations, or in-kind support that may be available through various agencies or organizations (e.g., technical support of environmental scientists).

From 2009 until 2017, CABY utilized a 501(c)(3) that had acted as the CABY RWMG. The CABY RWMG provided specific levels of organizational support, but the largest grants that were received from DWR were administered by specific CABY members that the group had selected, including The Sierra Fund, City of Nevada City, and Nevada Irrigation District. More recently, upon dissolution of the 501(c)(3), the CABY Joint Powers Authority (JPA) was formed by four water agencies, Placer County Water Agency, Nevada Irrigation District, El Dorado County Irrigation District, and El Dorado County Water Agency. The CABY JPA

was formed to provide the availability of a legal entity for funding, contracting, and IRWMP implementation. The CABY JPA agencies now appoint four representatives, and together with four non-water agency representatives from the CABY Stakeholder Group (SG), comprise the current CABY RWMG.

The CABY members may develop a fundraising strategy that could include project-related and project implementation grant funding from other sources, as well as modifying its approach for general support funds by such methods as adding CABY to various stakeholder proposals as a line item in their project budgets—such as for project management assistance, targeted technical support, monitoring, webpage maintenance, data management, and other CABY tasks.

The pursuit of local funding is discussed in greater detail below; however, the group is well aware that the CABY region includes private nonprofit organizations as well as public agencies that are functioning in a constrained fundraising environment.

The activities of the CABY SG have been based on the principle that each member entity would have a voice regardless of the organization's ability to contribute financially to IRWMP development or to other IRWMP-related implementation activities. Therefore, striking a balance between ability to pay, level of participation, and the need for operating funds has been of considerable interest and debate.

16.2.1 CABY RWMG's Funding Needs

The CABY RWMG will determine its work plan and funding needs on an annual basis. These tasks, roles, responsibilities, and funding needs will be provided by CABY member contributions, grants and/or CABY JPA funding.

The CABY RWMG estimates that ongoing IRWM support for the IRWMP will most likely entail the following:

- Approximately four governance meetings a year; meetings will focus on IRWMP implementation, annual evaluation of IRWMP implementation and performance measures, ongoing project development and integration, discussions and presentations focused on developing a common strategy for addressing water-related issues across the region, identifying and developing alternative sources of funding for IRWMP and organizational support, ongoing outreach and assistance to disadvantaged communities (DACs), and opportunities for collaboration between CABY SG members
- Ongoing Work Group activities for special-purpose or quick-turnaround efforts
- Committee work associated with project solicitations (e.g., project ranking and project review)
- Project monitoring and webpage maintenance

It is expected that CABY RWMG members and other stakeholders will continue to provide their representative staff members to support the ongoing IRWM effort, and that stakeholders will continue to participate actively in the process. Funding is not anticipated for continued IRWM meeting participation by members.

Additional funds may be needed, however, to support the CABY administrative functions. As described in Chapter 4, CABY Governance, annually the CABY RWMG will select an Administrator and Secretary from its members to support basic administration of the CABY IRWM group. The CABY RWMG recognizes that if available, additional funding will be used to engage a Coordinator or CABY Facilitator to support the CABY RWMG by organizing meetings, overseeing project solicitations, coordinating the continued

planning process, keeping stakeholders (and CABY RWMG members) engaged, and ensuring that IRWMP objectives are being monitored and met.

16.2.2 Organizational Budget

At this point, the CABY RWMG estimates that approximately $50,000 to $100,000 annually will be required to support the CABY IRWM. This spread in budget is the result of the variety of staffing models that the group has developed. This range represents a low-end/high-end estimate, ranging from a .25% full-time equivalent, plus expenses to a full-time position with attending expenses.

The CABY RWMG is tracking direct and indirect costs of CABY-related expenses that include staff time, meeting facilitation, provision of meeting rooms, word processing, web maintenance, legal, and other similar services. Ways to consolidate meetings and break Work Groups into watershed-level groups to minimize travel logistics and increase the ease of participation, delegating DAC and new stakeholder recruitment and communications to members rather than staff are also being considered.

16.2.3 Funding Source Identification – Program/CABY Organizational Support

As part of the exercise discussed above, a consideration of possible sources of revenues resulted in identification of the following options:

- Foundation Grants: CABY RWMG and/or CABY SG initiate the development of proposals and the cultivation of relationships with foundation funders (e.g., National Fish and Wildlife Foundation-funded partnership with American Rivers, Tuolumne County Resource Conservation District, and Environmental Defense Fund on Sierra-wide Meadows Project)
- Other Government Grants (state and federal): In addition to DWR grant programs, CABY or CABY stakeholders initiate the development of proposals pursuing other state and federal grant programs (i.e., U.S. Environmental Protection Agency, Sierra Nevada Conservancy, State Water Resources Control Board)
- DWR Bond Funding: As long as bond funding exists, CABY will continue to pursue planning and implementation funding. Also, CABY, with other IRWM groups, could consider actively campaigning for more bond measures2018er Grants: CABY stakeholders include CABY as a partner on project proposals submitted to foundations, state and federal grant programs (where applicable); CABY staff/consultants develop proposals that support CABY's capacity via an administrative fee or a more integrated role in the implementation of projects that, in so doing, develop CABY's organizational capacity; any project that is developed through CABY and gets funded by any source pays a CABY 'fee' for its support/services that can be provided by a contractor
- Initiate collaboration with other agencies and organizations, external to the CABY RWMG, that share similar goals and might benefit from IRWMP implementation; focus collaboration not only on project implementation, but also on options for donation of financial contributions or other resources toward the IRWM planning effort

16.2.4 Fundraising Plan Implementation

As capacity allows, the CABY RWMG and CABY SG may develop a detailed and targeted fundraising action plan. This action plan will be developed by a working group and will focus on identifying specific funding targets, based on the final staffing and organizational structure that evolves after IRWMP

adoption. The action plan will focus on concise and specific descriptions of funding targets and actions, based on input from regional stakeholders.

16.2.5 Organizational Fundraising Certainty and Longevity

As stated above, the certainty of funding for organizational support is currently unknown. The presence of an action plan does not guarantee the ability to raise funds. The CABY membership remains committed to developing funding to support ongoing activities such as governance, IRWMP updates, monitoring IRWMP performance, and monitoring the ability of the membership to meet the articulated goals and objectives of the IRWMP. This commitment may take the form of volunteer time, in-kind services, pursuit of targeted grant opportunities and other similar activities as articulated in the action plan described above.

16.3 Potential Project Funding Sources

A wide variety of grant sources to fund CABY projects is available and could be sought to meet the needs of natural resources, infrastructure, DACs, wetlands/meadows, education, data collection, forest management and restoration, and capacity building. Please see Table 16-1 for a current listing of federal, state, regional, and private grant and loan sources relevant to CABY IRWMP projects. This list is, necessarily, a 'snap shot,' as funding sources can change from year to year.

Table 16-1
Options for Project-Specific Implementation Funding

Capital Improvements Program Funding (Revenue Bonds, Certificates of Participation)

- Property Tax Assessment (Assessed Valuation)
- Hydroelectric revenue
- User Fees
- Private Financial options
- Rate restructuring

State Funding

- Proposition 1
- Proposition 68
- Other State Funding
  - California Department of Forestry and Fire Protection – CCI Forest Health Grant Program
  - California Financing Coordinating Committee
  - Sierra Nevada Conservancy
  - Safe Drinking Water, Infrastructure, and Clean Water SRF
  - Department of Housing and Community Development – Community Development Block Grant
  - California Energy Commission (CEC) – Energy Financing Program

Federal Funding

- U.S. Environmental Protection Agency (EPA), Source Reduction Assistance EPA, Wetlands Program Development Grants
- EPA, Five Star Restoration Program
- Water Resources Development Act
- National Rural Water Association Revolving Loan Fund
- National Park Service, Rivers, Trails, and Conservation Assistance Program
- U.S. Department of Agriculture – Rural Development, EQIP and WHIP, FRPP, Water and Waste Disposal Program
- U.S. Bureau of Reclamation, WaterSMART, Grant Programs
- U.S. Fish and Wildlife Service, North American Wetlands Conservation Act Grant

Given unpredictable financial status at all levels of government, it is not possible to predict which, if any, of the identified funds will continue to be available or what new sources of funding may emerge. The point of Table 16-1 is to illustrate that the organization has a good grasp of the diverse funding sources and has the capacity to track and identify changing trends or availability in funding sources.

Specific financing options or strategies for many of the CABY implementation projects have not yet been identified. CABY stakeholders are well aware that a reliance of grants for implementation is not prudent or practical. The Table 16-1 provides a variety of options available to CABY members for project and possibly program-level funding. As a group and as individual project proponents, these funds will be pursued as they become available or as individual projects are identified as being consistent with applicable funding guidelines and criteria.

16.4 Financing O&M Activities

Project development sponsors and committee members have been queried about the general state of O&M in the region. Some respondents painted a picture of substantial deferred maintenance in the region; some water and sewer pipes, for instance, are so old and crumbling they cannot be assessed with modern leak-detection equipment. Others brought up the additional concern that while much of the CABY region's infrastructure is still quite functional, state and federal infrastructure standards continue to increase, rendering that infrastructure noncompliant.

O&M support of municipal and district infrastructure is currently provided via rate structure. Sometimes grants are received for upgrades, although this is rare. In the case of infrastructure replacement, upkeep is usually anticipated to be covered by cost savings from the replaced infrastructure. This allows payoff of federal loans that will, in turn, allow for payment of O&M.

As is true for infrastructure projects in general, the source of O&M funding for infrastructure projects performed under the IRWMP must be determined during project development. The certainty of O&M funding must be evaluated to determine the project's viability. Non-infrastructure projects performed under the IRWMP may or may not require O&M funding. Therefore, consideration of O&M funding is an important part of the project feasibility and selection process. The need for O&M funding and the certainty of funding sources must be considered during project development and must be evaluated during the project selection process.

Appendix A
2006 CABY Charter

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

FINAL CHARTER *(Rev. 5/22/06)*

I. PURPOSE

The primary purpose of the CABY process is to produce the CABY Integrated Regional Water Management Plan (IRWMP).

The IRWMP is a planning document that identifies a vision, guiding principles, broadly-supported goals, objectives, strategies, actions and projects to enhance the beneficial uses of water for the CABY region, including the provision of long-term water supplies, protection and improvement of water quality, and enhancement of environmental and habitat resources. The IRWMP, initially informed by the various pre-existing plans in the region, will provide an integrated approach to water management across the region's four watersheds: **C**osumnes; **A**merican; **B**ear; and **Y**uba (CABY). Based on technical knowledge and endorsed by a united community, the resulting CABY IRWMP actions and projects will have significant opportunities to attract local, state and federal grants and other financial support into the region.

II. CABY PLANNING HORIZON

The CABY planning horizon is approximately twenty years into the future -- in the range of 2027 – 2030. It is acknowledged that many of CABY's discussions and actions will be informed by a longer time horizon of up to fifty years into the future.

III. CABY STAKEHOLDER STRUCTURE

1. **Planning Committee**: The Planning Committee, comprised of organizations representing diverse interests across all four CABY watersheds, is the decision- making body of the IRWMP process.

2. **Work Groups**: The Planning Committee will establish Work Groups, which will focus on preparing recommendations for Planning Committee's consideration and action on specific areas including: water supply, water quality, and environment and habitat protection. Groundwater management objectives will be included in work plan of the Work Groups.

3. **Coordinating Committee**: The Coordinating Committee, appointed by the Planning Committee, is a smaller, representative group of the Planning Committee that meets in-between Planning Committee meetings to assist staff with process planning, recommendations for process modifications, communications, and other issues for which staff needs advice.

The Coordinating Committee may play a role in the development of the IRWM Plan, at the request of the Planning Committee, including preparation of substantive proposals, but has no decision-making authority.

4. **Public Forum:** The "Public Forum" is the term used to describe the general public and the broad range of organizations interested in the CABY process that seek information about CABY activities either by attendance at meetings or through other means of communication. The CABY process will seek input from the Public Forum on the Plan's direction and content.

IV. ROLES AND RESPONSIBILITIES

Planning Committee

1. Organizations and governmental agencies participating in the CABY process will select one formal designee to represent them on the CABY Planning Committee. The designee will represent the views of the organization that selected them to participate in the process.

2. Planning Committee members will attend meetings consistently and, if unable to attend any session, will send an alternate also chosen by their participating group. However, use of alternates is not encouraged as this can interfere with the continuity of discussion and decision-making.

3. The Planning Committee is the decision making body of the IRWMP process, and its members will make a good faith effort to achieve consensus in order to produce a Plan with the strongest support possible.

4. Members will participate in at least one Work Group and attend these meetings regularly.

5. Members will regularly communicate information about the process to their organizations or agencies, as well as to the individual constituencies and communities they represent.

6. The Planning Committee will make decisions in accordance with the rules set out in Section VIII on Decision Making below.

7. A Planning Committee member's eligibility to take part in IRWM Plan decision-making depends on active participation by that member. Active participation is defined in Section VIII (4) below.

Work Groups (WG)

1. Each Work Group is dedicated to one of the three major problem areas or goals set out in the DWR proposal: water supply, water quality, and environment and habitat protection. The Planning Committee may establish additional goals and accompanying Work Groups.

2. Planning Committee Members may participate in more than one Work Group.

3. Work Groups are encouraged to seek additional participants from outside the Planning Committee to increase the diversity of interests represented, provide input from all four watershed areas,

provide additional expertise to the Work Group, or for other reasons deemed necessary by the Work Group.

4. Work Group membership must balance interests and diversity but should be kept to a workable number to facilitate in-depth discussions.

5. Work Groups should have members from all 4 watersheds in order to emphasize integration with respect to the major problem area each Work Group is examining.

6. Consistent attendance at Work Group meetings will be essential since a large part of the IRWMP workload will be carried by these groups.

7. Work Groups will be guided by:

8. Direction from Planning Committee (with feedback from public)

9. Requirements of IRWMP grant and final product

10. A project manager and a technical consultant will staff each of the Work Groups.

11. Work Groups will strive for consensus and, lacking that, will present the full range of opinions on any proposal to the Planning Committee to inform the Planning Committee's decisions.

Coordinating Committee (CC)

1. The Coordinating Committee consists of the following eight organizations, as determined at the Planning Committee's March 1, 2006 meeting: El Dorado Irrigation District; El Dorado County Water Agency; Placer County Water Agency; Nevada Irrigation District; Sierra Nevada Alliance; Natural Heritage Institute; South Yuba River Citizens League; and American Rivers.

2. The role of the Coordinating Committee is that of process planning and logistics to assist staff with scheduling, recommendations for process modifications, communication, and other issues for which staff needs advice in between Planning Committee Meetings.

3. The Coordinating Committee may play a role in the development of the IRWM Plan, at the request of the Planning Committee, including preparation of substantive proposals, but has no decision-making authority.

4. The Coordinating Committee will strive for consensus and, lacking that, will present the full range of opinions on any proposal to the Planning Committee to inform the Planning Committee's decisions.

Public Forum

The "Public Forum" is the term used to describe the general public and broad range of organizations interested in the CABY process that seek information about CABY activities either by attendance at

meetings or through other means of communication. The CABY process will seek input from the Public Forum on the Plan's direction and content.

Strategies for reaching this larger audience include:

1. Public comment time at Planning Committee meetings allowed in a flexible and inclusive manner rather than limited to a single period.

2. Interactive communication through the CABY website with full publication of work products, reports, public meeting materials, regional resource databases and other resources.

3. A master mailing list compiled by the Project Director consisting of lists contributed by member organizations as well as public inquiries, meeting attendance lists and website sign-ins.

4. Multi-media materials created by member organizations to assist members in updating constituent and other community groups on planning activities and to inform local and regional media of milestone achievements.

5. Special outreach to tribal governments to elicit their input in a manner consistent with protocols on government-to-government relationships

6. Additional efforts to identify and communicate with Environmental Justice communities throughout the region.

7. Other public participation strategies as developed by the Planning Committee or Coordinating Committee.

V. PLANNING COMMITTEE MEETING SCHEDULE

The regular meeting day for Planning Committee meetings will be the 1st Wednesday of the month as follows. Planning Committee meetings will be held from 9:00 a.m. to 4:30 p.m. due to the large amount of issues that require discussion and decision-making.

Wednesday, March 1, 2006

Wednesday, April 5, 2006

Wednesday, May 3, 2006

Wednesday, June 21, 2006

No July Planning Committee Meeting

Wednesday, August 2, 2006

Wednesday, September 6, 2006

Wednesday, October 4, 2006

Wednesday, November 1, 2006

Wednesday, November 29, 2006
(The Planning Committee may re-visit this date in the early Fall, if needed)

VI. ATTENDANCE

Given the volume of information to be considered and the short time frame, regular attendance by each member or his/her designated representative is essential.

VII. COMMUNICATION

1. Meeting summaries will be provided following each Planning Committee meeting.

2. The Planning Committee is encouraged to develop common IRWMP statements for periodic public release. Suggested text for such statements may be developed by staff and facilitators or may be offered by a group member. The Planning Committee may delegate this responsibility to the Coordinating Committee.

3. Members are asked to speak only for their organization or themselves when asked by external parties, including the media, about the CABY's progress, unless there has been a formal adoption of a statement, concepts, or recommendations by the Planning Committee.

4. In addition, staff will be available to provide presentations of the group's work at meetings, conferences or other venues. Members are strongly encouraged to provide or arrange presentations about the group's work wherever feasible to increase awareness of the IRWMP work.

VIII. PLANNING COMMITTEE DECISION-MAKING

1. **Consensus as the Fundamental Principle**: The Planning Committee shall strive for consensus (agreement among all participants) in all of its decision-making. Working toward consensus is a fundamental principle of the CABY process.

2. **Definition of "Consensus":** In reaching consensus, some Planning Committee members may strongly endorse a particular proposal while others may accept it as "workable." Others may be only able to "live with it." Still others may choose to "stand aside" by verbally noting a disagreement, yet allowing the group to reach a consensus without them if the decision does not affect them or compromise their interests. Any of these actions still constitutes consensus.

3. **Less than 100% Consensus Decision Making**: The Planning Committee shall not limit itself to strict consensus if 100% agreement among all participants cannot be reached after all interests and options have been thoroughly identified, explored, discussed and considered. Less-than-consensus decision-making shall not be undertaken lightly. If, after full exploration and discussion, the Planning Committee cannot come to 100% agreement, it will use the less-than-consensus decision-making protocols as described below. For proposals or the Plan to be endorsed by the Planning Committee, it must pass the two tests identified below, in the order as presented. This means that the Plan first has to meet the first test (a) before the second test (b) can be applied.

    a. **Broad Support of the Planning Committee Membership**: The Plan must be endorsed by a 75% supermajority of the total number of *active* members of the Planning Committee. (In

other words, the Plan cannot be opposed by more than 25% of the total number of *active* members of the Planning Committee.) *Active* participation is defined in item 4 below.

b. **Representation from Major Interests**: The above 75% supermajority must include three of the four following public agencies: El Dorado Irrigation District; El Dorado County Water Agency; Placer County Water Agency; Nevada Irrigation District; and three of the four following non-profit organizations: Sierra Nevada Alliance; Natural Heritage Institute; South Yuba River Citizens League; American Rivers.

4. **Definition of Active Participation by Planning Committee Members**: Active participation means regular attendance at Planning Committee meetings; regular participation in at least one Working Group or ensuring that a designee of the Planning Committee member's organization participate in a Work Group under the Planning Committee member's close guidance; and reviewing planning and other written documents before discussions or decisions will held. It is understood that occasionally Planning Committee members may need to miss Planning Committee and / or Work Group meetings. If there is a question as to whether a Planning Committee member should be considered "active" for purposes of decision-making, the Coordinating Committee will make that determination.

5. **Check-Ins:** Throughout the process, in order to determine if the group is moving in a particular direction, the facilitator may also ask for an informal "read" of the group's perspective. Answers to this type of facilitator's request are used for the purpose of developing the dialogue and not in anyway binding.

6. **Conditional Endorsements:** It is also understood that Planning Committee members represent organizations and, in some cases, may not be unable to make final commitments without conferring first with their organization. In this case, agreements will be considered conditionally endorsed, pending organizational confirmation.

IX. ENDORSEMENT AND ADOPTION OF THE PLAN

The Plan is to be endorsed by the Planning Committee. In addition to endorsing, four organizations will adopt the plan before January 1, 2006 (note: date may be changed following further discussion with DWR). The adopting organizations are to include a minimum of two of the four following public agencies: El Dorado Irrigation District, El Dorado County Water Agency, Placer County Water Agency, Nevada Irrigation District; and two of the four following non-profit organizations: Sierra Nevada Alliance, Natural Heritage Institute, South Yuba River Citizens League, and American Rivers. The Plan shall not go forward to the adopting organizations until the Planning Committee endorses the Plan using the decision-making rules as described in Section VIII above.

X. CABY PHILOSOPHY

The members of the CABY Planning Committee, the decision making body responsible for approving the IRWMP, affirm its commitment to work in good faith with all the diverse interests represented on the

Planning Committee. Good faith implies an obligation to regularly attend and participate in CABY meetings and Work Groups, strive to understand all perspectives, engage in dialogue and deliberation, and earnestly work toward building common ground and consensus with fellow Planning Committee members.

The CABY philosophy also acknowledges that Planning Committee members and their organizations may have to occasionally unilaterally pursue their interests during the CABY planning process. This is sometimes referred to as the reality of "living in two worlds" and does not imply that an organization is violating their good faith participation. No one participating in the CABY process is being asked to abandon their obligations to their organizations or give up any type of rights.

The Plan will not be a legally binding document. Rather, it will be a regional compact with accompanying commitments, possibly documented through a Memorandum of Understanding (MOU). Once an organization endorses the IRWMP, the act of endorsement comes with serious responsibilities to participate in the implementation of the Plan. This does not mean that, after the endorsement of the Plan, there will be no differences in approach, method or interpretation of the Plan. The Plan will be a living document and will need to change over time. But, what it does mean is that organizations endorsing the Plan agree to continue building common ground together and agree to resolve differences collaboratively through dialogue and, if necessary, dispute resolution processes.

XI. GROUND RULES

The group will utilize the following standing ground rules regarding meeting protocol and may modify them as appropriate.

The group agrees to:

- Listen and openly discuss issues with others who hold diverse views.
- View disagreements as problems to be solved rather than battles to be won.
- Refrain from ascribing motives or intentions to other participants.
- Respect the integrity and values of other participants.

Several specific rules apply during meetings: The group agrees to:

- Honor time.
- Use conversational courtesy.
- Keep pagers and mobile phones silent during meetings. Please return calls during breaks.
- Appreciate humor but do not engage in humor at the expense of others.

XII. OPEN PROCESS

1. All meetings of the CABY process are open to the public.

2. Planning Committee agendas will be sent out in advance of the meetings and posted on the CABY web site. At each meeting, the public will be given an opportunity to comment.

3. Members of the public are expected to adhere to the above CABY ground rules.

XIII. AMENDMENTS TO THIS CHARTER

The Planning Committee, utilizing the Charter decision-making process as described in Section VIII above, may adopt changes to this Charter.

Appendix B
Memorandum of Agreement and Resolution of Support

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

CABY Regional Water Management Group (RWMG) member organizations have executed the following Memorandum of Agreement (MOA) to outline procedures for adding and replacing member organizations of the RWMG, and for developing, administering, updating, and implementing an IRWMP for the CABY Region. CABY Stakeholder Group (SG) member organizations have executed the following Resolution of Support (ROS) to formally adopt the IRWMP. The MOA and ROS are attached here as Appendix B.

MEMORANDUM OF AGREEMENT ESTABLISHING
the
CABY REGIONAL WATER MANAGEMENT GROUP (CABY RWMG)

This Memorandum of Agreement (MOA) is between the signatories to this MOA, each of which is referred to individually as a "member organization" or “Party” and collectively as the "RWMG” or “Parties," as selected by Cosumnes American Bear Yuba (CABY) Stakeholders. The rights, responsibilities and relationship of the RWMG are defined in the CABY Integrated Regional Water Management Plan (IRWMP) and are summarized in this MOA. The member organizations of the RWMG are local water agencies, non-profit organizations, Tribal entities and Stakeholder groups involved with CABY regional water management.

The effective date of this MOA is _____.

PURPOSE

The rights, responsibilities and relationship between CABY Stakeholders are defined in the CABY IRWMP. The 2021 CABY IRWMP was created pursuant to the Integrated Regional Water Management Planning Act of 2002 (the "Act"; California Water Code, Division 6, Part 2.2) and has been found as compliant with current requirements for IRWMPs by the California Department of Water Resources (DWR). This MOA outlines procedures for adding and replacing member organizations of the RWMG, and for developing, administering, updating, and implementing an IRWMP for the CABY Region.

RECITALS

1. The CABY Integrated Regional Water Management (IRWM) Region consists of four (4) watersheds and twelve (12) sub-watersheds within the north central Sierra Nevada defined by the DWR through DWR’s “Regional Acceptance Process.”

2. California Water Code Section 10539 defines a RWMG as a group in which “three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements in Sections 10540 and 10541, participate by means of a joint powers agreement, memorandum of understanding, or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies.” The CABY IRWMP complies with California Water Code sections regarding a “written agreement” by requiring that all Stakeholder Group member organizations of the CABY IRWM adopt a standard Resolution of Support (ROS) for the CABY IRWMP as outlined in Chapter 4, Governance, of the IRWMP.

3. Based upon the requirements of the Act, a CABY IRWMP was originally adopted in 2007 which included a structural outline to develop and effectuate the purposes of the CABY IRWM group, a charter, a ROS adopted by the governing bodies of the participating parties, and governance framework. The structure of the CABY RWMG included the formation of a Planning Committee and a Coordinating Committee. This IRWMP and structure went through the “Regional Acceptance Process” and was accepted by DWR as compliant in 2009.

4. On May 30, 2014, the CABY Planning and Coordinating Committees adopted a 2014 IRWMP update. This update included a charter and a Resolution of Support, adopted by the governing bodies of the participating parties in further satisfaction of the requirements of Section 10539 of the Act, as well as set forth the intentions of the CABY IRWMP parties and provided a more detailed structure for governance.

5. In the 2021 CABY IRWMP, the "Coordinating Committee" has been renamed the "CABY RWMG."

6. The purpose of the CABY RWMG is to adopt, develop and update a CABY IRWMP that meets the requirements of the Act, as well as make decisions regarding the IRWMP process and related projects.

7. The Parties now enter into this MOA in furtherance of defining the roles of the CABY RWMG Parties. This MOA sets forth additional details and responsibilities with respect to the CABY RWMG and its member organizations.

GOVERNANCE

Policies and procedures for RWMG governance and operations are set forth in Chapter 4, Governance, of the CABY IRWMP. Representatives of organizations that adopt the ROS serve as the CABY Stakeholder Group "SG." This diversified set of participants can include water agencies, Tribal and other local governmental agencies, and nonprofit organizations. As described in Chapter 4 of the CABY IRWMP, the SG chooses the member organizations that serve on the RWMG.

RESPONSIBILITIES

As described in the 2021 CABY IRWMP, RWMG member organizations serve a two (2)-year term. Representatives of the CABY RWMG shall be appointed at the last meeting of the year, held in December. Member organizations of the RWMG agree to the following:

1. Member organizations shall support the CABY IRWMP.

2. Member organizations shall make every reasonable effort to attend all meetings of the RWMG. This includes the annual meeting held in December as well as any additional meetings that are scheduled.

3. RWMG member organizations shall be prepared to discuss the issues and business on the agenda, having read all background material relevant to the topics at hand.

4. Member organizations shall cooperate with, and respect the opinions of, fellow RWMG member organizations.

5. Member organizations shall represent the RWMG in a positive and supportive manner at all times and in all places.

6. Member organizations shall show respect and courteous conduct in meetings.

7. Member organizations shall observe established lines of communication between RWMG member organizations and SG member organizations.

8. Member organizations shall elect an administrator and a secretary as set forth in Chapter 4 of the 2021 CABY IRWMP. Those elected to these positions will have various responsibilities as set forth in Chapter 4 of the 2021 CABY IRWMP.

NEW PARTIES

1. A new Party may be added to this MOA, or a new Party may be substituted for an existing Party, upon the approval of the Parties to the MOA, in accordance with the process set forth in Chapter 4 Governance, of the CABY IRWMP.

2. This MOA shall be amended to reflect any change to the member organizations or composition of the RWMG.

RELATIONSHIP BETWEEN THE PARTIES; NO PARTNERSHIP OR JOINT VENTURE

1. The Parties to this MOA are not partners or joint venturers with each other.

2. The CABY RWMG shall have no authority to enter into contracts, sue or be sued, or otherwise incur liabilities.

3. No Party shall become liable by any representation, act or omission of any other Party.

4. This MOA is not for the benefit of any third party and shall not be deemed to give any right or remedy to any such party whether referred to herein or not.

MISCELLANEOUS

1. Withdrawal. Any Party may withdraw from this MOA thirty (30) days after providing written notice to the other Parties of its intent to do so.

2. Amendment. The Parties may not amend this MOA except by written agreement of the Parties.

3. Term. This MOA will remain in full force and effect until terminated in writing by all Parties.

4. Counterparts. The Parties hereto agree that this MOA may be executed and delivered in counterparts which, when taken together, shall constitute a fully-executed agreement. In addition, this MOA may be executed via electronic pdf transmission and any such pdf signature shall be deemed to be an original signature.

5. Funding. Entering this MOA is not a commitment of funds, but rather a commitment of participation.

The member organizations are signing this MOA as of the dates opposite their respective signatures.

[Signatures appear on the following pages.]

Member of

CABY Regional Water Management Group

[AGENCY/ORGANIZATION NAME]

Date: _____ By: _____

[NAME, TITLE]

ATTEST:

_____

[NAME, TITLE]

APPROVED AS TO FORM:

_____

[NAME, TITLE]

EXHIBIT A - CONTACT INFORMATION

Adopting RWMG Member Organizations for the 2021 CABY IRWMP

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

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Adopting RWMG Member Organizations for the 2021 CABY IRWMP

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

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Adopting RWMG Member Organizations for the 2021 CABY IRWMP

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

Member Organization:	
Physical Address:	
Primary Phone:	
Primary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	
Secondary Representative Name:	
Office Phone:	
Mobile Phone:	
Email Address:	
Term of Service:	

RESOLUTION ___[INSERT #]___ OF THE
BOARD OF DIRECTORS OF

_____
[NAME OF SIGNATORY ORGANIZATION]

Supporting the
Cosumnes, American, Bear and Yuba (CABY)
Integrated Regional Water Management Plan (IRWMP)

Whereas, population growth and development in the State of California will continue to pressure water resources, and balancing the needs of urban, agricultural, environmental and recreational water supplies will be a challenge for all involved in water management; and

Whereas, the CABY Integrated Regional Water Management (IRWM) Region consists of four (4) watersheds including the Cosumnes, American, Bear, and Yuba Rivers and twelve (12) sub-watersheds within the north central Sierra Nevada defined by the California Department of Water Resources (DWR) through their "Regional Acceptance Process"; and

Whereas, the CABY Stakeholder Group is composed of a diverse group of public agencies, water providers, agriculture, business, residential water users, community, recreation, and environmental organizations and tribal interests who have jointly developed a CABY Integrated Regional Water Management Plan (IRWMP) and have formally endorsed the CABY IRWMP; and

Whereas the CABY Stakeholder Group chooses representatives to serve as the CABY Regional Water Management Group (RWMG); and

Whereas, the CABY RWMG has formulated a cooperative governance structure necessary to implement the IRWMP as described in the IRWMP; and

Whereas, the IRWMP serves as a voluntary planning document that identifies a broadly-supported vision, guiding principles, goals, objectives and projects to enhance the beneficial uses of water for the CABY region; and

Whereas, this collaborative planning effort is intended to formulate water management strategies for the region and prioritize projects that address watersheds and regional issues; coordinate with other IRWMPs; address local, state and federal plans' priorities; achieve multiple benefits; encompass more than one watershed; and meet short- and long-term water resource needs; and

Whereas, an integrated regional approach to water management will streamline individual efforts and increase efficiencies; the CABY IRWMP will also increase partnership, collaboration and organizational capacity; and collaborative management will provide a forum for stakeholder input and support for projects that address the goals and objectives for the CABY region; and

Whereas, this regional planning effort will improve regional competitiveness for grant funding for projects and efforts to implement the IRWMP and achieve agency or organizational goals; and

Whereas, in January of 2018 the CABY RWMG began working on the update to the CABY IRWMP that was adopted in 2014; and

Whereas, by adopting this resolution of support, this organization is eligible to participate in the Stakeholder Group and is eligible to serve on the CABY RWMG; and

Whereas, the IRWMP is not be a legally binding document, but rather a regional compact with commitments to work together as a region to implement the plan; and

Whereas, though the IRWMP references many plans, and the adoption of the IRWMP does not equal an endorsement of all such plans or endorsement of all the plans that are referenced; and

Whereas, the IRWMP will be a living document, reviewed and updated over time, and signatory organizations can remain involved or terminate their involvement at any time.

THEREFORE BE IT RESOLVED, by _____[ORGANIZATION]_____ that:

The 2021 Cosumnes, American, Bear and Yuba Integrated Regional Water Management Plan is hereby approved and adopted as a voluntary document and plan.

The foregoing Resolution was duly adopted at a meeting of _____[ORGANIZATION]_____ held on ____[DATE]____ with the following vote on roll call:

Ayes:
Noes:
Abstained:
Absent:

Signed and approved by me after its adoption this _[DAY]_ day of __[MONTH]__, __[YEAR]__.

_____
[ORGANIZATIONAL REPRESENATIVE AUTHORIZED TO SIGN BOARD RESOLUTIONS]

ATTEST:

_____
[NAME AND TITLE OF PERSON WHO ATTESTS]

Appendix C
Community Needs Assessment

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

CABY, as part of the larger Mountain Counties Funding Area, contracted the Sierra Institute for Community and Environment to study the capacity, socioeconomic status, well-being, and water/wastewater needs of communities throughout the area. The Sierra Institute issued a report for the CABY region that articulates the current needs and capacities of Disadvantaged Communities with regards to water entitled, "Community Well-being & Water and Wastewater Needs Assessment for Cosumnes-American-Bear-Yuba (CABY) IRWM". It is attached here as Appendix C.

MOUNTAIN COUNTIES FUNDING AREA
INTEGRATED REGIONAL WATER MANAGEMENT DISADVANTAGED COMMUNITY INVOLVEMENT PROGRAM

COMMUNITY WELL-BEING & WATER AND WASTEWATER NEEDS ASSESSMENTS
FOR
Cosumnes-American-Bear-Yuba (CABY) IRWM

Prepared by the Sierra Institute for Community and Environment & Sierra Water Workgroup

2020

Jonathan Kusel, Ph.D., Sierra Institute (Executive Director)
Tracy Hruska, Sierra Institute
Andrew Mallinak, Sierra Institute
Lauren Miller, Ph.D., Sierra Institute
Valerie Hurst, Sierra Institute

Liz Mansfield, SWWG (Executive Director)
Jodie Monaghan, SWWG

This report is dedicated to the memory of Liz Mansfield.

We will miss Liz's energy and her dedication to improving watershed health and identifying ways to stimulate investment into the landscapes and communities of the Sierra Nevada. Liz had a passion to learn and to lead. This report would not have been possible without her and the Sierra Water Workgroup she so ably led.

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LIST OF FIGURES

CHAPTER 1. Executive Summary

As part of California's Proposition 1 funding for water supply, distribution, and infrastructure, all Funding Areas in the state received funds through the Disadvantaged Community Involvement program. In the Mountain Counties Funding Area, a portion of these funds were allocated to assess the capacity, socioeconomic status, well-being, and water/wastewater needs of communities throughout the region. These assessments utilized data from the U.S. Census Bureau, community meetings, focus groups, and surveys of water service providers. Community assessments were conducted by Sierra Institute for Community and Environment; assessments of water concerns and needs of water purveyors were conducted by Sierra Water Workgroup.

Portions of the CABY IRWM area are classified as "disadvantaged" or "severely disadvantaged" by the Department of Water Resources, based on median household income. However, this metric bears little correlation to other ways of assessing communities. The community capacity and socioeconomic status assessments reveal several persistent challenges shared by many communities throughout the CABY IRWM and the Sierra more widely, largely related to the combination of poverty, low population density, and decaying infrastructure. Communities in the CABY IRWM span a wide range of socioeconomic status, community capacity and community wellbeing, with communities on the outskirts of Sacramento and in the foothills scoring better than those deeper in the Sierras and with more rural populations. Many water service providers in El Dorado County (such as many Public Utility Districts) are challenged by lack of funds to hire staff, fund infrastructure maintenance, and keep pace with regulatory reporting requirements while simultaneously lacking the capacity to secure outside resources. Wildfire is a very significant threat to most of the IRWM, and most communities lack sufficient water storage and/or water pressure to fight fires effectively.

CHAPTER 2. Introduction

Coupled with state bond funding, Integrated Regional Water Management (IRWM) planning groups have significantly altered watershed management in California. Propositions 50 and 84 brought planning and implementation funds that were critically needed to address water-related issues in supply, quality and the environment. As these programs continued statewide, there emerged a growing gap between funded activities that addressed traditional water

management problems and those that addressed the needs of disadvantaged communities (DACs).

On November 4, 2014, California voters approved Proposition 1, the Water Quality, Supply, and Infrastructure Improvement Act. Proposition 1 authorized $510 million in IRWM funding to 12 hydrologic region-based Funding Areas. That $510 million was divided based on population, with the result that the Mountain Counties Funding Area – which includes CABY IRWM and much of the Sierra Nevada – received the least money of any Funding Area despite providing up to 60% of the developed water in the state. Prior to allocating the implementation funds, each Funding Area is required to implement a Disadvantaged Community Involvement Program, a program designed to ensure the involvement of DACs in IRWM planning efforts and close the gap of funded activities across a spectrum of communities.

The purpose of this report is to address that requirement and support Integrated Regional Water Management efforts in continuing to integrate and address the needs of DAC and Tribal communities within IRWMs. This report will: 1) build upon the 2016 IRWM Plan's identification of regional priority issues and challenges for DACs; 2) provide community assessments that may be more meaningful than DWR's single-measure determination of "disadvantaged" status based on income; 3) document the water and wastewater needs and challenges within the CABY IRWM; 4) document the technical assistance needs and requests for each IRWM; and 5) provide recommendations for how to benefit DACs and Tribes moving forward.

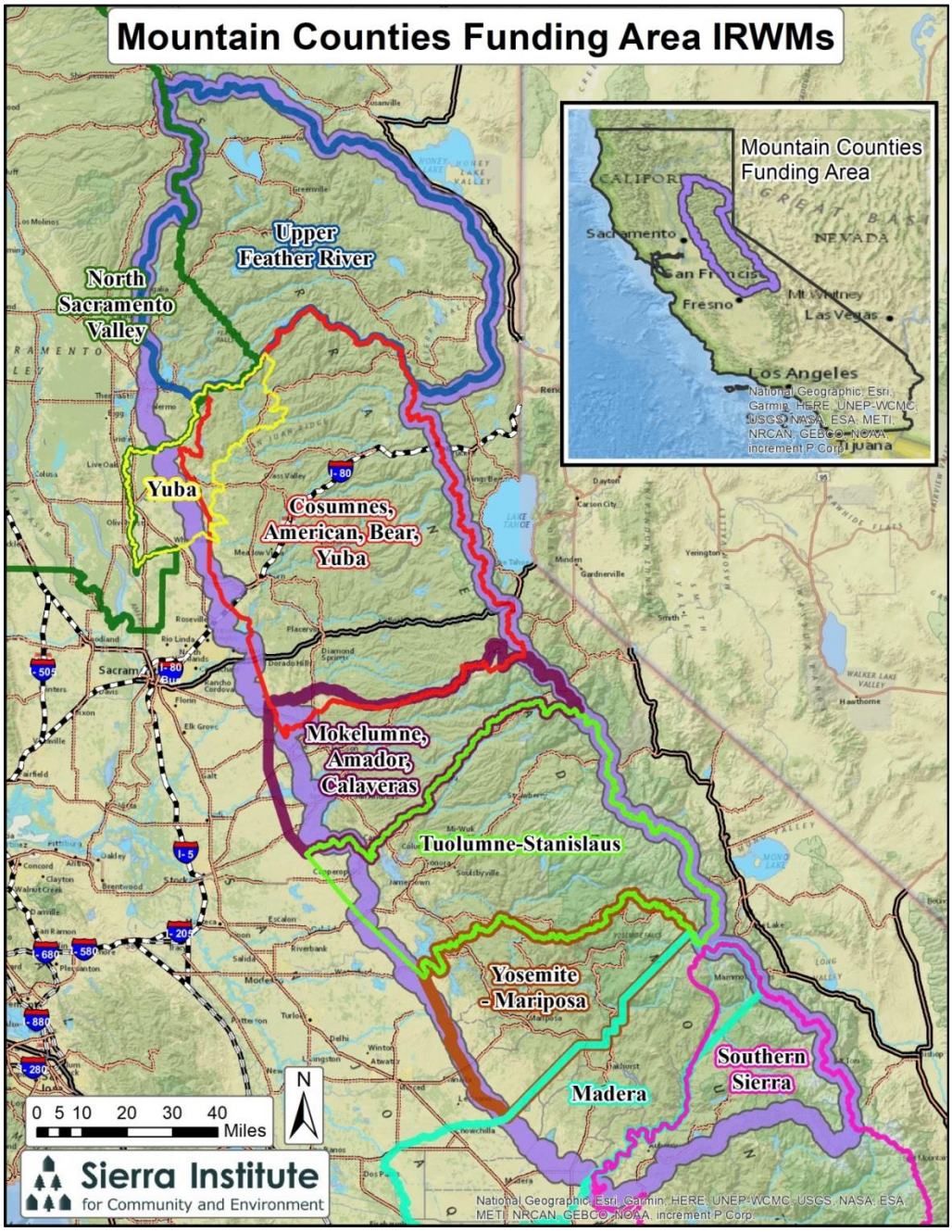
CHAPTER 3. Background

The DAC Involvement Program, authorized by Proposition 1, allocated $1.3 million over three years to the Mountain Counties Funding Area for the purpose of supporting and expanding involvement of disadvantaged communities, economically distressed areas (EDAs), Tribes, and underrepresented communities in IRWM planning efforts. Activities included in the Disadvantaged Community Involvement Program include funding for education, outreach and engagement, facilitation, technical assistance, site assessment, and project planning. Needs assessments to understand water related regions in the community are required.

There are 10 IRWM regions in the Mountain Counties Funding Area, each with its own Regional Water Management Group (RWMG) of the same name. They include:

- *American River Basin* (chose not to participate in the MCFA for Prop 1 funding)
- Cosumnes-American-Bear-Yuba
- Madera
- Mokelumne-Amador-Calaveras

- North Sacramento Valley
- Southern Sierra
- Tuolumne-Stanislaus
- Upper Feather River
- Yosemite-Mariposa
- Yuba County



Map 1. The Mountain Counties Funding Area with the nine participating Integrated Regional Water Management regions (American River Basin is not shown). Note that several IRWMs overlap with one another and some extend into adjacent Funding Areas.

Some of the IRWMs extend into adjacent Funding Areas (Map 1) and are eligible to apply for Prop 1 funding in both Funding Areas. In several instances, two or even three IRWMs overlap for a portion of their extent. In those cases, each IRWM has jurisdiction to work in the area of overlap, and they may choose to enter into formal agreements with other IRWMs sharing jurisdiction in order to improve coordination.

The MCFA Disadvantaged Community Involvement Program includes the following objectives:

1. Work collaboratively to involve DACs, community-based organizations, Tribes and stakeholders in IRWM planning efforts to ensure balanced access and opportunity for participation in the IRWM activities.

2. Increase the understanding of, and where necessary, identify water management needs of DACs and Tribes across the Funding Area.

3. Develop strategies and long-term solutions to address identified DAC and tribal water management needs.

In 2016, the MCFA DAC Coordinating Committee, which consisted of representatives from the nine participating IRWMs, participated in an open collaborative process to develop a Request for Proposals for implementing the DAC Involvement Program. A year later, the Sierra Institute for Community and Environment (Sierra Institute) was selected as the applicant for the MCFA DAC (and Tribal) Involvement Program.[1] The grant was executed November 2017.

The Sierra Institute, with guidance from the MCFA DAC Coordinating Committee, created a four-pronged approach for the DACI Program: 1) project management and grant administration; 2) identification, outreach and engagement of DACs and Tribes; 3) community capacity and needs assessment; and 4) technical assistance and capacity building.

Identification and assessment of disadvantaged, underserved, and low capacity communities through community capacity assessment and multiple socioeconomic indicators was a starting point to gain a more complete view of community well-being. Outreach and engagement of Tribes occurred concurrently, with California Indian Environmental Alliance (CIEA) leading the first year and tribal consultants Trina Cunningham and Dirk Charley taking a lead in the second year of the program.

[1] Though Proposition 1 and DWR laid out the requirement for a "Disadvantaged Community Involvement Program," the MCFA has typically referred to its program as the "Disadvantaged Community and Tribal Involvement Program" in an effort to acknowledge that Tribes may not be disadvantaged by the same standards as other communities but should also be better included and served in IRWM planning and management activities.

The benefit of this approach to DAC identification is the creation of a methodology that can be replicated so that communities are not excluded from funding based only on a single economic or environmental indicator, and so that the capability of communities to address local needs can also be considered. For the purposes of Proposition 1 funding, DWR defines "disadvantaged community" as an entity (Census tract, Census block group, or Census place) with a median household income less than 80% of California's overall median household income. Reliance on a single indicator using census data can skew results in areas with low populations and does not fully account for unincorporated communities. Additionally, single-indicator measures can be problematic with heterogeneous populations, as, for example, a large, well off group may swamp nearby less well off populations. Median household income (MHI) estimates in unincorporated areas often have a margin of error exceeding 100%. As a result, large portions of rural counties, like those in the MCFA, are excluded from funding that benefits DACs, even though most of the region is disadvantaged in some way, whether by poverty, a large number of female-headed households (that on average are considerably poorer) with children receiving public assistance, limited capacity, vulnerability to natural disasters, or distance from resources.

Community Capacity and Water/Wastewater Needs Assessment Workshops

A two-part series of workshops was held throughout the MCFA in 2018 and 2019. Part one of the workshop series assessed community capacity and part two assessed water/wastewater specific needs.

To assess community capacity, Sierra Institute first needed to identify communities. Using U.S. Census block groups, the smallest unit for which there is reliable and consistent demographic data, the approach ensured inclusion of dispersed populations throughout the region.

Sierra Institute followed the steps below for Community Capacity Workshops in each IRWM:

- Conducted a preliminary mapping exercise to identify communities in each IRWM (results shared and finalized at the workshops)
- Hosted Community Capacity Workshops with community members that could speak to the capacity of several communities in the IRWM. Those community members first reviewed preliminary maps and refined community delineations, then evaluated the physical, economic, human, social, and cultural capital of each of the communities they knew best, and discussed overall scores, identifying a consensus capacity score for each community.
- Finalized a report of capacity measures and narrative assessments of communities in all IRWMs in the MCFA

In addition to facilitating community capacity assessment, the community maps were subsequently used to gather U.S. Census data on five different aspects of socioeconomic status, which were then aggregated into a single socioeconomic status score. Merging community capacity and socioeconomic status allowed Sierra Institute to designate a relative Community Well-Being score to each community. These Community Well-Being scores serve as an alternative metric for determining "disadvantaged" status.

Part two of the workshop series was coordinated and facilitated by the Sierra Water Workgroup to address water/wastewater needs. The Sierra Water Workgroup (SWWG), which has worked with Sierra IRWMs for over ten years, was contracted by the Sierra Institute to fulfill Objective 2: *Identify the water management needs of DACs in each IRWM in the Funding Area.* The SWWG took the following steps to fulfill this objective:

- Conducted preliminary water and wastewater needs assessment survey
- Facilitated one Water/Wastewater Workshop in each IRWM (with the exception of Cosumnes-American-Bear-Yuba (CABY), which had 3 due to its size and population)
- Provided outreach and follow-up with water purveyors and other stakeholders on critical water issues and technical assistance needs
- Finalized DAC Water and Wastewater Needs Assessment for IRWM regions

CHAPTER 4. Community Assessments

For the purposes of Prop 1 funding, DWR defines "disadvantaged communities" (DACs) based solely on median household income (MHI). To qualify as disadvantaged, a Census tract, Census block group, or Census place must have a MHI below 80% of California's statewide average. To be "severely disadvantaged," an area must average less than 60% of the statewide average. To count as an "economically distressed area" (EDA), a status that brings with it certain lesser advantages in qualifying for Proposition 1 funding, a community must meet the following criteria:

1) Be a municipality of less than 20,000 people, a reasonably isolated and divisible segment of less than 20,000 people of a larger municipality, **OR** within an officially designated rural county;

2) Have a MHI less than 85% of California's statewide MHI

3) Be experiencing financial hardship (e.g. residential water/wastewater rate exceeds 1.5% of area's MHI), have an unemployment rate at least 2 percentage points higher than California's statewide average, **OR** have low population density (≤ 100 people/mi^2)

As discussed previously, the reliance on MHI presents several limitations, including a high margin of error in the statistics and the tendency for a pocket of wealthy residents to numerically obscure nearby impoverished areas. Furthermore, MHI is not necessarily a good indicator of capacity to respond to challenges such as wildfires, failing infrastructure, or water quantity/quality issues.

An alternative tool that some other state agencies use for determining community needs, CalEnviroScreen, combines public health and socioeconomic indicators with environmental metrics. Due to the formula used in CalEnviroScreen and the way unmeasured scores are treated among other deficiencies, rural communities in the Sierra often have high scores (meaning a low pollution burden and relative to other California communities minimally disadvantaged) despite significant challenges with episodic smoke from prescribed burning of forests and catastrophic wildfires, poverty, unemployment, failing infrastructure, fire risk, low political support or representation, low organizational capacity.

Sierra Institute employed a combination of two community assessments that avoid the pitfalls of both MHI and CalEnviroScreen: a community capacity assessment based on the knowledge of community residents regarding the capacity of their communities to tackle problems and a quantitative socioeconomic assessment based on five metrics drawn from U.S. Census Bureau statistics. Both of these assessment methods have relatively low correlation with simple MHI, with CalEnviroScreen, or with each other, indicating that they represent fundamentally different community attributes. Another way of understanding their important differences is that the socioeconomic assessment is a multi-component metric that provides a static measure of socioeconomic condition, while capacity is composed of five types of dynamic community attributes that collectively represent a community's ability to respond to resident needs and internal and external stressors. The two multi-item measures assess different dimensions of overall community well-being.

Community Capacity

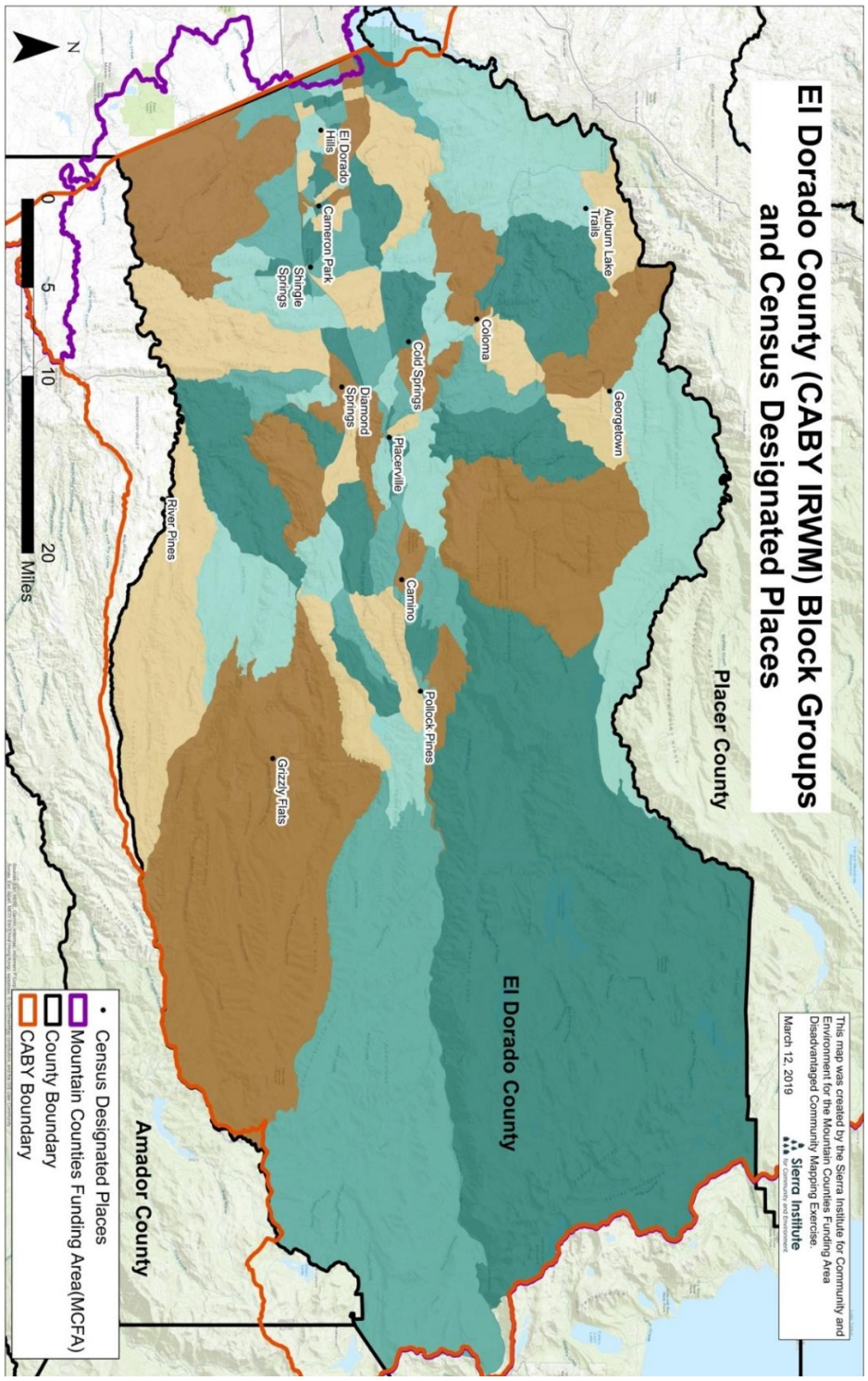
Methods

Step 1: Block Group Data- Mapping Exercise

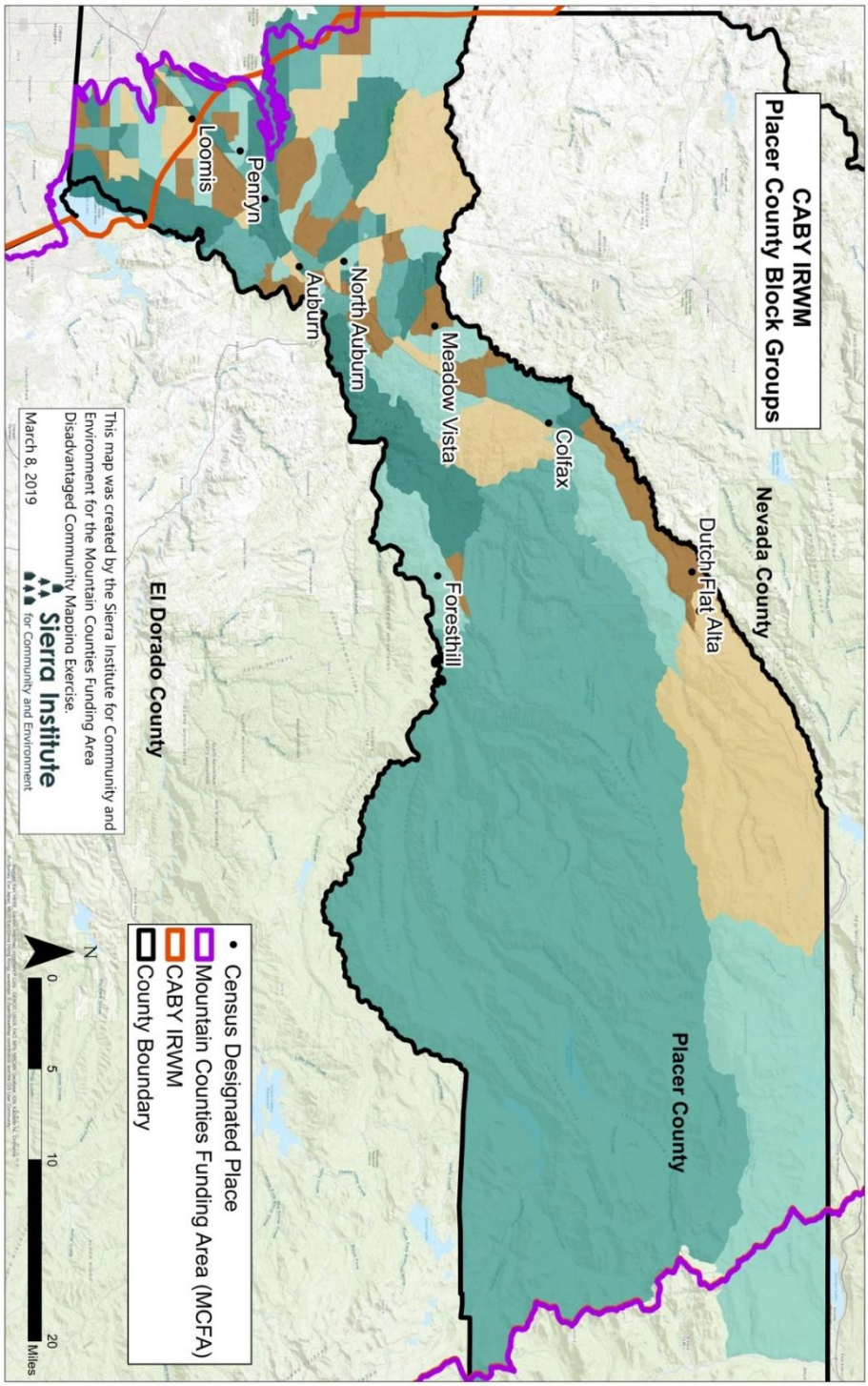
As part of an approach to identifying DACs, Sierra Institute first conducted a community mapping exercise involving county planners and local experts in order to delineate communities in the Mountain Counties Funding Area. The purpose of the exercise is to identify communities based on Census block group boundaries and social characteristics.

Sierra Institute first identified communities using block groups, which are an aggregation of U.S. Census Bureau blocks, and are the smallest unit for which there are reliable and consistent demographic data (Map 2). The use of block groups allowed for inclusion of all communities including the entire dispersed population across the regions. MCFA residents and local experts then aggregated adjacent block groups to create community units based on local knowledge of social process, economic activities, and administrative boundaries. Factors used for community delineation included common service centers, regular social and economic interactions, and/or shared social characteristics, geographic features, school systems and community service districts. Block groups were never split into smaller units to preserve data integrity. Identified community size varied, with borders spanning the size of a single block group, multiple block groups, and sometimes even crossing watershed and/or county boundaries.

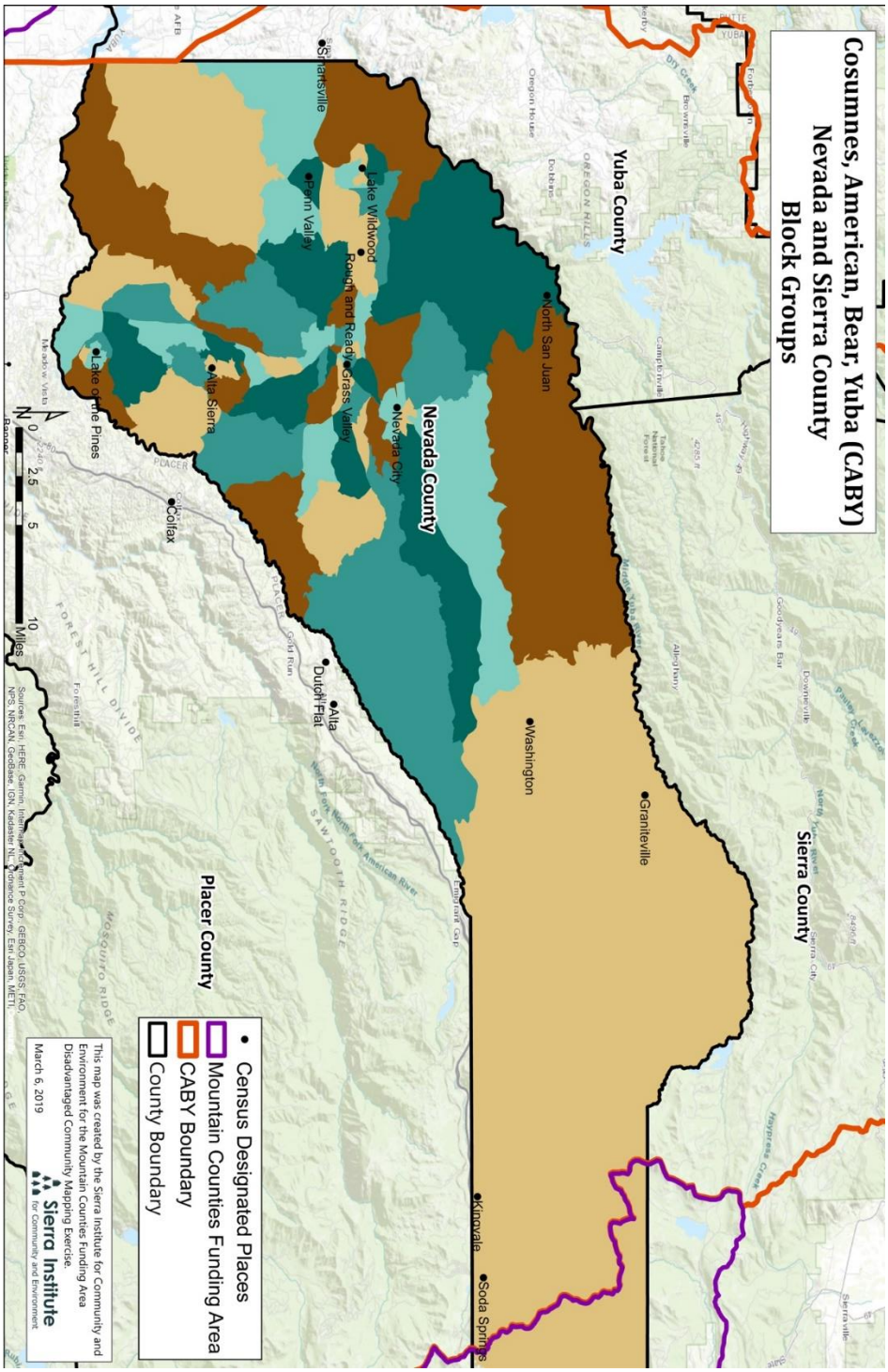
Exercise participants then named the communities resulting from the block group aggregations. A single name was occasionally sufficient for aggregated block groups but in a number of instances, two, three, and on occasion, even four names in conjunction were needed to capture the key population centers represented.



Map 2. Block groups in the El Dorado County region (CABY IRWM)



Map 3. Block groups in the Placer County region (CABY IRWM)



Map 4. Block groups in the Nevada and Sierra County regions (CABY IRWM)

Step 2: Community Capacity Assessment Workshop

Four workshops were hosted in the CABY IRWM, with each covering a different region. These regional workshops were comprised of El Dorado County (February 13th 2019 at the Gold Trail Grange in Coloma), Placer County (February 20th 2019 at the Sierra Vistas Community Center in Colfax), Nevada County (February 27th 2019 at the Nevada City Veterans Memorial Building in Nevada City), and Sierra County (Monday, March 18th 2019 at the Sierraville schoolhouse). These workshops had 25, 11, 15, and 10 participants respectively, with each participant bringing knowledge of several communities in the region.

After the Disadvantaged Community Involvement Program was explained, each workshop group was presented with a draft map of communities in the region that was informed by local knowledge from county planners and previous community capacity work for the Sierra Nevada Ecosystem Project (1996). Through small and large group discussions, participants edited the block group aggregations and community names in each region. For El Dorado County, Golden Valley/Greenwood was changed to "Garden Valley/Greenwood, " Mosquito became "Mosquito/Swansboro," Grizzly Flats/Mt.Aukum/Sumerset became "Grizzly Flats/Omo," the spelling of Newton/Sly Park changed to "Newtown/Sly Park," Cameron Park was removed from Shingle Springs/Cameron Park, and the name of "Quintett" was added onto the community of Volcanoville. Five new communities were formed by splitting block groups off from existing communities: "Cameron Park," "Somerset/Outingdale," "Auburn Lake Trails," and "Fair Play." For Placer County, participants altered Auburn/Bowman by removing "Bowman," added "Iowa Hill" to the existing community name of Colfax, changed the community of Eden Valley to "Weimar," changed Horseshoebar/Penryn to "Loomis/Penryn," and changed the community name of Rollins Lake/Dutch Flat to "Alta/Dutch Flat." For Nevada County, participants added "Airport" to Banner Mountain, added "Higgins" to the existing community name of Lake of the Pines, changed North San Juan to "San Juan Ridge/Newton," changed Cedar Ridge/Peardale to "Peardale", and combined the community name of Sunset with the community of Grass Valley. Participants edited Squirrel Creeks' boundary to encompass the formerly named community of Dead Man's Flat. The former community of Dark Horse became a part of the newly named "Lake of the Pines/Higgins" community. No alterations were made in the Sierra County region.

Final Communities Identified During Each Workshop

<u>El Dorado County</u>

- Auburn Lake Trails
- American River Canyon
- Camino
- Cedar Grove
- Coloma/Lotus
- Cool/Pilot Hill
- Diamond Springs
- El Dorado Hills
- El Dorado/Nashville
- Fair Play

- Georgetown
- Gold Hill
- Garden Valley/Greenwood
- Grizzly Flats/Omo/Somerset
- Kelsey
- Latrobe
- Mosquito/Swansboro
- Newtown/Sly Park
- Placerville
- Pleasant Valley
- Pollock Pines
- Rescue
- Shingle Springs
- Somerset/Outingdale
- Volcanoville/Quintett
- Fair Play
- Cameron Park
- Auburn Lake Trails

Nevada County

- Alta Sierra
- Banner Mountain/Airport
- Chicago Park
- Garden Bar
- Grass Valley
- Lake of the Pines/Higgins
- Lake Wildwood
- McCourtney
- Nevada City
- North San Juan Ridge/Newtown
- Peardale
- Penn Valley
- Red Dog/You Bet
- Rough and Ready
- Spenceville
- Squirrel Creek
- Tahoe National Forest

Sierra County

- Alleghany/Sattley
- Calpine/Downieville/Sierra City
- Loyalton/Verdi
- Sierraville

Placer County

- Applegate
- Auburn
- Auburn/Bowman
- Cape Horn/Moody Ridge
- Clipper Gap
- Colfax/Iowa Hill
- Weimar
- Foresthill
- Loomis/Penryn
- Meadow Vista
- Newcastle/Ophir
- North Auburn
- Placer East
- Alta/Dutch Flat
- Rural Lincoln
- South Auburn

CABY IRWM also includes areas of overlap with the Yuba, Upper Feather River, and Mokelumne-Amador-Calaveras (MAC) IRWMs, which were discussed in community capacity workshops for those IRWMs — Yuba workshop (December 5th, 2018 in Brownsville), Upper Feather River workshop (March 30th, 2018 in Quincy), and MAC workshop (August 14, 2018)

respectively. The communities identified through those workshops that fall within the CABY IRWM are as follows:

Yuba

- Challenge-Brownsville
- Dobbins
- Loma Rica
- Oregon House/Browns Valley
- Robinson Mill/Forbestown
- Smartsville
- Strawberry Valley/Camptonville/La Porte

Upper Feather River

- Meadow Valley/Bucks Lake

MAC

- Alpine Village/Kirkwood / Mesa Vista
- Ione/Jackson Valley
- Pioneer/Buckhorn
- Plymouth
- River Pines

Following community identification, the facilitator presented a definition of community capacity and the five capitals that collectively form capacity (Appendix B). Once participants had a strong grasp of these concepts, participants were asked to rate their own knowledge of each community on a scale of 1-3, then were assigned communities to assess based on their reported knowledge so that each community was assessed by at least two individuals. In El Dorado County, Shingle Springs, Auburn Lake Trails, Cedar Grove, Latrobe and Diamond Springs each had one survey completed. Camino, Fairplay, Newtown/Sly Park, Mosquito/Swansboro, Grizzly Flats/Omo, Kelsey, Gold Hill, Garden Valley/Greenwood, El Dorado Hills, Coloma/Lotus, Volcanoville/Quintett, Pleasant Valley and American River Canyon each had two surveys completed. Cameron Park, Placerville, Outingdale, El Dorado/Nashville, Georgetown, Cool/Pilot Hill, Rescue and Pollock Pines had three surveys completed. For Placer County, Cape Horn/Moody Ridge, Newcastle/Ophir, Meadow Vista, Loomis, Alta/Dutch Flat, Auburn/Bowman and Colfax/Iowa Hill each had one survey completed. Applegate, Chicago Park, Rural Lincoln, Placer East, Weimar, Foresthill, Auburn and Clipper Gap had two surveys completed. North Auburn had four surveys completed. For Nevada County, Spenceville and Garden Bar each had one survey completed. Lake Wildwood, Alta Sierra, Banner Mountain/Airport, Squirrel Creek, Rough and Ready, McCourtney, Red Dog/You Bet, Penn Valley and Peardale had two surveys completed. San Juan Ridge/Newtown, Chicago Park, Lake of the Pines/Higgins, Condon Park and Tahoe National Forest had three surveys completed. Grass Valley and Nevada City each had four surveys completed.

Most participants completed surveys for 3-4 communities, evaluating them based on their financial, social, cultural, human, and physical capital and overall capacity (see Appendix B). Results from these surveys were confidential and displayed to the whole group without attribution to prompt further discussion. Participants were encouraged not to identify how they personally scored a community to the rest of the group to facilitate discussion of scores. This was aimed at creating a comfortable and open dialogue to encourage all voices. During the full group discussion, communities were given an overall capacity score based on their assets and deficits across the five capitals and through intensive discussion, with the final score determined by consensus. Once all communities were scored, the scores were reviewed with respect to similar scores and relative to all the other communities, with the group agreeing on final consensus capacity scores for each community.

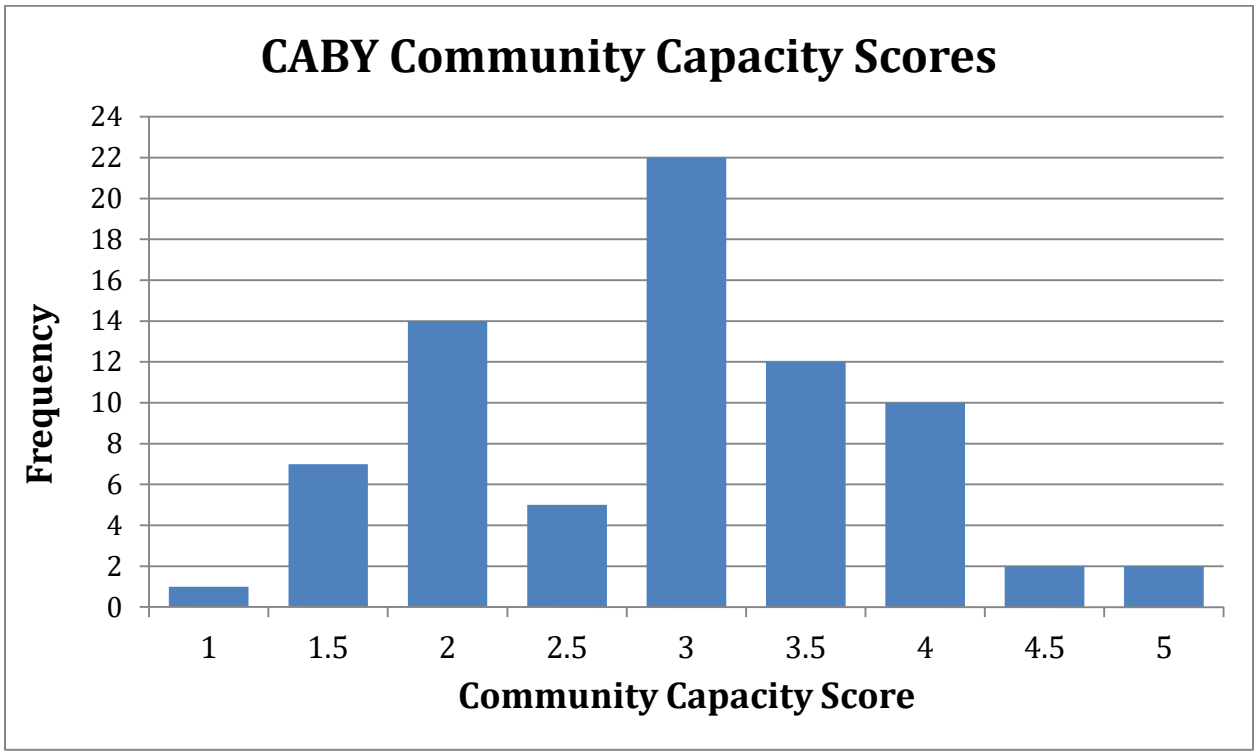
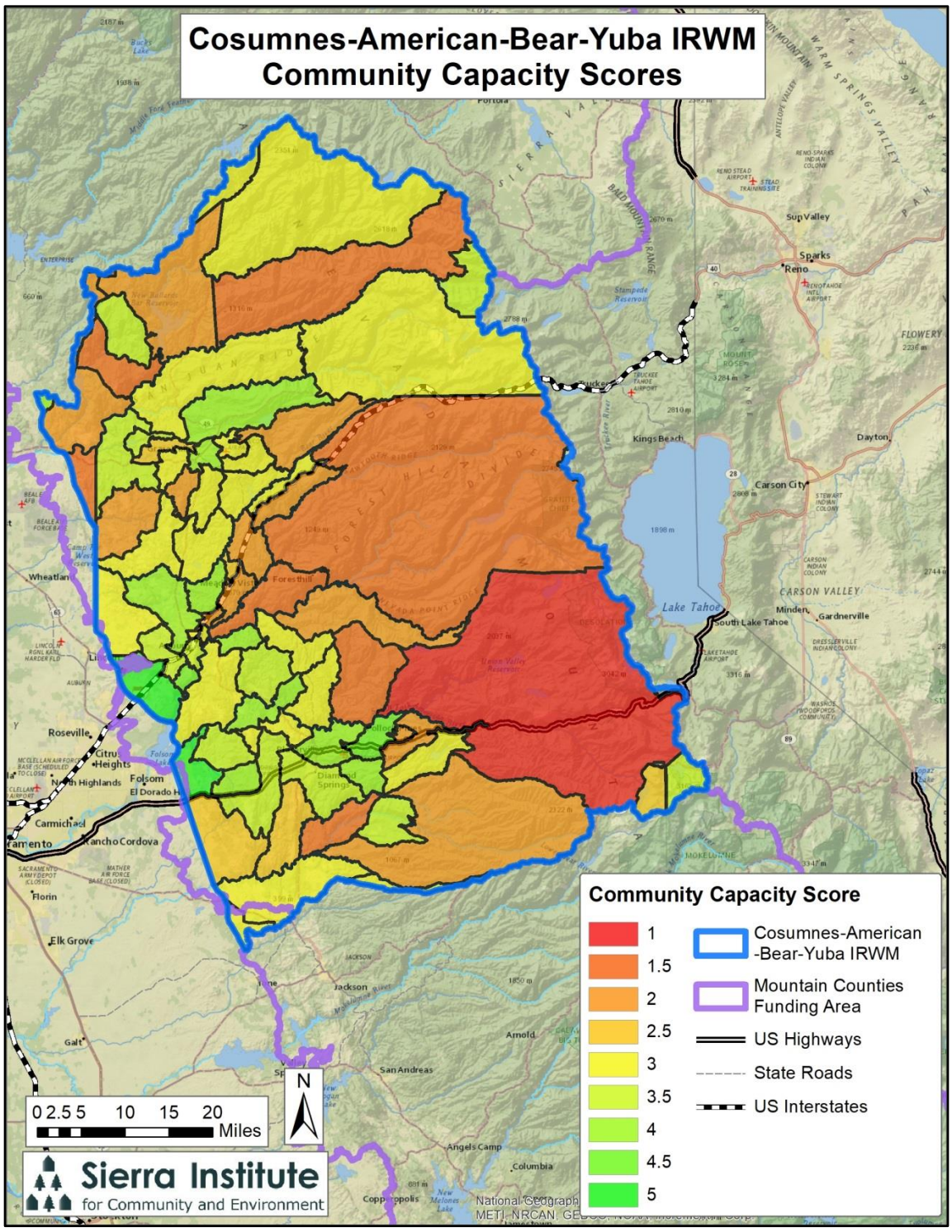


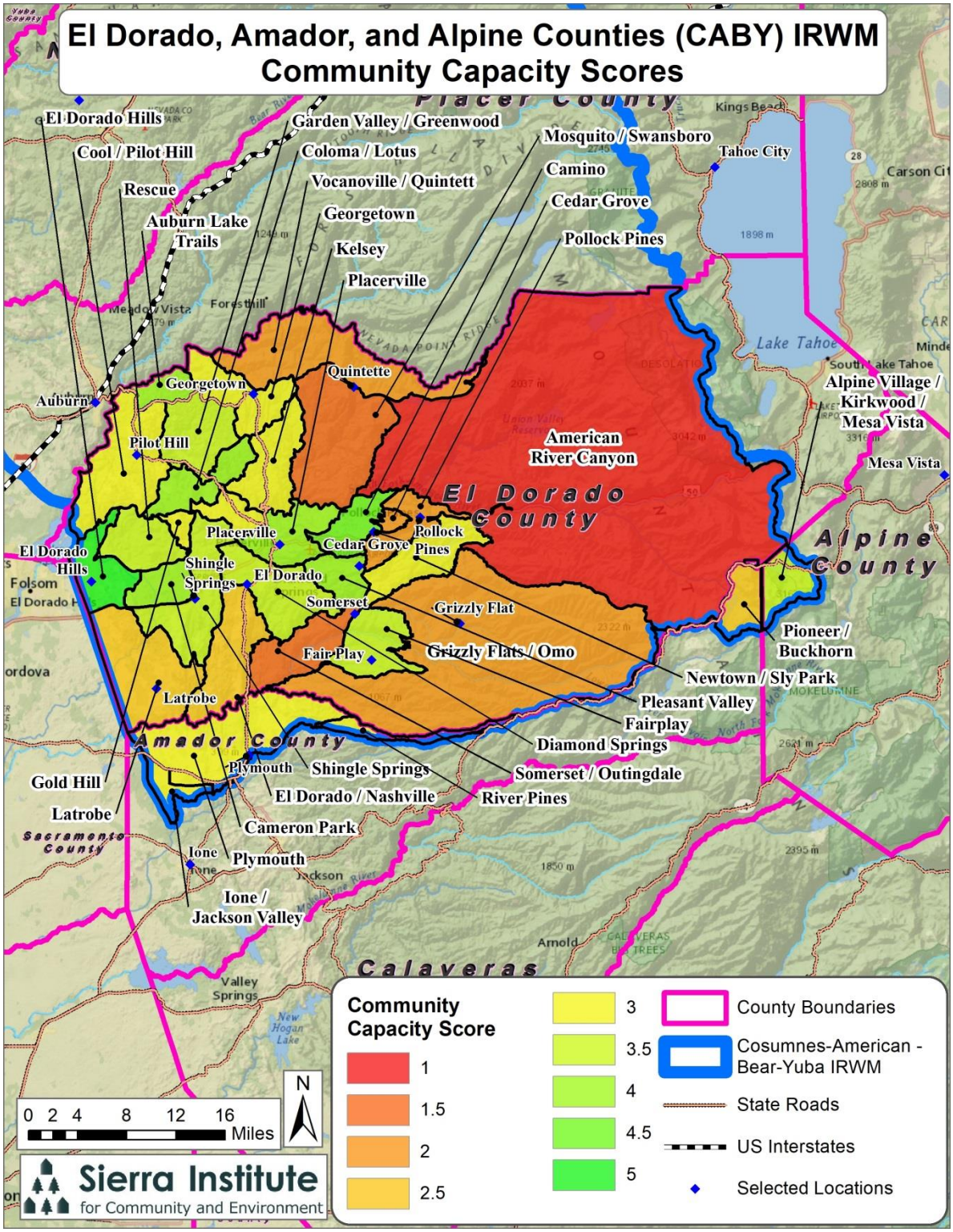
Chart 1. Histogram of Community Capacity scores for the El Dorado County region (CABY IRWM)

Above is a histogram of all community capacity scores for the CABY IRWM compiled from the capacity workshops. The histogram shows the overall frequency of each community capacity score, ranging from 1 – 5. CABY IRWM community capacity scores are generally normally distributed, with most communities scoring in the 2-4 range and a score of 3 being the most common. A large exception to this normal distribution is the low frequency of 2.5 score communities. This distribution mirrors the overall MCFA Community Capacity score distribution closely. Higher scoring communities are located closer to the greater Sacramento area and

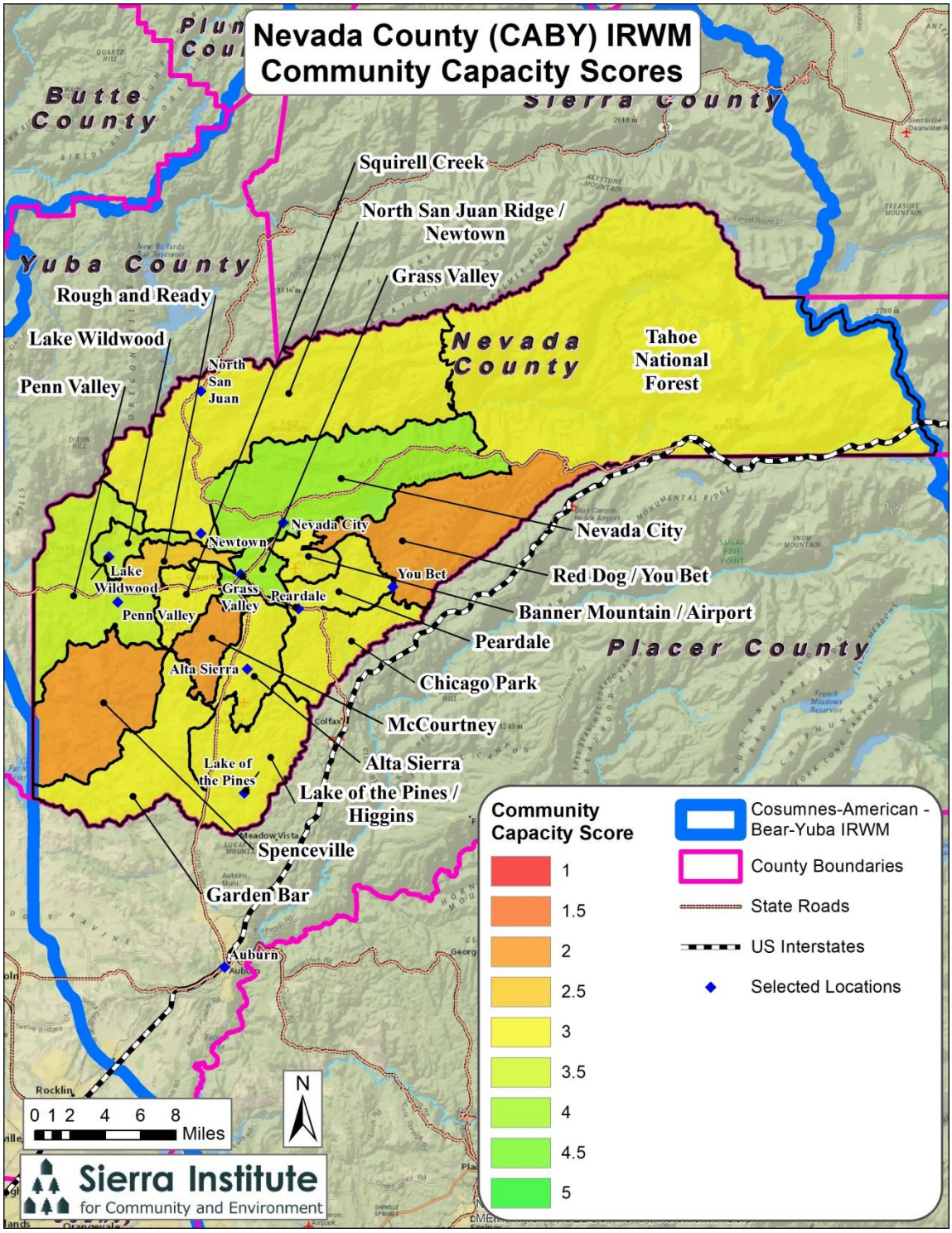
foothills, where commuting for work in the city is common, while rural areas deeper in the Sierra Nevada exhibit lower scores due to reasons such as lower population and poor infrastructure (Map 3). Nevada County in particular has greatly benefited from this ex-urban development despite the distance of some communities from the metropolitan areas of Sacramento and Reno (Map 5). Due in part to the IRWM's proximity to the aforementioned population centers, the CABY IRWM possesses some of the highest community capacity scores in the MCFA.



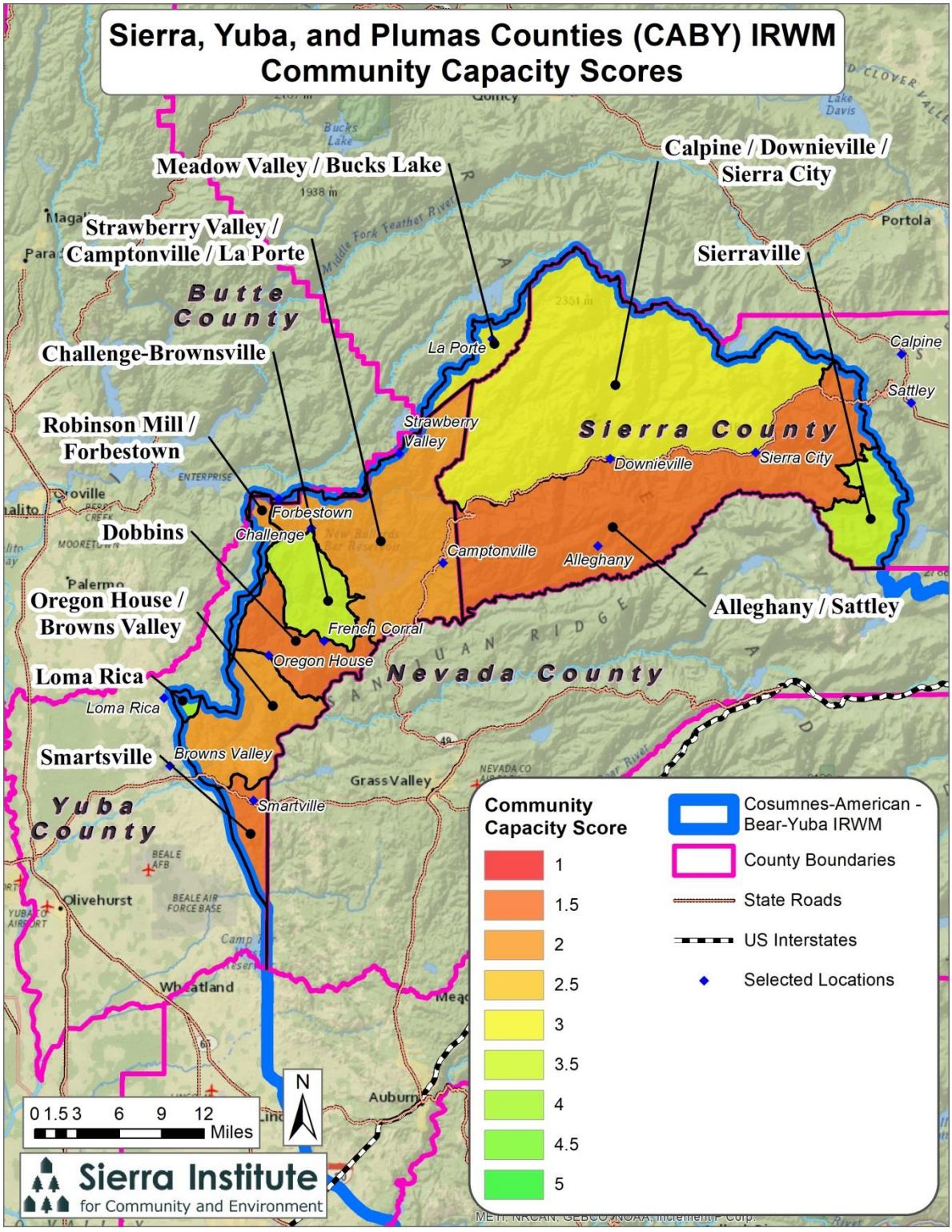
Map 3. Community Capacity scores for the CABY IRWM.



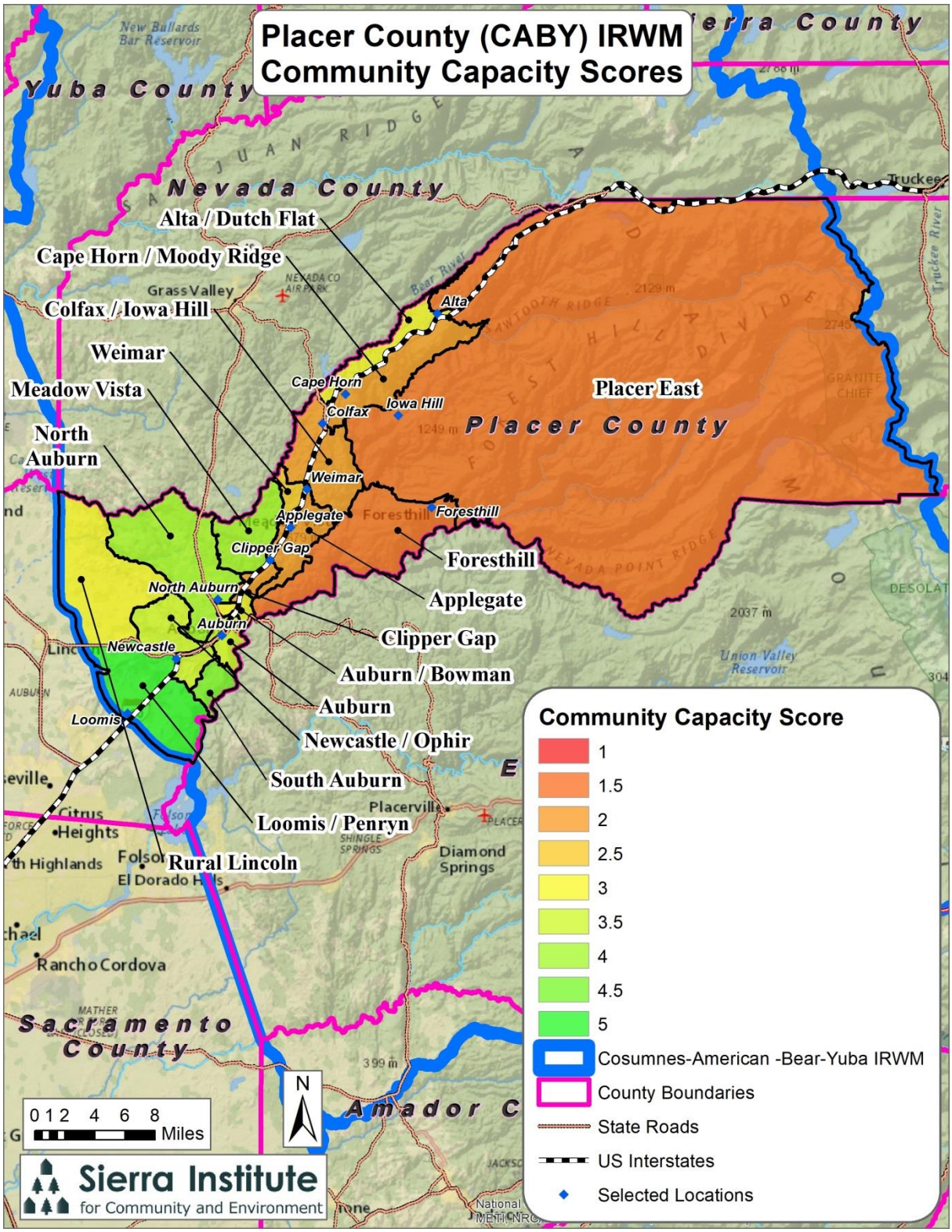
Map 4. Community Capacity scores for the El Dorado County region (CABY IRWM), which includes portions of Amador and Alpine counties.



Map 5. Community Capacity scores for the Nevada County region (CABY IRWM).



Map 6. Community Capacity scores for the Sierra County region (CABY IRWM), which includes portions of Yuba and Plumas counties.



Map 7. Community Capacity scores for the Placer County region (CABY IRWM).

Socioeconomic Status

The socioeconomic assessment used data collected at the level of Census block groups that was aggregated into the same communities identified through the Community Capacity workshop process. Data were drawn from the American Community Survey of the U.S. Census Bureau. Six categories were selected and analyzed to produce an overall Socioeconomic Status score:

- Housing Tenure – Proportion of housing in community that is occupied by the owner vs. rented. Housing tenure is suggestive of the relative wealth and permanence of residents in an area and offers an insight into the degree of local control over housing resources.
- Poverty Status – Proportion of residents with income below the annual income poverty threshold, calculated by family size, as well as the relative intensity of poverty of those individuals.
- Education Level – Measure of residents' (25 years and older) overall education level, with higher education producing a higher score
- Employment – Proportion of residents in the labor workforce who are currently employed
- Public Assistance – Proportion of children eligible for free and reduced-price school lunches

Community scores within each of the five categories were relativized across the entire MCFA before the five scores for each community were combined to create an overall composite score. The composite scores for all communities across the MCFA were then divided into seven categories, with 1 being the lowest and 7 being the highest.

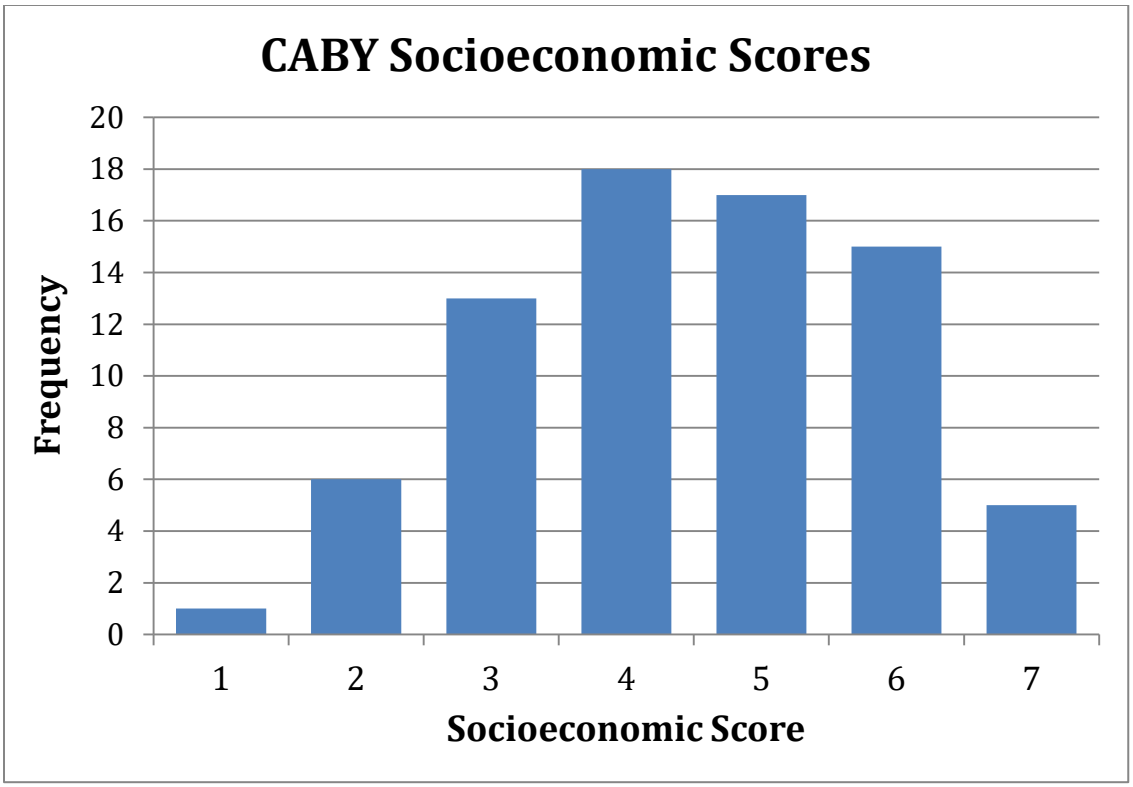
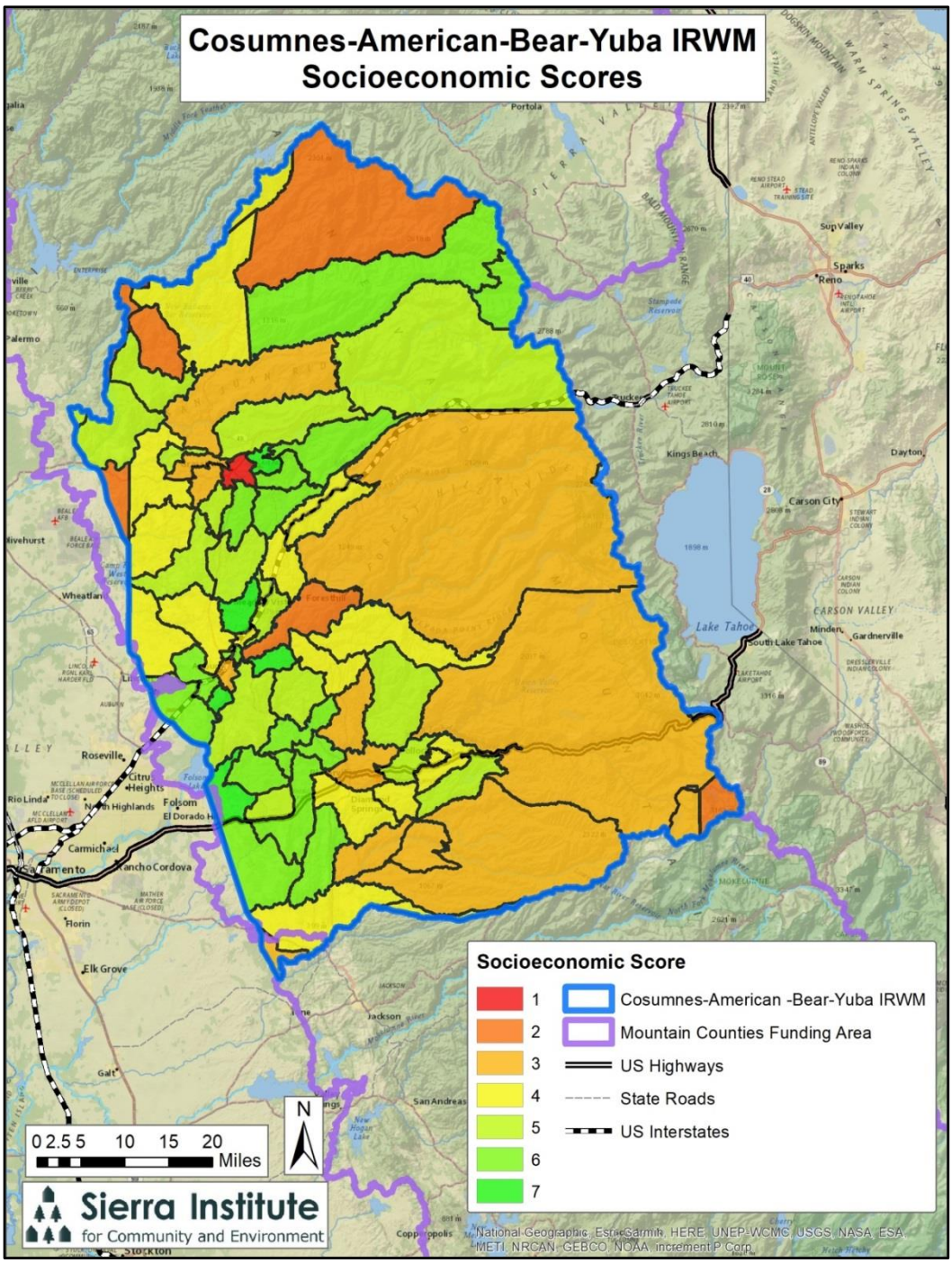
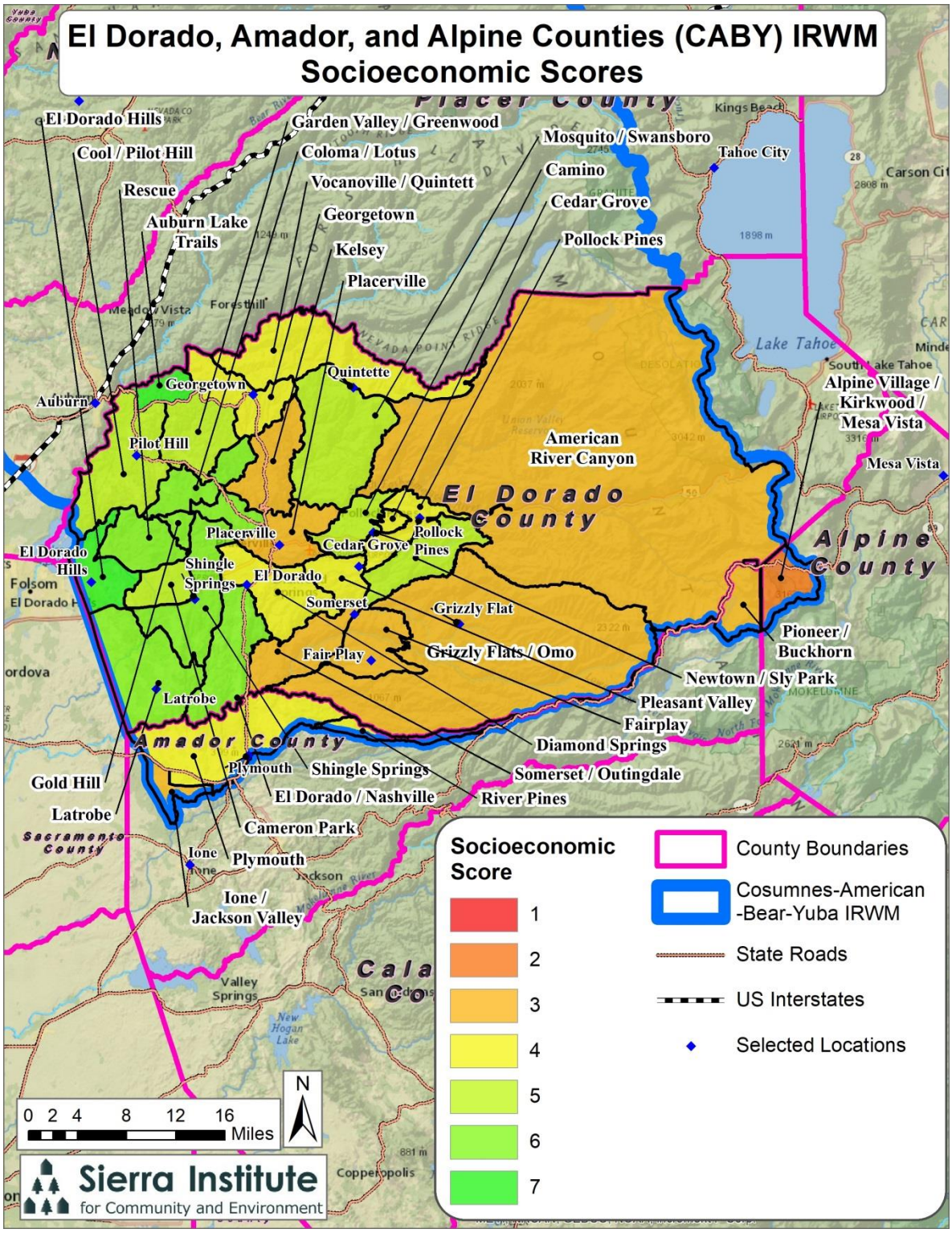


Chart 2. Histogram of Socioeconomic Status scores for CABY IRWM

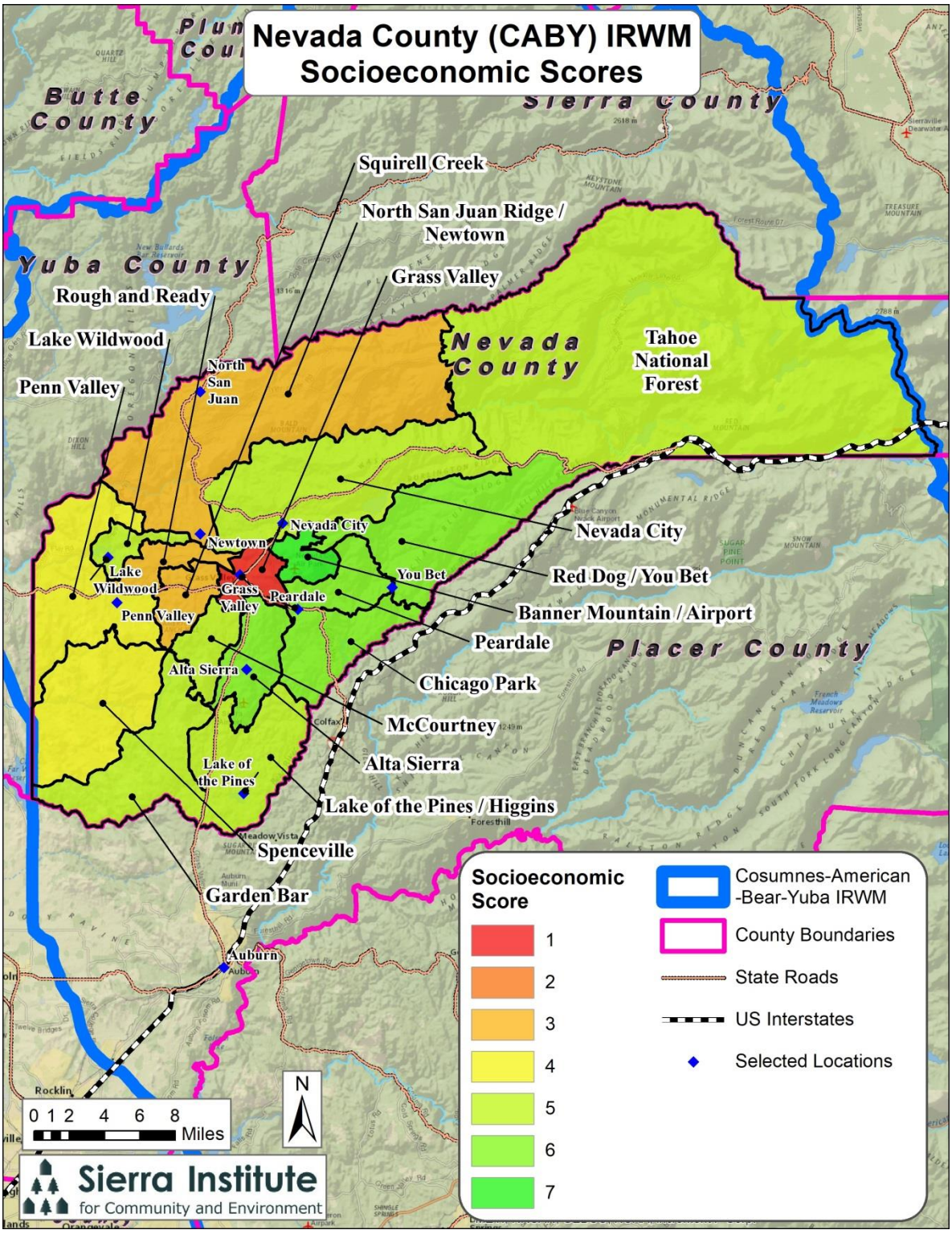
The distribution of MCFA communities across the 7 Socioeconomic Status scores follows an approximate normal distribution, with the majority of communities falling in the middle of the spectrum. CABY IRWM communities also follow this approximate normal distribution, with a slight skew towards higher scores and the most common Socioeconomic Status score across the IRWM being a 4 out of 7 (Chart 2). As with the Community Capacity scores, the Socioeconomic Status scores across the CABY IRWM generally increase with proximity to the Sacramento metropolitan area (Map 8). In general, MCFA communities score similarly in both Socioeconomic Status and Community Capacity scores. This relationship does not always hold true though. For example, there are many cases where communities possessing a large number of vacation homeowners who are only present seasonally raise the median household income for an area, but are not present to assist with community projects or be active in the communities at all, resulting in lower community capacity. This could be the case for several communities in Sierra County, which exhibit poor Community Capacity but high Socioeconomic Status scores (Map 11). However, just as in Community Capacity scores, the CABY IRWM possesses some of the highest Socioeconomic Status scores in the MCFA.



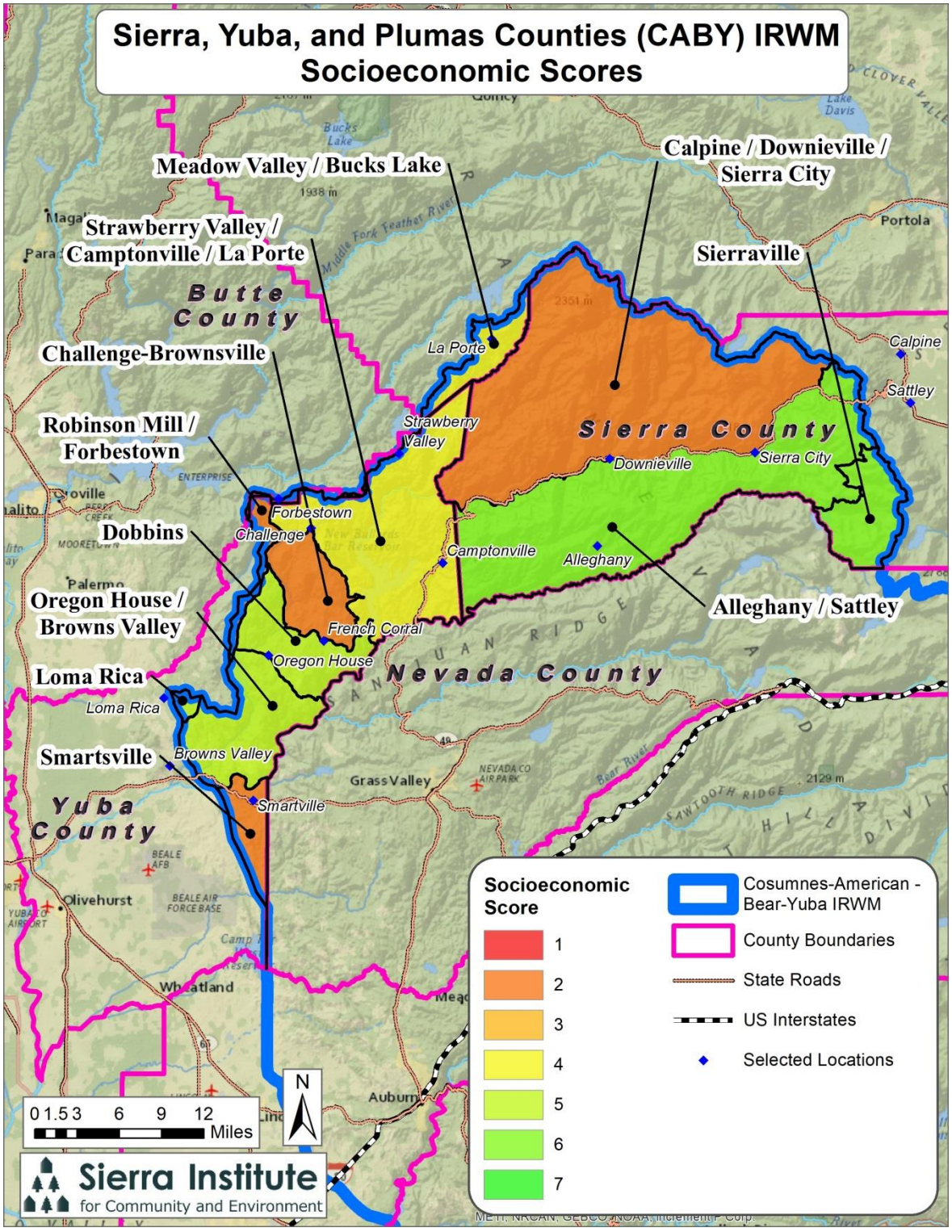
Map 8. Socioeconomic Status Scores for communities in the CABY IRWM



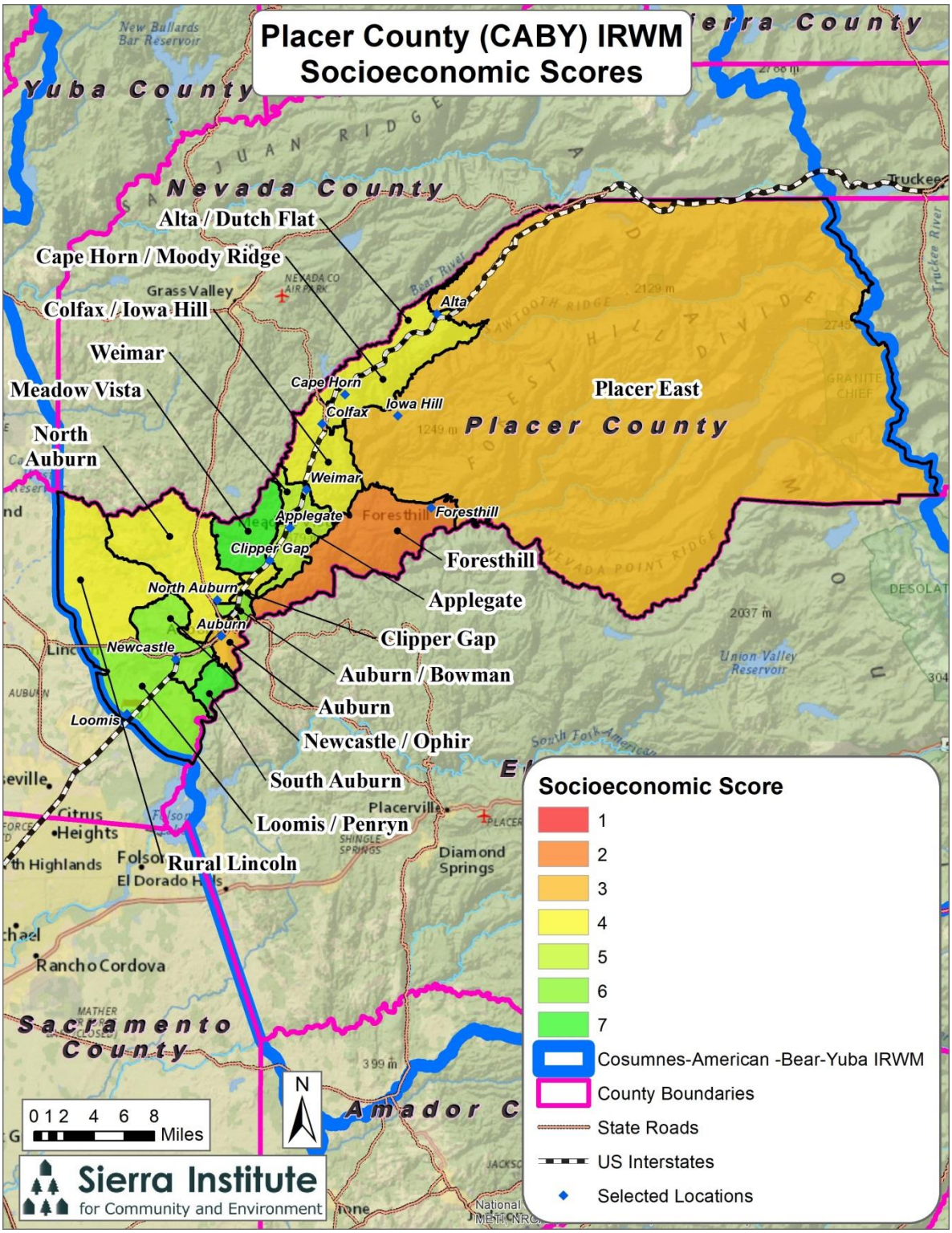
Map 9. Socioeconomic Status scores for the El Dorado County region (CABY IRWM), which includes portions of Amador and Alpine counties



Map 10. Socioeconomic Status scores for the Nevada County region (CABY IRWM). Note the Tahoe National Forest area, which is a large rural community deep in the mountains which, unlike most other similarly situated communities, has a high Socioeconomic Status. This could be due to its proximity to the wealthy town of Truckee or Reno.



Map 11. Socioeconomic Status scores for the Sierra County region (CABY IRWM), which includes portions of Yuba and Plumas counties. Note that Sierraville reports to have an increasing number of commuters to Truckee and Reno, while Downieville has experienced a relatively recent economic resurgence.

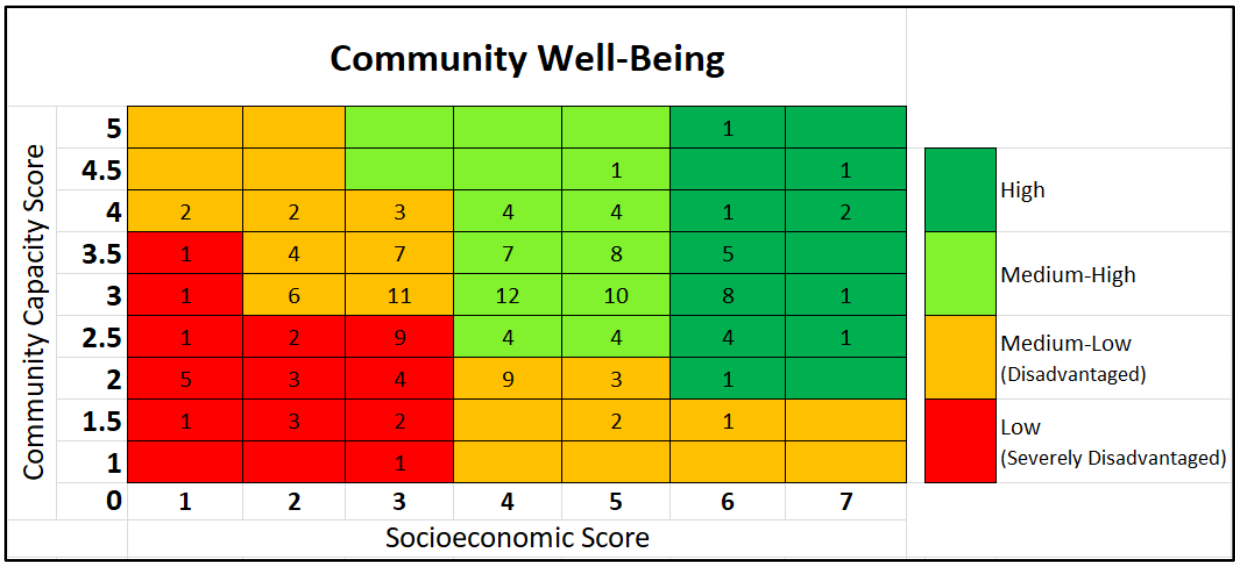


Map 12. Socioeconomic Status scores for the Placer County region (CABY IRWM)

Community Well-Being

Community Well-Being levels were created by combining Community Capacity and Socioeconomic Status scores. Communities that had low scores in both attributes were assigned a Community Well-Being score of Low, and communities with high scores in both categories received a score of High. Communities with Medium-Low and Medium-High scores were those that had either middling scores in both categories or had significant differences between their Community Capacity and Socioeconomic Status scores.

As discussed above, Community Capacity and Socioeconomic Status measure different dimensions of well-being, and so combining them into a single Community Well-Being score deserves some explanation. Community Capacity is a measure of a whole community's ability to respond to internal and external stressors, overcome obstacles, and take advantage of opportunities (or create opportunities) for improvement. Socioeconomic Status is a composite of attributes primarily at the individual household level. When a community is affected by an adverse event (fire, economic recession, water shortages), individuals with higher Socioeconomic Status are better able to avoid the worst effects and/or to recover more quickly.



Community Capacity Score	1	2	3	4	5	6	7
5						1	
4.5					1		1
4	2	2	3	4	4	1	2
3.5	1	4	7	7	8	5	
3	1	6	11	12	10	8	1
2.5	1	2	9	4	4	4	1
2	5	3	4	9	3	1	
1.5	1	3	2		2	1	
1			1				

Table 1. Matrix of MCFA Community Capacity scores and Socioeconomic Status scores. This table shows both how each combination of scores was assigned an overall Community Well-Being score and how many communities within the entire MCFA received each combination of scores, as indicated by the number in each box. A Well-Being score of Low can be interpreted as "severely disadvantaged," while a score of Medium-Low can be interpreted as "disadvantaged." Matrix of MCFA Community Capacity and Socioeconomic Status Scores.

However, in communities where Socioeconomic Status is high but Community Capacity is low, individual households within the region may pull through tough times but the community as a whole is less able to address challenges and therefore is more likely to be adversely affected, such as by the loss of already limited businesses or services.

To put the Community Well-Being scores into the language of Prop 1, "disadvantaged" and "severely disadvantaged" status can be viewed through the lens of capacity *or* socioeconomic status, the latter of which is more in line with DWR's definition based solely on median household income. Sierra Institute believes, however, that "disadvantaged" be viewed as a combination of both Community Capacity and Socioeconomic Status, as was done in the peer-reviewed Sierra Nevada Ecosystem Study (1996). When combining the two, a score of Medium-Low would constitute "disadvantaged" status, while a Low score would constitute "severely disadvantaged" status. The difference between this approach and use of median household income is considerable, as can be seen by comparing the different metrics in Tables 2-5.

As a result of the number of high scoring communities for both Community Capacity and Socioeconomic Status scores in the CABY IRWM relative to the MCFA, the CABY IRWM also exhibits higher Community Well-Being, with relatively few communities possessing a "low" score. However, it should be noted that the most common score is still "medium-low" Community Well-Being, showcasing the need for assistance across the MCFA despite the benefits that the CABY IRWM gains from its proximity to urban centers as noted previously in this report. Within the CABY IRWM, Sierra County experiences the lowest Community Well-Being. This is most likely due to its distance from any urban centers and its subsequent rural, sparsely populated status, with relatively few amenities to attract wealthy residents, businesses, or political attention.

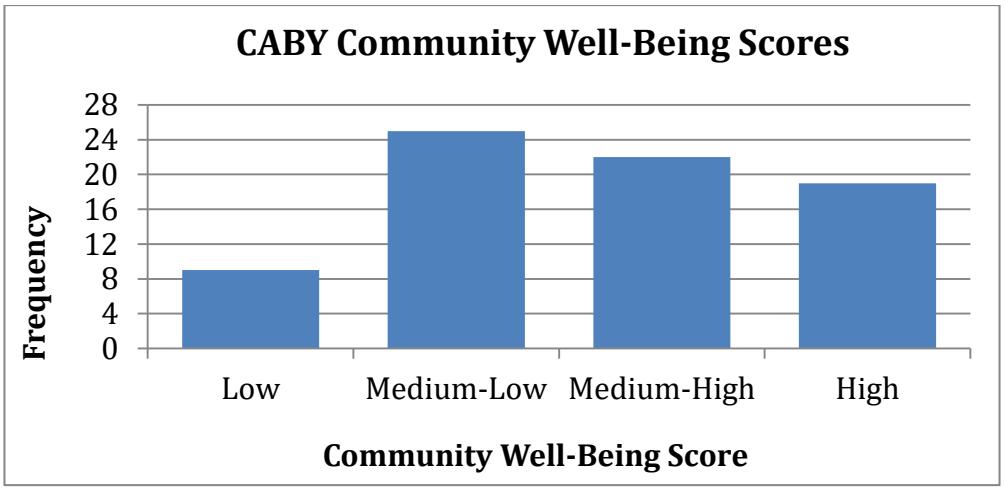
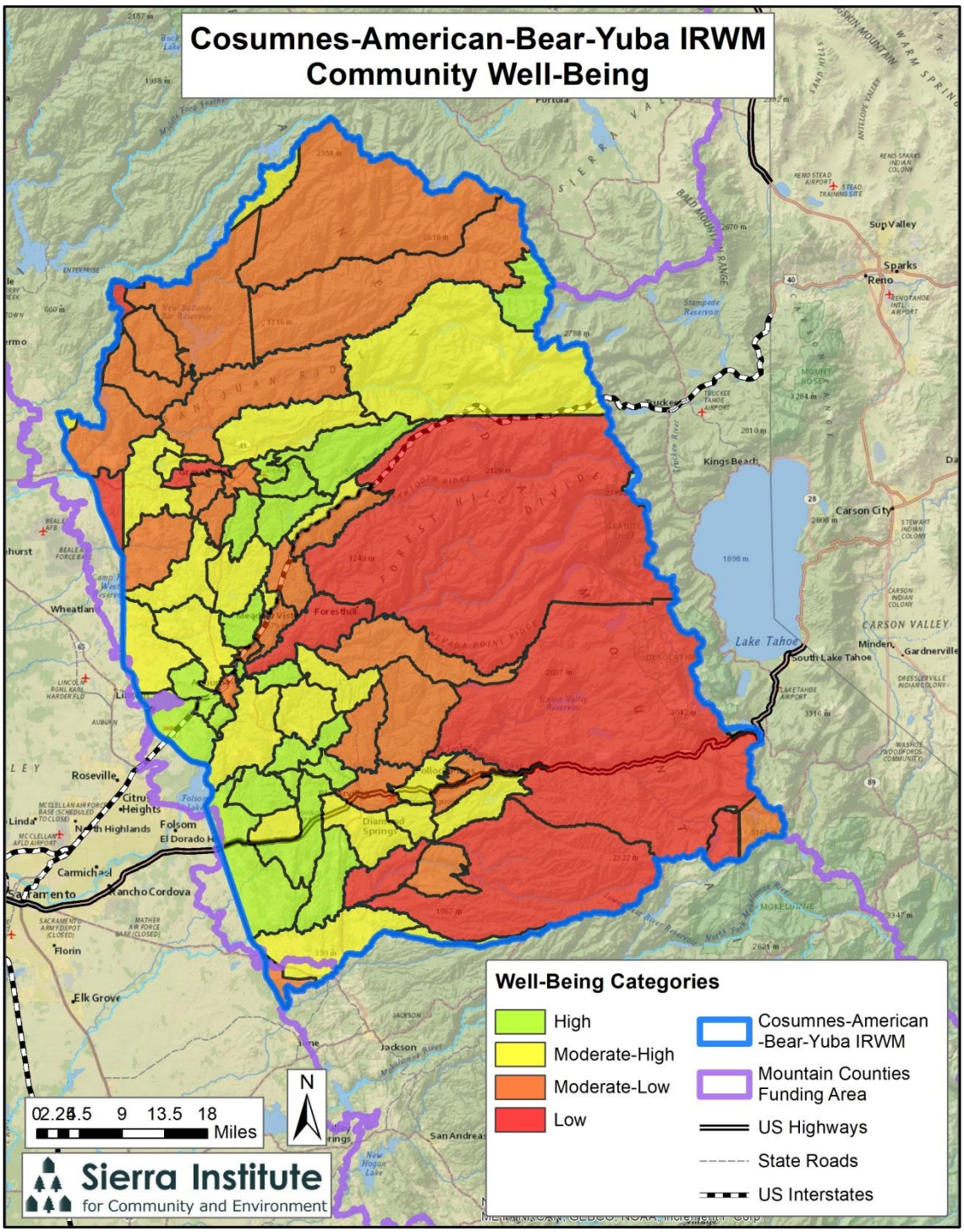
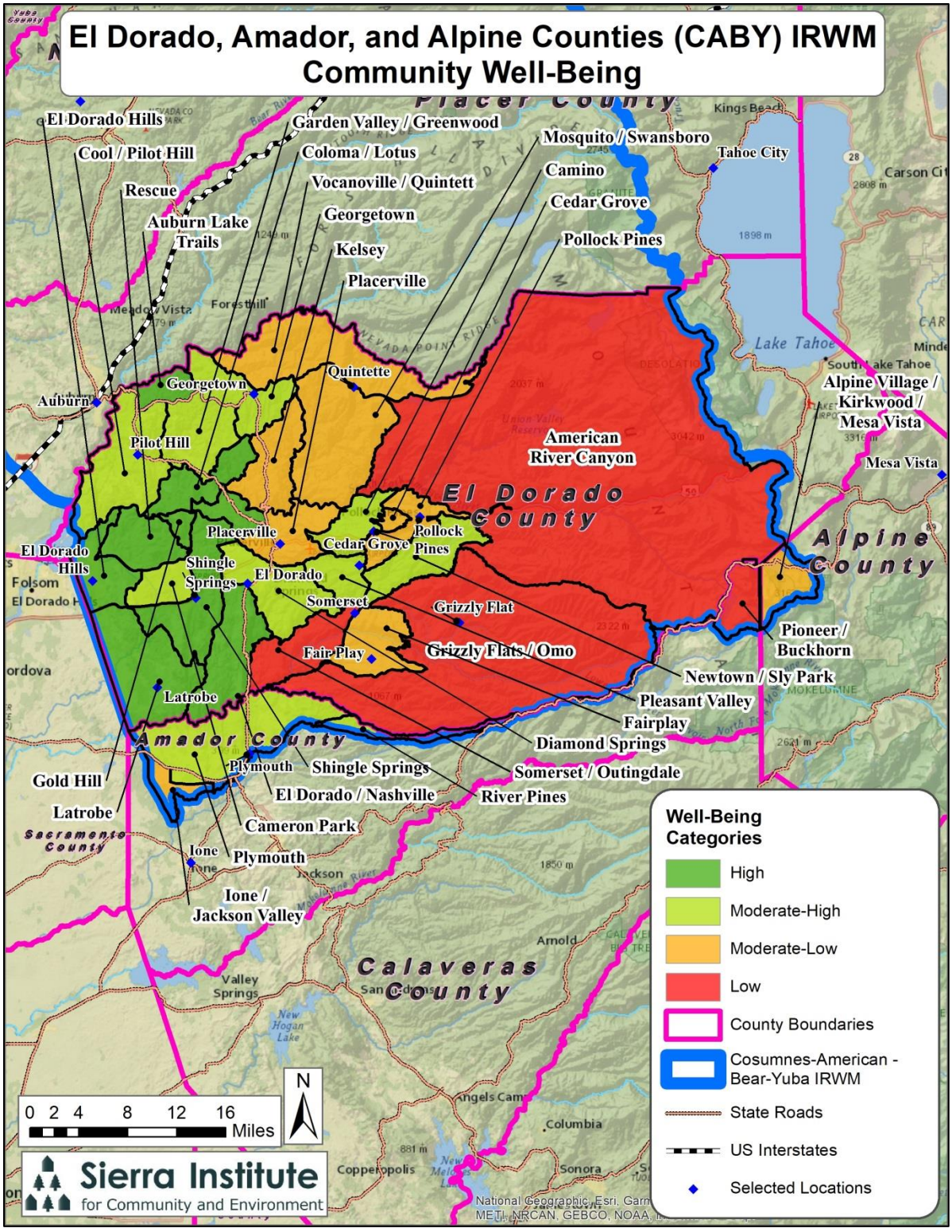


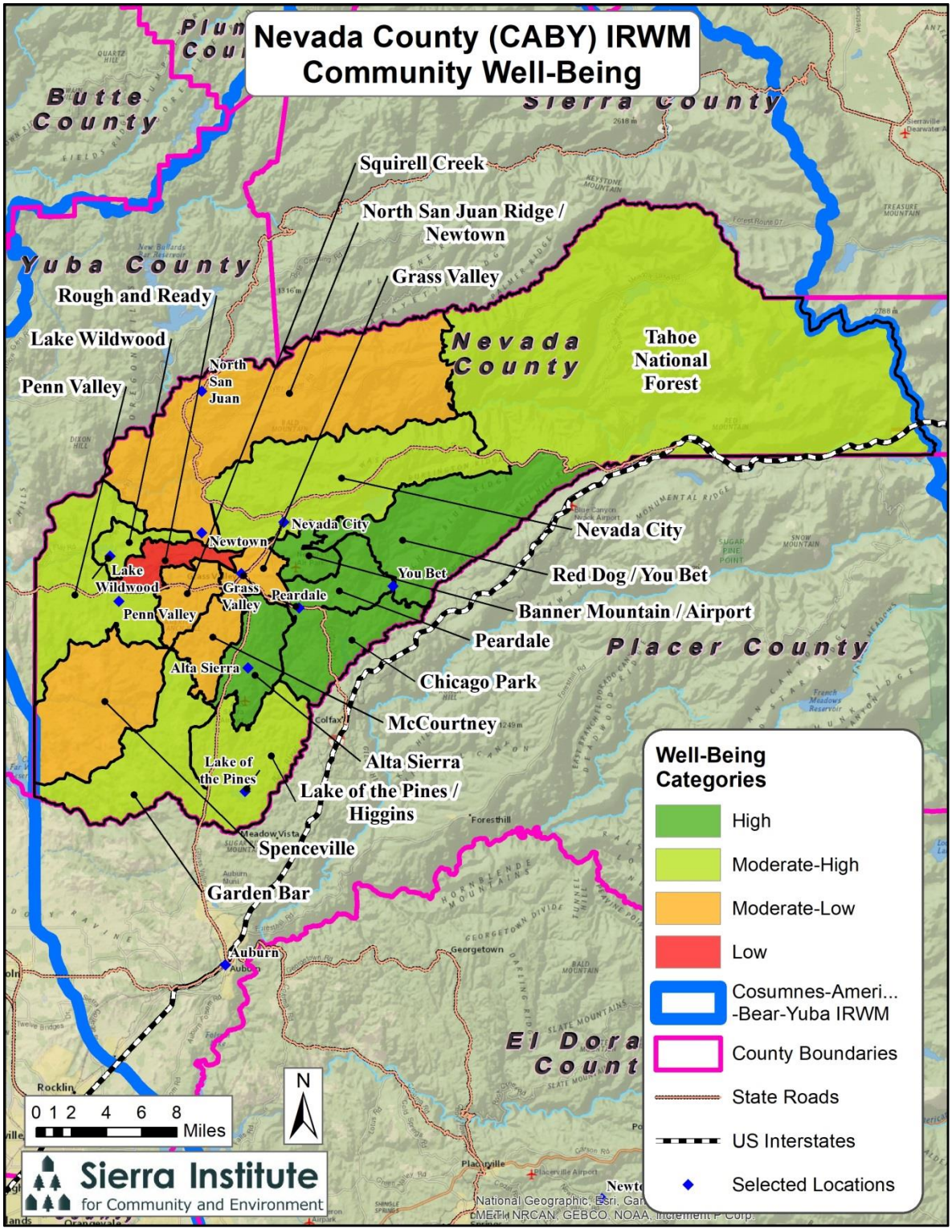
Chart 3. Histogram of Community Well-Being scores for CABY IRWM



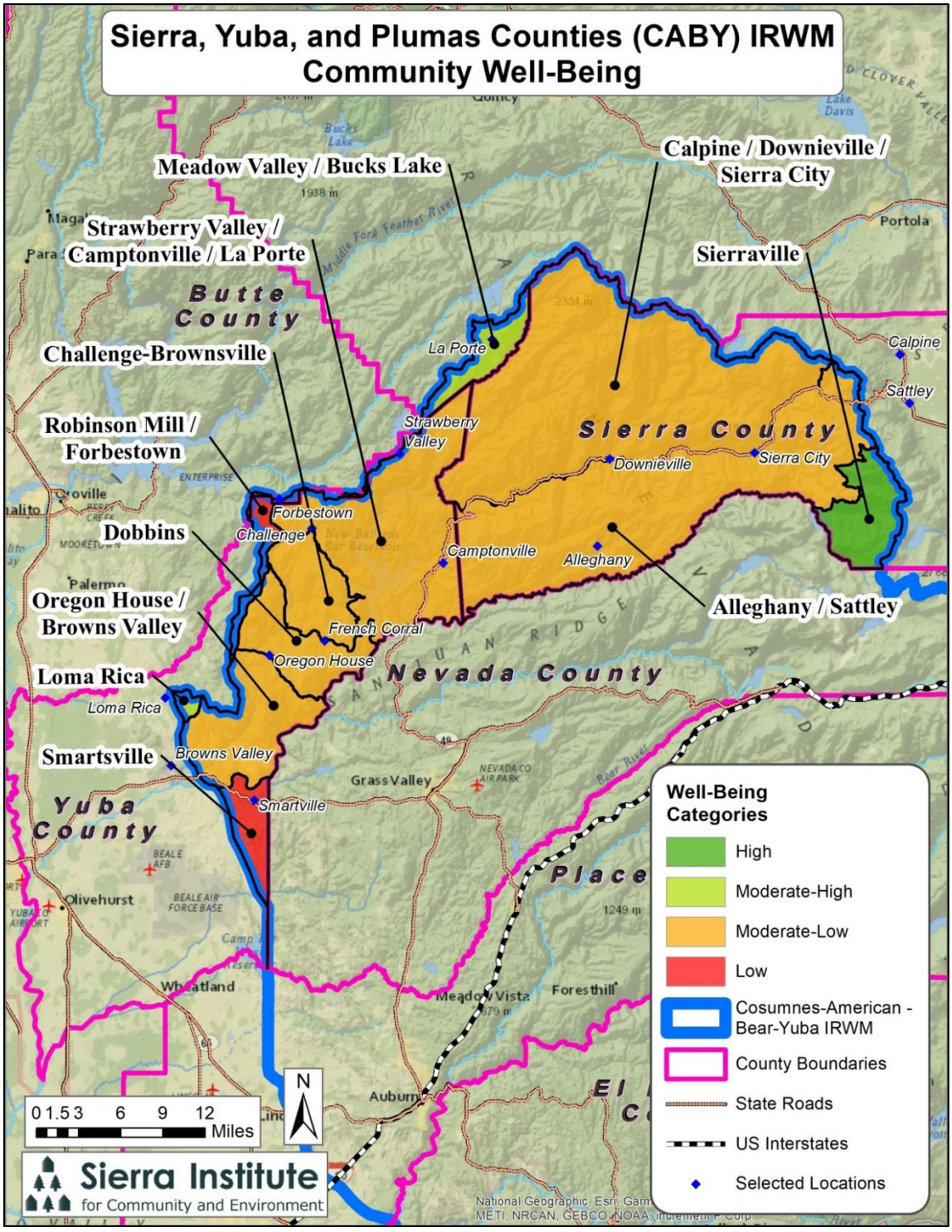
Map 13. Community Well-Being scores for the CABY IRWM. Community Well-Being is a composite score of both a community's Community Capacity score and the Socioeconomic Status. Note the lower Well-Being of the large rural communities in the mountains compared to the higher Well-Being of communities in the foothills.



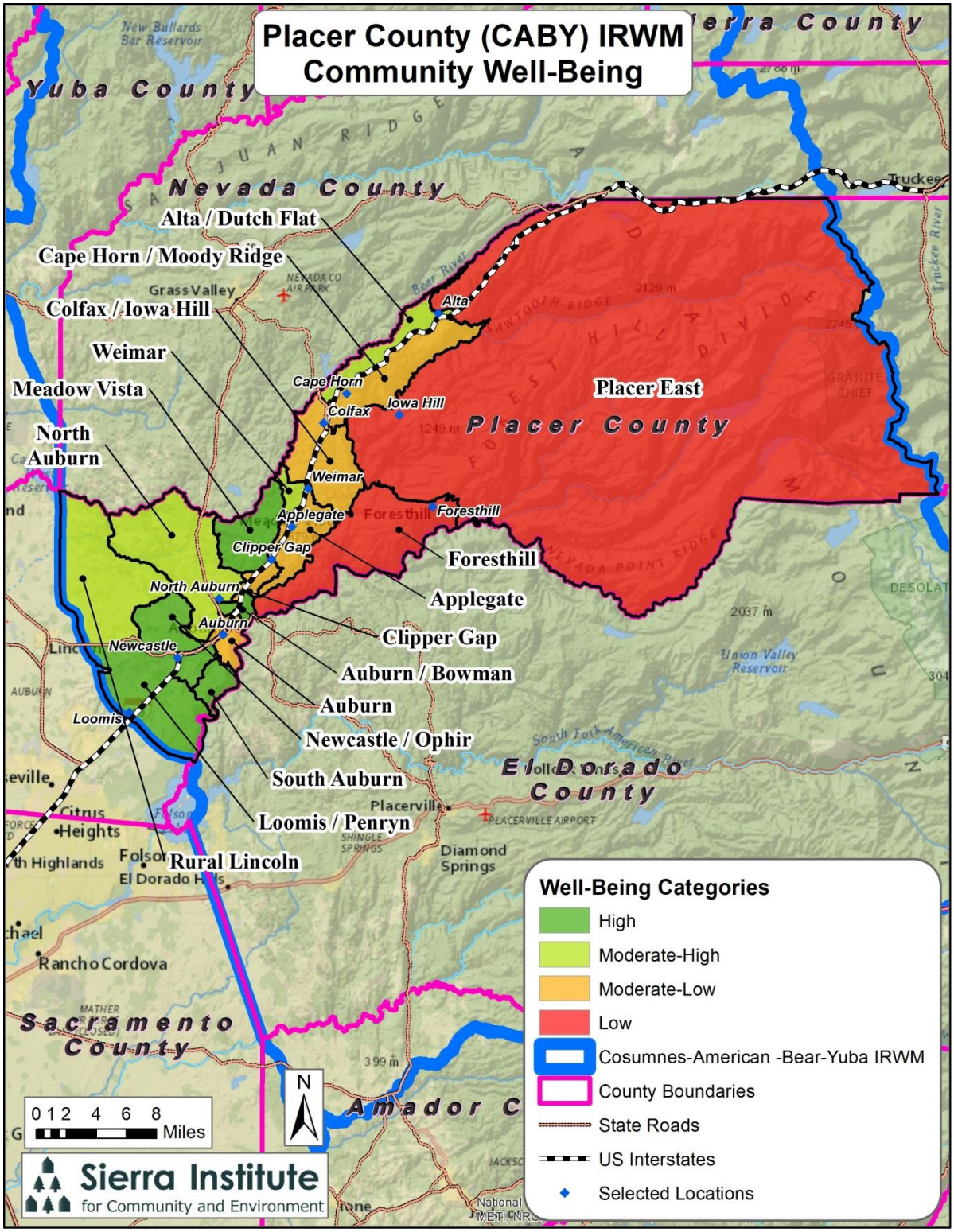
Map 14. Community Well-Being scores for the El Dorado County region (CABY IRWM), which includes portions of Amador and Alpine Counties. Note the lower Well-Being of the large rural communities in the mountains compared to the higher Well-Being of communities in the foothills.



Map 15. Community Well-Being scores for the Nevada County region (CABY IRWM). Note the unusually higher Well-Being scores of most communities despite their distance from the Sacramento metropolitan area.



Map 16. Community Capacity scores for the Sierra County region (CABY IRWM), which includes portions of Yuba and Plumas Counties. Note the lower Well-Being scores for most of the county with the exception of a few small communities.

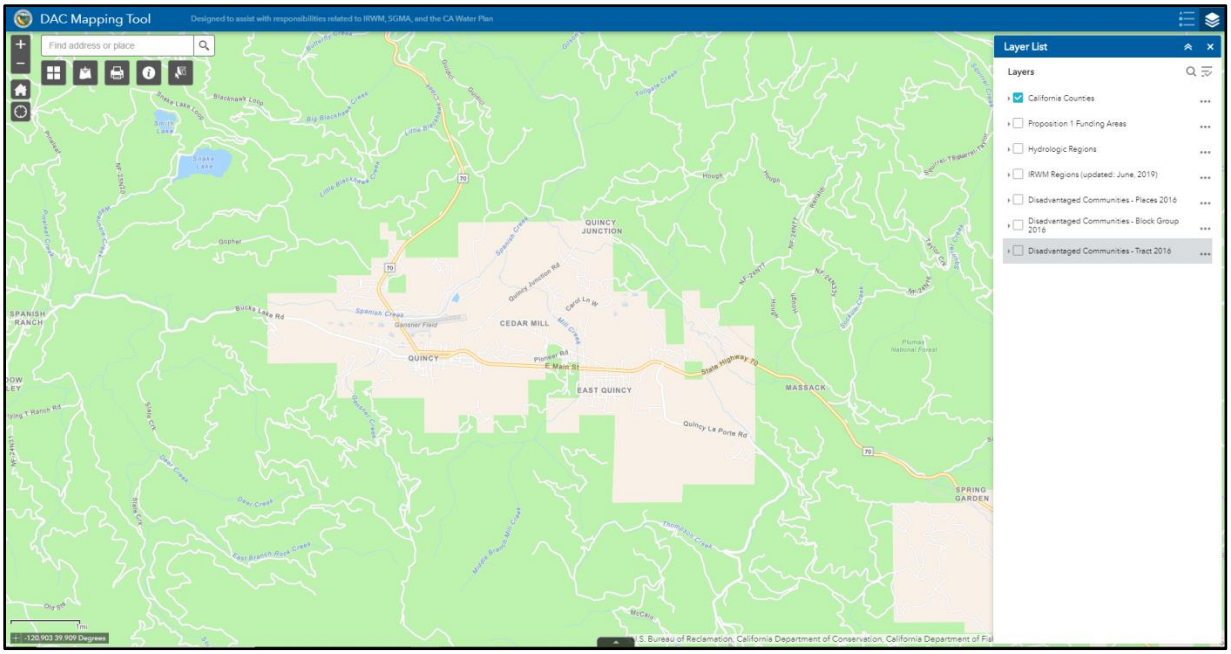


Map 17. Community Well-Being scores for the Placer County region (CABY IRWM), which includes portions of Yuba and Plumas counties. Note the lower Well-Being of the large rural communities in the mountains compared to the higher Well-Being of communities in the foothills.

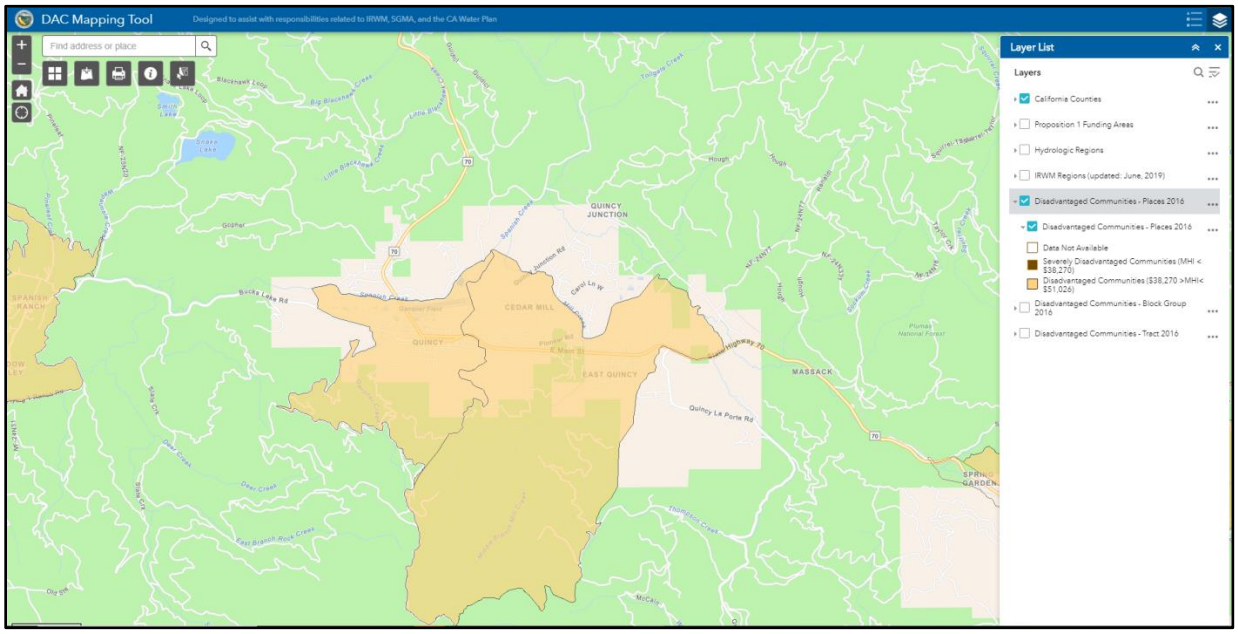
DWR Disadvantaged Status

Some communities have multiple DWR designations because DWR uses U.S. Census data from three different geographic scales to determine "disadvantaged" status: Census tracts, Census block groups, and Census places. Tracts are the largest Census area designation and contain multiple block groups. Block groups are smaller than tracts and more specific, while census places are typically small areas and cover only concentrated population centers (including both incorporated towns and unincorporated Census Designated Places). Census data at each of these geographic scales can be seen on DWR's DAC Mapping Tool online. To count as "disadvantaged" for the purposes of DWR funding, a community only needs to be listed as "disadvantaged" under any one of the three scales, but many communities are included in more than one.

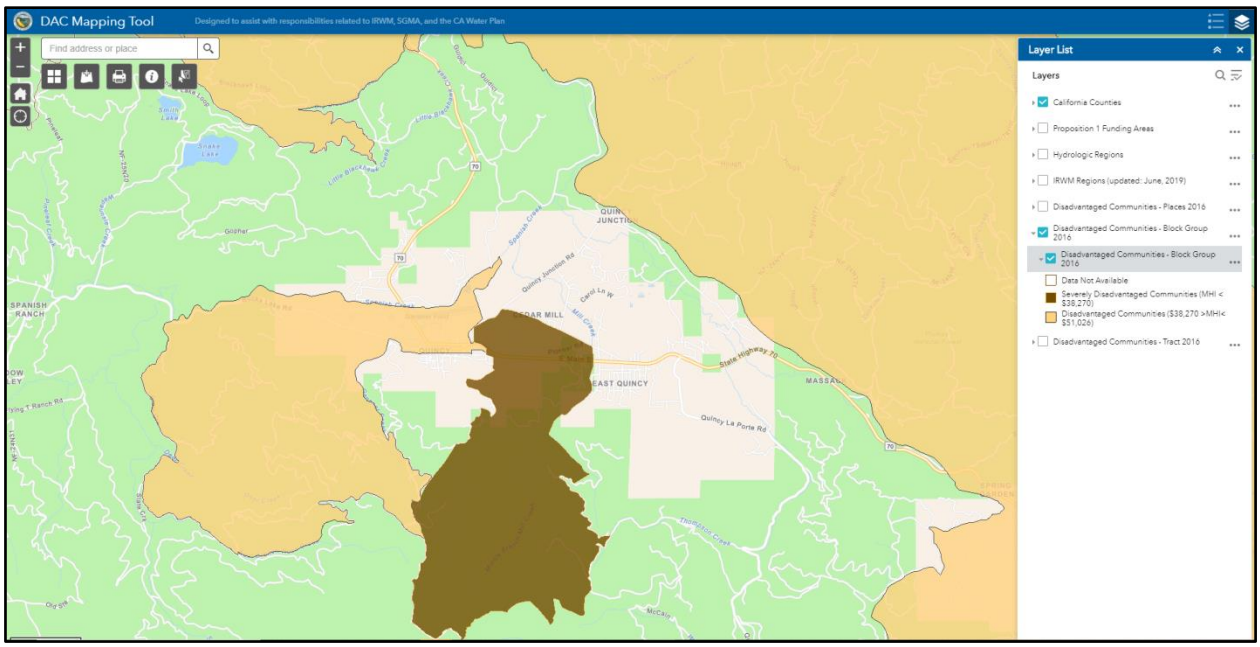
A community's disadvantaged classification can vary greatly depending on which geographic scale of Census data is used. While both Census tracts and block groups are statistical areas covering the entire United States, it is worth noting that for some sparsely populated rural areas, which are commonplace in the MCFA, the U.S. Census does not have median household income (MHI) data available at the finer block group or place scale due to an inability to acquire a sufficient sample size. In these cases, only coarser-scale tract data are available. This can help or hurt a community's ability to qualify as "disadvantaged." As an example of the negative impacts, at the larger Census tract scale, poorer communities in one block group area may be masked by the wealth of the communities in neighboring Census block areas and within the same Census tract, thus raising the MHI of the entire Census tract and precluding disadvantaged designation by DWR for all communities in that Census tract. This masking can also work conversely to include communities whose MHI is too high to qualify or whose MHI data is missing at the block group scale. But these communities could still qualify as "disadvantaged" at the tract scale due to data being available for poorer neighboring block groups within the same Census tract, which lowers the overall MHI for the area. See below for an in-depth example of the variability of disadvantaged status depending upon what scale of census data is used on DWR's DAC Mapping Tool.



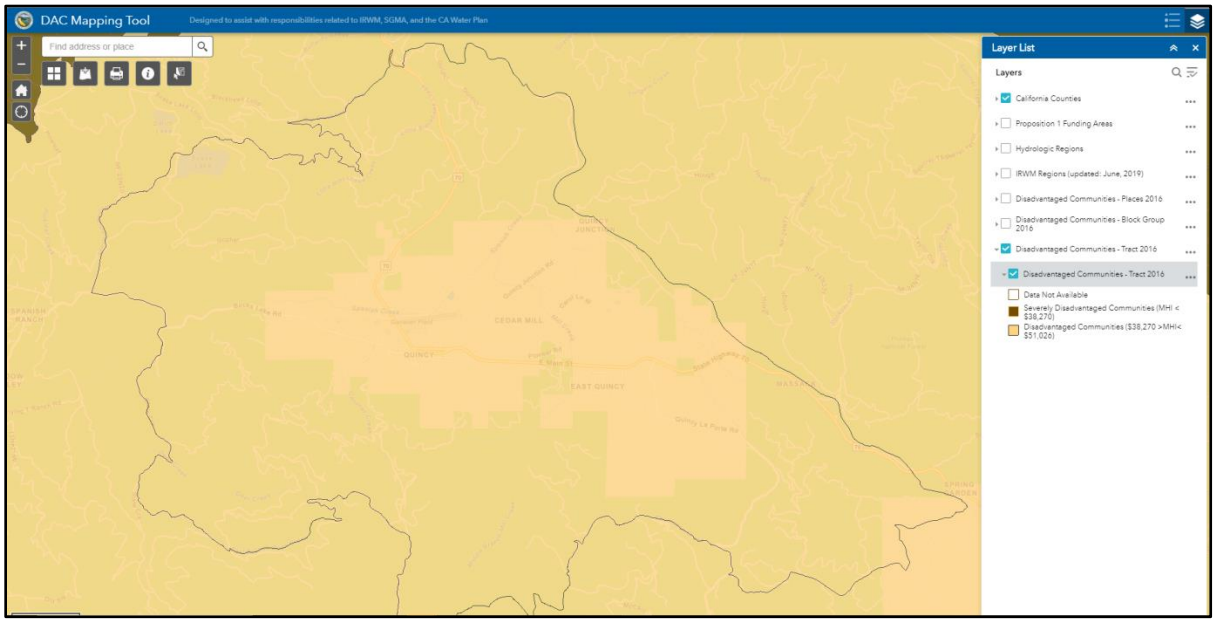
Map 18. DWR DAC Mapping Tool Screenshot – No Layers. Above is a screenshot of the unincorporated town of Quincy in the Upper Feather River IRWM displayed using DWR's DAC Mapping Tool. No "Disadvantaged Communities" layers are currently checked on the tool.



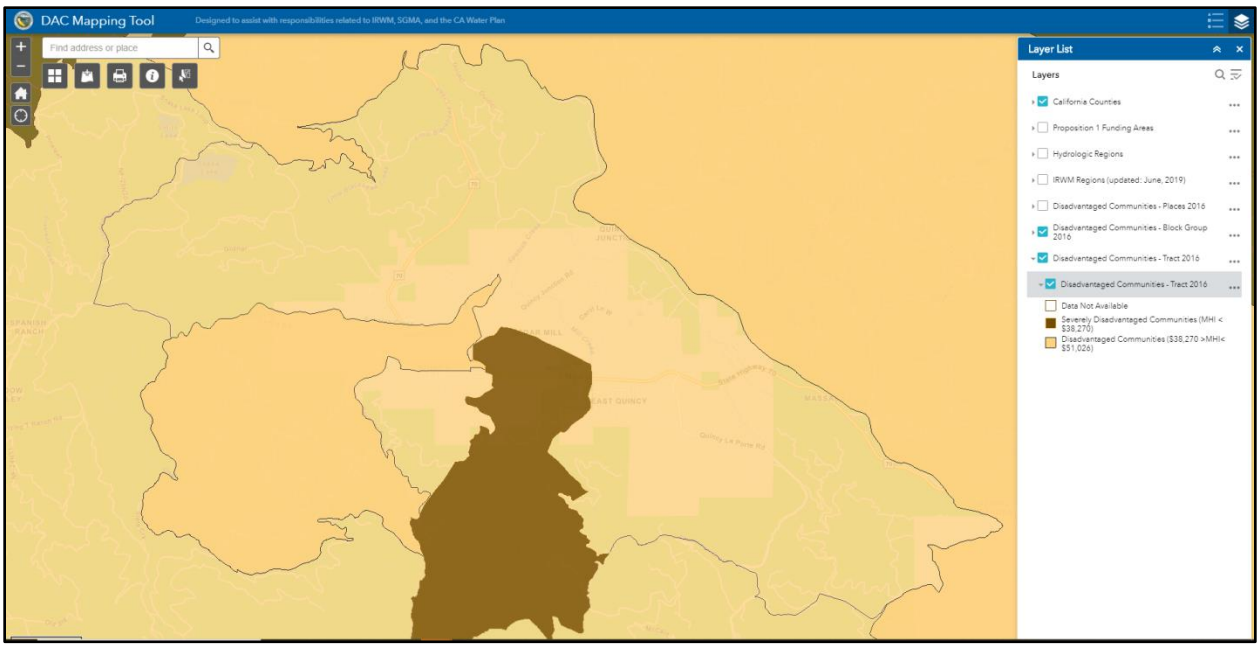
Map 19. DWR DAC Mapping Tool Screenshot – Places Layer. A screenshot of Quincy on the DAC Mapping Tool with the "Disadvantaged Communities - Places 2016" layer (Census-designated places and incorporated areas) checked and turned on. Quincy is split into two Census-designated places, Quincy and East Quincy, both of which are listed as disadvantaged by Median Household Income (as noted in light brown). Additionally, more areas around Quincy are now listed as disadvantaged.



Map 20. DWR DAC Mapping Tool Screenshot – Block Group Layer. A screenshot of Quincy on the DAC Mapping Tool with the "Disadvantaged Communities - Block Group 2016" layer checked and turned on. The Quincy area has both a "disadvantaged" block group (light brown) AND a "severely disadvantaged" block group (dark brown) when looking at MHI on a smaller scale.



Map 21. DWR DAC Mapping Tool Screenshot – Tract Layer. A screenshot of Quincy on the DAC Mapping Tool with the "Disadvantaged Communities - Tract 2016" layer checked and turned on. The MHI nuances from looking at block groups are masked by the MHI of the entire census tract. The overall "disadvantaged" designation of the Census tract obscures the block groups that individually would not qualify or would qualify as "severely disadvantaged."



Map 22. DWR DAC Mapping Tool Screenshot – Block and Tract Layers. A screenshot of Quincy on the DAC Mapping Tool with the "Disadvantaged Communities - Tract 2016" and "Disadvantaged Communities - Block Group 2016" layers checked and turned on. When both the Census tract and Census block group layers are turned on in the DAC Mapping Tool, the Quincy community is mixed between "disadvantaged" (light brown) and "severely disadvantaged" (dark brown), while outside of Quincy is "disadvantaged." Looking at the composite of multiple disadvantaged communities layers is vital to capturing all available data.

Comparative Assessment Results

It is helpful to see all of the assessment metrics side-by-side for each community – Community Capacity, Socioeconomic Status, Community Well-Being, and DWR's "disadvantaged"/ "severely disadvantaged" status. Because of the visual confusion caused by the overlap of the three census data scales as described above, we are not including a map of DWR "disadvantaged"/ "severely disadvantaged" status in this report. Instead, we list whether a community qualifies as either "disadvantaged," "severely disadvantaged," or has mixed status areas. If an area qualifies for multiple statuses, the greatest disadvantaged status is listed. All of the assessment metrics are listed in Table 2-5, below.

El Dorado County Region Community	Community Capacity Score	Socioeconomic Status Score	Community Wellbeing Score	DWR Greatest Disadvantaged Status (by either Census Block Group, Census Tract or Census Place)
Alpine Village / Kirkwood / Mesa Vista	3.5	2	Medium-Low	None
American River Canyon	1	3	Low	None
Auburn Lake Trails	4	7	High	None
Cameron Park	4	5	Medium-High	Disadvantaged
Camino	4.5	5	Medium-High	None
Cedar Grove	2	4	Medium-Low	Disadvantaged
Coloma / Lotus	4	6	High	None
Cool / Pilot Hill	3	5	Medium-High	None
Diamond Springs	3.5	4	Medium-High	Mix: None/ Disadvantaged/ Severely Disadvantaged
El Dorado Hills	5	7	High	None
El Dorado / Nashville	2.5	6	High	None
Fair Play	3.5	3	Medium-Low	None

Garden Valley / Greenwood	3.5	5	Medium-High	Mix: None/ Disadvantaged
Georgetown	3	4	Medium-High	Disadvantaged
Gold Hill	3	6	High	Mix: None/ Disadvantaged
Grizzly Flats / Omo	2	3	Low	Mix: None/ Disadvantaged
Ione / Jackson Valley	3	3	Medium-Low	None
Kelsey	3	3	Medium-Low	None
Latrobe	2.5	6	High	None
Mosquito / Swansboro	1.5	5	Medium-Low	Disadvantaged
Newtown / Sly Park	3	5	Medium-High	None
Pioneer / Buckhorn	2.5	3	Low	Disadvantaged
Placerville	4	3	Medium-Low	Mix: None/ Disadvantaged/ Severely Disadvantaged
Pleasant Valley	4	4	Medium-High	None
Plymouth	3	4	Medium-High	Mix: None/ Disadvantaged
Pollock Pines	2	4	Medium-Low	Mix: None/ Disadvantaged/ Severely Disadvantaged

Rescue	3.5	6	High	None
River Pines	3	4	Medium-High	None
Shingle Springs	3.5	6	High	None
Somerset / Outingdale	1.5	3	Low	None
Volcanoville / Quintett	2	4	Medium-Low	Mix: None/ Disadvantaged

Table 2. Comparison of 4 Assessment Metrics for the El Dorado County region (CABY IRWM) communities. For the DWR Disadvantaged status, communities are listed as "severely disadvantaged" and/or "disadvantaged" if they are designated as such in *either* the Census tract, Census block group, or Census place layers on DWR's online DAC Mapping Tool. A particular community may be listed as "disadvantaged" by one metric but not by another. For instance, a community may be listed as "severely disadvantaged" according to Census tract (the largest area used) but is not designated for any disadvantaged status when using the Census block group layer.

Nevada County Region Community	Community Capacity Score	Socioeconomic Score	Community Wellbeing Score	DWR Greatest Disadvantaged Status (by either Census Block Group, Census Tract or Census Place)
Alta Sierra	3	6	High	Mix: None/ Disadvantaged
Banner Mountain / Airport	3	7	High	None
Chicago Park	3	6	High	None
Garden Bar	3	5	Medium-High	None
Grass Valley	4	1	Medium-Low	Mix: Disadvantaged/ Severely Disadvantaged

Lake of the Pines / Higgins	3	5	Medium-High	None
Lake Wildwood	3.5	5	Medium-High	Mix: None/ Disadvantaged
McCourtney	2	5	Medium-Low	None
Nevada City	4	5	Medium-High	Mix: None/ Disadvantaged/ Severely Disadvantaged
North San Juan Ridge / Newtown	3	3	Medium-Low	Mix: None/ Severely Disadvantaged
Peardale	3	6	High	Mix: None/ Disadvantaged
Penn Valley	3.5	4	Medium-High	Mix: None/ Disadvantaged
Red Dog / You Bet	2	6	High	None
Rough and Ready	2.5	3	Low	Mix: None/ Disadvantaged/ Severely Disadvantaged
Spenceville	2	4	Medium-Low	None
Squirrel Creek	3	3	Medium-Low	Disadvantaged
Tahoe National Forest	3	5	Medium-High	None

Table 3. Comparison of 4 Assessment Metrics for the Nevada County region (CABY IRWM) communities. For the DWR Disadvantaged status, communities are listed as "severely disadvantaged" and/or "disadvantaged" if they are designated as such in *either* the Census tract, Census block group, or Census place layers on DWR's online DAC Mapping Tool. A particular community may be listed as "disadvantaged" by one metric but not by another; For instance, a community may be listed as "severely disadvantaged" according to Census tract (the largest area used) but is not designated for any disadvantaged status when using the Census block group layer.

Sierra County Region Community	Community Capacity Score	Socioeconomic Score	Community Wellbeing Score	DWR Greatest Disadvantaged Status (by either Census Block Group, Census Tract or Census Place)
Alleghany / Sattley	1.5	6	Medium-Low	Disadvantaged
Calpine / Downieville / Sierra City	3	2	Medium-Low	Disadvantaged
Challenge-Brownsville	3.5	2	Medium-Low	Severely Disadvantaged
Dobbins	1.5	5	Medium-Low	Severely Disadvantaged
Loma Rica	4	5	Medium-High	None
Meadow Valley / Bucks Lake	3	4	Medium-High	Disadvantaged
Oregon House / Browns Valley	2	5	Medium-Low	None
Robinson Mill / Forbestown	2	2	Low	Severely Disadvantaged
Sierraville	3.5	6	High	Disadvantaged

Smartsville	1.5	2	Low	Mix: Disadvantaged/ Severely Disadvantaged
Strawberry Valley / Camptonville / La Porte	2	4	Medium-Low	Severely Disadvantaged

Table 4. Comparison of 4 Assessment Metrics for the Sierra County region (CABY IRWM) communities. For the DWR Disadvantaged status, communities are listed as "severely disadvantaged" and/or "disadvantaged" if they are designated as such in *either* the Census tract, Census block group, or Census place layers on DWR's online DAC Mapping Tool. A particular community may be listed as "disadvantaged" by one metric but not by another. For instance, a community may be listed as "severely disadvantaged" according to Census tract (the largest area used) but is not designated for any disadvantaged status when using the Census block group layer.

Placer County Region Community	Community Capacity Score	Socioeconomic Score	Community Wellbeing Score	DWR Greatest Disadvantaged Status (by either Census Block Group, Census Tract or Census Place)
Alta / Dutch Flat	3	4	Medium-High	Mix: None/ Disadvantaged
Applegate	2	5	Medium-Low	None
Auburn	3.5	3	Medium-Low	Mix: Disadvantaged/ Severely Disadvantaged
Auburn / Bowman	3	6	High	None
Cape Horn / Moody Ridge	2	4	Medium-Low	None
Clipper Gap	2	4	Medium-Low	None
Colfax / Iowa Hill	2	4	Medium-Low	Mix: None/ Disadvantaged

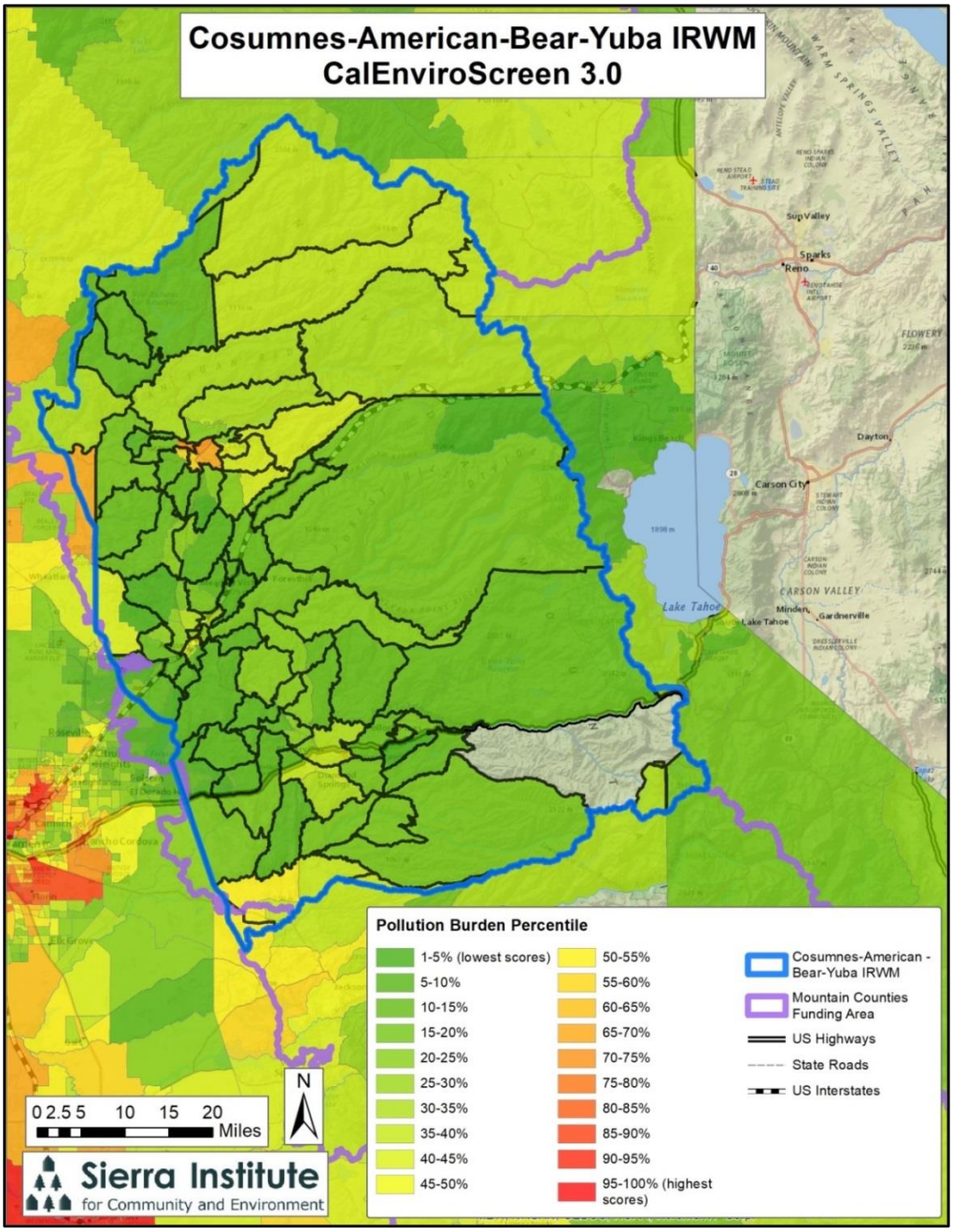
Foresthill	1.5	2	Low	None
Loomis / Penryn	5	6	High	Mix: None/ Disadvantaged
Meadow Vista	4	7	High	None
Newcastle / Ophir	3.5	6	High	Mix: None/ Disadvantaged
North Auburn	4	4	Medium-High	Mix: None/ Disadvantaged/ Severely Disadvantaged
Placer East	1.5	3	Low	Mix: None/ Disadvantaged
Rural Lincoln	3	4	Medium-High	None
South Auburn	4.5	7	High	None
Weimar	2.5	5	Medium-High	Disadvantaged

Table 5. Comparison of 4 Assessment Metrics for the Placer County region (CABY IRWM) communities. For the DWR Disadvantaged status, communities are listed as "severely disadvantaged" and/or "disadvantaged" if they are designated as such in *either* the Census tract, Census block group, or Census place layers on DWR's online DAC Mapping Tool. A particular community may be listed as "disadvantaged" by one metric but not by another. For instance, a community may be listed as "severely disadvantaged" according to Census tract (the largest area used) but is not designated for any disadvantaged status when using the Census block group layer.

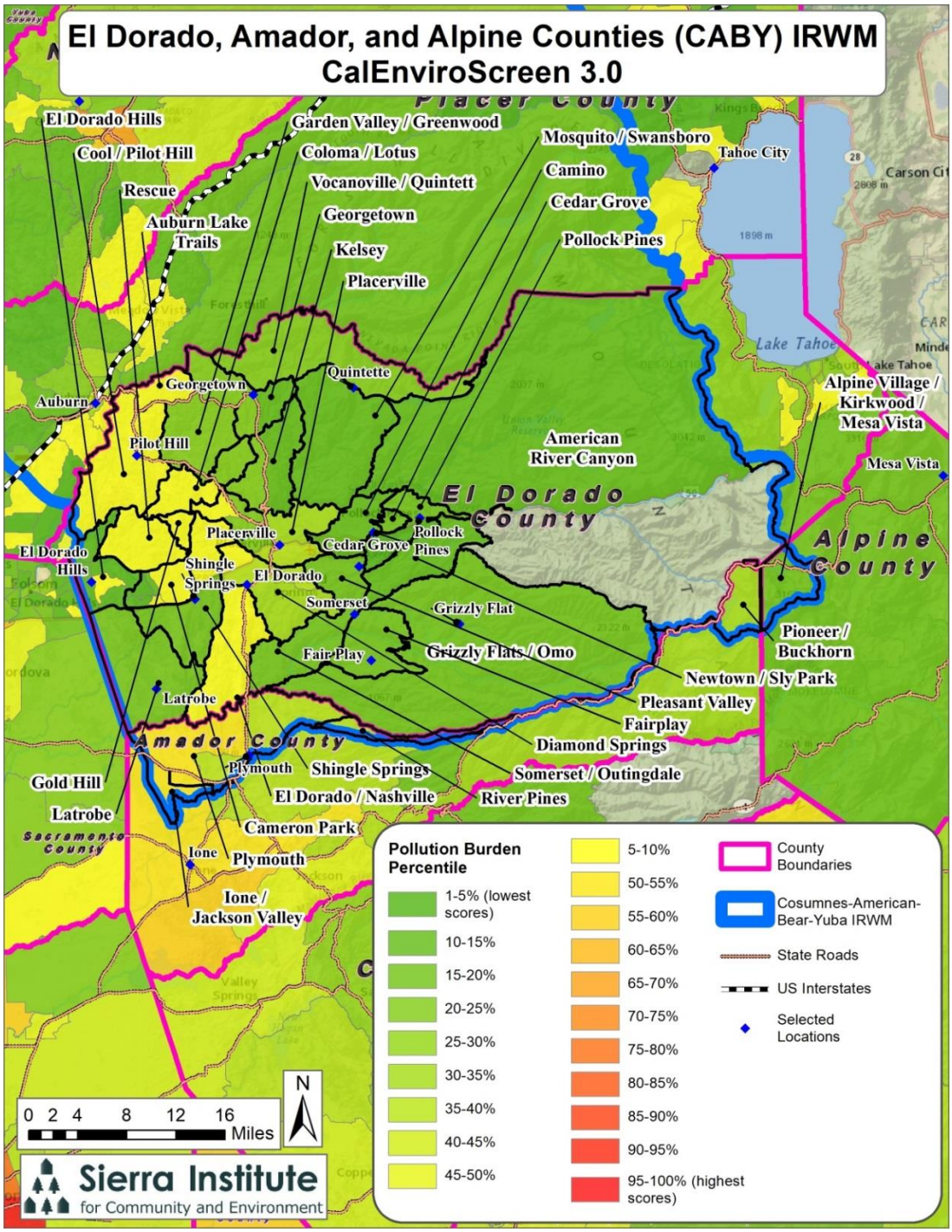
CalEnviroScreen vs. Community Well-Being

CalEnviroScreen is a tool created by the California Office of Health Hazard Assessment to determine the pollution burden of communities. The tool incorporates numerous environmental quality indicators (e.g. air quality, traffic density, groundwater threats) with public health and socioeconomic data that is included mostly because of its relationship to pollution vulnerability, but also because lower socioeconomic condition has been linked to

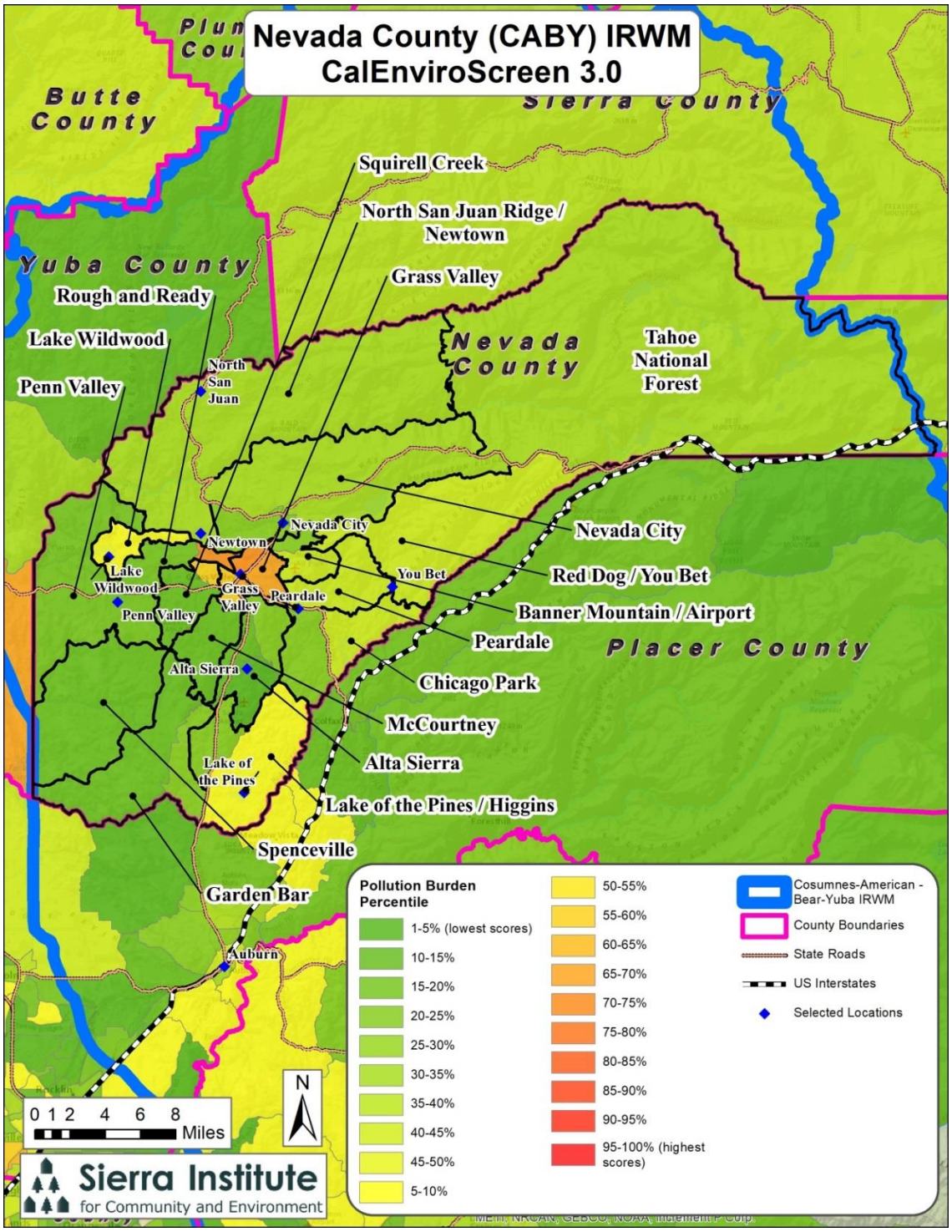
reduced “adaptability” or capability to escape pollution and other burdens affecting health and overall well being. The integrated tool is meant to capture both the degree of pollution exposure a particular community has and the vulnerability to that exposure. The CalEnviroScreen tool is used by the California Environmental Protection Agency (CalEPA) to designate communities as “disadvantaged” for the purpose of allocating funds from the Greenhouse Gas Reduction Fund, and is used for similar purposes by other agencies.



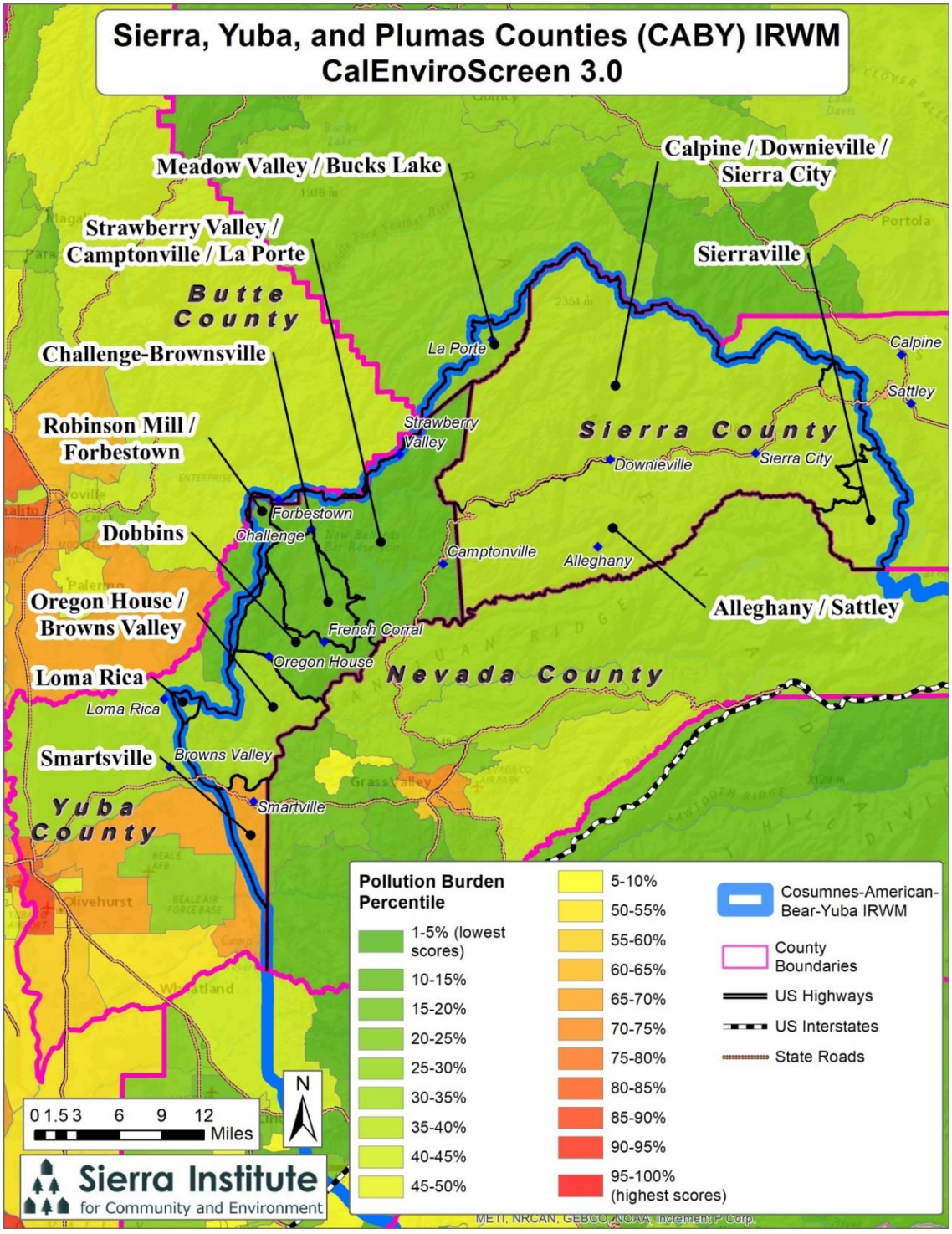
Map 23. CABY IRWM CalEnviroScreen Scores. Note that there are no high scoring communities in the mountains.



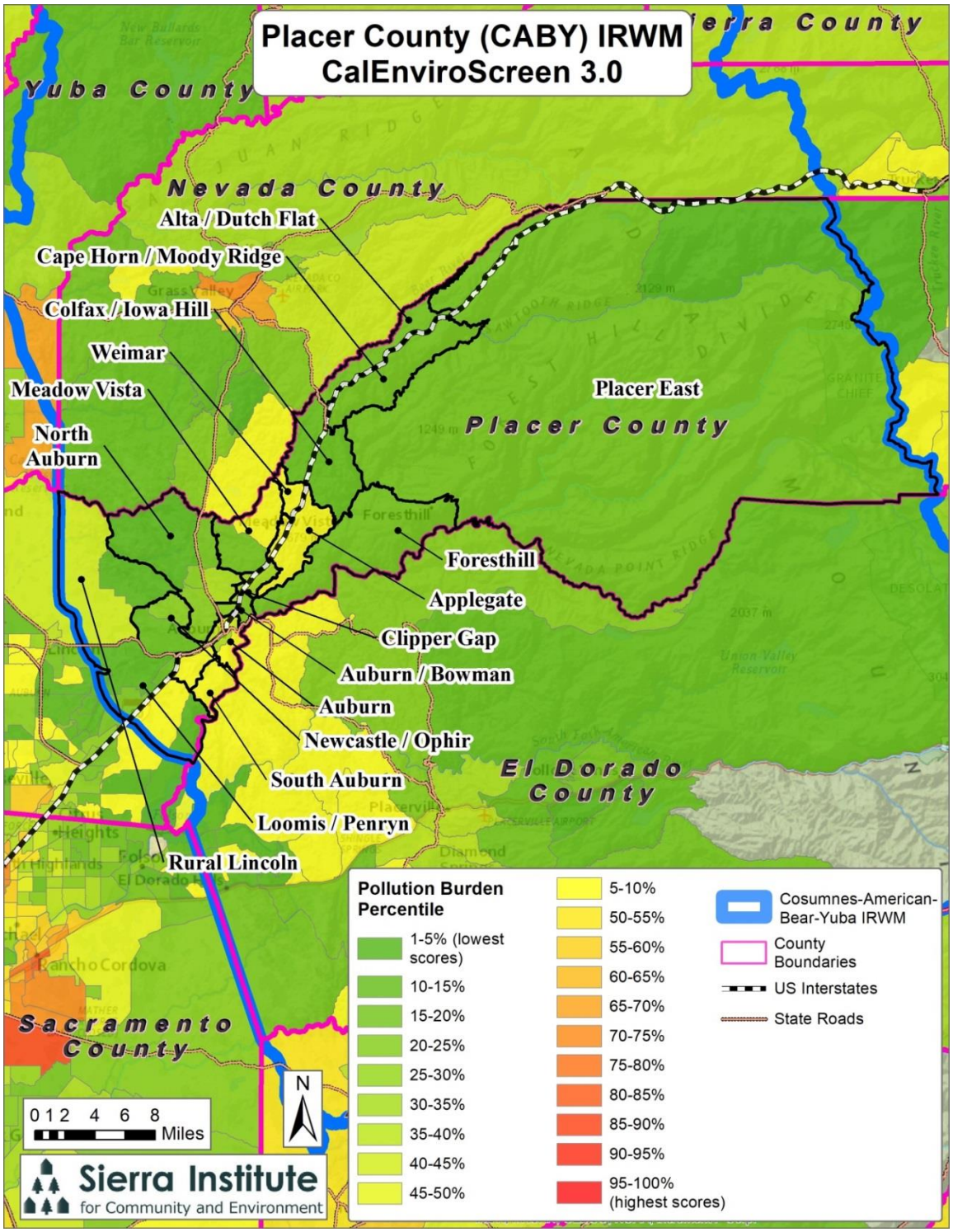
Map 24. CalEnviroScreen Scores for the El Dorado County region (CABY IRWM), which includes portions of Amador and Alpine counties. Note that there are no high scoring communities in the mountains.



Map 25. CalEnviroScreen Scores for the Nevada County region (CABY IRWM). Note that there are no high scoring communities in the mountains.



Map 26. CalEnviroScreen Scores for the Sierra County region (CABY IRWM), which includes portions of Yuba and Plumas counties. Note that there are no high scoring communities in the mountains.



Map 27. CalEnviroScreen scores for the Placer County region (CABY IRWM). Note that there are no high scoring communities in the mountains.

Statewide, the communities with the highest pollution burden according to CalEnviroScreen are all located in the Central Valley, urban areas, or in the state's southeast corner. There are no high-scoring or disadvantaged communities in rural mountainous areas. Environmental pollution burdens in general are low because, as the thinking goes, mountainous areas typically have lower levels of air, soil, and water pollution as a whole. But this is not always the case and underscores a deeply problematic and fundamental flaw in an otherwise robust CalEnviroScreen tool.

Rural forest communities that struggle with low socioeconomic conditions including those with pollution burdens do not qualify as disadvantaged under the CalEnviroScreen because they lack air quality or water pollution measurement equipment common in Central Valley and urban communities. Episodic smoke events from wildfire can result in extremely dangerous air quality for weeks on end in forest communities along with localized water pollution sources from fire and old mines that present serious contamination and pollution burdens. Similarly, prescribed burning of forest land can generate dangerous emissions, affecting locals for sometimes weeks. Lack of measures for constituent air, water and soil pollution are treated in CalEnvironScreen as if there are no pollution burdens. This is a fundamental methodological flaw of CalEnviroScreen for constructing a disadvantaged community scale that includes forest communities but does not capture critical dimensions that make such communities disadvantaged. For these reasons, along with others, CalEnviroScreen is an inappropriate tool to evaluate disadvantaged status for rural forest communities, and it is particularly problematic given that considerable state funding is based on this tool.

Furthermore, CalEnviroScreen does not reflect a community's capacity to address problems, such as wildfire risk or aging water infrastructure. There is no obvious connection between pollution burden and local ability to apply for and receive grant funds to improve local water infrastructure, for example. The alternative assessment methods described here are important for demonstrating a type of community need that is entirely absent from the CalEnviroScreen tool.

CHAPTER 5. Water and Wastewater Issues

In 2019, the Sierra Water Workgroup conducted a total of three Water and Wastewater Workshops in different portions of the Cosumnes, American, Bear and Yuba Integrated Regional Water Management region (CABY IRWM) to identify the water management needs of DACs and Tribes in the CABY IRWM. Those workshops consisted of El Dorado County (February 13th),

Sierra and Nevada Counties (January 16th), and Placer County (February 20th). The workshops were three of eleven to be held in the Mountain Counties Funding Area (MCFA). Water purveyors, wastewater service providers, local government officials, Tribal representatives and other interested stakeholders attended.

Prior to the workshops, extensive outreach was done to identify all water and wastewater service providers in the CABY IRWM. Through cross-referencing lists from the California State Water Resources Control Board and the Department of Water Resources, the CABY IRWM was found to have 350 water and wastewater service providers with a total of 121,111 connections. Of those total providers, 50% (174) are located in disadvantaged communities[2]. Of those providers in disadvantaged communities, 33% (58) serve residential customers, 32% (55) serve businesses, and 35% (61) serve unknown or other customer types. SWWG conducted outreach to all types of water and wastewater organizations, as well as neighborhood groups and other interested parties to encourage their attendance and participation in the Water and Wastewater Workshops.

In addition, a survey (Appendix C) was sent to all identified water and wastewater service providers to initially understand the challenges facing the purveyors and their needs for technical assistance. Two surveys were completed for El Dorado County, seven for Sierra and Nevada Counties, and three for Placer County. The results of the surveys indicated the topics of concern in each portion of CABY, prioritized based on responses. The concerns are listed by area below:

<u>El Dorado County</u>

- Aging infrastructure
- Fire Suppression Supply
- Access to Fire Hydrants
- Staffing and/or Training
- Regulatory Compliance

<u>Sierra and Nevada Counties</u>

- Aging infrastructure
- Drinking Water Supply
- Regulatory Compliance
- Water Quality

[2] Due to being unable to ascertain specific addresses for all water/wastewater providers, this is most likely an underestimation.

- Lack of Data / Information

Placer County

- Aging infrastructure
- Storage
- Information
- Fire Suppression Supply

NOTE: The topics of concern identified in the surveys and their priority, as well as the topics discussed at the workshop, may or may not be the same as those stated in the CABY IRWM Plan. The survey and workshop were open to anyone whether they participated in the CABY IRWM or not.

Workshop attendees reviewed the survey results and then identified and discussed additional water and wastewater issues of concern for Disadvantaged Communities. They also identified and discussed their technical assistance needs. Although some regional issues are already discussed in the CABY IRWM Plan, updated in 2019, the list below recognizes those existing issues, provides additional detail, and identifies new issues of concern.

El Dorado County

➢ Aging and Inadequate Infrastructure

Aging and inadequate infrastructure is a prevalent problem throughout the CABY IRWM. Many water and wastewater systems are degraded. Water purveyors do not have the revenue to fix or upgrade their systems.

- Need New Storage - The region requires more storage and conveyance to meet the needs of the growing population and the changes due to climate change. In addition to the storage there was discussion of new conveyance systems required to meet the flow needs.
- Additional or Deeper Wells – With current climate conditions there is a growing concern for additional drinking water supplies. The cost to address alternate water supplies with additional wells or deeper wells is also a concern.

- Failing Water Pumps - Commercial water well pumps and irrigation pumps have a lifespan dependent upon operation and maintenance. Failing pumps are a serious concern for water purveyors in this region.
- Water Leaks – Water leaks for potable supply can reduce conservation goals and increase costs to the water purveyor and/or their customers. Potable water supply leaks have been identified as a significant issue.

➢ Regulatory Compliance

Small service district often lacks the revenue, staff and expertise to meet regulatory requirements. Below is a list of the issues discussed at the water/wastewater workshop:

- Upgrades to water systems often require additional regulatory compliance.
- Compliance is too expensive; the cost of fees and permits are increasing and mandates are unfunded.
- Difficult to keep up with regulatory changes.
- Lack of monitoring data on water and wastewater.
- Reporting is difficult, time consuming and expensive.

➢ Limited staff and Training

- Staffing – Attracting and paying for qualified staff is an overarching problem in the rural areas of the Sierra region. Meeting administrative, operational or regulatory requirements is challenging for many small water purveyors.
- Training – Operational training is expensive and burdensome for the small water purveyors. Many have to travel extensive distances to receive training with little to no money budgeted for this effort. In addition, there is no capacity currently to coordinate training region wide.

➢ Water Quality

- Legacy Mining Toxins – Although these water quality parameters are discussed in your IRWM plan, the small water providers in the CABY region are very concerned with toxic impact to customers and the costs to treat these contaminates.
- Temperature and TMDLs – Maintaining appropriate temperatures and Total Maximum Daily Loads (TMDL) of pollutants allowed in water bodies is an issue for water purveyors in this IRWM.

- Ranching Irrigation - Stakeholders indicated their concern of the potential pollutants from ranching activities, and their impact on regional water sources.

➢ Treatment Systems

- Expense – Wastewater treatment systems are in constant need of repair and upgrade. Leaks can be a health hazard. The expense is too great for many of the small water providers.
- Regulatory Compliance – The compliance requirements are too burdensome for some of the small water providers in the CABY region. Regulatory compliance is not an option, and they need assistance.
- Water Treatment and Filtration – Wastewater filtration system is part of the treatment process that often requires upgrades to meet compliance. This can be too expensive for water purveyors in this region.

➢ Fire Suppression Supply

- Storage – The Sierra communities are in extreme danger of wildfire. It is imperative that these communities have substantial water storage to fight fire. The CABY Region does not have enough storage to suppress large wildfires.
- Pressure – In many areas there is inadequate water pressure for use by the California Department of Forestry and Fire Protection or CalFire. In addition, there are communities that lack the appropriate sized pipe for the water tankers.

➢ Storage / Operation

- Reliance on Wells- This region requires more storage to meet the needs of the growing population and the changes due to climate change. In addition to the storage, stakeholders are concerned that too much of the population depend on groundwater (wells) for their primary supply of drinking water.

➢ Water Conservation

- Drought Plan – There is no coordinated drought plan for the water purveyors in the CABY Region. Climate change models predict less snow pack, more flooding and extended dry periods.

- Metering – There is no metering provide by the small service providers who attended the workshop. Metering is required encourages conservation and can be used to identify leaks.

➢ Water Pressure

- Pressure – Water pressure is reported to be low in many communities in the CABY region. Water pressure is required for commercial purposes and often require the service provider upgrade pumps and retrofit pipes throughout the area.

Sierra and Nevada Counties

➢ Aging Infrastructure

As in most Mountain Counties communities, aging infrastructure is the most prevalent problem. Many water districts have been in existence for over 50 years. They are supported by the residents of these small rural communities and often do not have the revenue to fix or upgrade their systems to meet current regulatory standards.

Conveyance Systems need replacing – miles of pipes in smaller systems needs replacement. Some pipes are made of outdated materials and do not meet current standards. Water leaks for potable supply can reduce conservation goals and increase costs to water purveyors and their customers. Potable water supply leaks have been identified as a significant issue – particularly leakage from conveyance systems and water storage tanks. Agencies and communities reported the following pressing issues:

- Washington County Water District (WCWA)
  - Pipes are old - Various sites
  - Only tank falling apart – no back-up
  - Filter Building falling apart – needs roof
    - Slow sand filter system
    - If Filter Building fails, cannot process water
- Camptonville

    - Rusted tank - have back-up
    - 2 wells are over 30 years old
    - Diversion Dam (Camp Bells Gulch) is suffering from scour
    - Doesn't have stormwater collection system
        - Flooding due to overflow

- Nevada Irrigation District (NID)
    - 300 miles of pipe need updating
    - 1000's of culverts need updating
    - Currently need $18 – $20M in infrastructure improvements
    - Dams are over 50 years old
        - Scotts Flat Spillway a concern

- City of Nevada City
    - Pipes are over 100 years old
        - Multiple types of pipe
    - 70% of infrastructure over 100 years old

- City of Grass Valley
    - 100 year old pipes
        - Funding stalled for 1+ years
    - Flooding due to stormwater overflow
    - Grass Valley Sink Hole
    - Can't keep up with mining legacy

- North San Juan
    - Wastewater an unknown
        - No idea what's going on
        - Brain trust has passed on

➢ Drinking Water Supply

Drinking water supply issues have been exacerbated by recurring drought and timber die-off mainly the result of dehydration and beetle infestation. The sprawling stands of dead trees threaten to undermine such critical forest functions as providing clean water and absorbing heat-trapping carbon dioxide. Agencies and communities reported the following pressing issues:

- WCWD
    - No alternate source for drinking water when filter malfunctioning

- NID
    - Climate change
        - Affecting snowpack – issue is reliability
        - Drought is an issue – had to purchase water
- Grass Valley
    - Part of raw water supplied by NID
    - No large reservoirs
- Various Issues
    - Bacteria an issue in wells
        - Tri Vista
        - Downtown North San Juan
        - Rough and Ready MHP
        - Penn Valley Shopping Center (also iron and magnesium)
        - Grizzly Hill School
    - Mining issues
    - Herbicides in irrigation ditches

➢ Fire Suppression Supply

With the increasing impacts from climate change including wildfires, runoff from burnt areas, tree mortality, drought, etc., water storage, particularly for fighting wildfires, is more important than ever. Agencies and communities provided the following comments:

- Drinking water and fire suppression water comingled
    - Grass Valley (intertie with NID)
    - Washington (a fire would deplete all drinking water)
    - Nevada City (intertie with NID)
    - Camptonville
    - NID
- Water Pressure Issues / Hydrant size
    - Residential: 1M gallons per hour for 2 hours
    - Commercial: 1,500 gallons per hour for 2 hours
- Camptonville
    - Has stored water staged
- North San Juan

- North San Juan Plan requires 130,000 gallons and 6 hydrants for any new development

- Penn Valley
  - All on wells – no excess water available for fire

➢ Wastewater / Sewer / Treatment Systems

Many treatment systems are old and in need of upgrades. Agencies and communities provided the following comments:

- Smartville
  - Septic system = 55-gallon drums
- Nevada City
  - Treatment plant is old
- Grass Valley
  - Currently okay
  - Will be an issue if there is additional buildout
  - Need to replace:
    - Pipes with lines pipes
    - Unauthorized tie-ins
- NID
  - Contaminated raw water coming in from pasture lands
  - Irrigation customers drawing raw water

➢ Regulatory Compliance

Small service districts often lack the revenue, staff and expertise to meet regulatory requirements. Stakeholders expressed frustration with the lack of capacity and funding to meet ever-changing regulations. Agencies and communities provided the following comments:

- NID
  - Has to create new positions
  - Neg Dec for Aquatic and Terrestrial needs to be updated
- Grass Valley
  - TNI Standards (Lab testing standards)

        - Will have to contract out
- Issue: Illegal diversions from most any creek for marijuana grows

Staffing and Training

Staffing is a huge issue in the Mountain Counties. Agencies and communities provided the following comments:

- WCWD short operators and Directors
- Camptonville
    - Should have 2 operators – only have 1
- NID
    - Working with Community College to provide services
- RCAC offers free training classes
- Timely training difficult to schedule
- Small population and low wages make staff retention difficult

Lack of Data / Information

There was significant discussion on the issues regarding data management and information. Agencies and communities provided the following comments:

- Mapping
    - Particularly for evacuation in response to fire
    - Need incident location and resources locations
- Nevada City
    - GIS map shows resources
- Support to digitize infrastructure information, WQ and pesticide use
    - WCWD doesn't know where all the pipes are

Placer County

➢ Inadequate Infrastructure

Aging and inadequate infrastructure is a prevalent problem throughout the CABY IRWM. Many water and wastewater systems are degraded. Water purveyors do not have the revenue to fix or upgrade their systems.

- Colfax, Alta, Dutch Flats –
  - Canals and pipes very old – need major maintenance or replacing
  - Leaks a major issue; soils are porous
- Dutch Flats
  - Pipes are 2" electrical pipes
- Some areas still have wooden flumes to convey water
  - Can burn and interrupt water supply
  - Randy, PCWD, has inventory of flumes
- Other communities with infrastructure issues:
  - Foresthill PUD
  - Michigan Bluff
- Need New Storage - The region requires more storage and conveyance to meet the needs of the growing population and the changes due to climate change. In addition to the storage there was discussion of new conveyance systems required to meet the flow needs.
- Water Leaks – Water leaks for potable supply can reduce conservation goals and increase costs to the water purveyor and/or their customers. Potable water supply leaks have been identified as a significant issue.

➢ Water Quality

- Applegate
  - On bottled water for drinking and cooking
  - Using raw water for everything else (Contact Jason, Midway Heights for more information)
  - New wells not possible too close to septic leach fields – and parcels too small.
  - Residents can't sell their property
- Baker Ranch has water quality issues

- Legacy Mining Toxins – Although these water quality parameters are discussed in the CABY IRWM plan, the small water providers in the CABY region are very concerned with toxic impact to customers and the costs to treat these contaminates.
    - Issue: Todd Valley / Forest Hill – drains into the American River
- Disinfection By-products
    - Chlorination of organics is a problem from Dutch Flats to Auburn
    - Source water of good quality
- Off-road vehicles contaminate water when crashing into water supply
- Illegal pot grows contribute to degradation of water supply
- Temperature and TMDLs – Maintaining appropriate temperatures and Total Maximum Daily Loads (TMDL) of pollutants allowed in water bodies is an issue for water purveyors in this IRWM.

➢ Water Pressure

- Pressure – New code requires water sprinklers in homes to use 1-1/2" – 2" pipes. If used, depletes the water pressure and water supply.

➢ Water Supply

- Todd Valley / Forest Hill
    - Wells went dry during drought.

➢ Limited Staff and Training

- Staffing – Attracting and paying for qualified staff is an overarching problem in the rural areas of the Sierra region. Meeting administrative, operational or regulatory requirements is challenging for many small water purveyors.
- Training – Operational training is expensive and burdensome for the small water purveyors. Many have to travel extensive distances to receive training with little to no money budgeted for this effort. In addition, there is no capacity currently to coordinate training region wide.
- Need retention and succession planning.

➢ Treatment Systems

- Colfax Wastewater System (1,100 connections):
  - To alleviate the I&I problem, need to move from 13:1 to 8:1. Eventually want to get to 4:1.
  - Can't process all incoming water in the winter.
  - Connect to Applegate?
  - Need to replace DW treatment plant soon (currently upsizing system).

- No sewer system; septic only
  - Iowa Hills
  - Applegate
  - Heather Glen area

- Dutch Flat plant failing
  - Working to tie into Alta system (50' away)
  - Inter-tie already

- Pharmaceuticals
  - Pharmaceutical disposal in water supply impacts fish and wildlife.
  - Need low-cost method to remove pharmaceuticals from water supply.
  - Illegal pot grows

➢ Fire Suppression Water Supply and Issues

- Insufficient Storage
  - Iowa Hill has 4 tanks for fire suppression – inadequate quantity. Tanks are within a 1/8th of a mile from each other but community covers 5 sq. miles.
  - CalFire does top off tanks after they use.
- Need tanks (Luana has list of needs)
  - Sugar Pine View
  - Alta / Dutch Flat / Monte Vista
  - Moody Ridge / Cape Horn / Alpine Meadows
- Midway
  - Has irrigation system to do fire breaks but needs funding
  - Needs more hydrants
- Forest Hill

- Needs more hydrants

- Excessive underbrush and trees
  - Need plan to thin forests

Lack of Data / Information

- Midway
  - Can't definitively locate asbestos-lined pipes used for irrigation water
    - Ground-penetrating radar can't locate

Water Conservation

- Issue: Forced conservation of irrigation watering when adequate water supplies. Strains creditability.

Natural Resources – Tribal Concern

- Maintaining clean water through:
  - Meadow restoration projects
  - Wetland restorations
  - Cleaning out springs, creeks, etc.
  - Need long-term strategy for creation of new meadows and natural management of forests
- Need process to maintain watersheds that create new meadows for:
  - 0 – 50 years
  - 50 – 100 years

CHAPTER 6. Technical Assistance Needs

The CABY IRWM Plan adopted in 2007 (updated in 2014 and again in 2019 to meet Prop 1 requirements) lists goals addressing water supply, water quality, and climate change impacts including wildfires and forest health. Below is information from the surveys and workshop conversations that identify technical assistance needs to achieve the Plan's goals.

El Dorado County

- **Information Sharing**
  - Grants – notification, eligibility, requirements
  - Training Opportunities
  - No and Low Cost Resources
    - Bulleting Board of information and Technical Assistance opportunities

- **Training**
  - Add Continuing Education units to training classes

- **Equipment and Resource Sharing**
  - Need for backhoes
  - Funding for Design services

- **California Special Districts Association**
  - Can provide technical assistance

- **Water Quality**
  - Include Sampling protocols on list of Technical Assistance needs
  - Share WQ data in a standardized way

- **Miscellaneous**
  - Rate Structure Data
    - Share how water districts charge
  - Bear River Disturbance Data
  - Resources on Safety Measures / Program

Sierra and Nevada Counties

The CABY IRWM Plan adopted in 2007 (updated in 2014 and again in 2019 to meet Prop 1 requirements) lists goals addressing water supply, water quality, and climate change impacts including wildfires and forest health. Below is information from the surveys and workshop conversations that identify technical assistance needs to achieve the Plan's goals.

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  - Include Sampling protocols on list of Technical Assistance needs
  - Share WQ data in a standardized way

- **Miscellaneous**
  - Rate Structure Data
    - Share how water districts charge
  - Bear River Disturbance Data
  - Resources on Safety Measures / Program

Placer County

- **Information Sharing**
  - Grants – notification, eligibility, requirements
  - Training Opportunities
  - No and Low Cost Resources
    - Bulleting Board of information and Technical Assistance opportunities

- **Training**

- Grant writing
- Locally available training

➢ **Resource Sharing**

- Design services
- Engineering Support
- Project Planning
- Other Professional Services

CHAPTER 7. Recommendations

The following recommendations are for the entire CABY IRWM and were developed from a combination of work efforts that includes data collected from the Water/Wastewater Workshops, surveys, phone conversations, a "Lessons Learned" Conference, and discussions with State/Federal employees. It is our expectation that the RWMG within each IRWM will hold a meeting and discuss these suggested next steps.

1. **Information Sharing**

    a. More outreach is required to share information (annual workshops, outreach by phone and field trips) - There are a number of stakeholders within the CABY IRWM that do not participate in the IRWM nor have current information on opportunities for funding (e.g. upcoming grants), or other state and federal assistance program (e.g. Low Income Rate Assistance Program.)

    b. A comprehensive database of current grant opportunities managed by an NGO such as the Sierra Nevada Conservancy would greatly assist service providers to find and identify possible grant opportunities. The data base should detail:
        i. Grant Name and Funder
        ii. Basic Eligibility Requirements
        iii. Amount available and any match requirements
        iv. Grant Due Date
        v. Link to actual grant solicitation

2. **Education and Training**

a. Coordinate safety classes and training for multiple water districts. Many of these classes have no cost, however they need to be organized and located centrally if possible.
b. Provide regulatory compliance training classes.
c. Provide grant writing classes.
d. Provide coordinated operators training.

3. Regional Resource Center

a. Work with a willing provider (e.g. Water Agency, NGO, etc.) to expand services for local service providers, DACs and Tribes. This may include professional services such as environmental permitting (CEQA/NEPA), engineering and design, and project planning.

b. Create an equipment sharing program between water service providers to share items used infrequently. This may include equipment for:

    i. Leak detection
    ii. Pipe location

APPENDIX A. Community Capacity Narratives

Capital Measures

Financial Capital: Availability of dollars for local uses and projects and to meet pressing local needs. These may be public dollars or private dollars, but if private they are tightly linked to community purpose and not just self-interested purposes.

Human Capital: Individuals with knowledge/ability to address conditions and stressors of concern; it is also the experience and capabilities of local residents their willingness to use these locally.

Social Capital: The ability and willingness of local residents to work together towards community ends and purposes.

Cultural Capital: The prevalence and strength of shared local bonds and ways of living, and the uniqueness of and identification with this.

Physical Capital: The "hard infrastructure" of a community, such as roads, sewers, schools, etc., including the quality of this infrastructure and its ability to meet local need.

Overall Capacity: Overall capacity scores takes all five prior capacity scores equally into consideration.

Capacity Measures are on a scale of 1 (lowest) to 5 (highest)

CABY Region Overall

Capacity Measure Range: 1.0 to 5

El Dorado County Region

American River Canyon

Overall Capacity Score: 1

Workshop participants described the American River Canyon as a very low capacity community. With declines in infrastructure, development, and a sense of community, the overall rating was determined to be a "1" out of 5. Resources are extremely constrained and the area is vulnerable to natural disasters with unstable slopes in a mountainous region. Previously, a neighborhood known as Little Norway was a vibrant area with a scattering of houses. A fire swept through and there was not financial capacity to rebuild.

Today there are many vacation and recreational homes occupied during summer months. These part-times residents are said to have human capital, but do not use their skills to invest in the community. The few year-round residents have low incomes and "virtually no community."

Challenges exist with septic systems. There are areas that are unable to support septic systems and several commercial establishments (i.e., Whitehall) that lack private sewer capacity to sustain growth.

The American River Canyon is an important watershed for water supply and fish habitat. Participants noted some sense of community in Kyburz and Strawberry, but an overall decline as Highway 50 travelers now only pass through the area.

Auburn Lake Trails

Overall Capacity Score: 4

Auburn Lakes Trails is a forested community with some residents from the Bay Area. Traditionally the community consisted of ranchers and with the influx of retirees from the Bay, but there is a divide between the "ranchers" and the "golf community." Human capital is present among the community with both those who have retired in Auburn Lake Trails and those that are currently working. There are many organizations and communities that work well together, including the horse community, golf community, and other recreational groups.

There is a gated community with higher socioeconomic status that has decent funding from the homeowner's association. The gated community has a wastewater system with 200 lots shared, but owing to the design and merging of some of the lots, the wastewater system is becoming problematic. However, with more financial capacity to address challenges when they arise, this community is more resilient and may be able to maintain and repair septic issues. Auburn Lake Trails has wells and water from the Georgetown Divide Public Utilities District and is treated at the Auburn Lakes Trails treatment plant. Other physical infrastructure noted by workshop participants include buses for schools, access to broadband, and decent cellular service. A local fire station and a CalFire Station are nearby, but fire evacuation is difficult.

Camino

Overall Capacity Score: 4.5

The community of Camino was described by workshop participants as having a very strong community action committee with a large agricultural presence and an apple hill growers' association. The community is well organized; however, farms do not make much money. The human, social, and cultural capitals were rated very high and the community is very politically active. Residents have strong cultural bonds. Despite lower financial capital, workshop participants

felt that Camino had more access to money than other communities in the region because of their industries.

Camino has some economic dependence on tourism as one of the larger tourist destinations in the area because of their wineries and farms.

Camino is rural with the exception of a small downtown that was based around a lumber mill that has since closed. Residents are older with mostly blue collared workers and retired agriculturalists relying on lower incomes.

Cedar Grove

Overall Capacity Score: 2

Workshop participants felt that Cedar Grove is very similar to Camino based on a shared farm culture and agricultural lifestyle. However, workshop participants described many mobile home parks and a prevalence of drugs in Cedar Grove.

Cedar grove is considered economically depressed with lower social capital than Camino. While some agricultural community fundraisers do exist, the low financial capital and threat of wildfire with overgrown roads and limited evacuation routes make this community extremely vulnerable.

Cameron Park

Overall Capacity Score: 4

Overall workshop participants determined that Cameron Park had a relatively high overall community capacity with a "4" out of 5. Cameron Park has medium to high income housing with some low income and multi-family apartment options. The older parts of Cameron Park were developed before modern county design standards were implemented. Workshop participants noted drainage maintenance issues without much funding outside of the community services district and zones of benefit. There are many drainage complaints from residents due to the flooding and property damage. Property owners need to perform some of the maintenance but many do not have the knowledge to address the challenges.

Participants discussed how there are some passionate residents who speak for the community and work together. One example was the collaboration on the Cameron Park design standards. The community has a fire district, but the fire station has very few volunteers. Cameron Park has strong community spirit where local residents work together to solve problems within the community and residents have a strong sense of community and way of life consisting of suburban residents and businesses. There are also many who commute for work outside of the community, but participants noted there is "some level of culture throughout community groups."

With its own community services district with tax based funding, there is some public funding for projects in the community. Also, owing to the population size, there is a range of technical expertise to solve local issues. There is a school, a water treatment plant and public water in the Cameron Park community, and "good infrastructure and financial capacity" overall with the "majority of infrastructure that is newer."

Coloma/Lotus

Overall Capacity Score: 4

Coloma is known for the "Marshall Gold Discovery State Park," and an important part of history during the gold rush. With class three sections of the American River, recreationalist and others moved here to appreciate this resource. Lotus Valley is very unique geographically and lends to a strong rafting and recreational tourist industry (e.g., biking, hiking, riding horses) with an estimated 400,000 visitors to the river and historic park annually. There is a strong "river community" identity and historic community sense of place with resident who actively participate in planning efforts and projects.

The Coloma/Lotus community was established in 1850 with a more recent wave of immigrants seeking out the river community and collectively fighting for river access. The American River Conservancy emerged in Coloma/Lotus, and "I can't think of any other community that has such strong organizations for an area of 750 houses."

While the sense of place reveals high cultural capital, the community is considered underserved and is unincorporated. A small retail commercial base exists with boater recreational fees from outfitter. There are high levels of education and strong base of volunteers. Local organizations that host volunteers include the American River Conservancy, the Coloma/Lotus Business Council, the Coloma/Lotus Fire Safe Council, the Gold Trail Grange, and Marshall Gold Discovery State Park among others.

Physical infrastructure includes some El Dorado Irrigation District service areas, some Georgetown Divide Public Utilities District service areas, and much of the community on wells and septic. Schools and roads are good, but there is a low maintenance budget. A new Murphy bridge is needed, but there is a sentiment to keep Coloma/Lotus rural. They do not "need the same level of capital as Placerville or El Dorado Hills." Coloma/Lotus is lacking a 24/7 fire station and there is not a community service district. The community depends on the County for some of their needs.

Cool/Pilot Hill

Overall Capacity Score: 3

Workshop participants underscored the differences between Cool and Pilot Hill. The areas are distinct and isolated from one another and "the cultures do not bleed over from one to the other." In

the more rural areas, Pilot Hill, there is a lot of disparity and rural isolation. There are also wineries and land ownership of wealthy residents from the Bay Area in Cool.

In regard to physical infrastructure, there is a fire station and CalFire. There is a single road in and out creating a fire hazard with a lack of egress. Although the road, water, and schools are reliable, the water pressure is lower leading to fire insurance issues. Lack of reliable cellular service and lack of reliable broadband internet are challenges. The major roads in the area are 49 and 193.

The wealthier segment of the community has private dollars that are used for community purposes and many projects use fundraising. Members throughout the community share their education, knowledge, and experience and fulfill community leadership roles. Community members tend to work together and convene throughout the year to attend fairs, parades, family markets, and community hall educational and outreach events. Local business owners work together and support one another.

The culture is rural with a lot of agriculture, farms, ranches, a horse community, pastures, and vineyards. The cultural, human and social capitals are considered high, but infrastructure challenges exist.

Pilot Hill is mostly underserved, unincorporated communities that are dependent on State Highway 49. Residents have lower incomes and "are not like Cool or Auburn Lake Trails." There is a small retail commercial base.

Diamond Springs

Overall Capacity Score: 3.5

Diamond Springs received an above average community capacity score overall, but was characterized as a financially depressed area with relatively low median household incomes. El Dorado County focuses some projects in this area, such as the Diamond Springs Parkway, which is about to break ground. This project will divert some of the traffic from downtown, relieving congestion. The community has a grocery store, fire department, and access to internet. There is a robust business area and "Financial Highway 49," a major traffic corridor. The Highway 49 corridor has sewer and water infrastructure funded by larger organizations such as CalTrans, El Dorado County and the El Dorado Irrigation District.

The community maintains a good level of local expertise to solve local problems and the Diamond Springs Fire Department and the Union Mine High School rally community action when needed. The Diamond Springs Fire Department is a local leader and actively fundraises for their needs, as well as other community needs. Diamond Springs has some local culture but is also somewhat of a "bedroom" community according to workshop participants.

El Dorado Hills

Overall Capacity Score: 5

El Dorado Hills received the highest community capacity rating in El Dorado county. With the highest financial capital of the communities in the county, the community of El Dorado Hills is collects valuable tax dollars and has a CSD. The community is fairly new as compared to others that were built during the Gold Rush years; therefore, roads and infrastructure are new. The community was characterized by workshop participants as "a 21st century community, and the rest of El Dorado is in the 1800's."

In addition to the CSD, El Dorado Hills has El Dorado Irrigation District, land developers, a library, senior citizen's center, recreational center, and a "really nice fire station."

Owing to the young nature of the community, there is not a long-term culture established, but residents are moderately engaged with social organizations in the community and real estate brochures cast "El Dorado Hills as the Marin of the Sierra." There is a very affluent community that has the ability to raise money fairly easily and a highly educated population that is engaged in the community.

El Dorado/Nashville

Overall Capacity Score: 2.5

Overall community capacity was rated as below average. Struggling with poor physical infrastructure, workshop participants pointed to a mobile home park situated on the river in Nashville, which has waste water transported over the river and presents E. coli challenges when there are water overflows. Gold Beach, the aforementioned mobile home park, is located on the river's shore and "is a code enforcement nightmare." It is "swirling with issues and there will never be a CSD at Gold Beach." Participants noted the challenge residents face in securing housing elsewhere. Nashville used to have a commercial core, a café with music, but now it's on the decline. "Even the highway sign has been stolen," noted a workshop participant. "The score for Nashville is pulling down the score for El Dorado."

El Dorado was described as a historic town with small mining houses. While there are not many residents, neighborhoods do exist. With private investment, county attention, an "up-and-coming" brewery, niche shops, and artists moving into the area, El Dorado was viewed in a positive light overall even with a very low median household income. Residents were described as "wanting to live there and very proud to live there."

The western edge has ranches and a small, nice subdivision. China Hill is another neighborhood that includes large lots and higher income houses. The area includes Christmas tree farms and ranches.

There are not non-profits in the area who are able to apply for resources on the community's behalf, according to workshop participants. The community has pockets of poverty, challenges with drugs, and septic issues.

Fair Play

Overall Capacity Score: 3.5

Fair Play has some affluent areas, large vineyards, and was described as being similar to Shenandoah Valley. The area with the wineries is higher capacity and considered very successful with a winery association and a strong sense of community. Participants mentioned a few pockets of less well-off residents.

Fair Play was described as almost identical to Somerset both culturally and economically. Some environmental issues exist with homeless encampments on the Cosumnes River. Dumping, vandalism, erosion of county maintained roads, all contribute to the extreme fire risk in this steep, massive canyon. The impact on water quality and fisheries from ORV use and non-maintained roads is a major problem. Independent wells and septic are found throughout the community.

Georgetown

Overall Capacity Score: 3

The workshop discussion about Georgetown started with the topic of a local school district study that revealed two distinct socioeconomic groups in the community, as opposed to a distribution of a normal bell curve. One group of residents is well-educated with decent incomes and fills supervisory roles, and the other group is considered low income with lower levels of education and some association with the timber industry. Few residents were found with average income and education levels demonstrative of the divide in the community, according to workshop participants. Workshop participants also described Hispanic immigrants that may not be reflected in the census and were characterized by lower economic status.

On the other hand, workshop participants discussed strong cultural bonds in Georgetown and a proud community: "it's awesome and has social, cultural, and human aspects as a group." Georgetown is considered a gateway to the national forest with trails that go across the Sierra.

Participants expressed concern regarding Georgetown Divide Public Utilities District water systems and the lack of financial capacity to deal with aging infrastructure and ongoing maintenance needs. There are many old parcels with old septic systems. The need for fire/fuels reduction work is much greater than the financial capacity as there are many overgrown forests creating fire hazards.

Other physical infrastructure concerns include the roads with the abundance of pot holes. One participant referred to the roads as the "Gold Rush road system," as much investment in the community was made during the Gold Rush Era.

In terms of social capital, participants stated that residents are reasonably involved in the community with lots of retired residents with different expertise. The community is rural with a relatively homogenous population in terms of ethnicity, mostly conservative, and many retired residents.

Many local service offices are located in Georgetown and provide services to a larger area, including water purveyors and school district offices.

Gold Hill

Overall Capacity Score: 3

Gold Hill was characterized by participants as rural, like much of the county, but with low levels of social or cultural capital. Nonetheless, originally, Gold Hill was a Japanese colony and that cultural heritage is described as strong.

There is the Gold Trail School District in Gold Hill, but the fire station is vacant, the CSD nonexistent, no public transit, and there are no bike or pedestrian lanes. Private roads create small communities, but there is not a sense of overall community. The culture is one of farming and there is a lot of open space as opposed to a town center. Some residents commute to jobs in more populated areas and there is a high number of retirees.

Garden Valley/Greenwood

Overall Capacity Score: 3.5

Garden Valley/Greenwood was compared to Georgetown and Cool at the onset by workshop participants and rated as slightly higher in overall community capacity. With a relatively sparse population, a mix of low income and high-income residents, large parcels of land, and lots of seniors, Garden Valley has an active community association with high levels of participation and many residents with high levels of expertise in diverse arenas.

The community is active in other realms, residents get involved in regular farmers meet-ups at the park and other events at the Garden Valley Park, one of the community's gathering places. Participants described high social capital.

Physical infrastructure such as roads and schools are considered "good" by workshop participants. Garden Valley has both a middle school and a high school. The central park is a community gathering space. However, internet access is suboptimal.

Financial capital is low with some residents commuting for higher pay, which also gives the area a bedroom community flavor, but participants also stressed how residents maintain a high value for rural life. Commuters were designated as the residents most able and most likely to respond to community stressors. Therefore, while there are some characteristics of a bedroom community, commuters still seem to invest in the local community.

Grizzly Flats/Omo

Overall Capacity Score: 2

The Grizzly Flat/Omo community received an overall community capacity rating of "2" out of 5. In terms of human, social, and cultural capital, workshop participants noted a strong fire safe council and community service district. The fire safe council tends to pull the community together and can sometimes address larger issues, such as school and water issues. Omo is starting their own fire safe council and pulling a number of residents together to participate. Overall, the community was described as having shared local bonds, able to work together, and capable of securing and executing grant funding, i.e., grants through the El Dorado Water Agency.

Grizzly Flats community was built in the 1850s. According to participants, the county does not have funds to redo roads. Omo needs road work as well. Problems with water supply systems were noted. Older physical infrastructure is problematic to finance, with lower socioeconomics across the community, and taxing the community would be challenging.

Participants described how developers thought they were developing summer homes rather than year-round housing and therefore, the roads were not originally designed for winter travel. Paved over roads with no subbase, lending to major road maintenance needed and typically repaired with "just Band-Aids."

Both Grizzly Flats and Omo have elementary schools and need buses for transporting the middle and high school students. Grizzly Flats has a water system and a few wells. Omo has parcels on wells and no fire hydrants. Water sources for residences during drought years can be challenging for firefighting as there is limited water storage and low flows. This also reveals vulnerability in terms of responding to climate change. There are needed conservation upgrades and hazards with trees. The community is rated as lower capacity overall because of physical capital and high-risk fire.

In this region, workshop participants were concerned with an observed increase in homeless encampments, dumping, and drug use along the river corridor. These activities pose a hazard to upstream communities because of fire and downstream due to sediment and contaminants that reach the river.

Kelsey

Overall Capacity Score: 3

Overall, Kelsey was rated about the same as Garden Valley with socioeconomic diversity across the community. Kelsey does have a fire station, but is also vulnerable to wildland fire. Other challenges relate to transportation, the quality of roads, the poor cell service and poor broadband.

There are many community residents with diverse expertise and knowledge, indicating high human capital. Social capital in Kelsey is demonstrated by the community coming together to meet at various community events, such as the Kelsey school breakfast program and the collaboration that occurs to host the community farmers' market. The community has a shared rural agricultural lifestyle and small, local business owners. Participants noted that "similar to many rural communities in the area, there is very good human, cultural, and social capital, but there are challenges with physical and financial capital."

For physical infrastructure, participants noted a single major road thoroughfare (CA-193), a high school, and the Georgetown Divide Public Utilities District servicing the area with water. The wastewater is mostly septic tanks and many residents are on wells. The community is also serviced by the Walton treatment plant.

Latrobe

Overall Capacity Score: 2.5

Participants characterized Latrobe as a big rangeland area without infrastructure or roads. The area has faced problems with wells running dry as private wells service most of this region. The local school is serviced by a well and there have been high levels of arsenic. Latrobe residents value the region for its open, non-urban nature as the community is full of large lots and they do not want to subdivide those properties.

Latrobe was described as having low capacity in terms of fire flow issues with long, strung out systems with inadequate flow at the end of the line. This creates vulnerability during fire season.

A Tribe bought an expanse of land in Latrobe and workshop participants are unsure how this will impact the current community.

Mosquito/Swansboro

Overall Capacity Score: 1.5

On the lower end of the community capacity range, Mosquito/Swansboro was described as a community with very few paved roads, and those roads that are paved are ridden with pot holes. Many dirt roads signage connect the community, so unless you are familiar with the area, it is very easy to get lost. Much of the community is an extension of USFS land with almost impassible roads.

There are some residents in Swansboro with higher personal financial capital, but many are retired and money isn't going directly into the community. Some of the well-off residents built an airport, but other residents do not approve of the airport.

Participants mentioned concerns with the number of fire hydrants in the area estimating there are probably between 8 and 12 fire hydrants in the whole area. The fire management technique implemented was described as "pumping water out of a pond" to fight fire. There is also a need for water tanks as PG&E shuts off power in the region in the summer, so well water is shut off.

Moving into the Mosquito area, it is more forested and there are fire breaks being burned to protect from fire. The community does express social capital in how they rally around the fire station and firefighters: "the community wants to help out."

For grants, some residents want to come together and support applying for grants. Residents also come together over a popular pancake breakfast and can gather nearly 500 people.

Newtown/Sly Park

Overall Capacity Score: 3

Newtown consist of large, rural parcels. Sly Park is rather different with tract living and more social, cultural and physical capacity than Newtown. Participants emphasized the modality between the two communities.

"Newtown is right on Newtown road, is only residential, and there really is nothing else there."

Placerville

Overall Capacity Score: 4

Placerville was considered "doing well, thanks to voters passing two measures to increase taxes on the ballot to revamp the water and sewer system." Forty-five million has been spent on the wastewater treatment plant in 2009. There is a health department and a social services office in Placerville. Many lower income people are drawn to the resource center in Placerville and there is a good stock of low-income housing. While workshop participants think Placerville "still has a long way to go," Placerville received a "4" rating for their ability to take care of their residents and has improved over the past 20 years with help from an active community.

Workshop participants felt that tax money stays in Placerville rather than dispersing out into the greater county. In addition to county dollars, workshop participants discussed how there are other funding sources available in Placerville, but did not cite specifics. As the county seat, Placerville attracts substantial capital for various county services. One workshop participant mentioned a tax that was just passed to tax tourists, which would help pay for infrastructure.

Physical infrastructure overall was described as good, but roads need repair outside of the main road. Workshop participants noted that roads have reached their maximum capacity. The "old city" was built around the Gold Rush road system and not planned like a modern city.

Highway 50 and traffic through to Tahoe has had a positive effect on local businesses. Participants discussed how businesses attract more engaged people, an entrepreneurial spirit. There also appears to be substantial support for arts in the community with funding for music and art.

Pleasant Valley

Overall Capacity Score: 4

Community capacity in Pleasant Valley was described as very high overall owing to high financial capital and well-maintained county roads. Most residents are on septic systems and wells, with some residents served by El Dorado Irrigation District. The community has a mix of residents with high financial resources and very low financial resources. Many roads are private requiring local cooperation among residents to fund repairs and maintenance. The community has large acre lots, lot of ranches, agriculture and winery activities.

Participants described a diverse range of residents and businesses that could provide expertise locally to solve local issues such roadside litter and fire prevention. Local businesses were cited as a common link between area residents. Area residents, which include multiple wineries, have a sense of pride and belonging, "I think the residents would rally if there is a need. However, most residents are self-reliant and tend to keep to themselves."

"This is an area that folks have no problem protecting their property assets and own the materials and equipment to assist themselves and neighbors to connect a situation."

Pleasant Valley Road is a major arterial road and requires lots of maintenance and snow removal and occasionally there are challenges due to flooding. Two schools are located in Pleasant Valley and families seem to participate with schools.

Pollock Pines

Overall Capacity Score: 2

Pollock Pines was described as having lower overall community capacity, but culturally very high capital. There is a good community center that people rally around and that provides hot meals for elderly with limited incomes. Other community services include Meals on Wheels. Financially, the area has extremely low capital as the community was a mining and timber dependent community and those industries are no longer present, including many small family-owned mills.

Physical infrastructure is somewhat limited as roads were built during the gold rush and, according to workshop participants, while the county maintains the roads, conditions are not great. With narrow, winding roads, originally developed for horse and carriage, access to emergency services is difficult. Roads need immediate egress fuels reduction.

There are many mobile home parks and other temporary housing that turned permanent and major challenges to housing that need attention.

Two El Dorado Irrigation District (EID) reservoirs are located in the area and EID does a good job according to participants, but much of the infrastructure is aging and needs more than simple maintenance. The water infrastructure developed originally for mining and agriculture, according to participants. Open ditches were described as being used in the community's "outdated water delivery system."

Due to the geography and flumes, the community is very vulnerable to wildfire and mud slides. Communities popped up along the main routes between Pollock Pines and Placerville. The roads very overgrown with large private sections without the county to support maintenance.

Events such as the wagon from that overnights in Pollock Pines, bring the community together. There are also free Christmas and Thanksgiving community meals provided each year.

Rescue

Overall Capacity Score: 3.5

Rescue was characterized by participants as having pockets of big homes, small homes, rich people and poor people with most residents on wells, many dirt roads, but most of those roads are privately maintained. As previously mentioned, Rescue has a mixed demographic of older fixed income and newer high earners and lots of agriculture.

Physical infrastructure includes a fire station, community hall, and small post office. Green Valley Road is a major arterial road, but the Rescue area doesn't receive a lot of outside traffic. Homes have been there since the Gold Rush, but workshop participants discussed how residents has decreased their land base owing to El Dorado Irrigation District taxes. There was an old story core of Rescue, which is now closed, but new commercial developments and subdivisions on the border of Cameron Park.

There is not a strong community network as many residents are very independent, but there is a shared rural lifestyle with older roads, wells, septic and a newer school.

Strong financial capital and human capital are found scattered throughout the area. Neighbors seem to work together and are very proud of where they live and their lifestyle. Rescue is a destination area, so there is not a lot of tourist activity.

Shingle Springs

Overall Capacity Score: 3.5

Over the last ten years, there have been many wealthy individuals and families building multi-million dollar estates in Shingle Springs. Prior to this, there were many manufactured homes. The community is split between longtime, retired residents and newer higher income private dollars.

Residents have strong social ties to the land in Shingle Springs and the overall community capacity is believed to be little above Cool and other more rural areas. Participants described the community as engaged in local issues with strong voices on certain issues, but there is no formal group. While participants noted some diversity, most "rally around a rural lifestyle and privacy."

There is access to water, a fire station, community services district, community resources and better infrastructure and roads than other areas. However, workshop participants described how physical infrastructure is mixed owing to many private roads in poor condition and a limited plan for fire emergency. Many residents also rely on wells and septic.

Volcanoville/Quintette

Overall Capacity Score: 2

Volcanoville/Quintette was relativized by the group as being "the flipside of the American River Canyon with nothing going through it." One workshop participant noted that this area is "the best example of a rural, underserved area." There were vibrant businesses in the past, but the community has lost many and people are isolated with severe fire risk and hazards in part due to the single fire evacuation route and lack of good cellular and broadband internet service.

The area does not receive significant dollars, but there is a local CSD, a small water district in Quintette, fire groups and a few organizations, but no community center. Several informal, active individuals volunteer in the community and community organizations help with shared local bonds among residents and a "willingness to try to help out one another in times of need."

Volcanoville is a rural area that includes the "Bear State" community and is mostly comprised of large residential lots that are mostly forested. The commercial core of Volcanoville is a hotel, storefronts, and other businesses that were burned down several years prior and no longer exists. Participants noted a limited tax base for area improvements, with the exception of road maintenance. There is minimal infrastructure with homes on private wells and a single elementary school noted by participants.

Overall community capacity is low as the area is not suited to increased population density, and geographically, the Bear State is an important forest land and watershed area.

Outingdale/Somerset

Overall Capacity Score: 1.5

Outingdale was considered to be a very densely populated community within Somerset by workshop participants. Participants described a unique culture and how there used to be a circus with elephants of which the community took great pride.

Currently, there are many retired residents on restricted budgets and the residents that live and work in the area are working class or farmers. Several overall community challenges result in an overall community capacity rating of "1.5." From dumping and drug issues to septic tank issues and drainage problems that both affect the river through contamination and increased sediment, the community has not been able to address these challenges. Somerset was described as having homeless encampments impacting the river. Additionally, participants mentioned the large fire risk, with limited egress routes and overgrown invasive species.

Workshop participants described low social capital in this community as it "does not seem gelled as a whole." Nonetheless, there are sub-groups that do work together like the wineries and farms. There are also some properties that are second homes owned by wealthy people from the Bay Area and are not involved locally. This community has a stratum of people with different interests. Agriculture and wineries would be ranked higher in capacity, like a "4" out of 5, however there are more people who are struggling socioeconomically in the community. "Data in the area could be skewed by the wealthy, out of town second homeowners, but they are not interested in the prosperity of the community." "There is a large presence of people who just want to live out there and be left alone and don't participate socially." There is a winery and agricultural association, but workshop participants stated that is has not quite brought people together.

Regarding infrastructure, El Dorado Irrigation District provides water services "which people say they do competently." Water delivery for agriculture is a pressing issue with climate change and there is pressure from residential wells on the water table. Roads were described as being in poor condition, but schools were said to be good.

Nevada County Region

Alta Sierra

Overall Capacity Score: 3

According to workshop participants, Alta Sierra's population is comprised of mainly retirees and wealthy residents, with a small impoverished population. Homeowner rates are high, but slightly declining due to an influx of families and people being priced out of cities. Some participants felt that Alta Sierra had strong community capacity 10 years ago and a greater number of wealthy families. Commuters use Alta Sierra as a base to Auburn and other business centers. Outside of Alta Sierra, property lots become larger, 5-acre ranchettes. Social, cultural and human capitals are

bolstered by location-based groups but are diminished by a lack of an incorporated city and cohesion. The homeowner's association is voluntary and very active, having become a fire wise community that focuses on fire mitigation. Regular HOA meetings and a board grant some sense of community. Alta Sierra Country Club draws retiree involvement who feel like they share a culture there. While there isn't one overall identity, a shared environment and resource constraints brings people together. A sense of community completely disappears outside Alta Sierra proper as the landscape become increasingly rural. Participants felt the older age of community members could pose an obstacle in capacity but also enable Alta Sierra where other communities may struggle. Crime, specifically the illicit manufacturing of methamphetamine in local homes, has negatively impacted cultural capacity. Their limited Infrastructure consists of the Alta Sierra School and some businesses near Highway 49. Road condition are described as "well" but participants emphasized that winding, convoluted roads contribute to a fear of unfeasible egress in the case of fire. "Unless you know your way around, then you can easily get lost or find a dead end" said one participant. Nevada Irrigation District serves some parts of Alta Sierra proper while the remaining residents use private wells. There is no sewer system and failing septic systems are driving people away from the area.

Banner Mountain/ Airport

Overall Capacity Score: 3

Banner Mountain/Airport has a diverse, highly educated population with various expertise and a willingness to help. If a major external stressor occurred, this community could respond by applying funding and knowledge, but would struggle uniting over its lack of cultural identity. Participants spoke of Banner Mountain leaning on other communities for support. A community group "Friends of Banner Mountain" was able to successfully fundraise for local issues. People associate themselves with different neighborhoods but Banner Mountain itself does not act as a unifying point. A large population of retirees reside here and while enthusiasm is high, their physical ability is limited. The college educated population earning higher incomes and the nearby Loma Rica business park bolster financial capital. Physical capital is strong in the sense that roads are in good shape and there aren't major problems with water or sewer. Residents are on wells and septic systems. Nevada Irrigation District is well developed in certain areas. There are three designated egress routes, as Banner Mountain was designed to be a fire wise community. An airport is situated here, as reflected in the community name.

Peardale

Overall Capacity Score: 3

Peardale was presented as more of a corridor of rural housing along Highway 174 that participants thought of as an "outer Grass Valley". Residents are not wealthy, but most own their homes and enjoy a quiet living that is not too far from town. A sense of community stems from the volunteer

fire department and good people who live in this community. Cultural and social capitals rank higher on the basis that people care about each other and the community has a clear identity. There's not really a place to gather in Peardale but in the nearby town of Cedar Ridge, people can visit the small main street. A post office and store are also in Cedar Ridge, important features especially after the Peardale store burned down. Participants noted the opportunity for organizing in Cedar Ridge but residents will need money and assistance. Physical capital is limited in that there is no sewer system, and residents rely on wells and septic. Roads are maintained.

Chicago Park

Overall Capacity Score: 3

This community contains a dichotomous group of residents, some of whom are newer and moved here from urban areas while others are older residents who work or formerly worked in forestry or agriculture. Both big houses and "shacks" dot the rural landscape. "I think of Chicago Park as a rural farm community" said one participant. Changing demographics in this community have riled some residents, like the old agriculture families who feel like the new comers are "infringing upon rights." Others feel like the mix of long-term residents with cultivated skills and knowledge compliments newer residents bringing in fresh ideas and skills. Cultural capital has suffered therefore from this divide and from residents' predilection to keep to themselves. But if people feel strongly about an issue, there is action. Folks are self-sufficient to maintain their own roads and clear brush, move earth and raise livestock on their properties. When residents do interact, it is within very specific family groups that live clustered near each other. This Chicago Park store and school also serve as community centers. A recent fire may have contributed to a greater community connection. There are a number of different activities, including a group for Chicago Parks fire-wise community and a local volunteer fire department, both which draw participation. Residents are more likely to have a high school level education. Financially, the participants thought of this community as low to middle income who "keep their money to themselves." Others believed Chicago Park has potential if only this community could receive grant funding. Physical capital is lacking from decrepit roads and sub-par Nevada Irrigation District Service. Every home is on septic and wells, which have been known to dry up.

Garden Bar

Overall Capacity Score: 3

Garden Bar is a homogenous, sparsely populated community of large farms, ranches, and land trust property set in a rural landscape. Situated alongside the Bear River, the area was a candidate for a dam site in the recent past. Ranching culture seems to be the only unifying tie here, especially since some are historic ranches. Participants explained that this area doesn't feel like a community or have much happening.

Grass Valley

Overall Capacity Score: 4

In comparison to other communities in Nevada County, Grass Valley is the most developed area, owing to its popular downtown and surrounding higher density housing. Residents find Grass Valley to be a culturally engaging place. Support for the arts and a variety of community events led some participants to say they believed this community is better than the Bay Area. Financially, Grass Valley believes itself to be a disadvantaged community. Social capital is strongly focused in institutions such as church and hunting clubs. The number of groups with distinct allegiances and various identities implies cohesion between smaller groups of friends. But, there seems to be a sense of responsibility and care for others within these groups that extends to the larger community. A small group of active citizens contributes to the area's development and care about solving community issues. Because Grass Valley is incorporated infrastructure already exists for social capital to flourish. Residents feel a strong loyalty to the area, its historic roots and forested environment. Cultural bonds in Grass Valley seem to stem from a pride for the working class, maintaining a high standard in work performed and support for the reduction of homelessness. The Hospitality House provides short-term housing for 75 people in need. However, these bonds may not be shared amongst everyone, especially new arrivals. A high degree of polarization exists that can separate the community into "us" verses "them" and is sometimes reflected politically. Often, the rift is between the older, wealthier, highly educated and typically retired "outsiders" and the younger, poorly educated, longtime residents with little economic opportunity. Longtime residents who struggle to survive economically tend to resent the retirees that can afford to like in Grass Valley comfortably. New retirees to the area may be less integrated into the resilience mechanisms, like support systems, that long-term residents from multi-generational families have in place from dealing with unemployment and response to disasters.

There is a demographic hole in the 25-45 age range that participants blame on a lack of primary industry and the pull of cheaper housing in the valley. After mining and logging disappeared the entire county of Nevada started hurting economically. This community now relies on retirees and tourism in downtown for an influx of money. One participant argued that some youth are returning as they are priced out of the Bay Area for homes, but not many. While there are a small number of wealthy individuals, the majority are low income residents who don't own their home and live paycheck to paycheck. Low income housing is prevalent. Businesses in the downtown matrix bring in money, there's a new brewery attracting attention and participants complimented the chamber of commerce's efforts. This City of Grass Valley recently passed a measure to increase local sales tax to provide additional funding for police, fire, streets and parks. The new measure was supported by the community and represented the biggest change for taxes in a decade. Through other taxing measures the city is able to spend money on projects and develop community resources in spite of large pockets of poverty. But if Grass Valley were to receive more grant funding as well, participants said the community could leverage the opportunity. For example, in the past Grass Valley received a grant that distributed an iPad to every child based on socioeconomic status. Participants stressed the influence of non-profits in the area due to the substantial amount of money that retirees donate

for various causes. Physical capital is adequate, as county supports services in this municipality like libraries. In the urbanized parts of Grass Valley roads, water delivery and flood control are well provided. Further out, the more "natural" areas find themselves vulnerable to egress issues, flood and wildfires. If a fire occurred, participants believed strong mutual aid agreements and the local airport would benefit the response. City workers actively solicit money to upgrade infrastructure and, again, use taxes for physical needs like updating the sewers. The City of Grass Valley provides water for downtown and the rest of the area receives water from Nevada Irrigation District. Private improvements are lacking in certain neighborhoods. Schools rate well but are hurting due to the lack of younger families.

Lake of the Pines/Higgins

Overall Capacity Score: 3

Lakes of the Pines/Higgins encompasses the gated community of Lake of the Pines (LOP) and the surrounding areas referred to as Higgins and Dark Horse. Most of the population in this community does not live in Lake of the Pines, but the ones who do benefit from a strong HOA and a tight knit community with common interests. Lake of the Pines residents fall into a higher socioeconomic bracket but tend to be reluctant to embrace taxation. Participants told of changing demographics in the community as more renters offset the seniors and retirees. There is a sense of community, but it's insular. Water features in LOP have filled up with mercury and require regular dredging. The surrounding area of Higgins and Dark Horse has an overall lower capacity when compared to Lake of the Pines. Higgins Fire District closed one fire station due to funding issues after a ballot measure failed that would have required each property owner to pay $35 per year. Now, fire protection costs increased by $2,000 per year and there's no full-time staff. Roads have potholes, schools are in adequate condition and there's no sewer system outside of LOP. A proposed centennial dam has the community worried and has already lowered local home prices. Higgins Marketplace also expects new development in the form of a shopping center project. The Dark Horse area is home to a large Hispanic population but participants say these residents are "invisible" to the greater community. Outside of LOP, cultural and social capital decrease. Population is scattered and there's no central meeting place available. Law enforcement doesn't patrol the area and participants complained of repeated mail theft problems.

Lake Wildwood

Overall Capacity Score: 3.5

Lake Wildwood is another gated community where the majority of residents are still seniors and retirees; however, shifting demographics favor more renters. Lake Wildwood has an identity as a neighborhood and gated community, but that identity is more imposed than created. While social events are available for residents, they don't necessarily always translate to high cultural capital. Regardless, residents stay involved through Lake Wildwood's own television station, newspaper,

theatre company and numerous subcommittees. Residents are highly educated with diverse job backgrounds. Homes are fairly high end and spread out around the lake which can detract from cohesion. Participants mentioned that while a good number of residents identify as affluent, a diverse spread of socioeconomic status does exist. The HOA, which collects fees, assumes responsibility for maintaining roads, culverts and common use areas. An extremely unique water problem of E.coli pollution has afflicted Lake Wildwood's lake. Swimming is no longer allowed and experts continue to struggle with resolving how and why this problem started. Because the response to the ongoing issues with water and a united front when McCourtney experienced a fire, participants thought Lake Wildwoods capacity to deal with threats as strong.,

McCourtney

Overall Capacity Score: 2

McCourtney displays its financial dichotomy when viewing thousand-acre horse ranches with mansions next door to a single wide trailer on an acre of land. Generally, high income households prevail that are self-sufficient. The population consists of older agricultural families while more recent residents originate from a variety of backgrounds. Residents possess phenomenal technical capabilities and knowledge that just isn't shared between one another. Most residents are interested in isolation and rarely talk to each other to cultivate a sense of community. Private road association serve as the best example of social capital. A common lifestyle of land use, agriculture and livestock cements what little cultural capital they share. This area is very susceptible to fire, flooding and drought. Most properties are on private roads, draw water from wells, and use septic.

Nevada City

Overall Capacity Score: 4

Nevada City is a mix of socio-economic levels and yet there is considerable wealth that may not be evident from the low-key lifestyle residents espouse. Nevada City has become a magnet for well-heeled retirees. At the same time, many residents, especially long term, live on a shoe string budget. Nevada City is a community with a high level of involvement and participation, despite being economically challenged. Nevada City's discretionary funding is quite limited as evidenced by their estimated $3 million-dollar city budget that's roughly three times smaller than Grass Valley's. The 2,500-person population means city doesn't have a big staff and means the suite of full services offered can sometimes feel on the cusp of being overwhelmed. Usually one person has multiple jobs, but there's a cohesiveness because of the small geographic area being served. Despite the budget, residents feel Nevada City services are adequate and private dollars are actively invested here. Non-profits serve the community and rely on donation from residents. The city relies on volunteers and home-grown fundraising, efforts which help span socioeconomic differences. Some participants felt the city relies too heavily on raising funds by donations for city projects. Causes often raise funds successfully, like the recent "Goat Fund Me" campaign that raised money for goat

herds to graze greenbelts in Nevada City in an attempt to reduce wildfire risk. Residents gather every week to work on city gardens.

Participants felt wary about burnout, since the same group of progressives spearheads new projects, which can feel like moving from one emergency to the next. One participant who moved to Nevada City from Fresno related that "…the difference in who shows up to volunteer is dramatic. Many people offer their abilities to community projects and bring talents, skills and intelligence." Nevada City, more than any place else in the county, is a center for the weed business. A cohesive group of growers have formed in the community but the topic has also created a fair amount of tumults in the past few years. There is a very strong sense of community and a high regard for place-based activities that support the art, music and entrepreneurship. Participants were impressed by the number of gatherings "almost every two weeks" like parades, fire wise community, Wild and Scenic Film Festival and concerts that present a sense of belonging to a community where people enjoy each other. Residents strive to preserve the health and safety of the area and often advocate for higher priced solutions. Nevada City receives a high level of civil engagement, in great part to due to loyalty to area and high retiree population with time on their hands. The local radio station KVMR and the online site YubaNet are well regarded as community engagement hubs. KVRM radio dates back to the 1960s and still brings manages to engage the "hippy, crunchy granola, nature lover culture of the area that drags people out from all over California." Cultural capital grows from shared bonds and values but the population can diverge into three communities that don't work together a lot: retirees, cannabis, nature locals. The overall education level in Nevada city is high for a rural community in the mountains, in part due to the retiree population. However, many young people leave the area for education and employment, draining the potential work experience and skills base. Many people previously lived in other cities and there is a strong regard for ideas from the outside. "I notice a lot of respect for educators, social activists and community participation. These are contributors that could lead to resilience and problem solving in stressful or disaster conditions" said one participant. Physical capital in the urban area is high but less so in rural areas, which are particularly vulnerable to fire, flood, drought, egress issues and lack of internet access. Participants mentioned the fact that this community includes rural and forested areas that bring down overall capacity. If a major fire occurred the results could be disastrous based on the minimal egress routes and spread out nature of the population. However, residents would rally in the case of a disaster. Roads and sewer systems have aged out and it is well known that vegetation management for wildfire is not sufficient.

San Juan Ridge/ Newtown

Overall Capacity Score: 3

San Juan Ridge is referred to as "The Ridge" by locals. Ridge culture is strong although the community is changing as time passes and new residents have less connection to the cultural heritage of the area. Residents lack structure and funding to build on their shared sense of community. "If they had funding, these people could mobilize and do something great" said one participant. People have organized large-scale projects like the Inimin Forest and Colombia Cultural

Center. The Ridge has one of the most diverse sets of residents in terms of creativity and skills that they generously contribute to the community. San Juan Ridge itself is very cohesive culturally but only amounts to a third of this community's area, whereas Newtown is less cohesive overall and associates more with Nevada City. Education and income levels are mixed. Cannabis grows could contribute substantial financial capital in the future yet many grows still aren't registered as of yet. Due to lack of public transportation, pockets of low incomes, limited access to children education and egress, the people of this community are extremely vulnerable. Financially, extremes at both ends of the socioeconomic spectrum live here, but the wealthy are willing to contribute resources. Capital is tied up is large land parcels. Public resources include a medical center, fire stations and nonprofits. Egress presents a particularly neglected issue. A number of neighborhoods only have one road in and out, potentially trapping people attempting to escape in a fire. Residents rely on private infrastructure like roads and wells and the condition of physical capital varies greatly based on neighborhood. Public infrastructure is neglected and in need of fire suppression resources. Participants explained many people of this community may be opposed to change, improvement and development in order to maintain privacy and rights. Infrastructure gaps, specifically for sewer and fire suppression, limit future commercial development. Physical capital is driven down by mining and mercury leaching from industry.

Penn Valley

Overall Capacity Score: 3.5

Penn Valley residents embrace the area's moniker of "Penn-tucky," that references their down to earth agricultural identity, and "Penn Valley formal," referencing the casual dress code of the blue-collar workers. Participants believed that this community has the overall capacity to respond well to external and internal stressors, even with pockets of poverty. Residents, who include marijuana growers and horse ranchers, have a high amount of knowledge of agriculture, land, technical expertise and business. The community comes together through events like the Penn Valley Rodeo, Easter egg hunt and through community groups such as the Penn Valley Park District, Chamber of Commerce and Municipal Advisory Council. During the 2015 Nevada County housing element update regular town hall meetings drew crowds of 200 to 300 people. Penn Valley recently received a new sewer pipeline, greatly increasing its physical capital. Penn Valley preformed their own survey on disadvantaged communities and used the results to justify a block grant to pay for the new sewer pipeline. The Western Gateway Park is considered a "jewel" that receives regular upkeep. Roads were just refurbished and a downtown area draws people inwards.

Red Dog/You Bet

Overall Capacity Score: 2

Red Dog/You Bet includes a significant area of BLM and national forest land, which contributes to the feel of an extremely rural lifestyle. Residents live on large parcels and typically stay to

themselves. A number of illegal cannabis grows exist here. Neighbors on the same road may know each other to coordinate things like road re-paving or borrowing a tractor. This is not an impoverished community, and skilled people live in the area who can maintain their properties and fix their own cars but that human capital is offset by little to no sharing of services. Their independence is exemplified by an ability to self-assess their own problems; residents own trucks and earth movers that can grade, cut fire breaks and clear snow. The main road is well maintained but somewhat narrow and contains many curves. A well-kept bridge over Greenhorn Creek was replaced within the last 20 years. As with the rest of rural Nevada County, this community relies on wells and septic.

Rough and Ready

Overall Capacity Score: 2.5

Rough and Ready unites over their strong community identity of independence. Residents are limited by low incomes, that aren't typically shared for community projects, and low education levels. In a pinch however, participants expected these folks to work together if needed. An annual festival celebrating their secession from the Union draws large crowds. Wildfire poses a threat here but residents try to clear property. Physical capacity includes the use of wells, septic tanks and intricate road systems.

Spenceville

Overall Capacity Score: 2

Spenceville is another community where residents value an independent lifestyle and prefer to be left alone. Incomes vary widely, there's a number of pockets of low income, and the higher income areas somewhat work together. Drug crime plagues neighborhoods. Overall, participants implied a number of infrastructure challenges. A knowledge and skill base does exist and contributes to a loose sense of community. Cultural capacity is low. Wells are susceptible to groundwater contamination and drought. A few roads provide egress and ingress routes.

Squirrel Creek

Overall Capacity Score: 3

To many participants, Squirrel Creek represented a non-descript, independent, rural area that nonetheless has a community-oriented culture. Residents want to be left alone unless there's an imposing need. Participants related an example where a house manufacturing methamphetamine was repeatedly reported to the Sheriff's office in an organized fashion until the offenders were taken care of, upon which everyone "went back to ignoring each other." Financial capital is highly

diverse. These independent residents don't expect outside help or funds. Many highly educated, capable people with a variety of skills live in Squirrel Hill. In terms of human and social capital, there's little motive to work together but with identified need and leadership, the community has resources to self-assess in some situations. Residents strongly associate with Grass Valley as an economic and cultural hub. Almost everyone uses septic systems and wells and participants referred to physical infrastructure as fragmentary.

Tahoe National Forest

Overall Capacity Score: 2.5

This sparsely populated community overlaps with Tahoe National Forest Land, which receives funding from the federal government for upkeep. Other than the few private residents who participants described as a mix of "miners, growers and well-off individuals," public agencies, private corporations and recreationalists are the main human influence. Most decisions are made by non-residents and special interest groups. Human capital increases by the presence of scientists in diverse fields involved in public and private projects. If there is a need, people commute for groceries, schooling and jobs. Recreationalists statewide recognize this national forest as a destination and would lend support for the area if needed. Participants noted however that recreationalists generally have little knowledge of how to care for the land and resources. Participants noted that collaboration and financial capital were higher during the 1970s to 1980s, but some of the knowledge base is still somewhat in place. Private land is isolated, has low economic value except for occasional revenue from timber. The main land owners have a history of caring for the land but decisions are generally out their hands. A lack of law enforcement from the county and Tahoe National Forest transfers responsibility to residents. Illegal cannabis grows have been a problem. Roads are the main infrastructure usually fixed rather quickly. Participants told of aging PG&E water infrastructure that's now in limbo after the company declared bankruptcy. Defensible space issues also pose a threat as residents lack incentive to invest in the land long term. People in this are very spread out and live as individuals that are self-sufficient and desire privacy.

Sierra County Region

Regional Overview:

Sierra County is economically depressed with low income residents, has inadequate housing for the demand, and is limited in expansion by zoning. However, in many parts, there is a strong sense of community, pride in the rural way of life, and residents working together to tackle challenges.

Alleghany/Sattley

Overall Capacity Score: 1.5

Workshop participants differentiated between the communities of Alleghany and Sattley. Situated in the hill about 40 miles west, slightly southwest of Sattley, Alleghany was described as a fiercely independent, remote community. As an area previously committed to mining, Alleghany was said to contribute to historical significance and related business opportunities have emerged in the area. Since the closure of mines, participants told of low financial resources in the Alleghany area, with a dependence on the Forest Service, and some property owners cultivating marijuana for economic gain.

Residents were described in two manners, those who do not want the government involved with their lives and others living there because they are unable to move. The school in Allegheny is closed, leaving the residents without a community center, garden, or social space for residents to congregated. What remains is two businesses and a bar. Physical infrastructure is "poor, not the best." Nonetheless, the water district is successfully maintained by volunteers, yet the reliance on volunteers leaves the community vulnerable if something were to occur. Participants noted the high number of volunteers that help to keep county facilities operating. If communities could be separated, workshop participants would designate Alleghany as a 1 for overall community capacity. "We tried to do a grant in Allegheny years ago, everyone qualified, definitely disadvantaged. Even with money in pot, they didn't want people to come into their homes to fix things."

Sattley is part of Sierra Valley and offers "a totally opposite conclusion with pastoral scenes and strong agricultural values." Sattley exhibits a tightly knit community devoted to agricultural uses and "is on the coattails of the agricultural community of Sierra Valley." Both Alleghany and Sattley have low populations and income levels; however, workshop participants noted that ranchers and other private businesses have more resources and a close tie to the land. Sattley has few employment opportunities and low human capital.

The communities try to pull together, but this is not always possible due to the long distance to travel in-between communities, resulting in two very distinct with little communication.

Calpine/Downieville/Sierra City

Overall Capacity Score: 3

Sierra City and Downieville have many residents with historic ties to the area. The residents of the community are heavy into fundraising evidenced by several community supported programs, volunteer fire departments, the school and community members working together to better the community, and everyone's "willingness to help." Participants described high levels of volunteerism, with a population small enough to create a fishbowl, it is difficult not to participate or know what is going on. There area has a high percent of motivated professionals or businessman who may work outside the area or have home business. Private funds are quite often offered at fundraisers with above average per capita income in Sierra City and Calpine occupied by vacation and second homes. Downieville has lower overall income levels.

With a unique geography, rich history and active community involvement, workshop participants told of a "love of our rural lifestyle." Calpine and Sierra City have a large percent of professionals residing in the county. Downieville is the county seat and is the home of governmental activity. Historically, tax values were high in Sierra City and Calpine. Sierra City has a high value recreation area (Lakes Basin) and the Downieville-Sierra City area has a rich "gold country" historical with high value resources to access.

Infrastructure is almost nonexistent in some areas, but is very much needed. There is not sufficient funding to meet infrastructure needs. Inadequate infrastructure includes road improvements, challenges with water and sewer, a lack of cell service on the west side, poor cell coverage on the east side, and limited broadband. However, with high social capital noted by participants, "when infrastructure really needs improvement, we manage to find the funds."

"There's no place like home! For all the negatives, this is still my way of life."

Calpine was more specifically characterized as a ranching and retirement community and incredibly active with volunteers.

As the county seat, Downieville also has many volunteers and is well known for hosting successful events (e.g., Downieville Classic Mountain Bike Race). There has been a loss of business and participants told of gas not always readily available. The Downieville school has decent program, including arts and theater, and increasing enrollment. The school drives a lot of people on the west side (Downieville/ Sierra City), and socially the school gets a lot of people out. We need a bunch of infrastructure. The clock doesn't work on the courthouse in Downieville, which did not surprise workshop participants.

Sierra City has a business community which has become seasonal. Fun volunteer activities are planned throughout the year with volunteer fire and recreation, but like many of the communities in Sierra County, there is a transition toward bedroom communities for Truckee and Reno.

There is a clear divide between the east side and the west side of the county with more transient tourism on the west side compared to more agricultural and ranching on the eastside.

Loyalton/Verdi

Overall Capacity Score: 2.5

The City of Loyalton and Verdi are distinct areas. In describing Loyalton, workshop participants told of a city on the verge of financial bankruptcy and plagued by governance challenges. In need of road repair and water treatment plant maintenance, Loyalton suffers from physical infrastructure issues. Loyalton is an incorporated area that hosts about a third of the county's population, lots of vacant homes, and properties in disrepair. A low-income trailer park was closed with residents displaced, increased homelessness, and leaving the property in shambles. Some residents were moved to Reno, but some assimilated into Loyalton. "The schools could be better in terms of adding arts and

classes that support knowledge of farming and ranching." Workshop participants recognized the value of their rural lifestyle and passing on knowledge of land management to younger generations.

A few organizations (i.e., ESVCC and Rotary) actively raise money that is funneled back into the community as donations to the hospital and educational scholarships. Loyalton has some professionals with knowledge and experience who are able to address community problems and are willing to work together to try to improve conditions; however, there are also residents who are unaware or unwilling to address community challenges or be involved. Many residents will get involved in a crisis and contribute their capabilities then.

Loyalton community meetings were said to have limited attendance and of those who attend, many will argue on community issues and will express disagreement with decisions made by city officers and county supervisors. Another workshop participant described resident participation as good, but with many activities for the small community, including an "excellent museum."

The overall community capacity score for Loyalton was "increased because of Verdi and Verdi and Loyalton are different worlds."

Verdi was characterized as a bedroom community to Reno. Small ranchettes or high value properties scatter the terrain of this ranching community. Residential infrastructure is challenged already with respect to sewer and water. Participants described diversity within the community with a large segment of seniors and another sizable segment commuting to other locations for work and living in Verdi "and not paying attention." Many commuters take their children to school in Reno or Truckee because Sierra County doesn't have bus service in the area. Lastly, participants described volunteers, teachers, and social services—the people who show up.

Verdi is populated by capable people, but there is reliance on a portion of the community to help resolve issues with the "same people coming and helping and a lack of community interest by others."

One workshop participant noted that overall social capital in the lower socioeconomic areas has stronger support systems. For example, "in the trailer park, if someone has a need, neighbors come together and take care of one another." There is weariness outsiders coming in and helping. "Seems that some of the higher socioeconomic areas do not have the same community support," like the bedroom communities.

Sierraville

Overall Capacity Score: 3.5

Sierraville is both a community of ranchers for some and a bedroom community for other residents who commute to Truckee for work. Financial capital is higher than other areas in the county with the influx of workers from Truckee choosing to live in the area; however, there is more money in bank accounts than invested in the community."

Some contention exists among "new comers" and old-time residents. Participants told of new comers not supporting change and pointed toward old-time residents recognizing the need for development and revitalization.

"We are on the verge of some very significant changes with bedroom community issues. Some people are not contributing to the community." There are also limitations on growth as "agricultural properties are very well defined by law. There's a real limit or where it will grow and how."

The community dynamics are increasingly more bedroom oriented. "People moving in live here, take their kids to Truckee where they work, resulting in a lack of contribution to the health of the community." Schools are declining enrollment. As they retire, they are living here, but not volunteering. "There are mattresses in home, but no contribution to communities. Sitting in this building [old school house] shows what has happened. This used to be a thriving K-12 school, but slowly the population declined. They closed the mill and the population started to change. When we closed Sierraville school, we had three students remaining."

Regarding social capital, one participant told of how the "community came together to raise money for a cancer patient ($50,000). That is a huge scale to help a local community member." The fire department is all volunteers and has "nice trucks and an annual successful bike tour" in Sierraville. "New comers have come together for meetings, such as what to do with the old school house, but then no one wants to be a part of the process. They want someone else to do it."

Community gatherings include catching games at the ball fields and a few local events, but no historical society within the immediate area. Longtime residents get very involved in events and any new projects. They hold community meetings and write letters to the editor.

Regarding physical infrastructure, residents have recently repaired old barns downtown and other old buildings. Road work is still needed owing to last year's flood on the state highway, but most roads are in decent shape.

"Everyone loves where we live and doesn't want it to change. There is a strong community with capable individuals. This is a small, close knit community."

Placer County Region

Loomis/Penryn

Overall Capacity Score: 5

The residents of Loomis like to be called a town, not a city, keeping in line with their preference for limiting growth. On the whole, Loomis is less disadvantaged than other communities in Placer due to the number of wealthy people residing in this community. "When there is a code enforcement issue…they call the board of supervisors" said one participant in reference to the wealthier residents' ability to self-assess and utilize political channels to solve their problems. "They're fine

without everybody else and don't need anyone" summarized another participant. However, participants noted stratification along socio-economic lines since there are some pockets of lower income residents. Community members will go out and support their community, particularly through the various social events like the Mandarin Festival. Infrastructure rated well, with schools thought to be in very good shape.

South Auburn

Overall Capacity Score: 4.5

South Auburn is in a better financial position compared to the City of Auburn. Portions of this community are unincorporated while others are incorporated into the city. There are some large, wealthy subdivisions. Physical infrastructure, in terms of roads, sewer, water and a regional park, is strong and doesn't require much work. Culturally, residents socialize at fairground events. The Auburn Indian community also has an office located in South Auburn. Residents of South Auburn are not very good at working together as a group. There is no Municipal Advisory Council for the area, which are groups that communicate constituent concerns directly with their Board of Supervisors representative.

Auburn

Overall Capacity Score: 3.5

Auburn is experiencing a growing community base from the influx of people moving from high density population areas. However, the newcomers haven't yet connected socially to the rest of the community. Although, some of the "old Auburn" groups have been influenced by new members with different values. Auburn has a strong sense of community with many involved citizens and residents of the incorporated portion of Auburn are very willing to use their capabilities to address the town's needs. Still, participants indicated that residents cannot solve problems together very well. On an individual basis, there are a number of high-income residents who have the financial capability to deal with potential problems. Auburn promotes its cultural events well and is known as the "endurance capital of the world." Generating funds and improving the city is a major problem for Auburn. Participants noted the number of large houses in the unincorporated region of Auburn, exacerbating the drain of funding from the city center. The property tax base is in North Auburn, and income isn't shared equally in unincorporated area. Locals consider the process of incorporating the surroundings regions of Auburn together and want to keep North Auburn rural. More infrastructure is needed to handle the recent population influx, which has the potential to overwhelm Auburn's capacity. Even though the City of Auburn needs to improve water and sewer infrastructure, the city lacks staff, has difficulties uniting people behind projects and takes a long time to organize grant funding. "The City of Auburn does not have a robust fund to serve residents" said one participant, for example, local roads are constantly in need of repairs. Auburn has a well-equipped emergency structure but some residents are hard to access in the more rural areas.

Auburn/Bowman

Overall Capacity Score: 3

Auburn/Bowman functions more as a commercial center than a residential area. There is almost no sense of community or shared culture in Bowman. Some well-connected residents get together to advocate on shared issues like the Bowman Charter School and road widening. The community is unincorporated and relies on county funding, but compared to other unincorporated area Auburn/Bowman has a higher capacity to provide for residents. Development in the area is stymied by their sewer system reaching capacity, steep hillsides and proximity to BLM and protected lands. Water is also hard to come by.

Clipper Gap

Overall Capacity Score: 2

The majority of Clipper Gap residents are elderly or retired without much financial capital. Participants labeled this as a bedroom community that has no strong social hub like a town center. Clipper Gap has a limited supply of treated water for fire and domestic use. Some areas require updated sewer infrastructure. Human and social capital are mixed. Placer County Water Agency attempted to get the community to work together but found that the residents weren't willing to do so. Other participants said that the community is willing to meet together for a common purpose.

Applegate

Overall Capacity Score: 2

Applegate is a smaller, rural community of mostly elderly on a fixed income. Incomes are low to middling though some newer developments have been marketed towards higher income individuals. A number of private projects, like the expansion of the Applegate grange, were recently approved and constructed, demonstrating the availability of private funding. Living a rural lifestyle underpins the main shared bond between residents. Some people in the community are willing to work together, but a loose sense of community pervades with no community organizations and a lack of local advocates. There are no central areas like a downtown to gather in other than churches. For a rural area, Applegate residents are generally well served in terms of roads, water, sewer and access to infrastructure but certain problems still persist for constricted residents. Most of the neighborhoods that have water issues reach out to Placer County Water Agency (PCWA), but they serve such a small portion of the population that "PCWA can only support the ratepayers they have." One participant mentioned the area of Meadow Glen, which has wells 500 to 750 feet deep and would require tens of thousands of dollars to fix. Heather Glen, an elderly home in Applegate, has clientele on fixed incomes and doesn't have sewer or a water connection and "brings down the

capacity in this region." Residents experience wells drying up during drought periods. Participants also warned that if a forest fire occurred in Applegate, the results would be devastating. Meadow Vista is close by and PCWA is talking about having a water tie-in between Meadow Vista and Applegate, which would help during a fire.

Foresthill

Overall Capacity Score: 1.5

Consistent with the title of this community, quite a bit of land in the community belongs to the USFS and state park property. The timber and mining industry used to sustain this community but now those industries are gone. Foresthill ranges from retirees to working people who travel off the mountain to work. Participants labeled Foresthill an "interesting little town" that has a number of old families. Job opportunities are limited to Placer Water Agency, public utility or the Forest Service, pushing young people off the hill to find work. More affluent residents tend to not associate with locals and spend more time in the Auburn area than they do in Foresthill. A significant number of people live paycheck to paycheck or receive government assistance. "This is a depressed area with pockets of financial resources not available for community use" said one participant. The community is divided between those people with historic roots in the community and those who have lived there for 10 years or less. Newcomers are influential in community decisions and often at odds with larger local member ideas. The community works together on issues concerning fire and water. For other issues, working together takes a great deal of communication and pre-event planning. A movement that addresses that wildlife concerns for the community is bringing local agencies and community members together. Foresthill's history that dates back to the Gold Rush and mining knits together local culture. Participants noted a definite divergence in population priorities based on the immediate living area. Roads are in constant need of repair and upkeep. There are two schools in this community, one of them is a high school managed through Auburn School District, and both have a high number of disadvantaged students.

Placer East

Overall Capacity Score: 1.5

Placer East's small population is dispersed across a large area that is primarily owned by the United States Forest Service, Bureau of Land Management or wildlands. There are pockets of financial prosperity where the most county resources are focused. A Native American population exerts significant influence in this community. The Cedars is a wealthy enclave of seasonal residents that has historical ties to the Central Pacific Railroad Company. People retain an independent nature and ties to their neighbors, as opposed to a relying on county resources.

Cape Horn/Moody Ridge

Overall Capacity Score: 2

Participants relayed the history of the Cape Horn/Moddy Ridge as originating in 1960s when squatters moved onto the land. Part of the community is now made up of many people living on one large piece of property. Properties are still not accumulating taxes because participants said the county doesn't know those people still squatting. All of Moody Ridge still has dirt roads and relies on wells. Participants noted that roadways are one of the biggest problems Cape Horn/Moody Ridge has in terms of infrastructure and fire danger. Within the last 30 years, Cape Horn has built out in the last 30 years but there is still limited infrastructure. Roads are one lane, there are no hydrants and residents rely on wells. Railroad tracks run across the one lane road into the community and participants warned that if a train breaks down while a fire happens, no one will be able to escape. Egress is limited regardless. The area has a history of fire damage, for example, when the 2004 Stevens fire destroyed several homes.

Alta/Dutch Flat

Overall Capacity Score: 3

Alta/Dutch Flat has been the largest community in this area for a long time. Although there is a limited local tax base from both businesses and residents, most revenues from this area are absorbed by the county. There is no economic structure or town center, however, residents were said to have wealth. Infrastructure is maintained by Placer County and the water system is fine, but there are issues with roads. A number of resident's volunteer for the fire department but more fire protection is needed. There is a community center. This community is very close knit and people will do things for free. Members work together to make up for project shortcomings and to keep the community maintained where the county does or cannot. A monthly community potluck brings large crowds of up to 100. Elderly people work well together and stay involved in the community.

Colfax/ Iowa Hill

Overall Capacity Score: 2

This community includes two very different areas of Colfax, which is one of the most populated areas in the county, and Iowa Hill, which is extremely rural. Both areas feel connected to each other due to their proximity to the American River, sharing the same zip code and sending their children to the same elementary school. Culture capital benefits from generations of families who love their isolated lifestyle, share family values, support local sports and the high number of community events, like fourth of July celebrations. The community will pull together when needed, as one participant said, "when the fire comes everybody gets out and helps." Colfax has a small-town

center with many rural, satellite residents who still identify as a part of the Colfax community. The city relies on grants for financial assistance. For years Colfax has had strong human, cultural and social capital but still struggles with financial issues, most of the funding originating from sales tax. Infrastructure in Colfax has been difficult to maintain due to its population and boundaries. Even with Highway 80 running through the middle of Colfax, there isn't much development. Iowa Hill is extremely rural and community members have had to learn how to survive in this area, as well as work together. Local Iowa Hill residents are willing to share knowledge. Practically no infrastructure exists. Residents just recently received phone service but still lack integrated systems for water, sewer, and power. Everyone relies on generators, wells and septic systems. Roads in Iowa Hill are maintained by the county and the school recently closed due to a lack of students.

Weimar

Overall Capacity Score: 2.5

Weimar's history started around the inception of the Weimar Institute in 1978 given there was little record of logging in the area. This bedroom community is all rural country but it is located off of the Highway 80 corridor, "perfect for commutes to jobs in Sacramento." Much of this community is unincorporated. Resident must travel outside of the area for attractions since there is no economic hub other than service stations, the Weimar Institute and schools. Regardless, residents feel pulled to live here given its location outside of high-density areas. Several large developments with HOAs have recently brought more financially well-off residents. Community identity is very individualistic per household with people mostly wanting to be left alone.

Meadow Vista

Overall Capacity Score: 4

Meadow Vista is a community that has the ability to support itself relative to others in Placer. The majority of residents are affluent and highly educated. Residents remain well connected to the community and active in issues. Meadow Vista has its own Municipal Advisory Committee, which is a group that communicates constituent concerns directly to their Board of Supervisors representative. Winchester golf course is a location of note that residents use. Physical capital is not all there and hydrant capacity is unclear.

North Auburn

Overall Capacity Score: 4

North Auburn is an unincorporated area in Placer County that has a large, educated population. Property values are moderately high to very high and the community is a mix between residential and industrial. Funds come from county tax dollars and while the county does fund projects in North Auburn, there are no core community groups advocating for funds. Traffic fee imposed on development are used to make road improvements, many roads in North Auburn are county maintained. "It is not a distinct community, mote rural and small housing development that has a growing population base" said one participant. Neighborhoods are stratified with poor, higher density development generally flanking Highway 49, and large-lot rural farms in the outlying area. Furthermore, compared to the rest of Auburn, North Auburn has higher crime and poverty rates. Nobody wants to incorporate surrounding places together, the process is considered too difficult and North Auburn likes being more rural. Despite being in an unincorporated area, North Auburn does meet its residents' needs. Public services are centrally located and most of the county officers are located in North Auburn. Further away from the highway, groups like "Protect Rural Placer" opposed expansion of a park and can join together to self-assess. Rural North Auburn has a strong sense of local bonds and ways of living (i.e., farming) but the less affluent residents do not appear to have the same sense of community. North Auburn also came together to raise awareness of homelessness and to oppose development of big box stores. Wineries and agriculture tend to bond the community together. Infrastructure is often not well maintained in areas around Highway 49 and 80. Public sewer and water are available. Wells and leach fields are used for water and sewer but aren't major infrastructure problems because North Auburn can always find funding. Some areas struggle with water issues. Constructed conveyance customers are using canal water, a lower quality water, for domestic purposes. Others cannot drill wells because lots are too small and need treated water infrastructure. Participants were worried about water quality due to a history of mining in the area.

Newcastle/Ophir

Overall Capacity Score: 3.5

Newcastle/Ophir is very diverse financially. Residents range from rural farms to high end HOAs in large, wealthy subdivisions. Generations of family members from old farming and ranching communities shared cultural bonds. The community has its own Municipal Advisory Committee, which is a group that communicates constituents' concerns directly to their Board of Supervisors representative. Newcastle has a very tight community that is learning to work on a variety of issues including fire, water and community structure. Because the town of Newcastle is a small area, there are issues with funding for the fire department. Participants also qualified Newcastle as an affluent bedroom community.

Rural Lincoln

Overall Capacity Score: 3

Rural Lincoln is a stratified community with a mix of wealthy resident who are more independent and very socio-economically disadvantaged residents who have tight-knit community ties. The Sheridan area rates especially low socio-economically and can't grow because the sewer system capacity isn't sufficient. Sheridan falls within the Western Placer School District, which participants characterized as "forgotten." Most of the children in Rural Lincoln attend a Title 1 school and receive free and reduced lunches. Because of the deep stratification, the more economically disadvantaged communities tend to be underserved and underrepresented. Rural Lincoln used to be a poorer community but in more recent years residents with wealth have moved into the area. One participant explained that the socioeconomic matrix has been changing so much over the past 5-8 years that, even though there's still a fair bit of impoverishment, they can't decide if the current situation reflects "pockets of wealth or pockets of impoverishment." The community is challenged to come together as a whole, partially because people are so spread out. Culturally, residents associate themselves with Lincoln but can't interact as much because there is no community center. In terms of social and human capital, the less wealthy residents generally have more of a willingness to work toward community projects. Wealthier residents, who participants referred to as living in "mansions," don't work together much on overall community needs and are able to sue their wealth to self-assess any problems. Agriculture and wineries on the "Placer Wine Trail" bring some of the community together. Ability to meet infrastructure needs hasn't been an issue yet, but there is no sewer treatment system and the community uses wells and leach fields.

APPENDIX B. Community Capacity Assessment Worksheet

Sierra Institute Socioeconomic Monitoring: Community Capacity Assessment Workshop

March 30th, 2018

Community Name_____

Please circle the number that best reflects your community's level of capital or capacity (on a scale of 1-5, 1 being the lowest level of capital or capacity and 5 being the highest level). Use space beneath each type of capital to provide narrative information. For example, describe the unique or important characteristics of your community that informed your decision. Additional space is provided at the end of this worksheet.

FINANCIAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(Availability of dollars for local uses and projects and to meet pressing local needs. These may be public dollars or private dollars, but if private they are tightly linked to community purpose and not just self-interested purposes.)

Please describe why you rated this community as you did in the box below.

HUMAN CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(Individuals with knowledge/ability to address conditions and stressors of concern; it is also the experience and capabilities of local residents their willingness to use these locally.)

Please describe why you rated this community as you did in the box below.

SOCIAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(The ability and willingness of local residents to work together towards community ends and purposes.)

Please describe why you rated this community as you did in the box below.

CULTURAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(The prevalence and strength of shared local bonds and ways of living, and the uniqueness of and identification with this.)

Please describe why you rated this community as you did in the box below.

PHYSICAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(The "hard infrastructure" of a community, such as roads, sewers, schools, etc., including the quality of this infrastructure and its ability to meet local need.)

Please describe why you rated this community as you did in the box below.

OVERALL CAPACITY RATING

LOW **1** **2** **3** **4** **5** HIGH

Please describe why you rated this community as you did in the box below.

Additional Narrative Information:

APPENDIX C: Water/Wastewater Preliminary Survey

CABY IRWM

Small Community Water/Wastewater Preliminary Survey



Disadvantaged Community and Tribal Involvement Program (DACTI)
Small Community Water/Wastewater Preliminary Survey

Thank you for participating in our survey. Your feedback is important. The purpose of this survey is to understand the challenges you face and your need for technical assistance. We expect the survey will take no more than five to ten minutes to complete. This is a "fillable" PDF form. Enter your responses, then save as a PDF file and email to:

jodie@jmconsultants.net

This information is being collected for discussion purposes at the following Small Community Water/ Wastewater Workshops scheduled for 1 - 4 p.m. on Wednesday, February 13, 2019 (El Dorado County), January 16, 2019 (Sierra and Nevada Counties), and February 20, 2019 (Placer County).

1. Please provide your organization's information:

Organization Name:

Address:

City:

State:

Zipcode:

Phone:

Email:

2. Please provide your primary contact'sinformation:

Name:

Phone:

Email:

3. Which communities do you serve?

4. Do you have an Emergency Response Plan(s) or are you part of a community that has one?

Yes ○

No ○

Do Not Know ○

If yes, please specify your plan(s):

5. What services do you provide?

- Drinking water treatment and supply ☐
- Irrigation/agricultural water distribution ☐
- Wastewater treatment/collection ☐
- Other (list below) ☐

6 What Tribes (federally recognized, state recognized or unrecognized) or Tribal members/communities are in your service area?

7. Please indicate your source(s) of water supply:

- Wells ☐
- Canals/ditches ☐
- Reservoir ☐
- Instream ☐
- Other (please specify) ☐

7a. Is there seasonal variability in your water supply source(s)?

- Yes
- No
- Do Not Know

7b. Does your water purveyor have a water conservation plan?

- Yes
- No
- Do Not Know

8. Approximately how many hook-ups or connections do you have for water supply?

- 0
- 1-50
- 51-100
- 101-250
- 251-500
- 501-1000
- 1001-5000
- Over 5000

9. Approximately how many hook-ups do you have for sewer?

- 0
- 1-50
- 51-100
- 101-250
- 251-500
- 501-1000
- 1001-5000
- Over 5000

10. Challenges

(Please indicate your level of concern for each category. If you indicate a Strong or Extreme Concern for any category, please briefly explain.)

	No Concern	Limited Concern	Moderate Concern	Strong Concern	Extreme Concern
a. Drinking Water Supply Comments:	◯	◯	◯	◯	◯
b. Water Quality Comments:	◯	◯	◯	◯	◯
c. Water Pressure Comments:	◯	◯	◯	◯	◯
d. Treatment System Comments:	◯	◯	◯	◯	◯
e. Aging Infrastructure Comments:	◯	◯	◯	◯	◯
f. Fire Suppression Supply: Comments:	◯	◯	◯	◯	◯
g. Access to Fire Hydrants: Comments:	◯	◯	◯	◯	◯

	No Concern	Limited Concern	Moderate Concern	Strong Concern	Extreme Concern
h. Staffing and/or Training Comments:	◯	◯	◯	◯	◯
i. Regulatory Compliance Comments:	◯	◯	◯	◯	◯
j. Storage/Operation Comments:	◯	◯	◯	◯	◯
k. Irrigation Water Supply: Comments:	◯	◯	◯	◯	◯
1. Water Reuse/Recycling: Comments:	◯	◯	◯	◯	◯
m. Groundwater Recharge: Comments:	◯	◯	◯	◯	◯
n. Lack of data/information: Comments:	◯	◯	◯	◯	◯
o. Other:					

11. Technical Assistance and Training Needs

(Please indicate your level of need for the following types of Technical Assistance)

	No Need	Limited Need	Moderate Need	Strong Need	Extreme Need
a. System Infrastructure Comments:	○	○	○	○	○
b. Operations and Maintenance Comments:	○	○	○	○	○
c. Safety Training Comments:	○	○	○	○	○
d. Program Management (recreation, watershed management, etc. Comments:	○	○	○	○	○
e. Project Planning/Development Comments:	○	○	○	○	○
f. Engineering/Design Comments:	○	○	○	○	○
g. Mapping Comments:	○	○	○	○	○
h. Regulatory Compliance Please specify if needs are for tribal, federal, state and/or local:	○	○	○	○	○

	No Need	Limited Need	Moderate Need	Strong Need	Extreme Need
i. Environmental Compliance (NEPA/CEQA) Comments:	◯	◯	◯	◯	◯
j. Financial Management (budget, rate structure) Comments:	◯	◯	◯	◯	◯
k. Grant Writing/Administration Comments:	◯	◯	◯	◯	◯
l. WQ Sampling and Testing Procedures Comments:	◯	◯	◯	◯	◯

m. Other Needs - Please explain:

12. Integrated Regional Water Management Involvement

(Please indicate your level of involvement)

How involved is your organization in the CABY IRWM?

- Not involved ◯
- Rarely involved ◯
- Often involved ◯
- Very Involved ◯

Please share any additional concerns, technical needs or suggestions.

If you have any questions about this survey or the workshop, please contact:

Jodie Monaghan
Sierra Water Work Group
(916) 616-1134
jodie@jmconsultants.net

- or -

Liz Mansfield
Sierra Water Work Group
(916) 273-0488
sierrawaterworkgroup@gmail.com

Thank you for your time – we appreciate your input!

Appendix D
Region Description Supplement

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

The following tables list special-status species and habitats in the CABY region and are a supplement to Chapter 5, Region Description.

Table D.1: Vegetation Communities of the CABY Region

CODE	Vegetation Community	Acres	Percent
6518	Sierran Mixed Coniferous Forest	744,121	26.7
4466	Westside Ponderosa Pine Forest	451,384	16.2
5754	Foothill Pine-Oak Woodland	281,262	10.1
5773	Red Fir Forest	173,229	6.2
3411	Black Oak Woodland	170,975	6.1
4839	Interior Live Oak Forest	115,256	4.1
5650	Mixed Montane Chaparral	107,142	3.8
4622	Jeffrey Pine-Fir Forest	102,602	3.7
6347	Non-Native Grassland	71,441	2.6
4577	Agricultural Land	54,798	2.0
5867	Red Fir (Lodgepole Pine)-Western White Pine	50,841	1.8
3297	Canyon Live Oak Forest	49,590	1.8
3238	Bare Exposed Rock	48,224	1.7
3704	Interior Live Oak Woodland	44,257	1.6
3825	Blue Oak Woodland	43,994	1.6
3305	Lodgepole Pine Forest	39,402	1.4
3491	Mid-elevation Conifer Plantation	32,494	1.2
5678	Chamise Chaparral	30,229	1.1
3189	Sierran White Fir Forest	29,707	1.1
3611	Urban or Built-up Land	26,513	1.0
3647	Permanently-flooded Lacustrine Habitat	25,295	0.9
3828	Huckleberry Oak Chaparral	14,818	0.5
3905	Valley Oak Woodland	13,931	0.5
3420	Jeffrey Pine Forest	12,604	0.5
3734	Open Foothill Pine Woodland	10,258	0.4
3375	Montane Manzanita Chaparral	9,367	0.3
3994	Non-Serpentine Foothill Pine Woodland	7,161	0.3
3748	Big Sagebrush Scrub	5,094	0.2
3785	Oregon Oak Woodland	2,963	0.1
5608	Aspen Forest	2,074	0.1
5124	Leather Oak Chaparral	1,911	0.1
4012	Subalpine Sagebrush Scrub	1,846	0.1
3721	Tan-Oak Forest	1,673	0.1

4238	Subalpine or Alpine Meadow	1,302	< 0.1
3958	Bush Chinquapin Chaparral	1,110	< 0.1
5005	Scrub Oak Chaparral	989	< 0.1
5248	Buck Brush Chaparral	967	< 0.1
6021	Montane Riparian Scrub	852	< 0.1
5572	Upper-elevation Conifer Plantation	801	< 0.1
6105	Whitebark Pine Forest	773	< 0.1
5476	Transitional Bare Areas	634	< 0.1
5101	Interior Live Oak Chaparral	592	< 0.1
4742	Whitebark Pine-Mountain Hemlock Forest	448	< 0.1
3556	Knobcone Pine Forest	347	< 0.1
4931	Great Valley Cottonwood Riparian Forest	328	< 0.1
3858	Montane Meadow	287	< 0.1
4452	Strip Mines, Quarries and Gravel Pits	238	< 0.1
3481	Eastside Ponderosa Pine Forest	128	< 0.1
5725	Whitebark Pine-Lodgepole Pine Forest	32	< 0.1
	Totals	**2786285**	**100.0**

Code numbers refer to the vegetation community maps.

Table D.2: Number of habitats and species of special concern organized by life form

Life Form	No. of Species
Amphibian	5
Birds	17
Fish	2
Habitat	9
Invertebrate	16
Mammal	14
Plant	65
Reptile	2
Total	**130**

Table D.3: Animal Species of Special Concern

A list of species, life form, scientific and common names, state and federal status, as well as the number of documented occurrences within the CABY region

Life Form	Scientific Name	Common Name	FEDLIST	CALLIST	No. of Occurrences
Amphibian	*Hydromantes platycephalus*	Mount Lyell salamander	7	3	3
Amphibian	*Rana aurora draytonii*	California red-legged frog	2	2	7
Amphibian	*Rana boylii*	foothill yellow-legged frog	7	2-3	38
Amphibian	*Rana muscosa*	mountain yellow-legged frog	1	1	64
Amphibian	*Lithobates pipiens*	northern leopard frog (native populations only)	5	2	
Bird	*Accipiter cooperii*	Cooper's hawk	7	3	1
Bird	*Accipiter gentilis*	northern goshawk	7	3	16
Bird	*Accipiter striatus*	sharp-shinned hawk	7	3	1
Bird	*Agelaius tricolor*	tricolored blackbird	7	2	4
Bird	*Asio otus*	long-eared owl	7	5	1
Bird	*Aquila chrysaetos*	golden eagle	7	3	1
Bird	*Cypseloides niger*	black swift	7	2	3
Bird	*Dendroica petechia brewsteri*	yellow warbler	7	2	3
Bird	*Elanus leucurus*	white-tailed kite	7	3	1
Bird	*Empidonax traillii*	willow flycatcher	7	1	3
Bird	*Falco peregrinus*	American peregrine falcon	8	2	
Bird	*Grus Canadensis*	Sandhill Crane	7	2-4	
Bird	*Haliaeetus leucocephalus*	bald eagle	8	2	5
Bird	*Histrionicus histrionicus*	harlequin duck	7	2	1

Life Form	Scientific Name	Common Name	FEDLIST	CALLIST	No. of Occurrences
Bird	*Laterallus jamaicensis coturniculus*	California black rail	7	1	1
Bird	*Pandion haliaetus*	osprey	7	3	1
Bird	*Strix nebulosa*	great gray owl	7	1	4
Bird	*Strix occidentalus*	California spotted owl	7	3	
Fish	*Oncorhynchus clarkii henshawi*	Lahontan cutthroat trout	2	5	2
Fish	*Oncorhynchus tshawytscha*	spring-run chinook salmon	2	2	1
Invertebrate	*Desmocerus californicus dimorphus*	valley elderberry longhorn beetle	2	2	4
Invertebrate	*Ammonitella yatesi*	tight coin (=Yates' snail)	7	1	1
Invertebrate	*Andrena blennospermatis*	a vernal-pool andrenid bee	7	2	1
Invertebrate	*Andrena subapasta*	an andrenid bee	7	1-3	2
Invertebrate	*Banksula californica*	a cave-obligate harvestman	7	H	1
Invertebrate	*Banksula galilei*	a cave-obligate harvestman	7	1	1
Invertebrate	*Branchinecta lynchi*	vernal pool fairy shrimp	2	2-3	1
Invertebrate	*Cryptochia excella*	Kings Canyon cryptochian caddisfly	7	1-2	1
Invertebrate	*Desmona bethula*	amphibious caddisfly	7	2-3	3
Invertebrate	*Ecclisomyia bilera*	Kings Creek ecclysomyian caddisfly	7	1-2	1
Invertebrate	*Farula praelonga*	long-tailed caddisfly	7	1-2	1
Invertebrate	*Megaleuctra sierra*	Shirttail Creek stonefly	7	1	1
Invertebrate	*Monadenia mormonum buttoni*	Button's Sierra sideband (snail)	7	1	2
Invertebrate	*Nebria darlingtoni*	South Forks ground beetle	7	1	4
Invertebrate	*Orobittacus obscurus*	gold rush hanging scorpionfly	7	1	2
Invertebrate	*Rhyacophila spinata*	spiny rhyacophilan caddisfly	7	1-2	2
Mammal	*Antrozous pallidus*	Pallid Bat	7	3	
Mammal	*Aplodontia rufa californica*	Sierra Nevada mountain beaver	7	2	2
Mammal	*Corynorhinus townsendii*	Townsend's big-eared bat	7	2-3	1
Mammal	*Gulo gulo*	California wolverine	7	1	8
Mammal	*Lasionycteris noctivagans*	silver-haired bat	7	3-4	1
Mammal	*Lasiurus blossevilli*	Western red bat	7	3	
Mammal	*Lepus americanus tahoensis*	Sierra Nevada snowshoe hare	7	2	3
Mammal	*Lepus townsendii townsendii*	western white-tailed jackrabbit	7	3	1
Mammal	*Martes americana sierrae*	Sierra Marten	7	3-4	31
Mammal	*Martes pennanti (pacifica) DPS*	Pacific fisher	5	2-3	15
Mammal	*Myotis thysanodes*	fringed myotis	7	4	1
Mammal	*Myotis yumanensis*	Yuma myotis	7	4	5
Mammal	*Taxidea taxus*	American badger	7	4	1
Mammal	*Vulpes vulpes necator*	Sierra Nevada red fox	7	1	2
Reptile	*Phrynosoma blainvillii (frontale population)*	coast (California) horned lizard	7	3-4	10
Reptile	*Emys (=Clemmys) marmorata*	western pond turtle	7	3	1

FEDCODE: 1: Federally listed as Endangered 2: Federally listed as Threatened 3: Proposed for federal listing as Endangered 4: Proposed for federal listing as Threatened 5: Candidate for federal listing 6: Species of concern 7: None - no federal status 8: Delisted - previously listed.
CALCODE: 1: State listed as Endangered 2: State listed as Threatened 3: State listed as Rare 4: Candidate for state listing 5: None - no state status 6: Delisted - previously listed.

Table D.4: Plant Species and Habitats of Special Concern

A list of species, life form, scientific and common names, state and federal status, as well as the number of documented occurrences within the CABY region

Life Form	Scientific Name	Common Name	FEDLIST	CALLIST	No. of Occurrences
Plant	*Allium jepsonii*	Jepson's onion	7	5	2
Plant	*Allium sanbornii var. congdonii*	Sanborn’s onion			
Plant	*Allium sanbornii var. sanbornii*	Sanborn’s onion			
Plant	*Allium tribracteatum*	Three bract onion			0
Plant	*Androsace occidentalis var. simplex*	simple androsace	7	5	1
Plant	*Arctostaphylos myrtifolia*	Ione manzanita	2	5	1
Plant	*Arctostaphylos nissenana*	Nissenan manzanita	7	5	6
Plant	*Asplenium trichomanes-rasmosum*	green spleenwort	7	5	1
Plant	*Balsamorhiza macrolepis var. macrolepis*	big-scale balsamroot	7	5	1
Plant	*Boechera constancei*	Constance's rock cress	7	5	2
Plant	*Botrychium ascendens*	Upward-lobed moonwort			4
Plant	*Botrychium crenulatum*	crenulate moonwort			8
Plant	*Botrychium lunaria*	moonwort			
Plant	*Botrychium minganense*	Mingan moonwort			1
Plant	*Botrychium montanum*	mountain grape fern			
Plant	*Bruchia bolanderi*	Bolander's bruchia	7	5	1
Plant	*Calochortus clavatus var. avius*	Pleasant Valley mariposa lily	7	5	120
Plant	*Calystegia stebbinsii*	Stebbins's morning-glory	1	1	19
Plant	*Carex limosa*	shore sedge	7	5	3
Plant	*Carex sheldonii*	Sheldon's sedge	7	5	1
Plant	*Ceanothus roderickii*	Pine Hill ceanothus	1	3	17
Plant	*Chaenactis douglasii var. alpina*	alpine dusty maidens	7	5	3
Plant	*Chlorogalum grandiflorum*	Red Hills soaproot	7	5	25
Plant	*Clarkia biloba ssp. brandegeae*	Brandegee's clarkia	7	5	42
Plant	*Cypripedium fasciculatum*	clustered lady’s slipper			6
Plant	*Cypripedium montanum*	mountain lady’s slipper			1
Plant	*Collybia racemosa*				1
Plant	*Downingia pusilla*	dwarf downingia	7	5	1
Plant	*Draba asterophora var. asterophora*	Tahoe draba	7	5	2
Plant	*Draba asterophora var. macrocarpa*	Cup Lake draba	7	5	1
Plant	*Epilobium howellii*	subalpine fireweed	7	5	4
Plant	*Epilobium oreganum*	Oregon fireweed	7	5	5
Plant	*Erigeron miser*	starved daisy	7	5	14

Life Form	Scientific Name	Common Name	FEDLIST	CALLIST	No. of Occurrences
Plant	*Eriogonum tripodum*	Tripod buckwheat			1
Plant	*Eriogonum umbellatum var. sirrensis*	Ahart's sulpher flower	7	5	1
Plant	*Eriogonum umbellatum var. torreyanum*	Donner Pass buckwheat	7	5	11
Plant	*Eryngium pinnatisectum*	Tuolumne button-celery	7	5	1
Plant	*Fissidens aphelotaxifolius*	fissiden's moss			
Plant	*Fremontodendron*	Pine Hill flannelbush	1	3	11
Plant	*Fritillaria eastwoodiae*	Butte County fritillary			
Plant	*Galium californicum ssp.*	El Dorado bedstraw	1	3	11
Plant	*Helianthemum suffrutescens*	Bisbee Peak rush-rose	7	5	17
Plant	*Helodium blandowii*	Blandow's helodium moss			
Plant	*Horkelia parryi*	Parry's horkelia	7	5	13
Plant	*Hulsea brevifolia*	short-leaved hulsea	7	5	1
Plant	*Peltigera hydrothyria*	Veined water lichen			
Plant	*Lewisia cantelovii*	Cantelow's lewisia	7	5	23
Plant	*Lewisia kelloggii* ssp. *hutchisonii*	Kellogg's lewisia			19
Plant	*Lewisia kelloggii* ssp. *Kelloggii*	Kellogg's lewisia			11
Plant	*Lewisia longipetala*	long-petaled lewisia	7	5	12
Plant	*Lewisia serrata*	Saw-toothed lewisia			3
Plant	*Lupinus dalesiae*	Quincy lupine	7	5	5
Plant	*Lycopodiella inundata*	bog club-moss	7	5	2
Plant	*Meesia triquetra*	Three-tanked hump-moss			3
Plant	*Meesia uliginosa*	Borad-nerved hump moss			0
Plant	*Mielichhoferia elongata*	elongate copper-moss	7	1	1
Plant	*Monardella follettii*	Follett's monardella	7	5	1
Plant	*Navarretia prolifera* ssp. *Lutea*	Burr pincushionplant			51
Plant	*Ophioglossum pusillum*	northern adder's-tongue	7	5	1
Plant	*Packera [Senecio] layneae*	Layne's ragwort			2
Plant	*Peltigera hydrothyria*	none			15
Plant	*Penstemon personatus*	closed-throated	7	5	2
Plant	*Phacelia stebbinsii*	Stebbins's phacelia	7	5	45
Plant	*Phaeocollybia olivacea*	Olive Phaeocollybia			2
Plant	*Potamogeton epihydrus ssp.*	Nuttall's pondweed	7	5	1
Plant	*Stuckenia filiformis*	slender-leaved pondweed	7	5	1
Plant	*Potamogeton praelongus*	white-stemmed pondweed	7	5	1
Plant	*Rhynchospora alba*	white beaked-rush	7	5	1
Plant	*Rhynchospora capitellata*	brownish beaked-rush	7	5	3
Plant	*Schoenoplectus subterminalis*	water bulrush	7	5	1
Plant	*Packera layneae*	Layne's ragwort	2	3	42
Plant	*Sidalcea stipularis*	Scadden Flat checkerbloom	7	1	2
Plant	*Tauschia howellii*	Howell's umbrellawart			2
Plant	*Viburnum ellipticum*	oval-leaved viburnum	7	5	3
Plant	*Wyethia reticulata*	El Dorado County mule ears	7	5	29
Habitat	Central Valley Drainage Hardhead/Squawfish Stream	Central Valley Drainage Hardhead/Squawfish Stream	7	5	1
Habitat	Central Valley Drainage Resident Rainbow Trout	Central Valley Drainage Resident Rainbow Trout	7	5	3
Habitat	Central Valley Drainage Spring Stream	Central Valley Drainage Spring Stream	7	5	2
Habitat	Darlingtonia Seep	Darlingtonia Seep	7	5	10
Habitat	Fen	Fen	7	5	50
Habitat	Ione Chaparral	Ione Chaparral	7	5	1
Habitat	Sacramento-San Joaquin	Sacramento-San Joaquin	7	5	1
Habitat	Sphagnum Bog	Sphagnum Bog	7	5	16

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CALCODE: 1: State listed as Endangered 2: State listed as Threatened 3: State listed as Rare 4: Candidate for state listing 5: None - no state status 6: Delisted - previously listed.

Appendix E
Relevant Local Water/Land Use Plans

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

The following table lists the local water and land use planning documents applicable to the CABY region. These documents were reviewed to update the CABY IRWMP objectives and projects, and to ensure that the goals and objectives of the CABY IRWMP are compatible with and support local planning efforts. The following paragraphs provide brief descriptions and background of relevant plans.

Urban Water Management Plans: The 2011 Urban Water Management Plans (UWMPs) serve two primary purposes: 1) compliance with the requirements of California's Urban Water Management Planning Act (Act); and 2) as a master plan for water supply and resources management consistent with the jurisdiction's goals and policy objectives. These plans function as long-term planning documents and the conclusions and recommendations from the UWMPs will determine key aspects of long-term capital investment by each agency, and guidance for Plan project development.

- UWMPs describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, both of which inform the IRWMP.
- For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, the UWMP describes plans to replace that source with alternative sources or water demand management measures, for an average water year, a single dry water year, multiple dry water years. This adaptive strategy will relate to the climate vulnerability assessment.
- The UWMP describes opportunities for exchanges or transfers of water on a short-term or long-term basis and actions to be undertaken to prepare for and implement during a catastrophic interruption of water supplies, including a regional power outage, an earthquake, or other disaster.

Preparation of the plan is coordinated with local water, wastewater, groundwater, and planning agencies and includes a description of the wastewater collection and treatment systems in the service area. Coordination such as this is essential to successfully implementing an IRWMP.

County General Plans: California State law requires each county to adopt a general plan, "for the physical development of the County and any land outside its boundaries which ...bears relation to its planning" (Government Code Section 65300). The General Plan serves as the county's constitution for the physical use of the county's resources, and is the foundation upon which all land use decisions are made. The general plan expresses the community's development goals and embodies public policy relative to the distribution of future public and private land use. Planning and land use play a vital role in water use and distribution, and as such will influence infrastructure needs, water demand and supply, and impacts on natural systems addressed in the Plan. **Please note:**

While all nine counties within the region have adopted general plans, the Placer, Nevada, and El Dorado county general plans are summarized below, as they apply to 77 percent of lands under county jurisdiction in the region. Remaining counties generally represent relatively small portions of the region.

City Plans: City plans were prepared pursuant to California Government Code Section 65300 eq set., that requires all general service local governments to prepare and adopt a general plan. The influence of city plans on the development and implementation of the IRWMP are similar to county general plans.

Agricultural Water Management Plans: The Agricultural Water Management Planning Act (Act) [§10826 (a)] requires every agricultural water supplier providing water to more than 10,000 irrigated acres, excluding recycled water, to adopt and submit an Agricultural Water Management Plan (AWMP) every five years to DWR. Plans are intended to assure the appropriate level of reliability in a water service to sufficiently meet the needs of its customers during normal, dry, and multiple dry years. As such, they indicate water use over time for a major economic sector, again informing the IRWM process toward balancing water needs and in potential project development.

Stormwater Management Plans: The United States Environmental Protection Agency (EPA) has established a two-tiered program to address municipal stormwater discharges, administered by the applicable regional water quality control board. These plans address and affect the IRWMP primarily about water quality and stormwater management, and related projects.

Watershed Management Plans: These are plans based on watershed planning units, and vary in their scope, location, and authority. They were used to identify issues and vulnerabilities, and often suggest adaptive strategies to make watershed more resilient – thus they help inform objectives and projects.

Hazard Mitigation Plans: These plans identify and develop strategies to address the risks from natural hazards such as wildfires, flooding, severe weather, dam failure, drought and climate change. They also establish a basis for coordination among participating agencies and assist in meeting the requirements of federal assistance programs. They assist in identifying vulnerabilities in the region that may be exacerbated by climate change, and the need for updating historic or poorly functioning infrastructure. **Please note: While all counties have Hazard Mitigation Plans in either adopted, draft, or update status, the Placer, Nevada, and El Dorado county plans are summarized below, as they apply to 77 percent of lands under county jurisdiction in the region. Remaining counties generally represent relatively small portions of the region.**

Other regional plans: Some entities have prepared climate actions plans, water supply assessments, river and/or fire management plans, federal resource management plans, and conservation plans that also have bearing on the IRWMP and so are included here.

DOCUMENT TYPE	DATE LAST ISSUED/ UPDATED	AGENCY or AUTHOR/ JURISDICTION	DOCUMENT SUMMARY
Urban Water Management Plan	2011	Nevada Irrigation District	Agricultural water use accounts for nearly 90 percent of total demand on NID's water supply. The remainder is delivered primarily to single-family residential accounts. NID's 287,000-acre boundary includes 66,500 acres in Placer County, generally the area between Auburn and Lincoln and to the north. Land use in Lincoln is rapidly changing from rural to urban, and water demand is changing from irrigation (raw) to treated water. NID depends on surface water for its supply for both irrigation and urban water demands. Supply falls into four main categories: runoff from the watershed, carryover storage in surface reservoirs, contract purchases, and recycled water. NID currently receives recycled water from four municipal wastewater treatment plants. The amount of wastewater treatment plant effluent taken on an average year makes up only 1 percent of the total supply. The district will consider expanding its use of recycled water in the future as wastewater treatment plants are upgraded. The recycled water can be used not only for agriculture but landscape irrigation, street washing, and golf course irrigation. NID is required to maintain a total minimum pool of 39,675 acre-feet of water between all of its reservoirs to make flow releases for fisheries and account for dead storage. Water supply and demand conservation is a priority for NID; NID is committed to implementing water conservation measures for all customer sectors.
Urban Water Management Plan	2011	Placer County Water Agency	PCWA primarily uses surface water as its source of supply. A relatively small amount of groundwater is currently used for emergency purposes from one existing well in the Sunset Industrial Area. Recycled water is used by the cities of Roseville and Lincoln that also receive PCWA wholesale surface water. The Water Systems Division's current largest source of water is from the Yuba and Bear rivers for consumptive uses. This supply comes from Lake Spaulding and is purchased from PG&E. The American River provides a second source from appropriated water rights developed through construction of the Middle Fork Project. A third source is from the United States Bureau of Reclamation's Central Valley Project (CVP). To maximize water resources, PCWA focuses on increasing water use efficiency, integrating the available mix of water sources, including groundwater, surface water, and recycled water, and upgrading water supply and delivery facilities. PCWA is in the process of completing an integrated water resource plan and a groundwater management plan. It is actively participating with the CABY IRWMP Update, a regional water conservation master plan, and various cooperative agreements.
Urban Water	2011	Georgetown	GDPUD's primary source of water is the Stumpy Meadows Project, with a capacity of 3.35 million

DOCUMENT TYPE	DATE LAST ISSUED/ UPDATED	AGENCY or AUTHOR/ JURISDICTION	DOCUMENT SUMMARY
Management Plan		Divide PUD	gallons, diversion structures, and a conveyance system to the service area. The District has no plans to use groundwater to supplement the surface water source because local groundwater is not of adequate quality or quantity. GDPUD is geographically separated from its neighboring water purveyors by the three forks of the American River, and therefore has no direct inter-ties with any adjoining water systems. Consequently, there is no immediate mechanism for the transfer of water into or out of the District through a mutual aid agreement, should the need arise. The District's ongoing management practices and conservation programs to reduce losses in the water conveyance system by lining ditches with gunite, replacing ditches with pipelines, and improving operations that affect losses, will preserve the present water supply. Water meters serve as the primary tool in promoting water conservation, a practice recognized as sound urban water management practice as well as a basic water conservation measure (DMM 4). Currently no recycled is water being used; no treatment systems produce adequate effluent.
Urban Water Management Plan	2011	El Dorado Irrigation District	EID currently serves a population of about 100,000 people through more than 38,000 active water meter connections within a contiguous service area of about 220 square miles on the western slope of the Sierra in El Dorado County. The City of Placerville, located in the central part of the district, receives water from EID as a wholesale customer. It also operates two satellite water systems in the Strawberry and Outingdale communities. EID obtains water from the North and Middle Forks of the Cosumnes River, Clear Creek, Squaw Hollow Creek, Park Creek, Camp Creek, Slab Creek, Weber Creek, and the South Fork American River in accordance with appropriative water rights. Some supply is diverted directly from rivers and creeks to be treated or conveyed as raw water. Other water is diverted to storage for subsequent treatment and distribution into the potable system. EID diverts water from the South Fork American River, its tributaries, and Echo Lake for both power generation and consumptive uses. EID produces recycled water at both the El Dorado Hills and Deer Creek wastewater treatment plants, then used by EID customers for irrigation of residential landscape, commercial landscape, recreation turf and in a few areas for fire suppression and dust control. The availability of recycled water is currently limited to the El Dorado Hills and Cameron Park areas. EID also diverts water into the Crawford Ditch from the North Fork of the Cosumnes River as a raw water source. Aside from a USBR Contract, EID does not currently purchase water from any wholesale supplier. In the future, EID expects to purchase water wholesale from the El Dorado County Water Agency.

DOCUMENT TYPE	DATE LAST ISSUED/ UPDATED	AGENCY or AUTHOR/ JURISDICTION	DOCUMENT SUMMARY
Water Supply Assessments	2009	Nevada Irrigation District	The Water Supply Assessment is prepared for the Loma Rica Ranch Project, which is primarily undeveloped, composed of naturally wooded vegetation and grasslands with four development areas located in Nevada County. The district, which would be the water purveyor of the project, has water rights to the majority of its water supply. Approximately 3% of the district's water supply is from outside sources. The total estimated project water demand is 819 acre-feet per year. The district's primary water supply is surface water, which falls into four main categories: runoff from the watershed, carryover storage in surface reservoirs, contract purchases, and recycled water.
Agricultural Water Management Plan	2012	Nevada Irrigation District	This plan includes information about the agricultural water supplier and service area, inventory of water supplies, water balance, climate change, and efficient water management practices. NID serves about 5,400 agricultural customers with an average total reported irrigated acreage of 29,400 acres. Water uses within the district's service area are domestic, agricultural, environmental, municipal and recreational.
Regional Climate Action Plan	2009	Sierra Nevada Conservancy Climate Action Plan of the Sierra Nevada	The Sierra Nevada Climate Action Plan (SNCAP) is one of three efforts being led by the Sierra Nevada Conservancy (SNC) in response to the direction of its board in the development of the Sierra Nevada Climate Change Initiative. The plan addresses potential impacts to water, habitats, endangered species, fire and recreation resources in the entire Sierra Nevada including the CABY region. The plan discusses quantifying and protecting carbon sequestration in the CABY region, enhancing land and resource values, and further providing contiguous habitat and migration corridors as an adaptation strategy. SNCAP works toward the goal of protecting and balancing water supply, quality, and ecosystem health needs in all Sierra watersheds by first looking to improve natural water storage systems, focusing on meadow restoration. The plan also aims to assist DWR to identify and provide funding for Integrated Regional Water Management (IRWM) regions throughout the Sierra Nevada watersheds and for research and analysis on climate change impacts and adaptation strategies.
General Plan	1996	Nevada County	Nevada County is characterized by a large and diverse hydrologic system. Surface water drainage is comprised of three watersheds: the Truckee River Basin in the eastern county (draining into the north Lahontan region) and the Yuba River and Bear River basins in the western county. These watersheds supply water to portions of northern California and western Nevada. Many of the creeks and rivers also produce hydroelectricity. Land use policies directly affect the county's

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			hydrologic systems. Nevada County supports a variety of important or unique wildlife habitats, including movement corridors, wetlands and riparian areas, and breeding/foraging areas. Protection and management of the forest resources in Nevada County are important considerations in the general plan, contributing to the economic vitality and scenic quality of the county. Protective corridors are recommended along all major streams in the planning area to prevent development in these environmentally sensitive areas. These corridors will also help to preserve the water quality. Development can put a strain on water supply and water treatment capacity, and the Nevada County General Plan makes allowances that affordable housing developments be given a priority in receiving those resources (important to IRWM DAC considerations). The county is also looking to expand their sanitary sewer capacity to serve a greater portion of the unincorporated area. Within Nevada County, the interface of the natural and manmade environment creates potential safety hazards such as wildfires, earthquakes (along with related dam failures), and flooding. Areas within Nevada County subject to flood hazards are generally confined to localized overflow from rivers and streams and are not extensive. Goals, objectives and policies on the above topics relate to the CABY IRWMP.
General Plan	1994	Placer County Planning Department	Placer County is characterized by a large and diverse hydrologic system. Surface water drainage is comprised mainly of the North and Middle Forks of the American River. Land use policies directly affect the counties hydrologic systems. Placer County contains a variety of wildlife habitats that are important or unique, including movement corridors, wetlands and riparian areas, and breeding, and foraging areas. Protection and management of forest resources in Placer County are important considerations in the general plan, and contribute to the economic vitality and scenic quality of the county. Flooding and flood hazard abatement also are addressed. Applicable goals, objectives and policies that relate to the CABY IRWMP address sustainable forestry practices, habitat protection and enhancement, protecting sustainable water supply, preference for affordable housing and infrastructure (important for DAC), promotion of community water and sewer systems in this largely rural county, flood and fire management and abatement, and encouragement of land use patterns that accommodate natural systems.
General Plan	2004	El Dorado County Planning Department	This plan acknowledges that the county will continue to grow but will attempt to retain the qualities of its natural resource base, both consumptive and environmental, to maintain its custom and culture, and to assure its long-term economic stability. This plan acknowledges the ecological and

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			historic values of these lands, while saving and conserving the lands for future economic benefits for all the purposes. The plan is intended to maintain and protect the county's natural beauty and environmental quality, vegetation, air and water quality, natural landscape features, cultural resource values, and maintain the rural character and lifestyle while ensuring the economic viability critical to promoting and sustaining community identity. Where appropriate, it encourages clustered development as an option to maintain the integrity and distinct character of individual communities, while protecting open space and promoting natural resource uses. Goals and objectives related to the IRWMP include those addressing water quality, supply, distribution; protection of natural resources; encouragement of energy and water conservation in new developments; conservation and promotion of El Dorado County's waterways, particularly the South Fork of the American River; and recognition of the biological and economic importance of the county's forested lands/watersheds.
Conservation Plan	2011	Placer County Conservation Plan/ City of Lincoln, Placer County, PCWA	In June 2000, the Placer County Board of Supervisors directed staff to initiate the implementation of the Placer Legacy Program. One of the objectives of the program was to prepare a Natural Communities Conservation Plan and Habitat Conservation Plan in three phases. This effort became known as the Placer County Conservation Plan (PCCP). The PCCP will provide 50 years of compliance for the following state and federal regulations for Placer County, the City of Lincoln, and the Placer County Water Agency: 1. Incidental Take Permit – Federal Endangered Species Act 2. Natural Communities Conservation Plan – CA Endangered Species Act and Natural Communities Conservation Act 3. Section 404 and 401 of the Federal Clean Water Act related to wetlands and water quality 4. Section 1600 of the CA Fish and Game Code – Streambed Modification Agreements Biological objectives are offered for vernal pools, wetlands, agricultural lands and oak woodlands. Of particular importance to the IRWMP are riverine and riparian objectives to: "Improve the ecological health of riverine systems by protecting, enhancing, and restoring hydrologic and botanical and geomorphic processes to maintain functional aquatic and riparian communities that benefit covered species and promote native biodiversity."
Conservation Plan	2001	American River Conservancy/	This plan used GIS analysis and overlays to identify target areas for conservation easements in the Upper Cosumnes River Watershed. Primary consideration was given to special status plant and

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		Strategic Plan for Conservation of the Cosumnes River	wildlife species and their habitats including distance to riparian zones, number of listed species present, etc. Other secondary considerations included open space and recreation.
Watershed Plan	2009	South Fork American River Watershed Management Group/ American River Watershed Management Plan	This plan was designed specifically for the South Fork American River watershed and incorporates many of the principles and processes of the CABY IRWMP including goals and objectives, RMS and it includes a ranking system for projects. The South Fork American River Watershed Group authored the South Fork American River Watershed Plan (also begun with a previous watershed coordinator grant), which is largely made up of agency representatives.
City Plan	1999	City of Grass Valley	This city plan is a policy document designed to guide the future growth and development of Grass Valley in a manner consistent with its physical, social, economic, and environmental goals.
City Plan	1983	City of Nevada City	This city plan is a policy document designed to guide the future growth and development of Nevada City in a manner consistent with its physical, social, economic, and environmental goals.
City Plan	1998	City of Colfax	This plan is a guide for decision making regarding the long term physical development of Colfax. It is used as a starting point for city planning and procedures such as capital improvement planning, building code enforcement, subdivision map review, zoning changes, environmental reviews of projects, and specific plan development. The eight elements addressed are land use, circulation, housing, natural environment, noise, safety, community design, and economic elements.
City Plan	2001	City of Loomis	This plan provides a basis for long term growth and implementation measures by Loomis. The plan addresses community development, circulation, housing, public facilities and services, conservation of resources, and public health and safety elements. The Plan identifies goals for the protection of stream corridors and riparian habitat for wildlife and plant species as well as groundwater supplies.

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City Plan	2004	City of Placerville	This is a strategic plan that establishes guidelines and priorities for the community of Placerville. It addresses: land use, circulation, housing, conservation, open space, noise, and safety.
City Plan	2009	City of Plymouth	This is a strategic plan that establishes guidelines and priorities for the community of Plymouth. It addresses: land use, circulation, housing, conservation, open space, noise, and safety.
City Plan	2005	City of Placerville Stormwater Management Plan	This plan is implemented to support the goal of the General Small MS4 Permit which is designed to protect water quality from urban runoff pollution. The plan addresses various ways stormwater quality can be impacted by the public, municipal activities and development, and discusses six minimum control measures and measurable goals and schedules for implementation.
Flood Management Plans	2005	City of Placerville Stormwater Management Plan	*Purpose :* The United States Environmental Protection Agency (EPA) established the following two-phased program to address stormwater discharges from municipal storm sewer systems (MS4s), and industrial and construction activities to surface waters (e.g., Hangtown Creek): • The Phase I regulations require that stormwater management programs be developed and implemented by Large MS4s (serving populations of 100,000 people or more), certain industrial activities and construction activities disturbing five acres or more. • The Phase II regulations require that stormwater management programs be developed and implemented by Small MS4s (serving populations of less than 100,000) and construction activities disturbing one acre or more. • Placerville has been specifically designated by the RWQCB as the owner and operator of a Small MS4. The main goal of the General Small MS4 Permit is to protect water quality from urban runoff pollution. This is accomplished by addressing the various ways stormwater quality can be impacted by the public, municipal activities, development and redevelopment.
Land Management Plan	2004	Sierra Nevada Forest Plan Amendment	The Sierra Nevada and the Modoc Plateau encompass dozens of complex ecosystems each with numerous, inter-connected social, economic, and ecological components. The Sierra Nevada Forest Plan Amendment lays out broad management goals and strategies for addressing five problem areas identified during the planning process: old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and lower westside hardwood ecosystems.

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River Management Plan	2005	South Yuba River Comprehensive Management Plan	Chapters 3 (Riverwide Management Direction) and 4 (Recreation Management) contain the broad goals and objectives for the South Yuba River: Riverwide Management Direction sets the desired future condition, existing condition, and management actions for each of several key resource categories. desired future conditions are defined as, "land or resource conditions that are expected to result if the vision is fully achieved." The plan also includes more specific and detailed management actions within five planning units for recreation. It also contains an implementation plan that incorporates monitoring and adaptive management.
Land Management Plan	1990	Tahoe National Forest Land and Resource Management Plan	The Summary of the Analysis of the Management Situation chapter briefly describes the current management direction, supply or production capability, existing and projected demands for forest goods and services, and the need or opportunity for changes in current management direction. Applicable resource areas discussed include recreation, fish, wildlife, and sensitive plants, diversity, riparian areas, water, ownership, land uses, and the urban/rural/wildland interface. The Public Issues, Concerns, and Opportunities Summary describes the process used to identify public issues, management concerns, and resource use and development opportunities. It also discusses how each issue, concern, or opportunity is resolved or addressed during the planning process. The Management Direction chapter presents both forest-wide and area-specific management direction for the TNF. The forest-wide management direction consists of forest goals and desired future conditions, objectives, standards, and guidelines.
Land Management Plan	1988	Eldorado National Forest Land And Resource Management Plan	Chapter 2: Public Issues and Management Concerns outlines the major issues facing the forest. Issues include energy, mining, outdoor recreation, timberlands, fish and wildlife, fire, transportation system, range, water quality and quantity, and roadless areas. Many of these relate directly to water resource issues (e.g., water quality and quantity). Each issue is stated, summarized, and a solution is presented. The third chapter is a summary and analysis of the current management situation. The chapter on management direction outlines the goals and objectives for management policies. It also outlines the hierarchy of policy levels, and how management directives move through the system. Monitoring and evaluation of management practices is also included.
River Management Plan	2001	El Dorado County River Management Plan	The El Dorado County RMP provides regulatory, plan, and policy guidance for El Dorado County's management of whitewater recreation and related activities along the 20.7 mile segment of the South Fork of the American River between the Chili Bar Dam and Salmon Falls Road in El Dorado County. These rules define and update the county's river management and reporting activities in

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			accordance with El Dorado County Ordinance No. 4365. In addition to providing a set of operations rules for commercial and private boaters along the South Fork, the purpose of the plan is to protect the environmental quality of the river; maintain the values sought by the river users and landowners; and to protect the public's safety, health, and welfare. The RMP is an implementing tool of the Parks and Recreation Element of the general plan, and is responsive to goals and policies identified in other general plan elements. There are a number of applicable goals, objectives and policies that relate to the CABY IRWMP.
River Management Plan	2004	The South Fork American River Management Plan/BLM	This plan will guide the management of the public lands (BLM) along the South Fork American River well into the future, allowing for public use and for protection of natural resources. It pertains only to federal lands along the 21-mile stretch of the South Fork American River between Chili Bar and Salmon Falls Bridge, but is meant to dovetail with private management per the El Dorado County RMP. It contains detailed information on how the federal lands will be used and developed. Plan organization: The RMP is divided into three sections. The first is an overview of the entire river. The second section consists of general management direction and decisions that will be applied to more than one planning unit. The third section divides the public lands along the South Fork American River into seven distinct planning units to facilitate the planning process. Each planning unit is physically separated from other planning units by private property.
Fire Management Plan	2004	Amador County Fire Hazard Reduction Plan	This county-wide plan covers approximately 600 square miles and identifies the numerous agencies involved in fire prevention in the county and their responsibilities. It recommends 42 fuel-reduction projects based on fuel rankings and other factors such as fuel types, topography, elevation, aspect, fire threat, and watershed boundaries.
Fire Management Plan	2004	El Dorado County Wildfire Protection Plan	The plan identifies specific fire protection problems and issues; lists plan goals and strategic action plan recommendations; identifies and lists communities for fire safe planning; provides for formation of local community fire safe councils; adopts a standard outline for community wildfire protection plans (CWPP); identifies the EDCFSC as a focal point for bringing citizens and protection agencies together to plan and accomplish fire safe measures; and establishes a public education role for the EDCFSC.

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Wildfire Protection Plan	2008	Placer County Wildfire Protection Plan	The plan identifies specific fire protection problems and issues; lists plan goals and strategic action plan recommendations; identifies and lists communities for fire safe planning; provides for formation of local community fire safe councils; adopts a standard outline for community wildfire protection plans (CWPP); identifies the Placer County Fire Safe Alliance (PCFSA) as a focal point for bringing citizens and protection agencies together to plan and accomplish fire safe measures; and establishes a public education role for the PCFSA.
Fire Plan	1996	California Department of Forestry (CDF) Fire Plan	California has a complex fire environment, with multiple climates, land use, diverse topography and many complex vegetation communities. To respond to this complex fire environment, custom strategies for each situation have been developed through combinations of pre-fire management, suppression, and post-fire management. These strategies are intended to lessen the costly impacts of future wildfires and offer alternatives to continually increasing suppression forces. The five components that form the basis of the planning process in the fire plan include: 1) Wildfire protection zones; 2) Initial attack success to measure the level of service provided by the fire protection system for wildland fire; 3) Assets protection to establish a methodology for defining assets protected and their degree of risk from wildfire; and, 4) Pre-fire management to focus on system analysis methods that assess alternatives to protect assets from unacceptable risk of wildland fire damage and a fiscal framework to assess and monitor annual and long term changes in California's wildland fire protection systems. Chapter 4 of the plan describes the assets at risk to wildfire, including water and watersheds and describes the commodity and environmental values of water and watersheds and the effects of wildfire on these values. Some of the risks detailed are relevant to the IRWMP in that they address increased amounts of sediment delivered to streams, diminished reservoir capacity, and harm to fisheries. This chapter also outlines the risks (vulnerabilities) to rangelands, wildlife, habitat, plants, and ecosystem health relevant to the IRWMP.
Conservation Plan	January 2011	South Yuba River Citizens League/ 21st Century Assessment of	The 21st Century Assessment of the Yuba River Watershed describes the Yuba watershed and impacts of historical and more recent factors to watershed health, restoration priorities for the Yuba River, (which contain remediating mining toxins, reforming water and watershed management and restoring the functions of the forest, meadows and floodplains), and plans for the future. This includes restoration of salmon habitat as well as effective watershed protection and restoration. The plan discusses land use practices in the Yuba Basin, including timber extraction, grazing, fire

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		the Yuba River Watershed	suppression, invasive species, human development patterns, impact of roads on aquatic ecosystems, and the combined effect of land use impacts on upland forest conditions.
Conservation Plan	March 2011	The Sierra Streams Institute/Deer Creek Watershed Restoration Plan	The Deer Creek Restoration Plan is an assessment of the entire watershed, expanding upon the Upper Deer Creek Assessment and Restoration Plan, and incorporating the cultural perspective of the Maidu. The report identifies the outcomes of impacts from a century and a half of mining, development, water diversions and agriculture, which include altered flows, reduced frequency of substrate mobilization, infrequent inundation of floodplain habitat, residual mining deposits, reduced complexity and cover of riparian vegetation communities, prevalence of non-native riparian vegetation, excessive fine sediment deposits in certain reaches, excessive nutrient loads in certain reaches, non-point source pollution inputs and sources of mercury and other heavy metal contamination from past mining activities.
Restoration Plan/Study	2008	The Sierra Fund/ Mining's Toxic Legacy	This report discusses the environmental impacts of historical mining techniques, including the widespread distribution of toxins, such as mercury used for gold mining, as found in the reservoirs in the foothills of the Sierra Nevada. Specifically, it is estimated that 13 million pounds of mercury were left in the land and water from historic gold mining in California. The report addresses four strategic recommendations to adapt to these mining impacts.
Basin Plan	1998	Fourth Edition Of The Water Quality Control Plan (Basin Plan) For The Sacramento River And San Joaquin River Basins	The Basin Plan sets water quality standards and identifies beneficial uses of water resources. It also sets forth an implementation and monitoring plan to achieve the objectives and preserve the beneficial uses. Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (and not limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. By identifying these beneficial uses, all water quality problems can be stated in terms of whether there is water of sufficient quality and quantity to protect or enhance those stated uses. Water quality objectives set explicit criteria for meeting the plan's goals for several water quality parameters.

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CALFED Bay-Delta Program Programmatic Record Of Decision (Rod)	See Document Summary	CALFED	The programs and implementation plans associated with the CALFED Bay-Delta system relevant to the IRWMP include: the CALFED Bay-Delta Ecosystem Restoration Program (2000); the Strategic Plan for Ecosystem Restoration (2000); the Upper Yuba River Studies Program (ongoing); the Delta Regional Ecosystem Restoration Program (in progress); the Habitat Management, Preservation, and Restoration Plan for Suisun Marsh (in progress); the Sacramento Valley Region Restoration Plan (in progress); the San Joaquin Valley Restoration Plan (in progress); the Mercury Strategy for the Bay-Delta Ecosystem (2004); and the 2001 Addendum to the CALFED Bay-Delta ROD (contains minor organizational changes to the 2000 ROD). The objective of the Ecosystem Restoration Program is to develop comprehensive plans and programs to restore ecological processes, habitats, and species on rivers and tributaries to the Bay-Delta. The Upper Yuba River, Delta Regional, Suisun Marsh, Sacramento Valley, and San Joaquin plans are all a part of the Ecosystem Restoration Program. Regional plans guide the implementation of the Ecosystem Restoration Program, but provide regionally-specific guidance, evaluation, and adaptive management feedback. The Mercury Strategy document outlines a strategy for integrated mercury investigations linked to restoration and adaptive management of the Bay-Delta ecosystem. Goals and objectives address water management, water storage, conveyance, water use efficiency, water transfers, an environmental water account, drinking water quality, watershed management, levees, ecosystem restoration, and establishing a science compendium relevant to CALFED.
Hazard Mitigation Plan	2011	Nevada County	The Nevada County Hazard Mitigation Plan was prepared to provide awareness of local risks and tangible mitigation plans for reducing long-term risk to people and property from natural and human caused hazards and their effects. The greatest hazard risks and vulnerabilities to Nevada County are associated with wildland fire and flood, specifically 13 flooding disasters between 1950 and 2008. The fire problem is directly related to the amount of hazardous fuels that have accumulated since the distribution of the natural fire cycles that normally occurred prior to land use changes that began at the start of the 20th Century.
Hazard Mitigation Plan	April 2010	Placer County	Placer County developed this plan to make the county less vulnerable to future hazard events, recommending 112 mitigation actions. The county identifies and analyzes several hazards, including floods, wildfires, severe weather and drought hazards which are termed as having significant impact on the county.

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Hazard Mitigation Plan	November 2004	El Dorado County	The plan's primary goal is to protect the county's residents and their property from the consequences of hazards by reducing the potential for future damages and economic losses that result from natural hazards. Several hazards are identified, including floods, dam failure, winter storms and drought. However, the most significant hazards to the county addressed are flooding and wildfire. Flooding is the primary hazard related to stormwater runoff, along with erosion, sedimentation and degradation of water quality.

Appendix F
Background Information

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

The following supplemental background information was prepared by the Objectives Work Group, and supports the development of CABY IRWM objectives and measurements of outcomes.

1. Programmatic Area: Water Supply

- The issue of water supply is important to the region because:
  - Sharing resources/amenities – including knowledge, available water resources, and financial resources – is part of how needs will be addressed in the future
  - Water resources are disproportionately available within the CABY Region, with some ability to transfer those resources across the region
  - A consistent and reliable water supply is a strong driver of the regional economy, including water for agriculture, recreation, and municipal uses
- CABY will address this issue through:
  - A holistic approach to water management, including looking at the issue for consumptive and non-consumptive use in an environmentally responsible way: water "supply" for municipal, agricultural, and industrial uses, and water "quantity" for a healthy environment
  - Providing opportunities for areas lacking adequate water resources to develop and manage local supplies to meet the needs of their citizens
  - Encouraging joint and conjunctive uses of water within the CABY Region and with neighboring IRWMP regions to maximize beneficial uses in the region

1.1. Primary Issue: Conservation

- Water conservation is an effective way for consumers to save money and for purveyors to stretch supply
- System leakage can be extremely high in rural systems with greater infrastructure-to-customer ratios
- The larger purveyors in the region have existing water conservation programs, and several also offer agricultural water conservation programs
  - When El Dorado Irrigation District's Irrigation Management Service (IMS) program was evaluated in 1986 after the program had been running approximately 7 years, the results showed that agricultural water use conservation was over 2,000 acre-feet annually (when measured against pre-program levels)[1]

[1] El Dorado Irrigation District, 2008. Final Program Report: Scheduling irrigation for commercial agricultural growers within the El Dorado Irrigation District using permanently placed soil moisture sensors. Placerville, CA. Available at: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044941.pdf.

- Small districts often have fewer options with regard to additional water supplies, and can benefit greatly from customers practicing conservation
- Help agencies to preserve their water supply for system resiliency/reliability and future demands, while preserving regional instream flows

1.2. Primary Issue: Infrastructure

1.2.1. Aging Infrastructure

- Water delivery infrastructure can be as old as the legacy gold mining activity in the region (from the late 1800s); as a result, much of CABY Region water delivery infrastructure is old and/or failing
- Sierra systems have a higher ratio of water delivery infrastructure-to-retail connections than more urbanized areas, leading to higher per-capita costs for consumers
    - The higher ratio of infrastructure means that fewer customers bear greater cost; this is often the case in disadvantaged communities throughout the region
- System leakage can also be extremely high in rural systems with greater infrastructure-to-customer ratios, which can affect drinking water quality through intrusions into potable water piping
- Small districts often have fewer options with regard to additional water supplies, and can benefit greatly from practicing supply-side (system) conservation; this usually includes upgrading to more efficient infrastructure
- Diversion points are a special component of this issue: diversions are now done somewhat differently from how they were done in the past, doing less environmental harm but requiring upgrades
    - There are opportunities to improve *and repair* diversion structures throughout the region

1.2.2. Interties

- CABY stakeholders have identified interties as: a legal and physical connection within and/or between systems
- Water systems throughout the CABY Region are at risk for catastrophic failure from a variety of causes: fire, flooding and mass slumping, and even simple spontaneous failure due to long-term stress
    - Because of the remote nature of water delivery systems in the CABY Region, catastrophic failures can be difficult to reach with repair equipment
    - This sometimes indicates a longer lag-time in repairing catastrophic failures, and can also complicate regular repair efforts
- In addition to unplanned catastrophes, water managers may schedule maintenance events where an alternate source is essential: interties assist necessary maintenance of purveyor systems
    - Interties within a system as well as between systems can help to provide the redundancies needed for the provision of backup supply directly to customers and/or to water treatment plants
    - Redundancies between systems can provide a mechanism to convey water for environmental purposes (streamflow)

- Interties between agency systems are also a way to ensure a more reliable supply for CABY purveyors

1.3. Primary Issue: Water Storage

- Regional interest in water storage varies amongst those stating that storage is an essential way to meet future water demands (municipal, agricultural, and environmental) and member groups who oppose additional storage until a certain level of conservation and alternate supply augmentation methods can be implemented
- The current storage system in the region is an essential tool in providing urban, agricultural, industrial, and environmental water of the appropriate amount and temperature throughout California's dry season, as well as an important flood control tool in the rainy season
- Purveyors in the region generally have adequate storage for existing needs, but may determine that future needs necessitate the consideration of additional storage
    - Smaller agencies and isolated systems may have immediate storage deficiencies
- CABY stakeholders want to be included in the early stages of new storage project development: this represents an opportunity on the part of the project proponent to get early conceptual input
- CABY stakeholders generally have a pragmatic approach to the issue: the most cost effective, least environmentally damaging option that meets multiple water supply needs is usually the best
- At least one water agency in the region is interested in determining the feasibility of additional new storage facilities; CABY stakeholders identify that this must accomplish multiple benefits (including environmental, recreational, and water quality benefits)
- While there may not be much opposition to modifications, such as dam raises (note PCWA's recent experience with Hell Hole), new on-stream storage would likely face significant opposition as-is
- Water banking and conjunctive use could be viable alternate water supply management opportunities for purveyors within the CABY Region
    - Wet year surplus could be stored in valley floor groundwater basins, creating an interregional partnership
- The significant forest lands in the CABY Region represent a resource that can be managed for water supply and storage; a programmatic approach to protecting CABY's headwaters is essential to the water supply and quality status of purveyors in the region and throughout the state

1.4. Primary Issue: Water Management Operations

1.4.1. Drought

- Drought cannot be avoided, especially as climate change begins to alter California's hydrology
- As climate change increases the likelihood of more extreme weather events, drought planning becomes more important
- Drought preparedness is important in a region dependent largely upon snowpack
- The term "drought" can also apply to situations where supply has been curtailed by a catastrophic failure, by planned maintenance, or for regulatory reasons

- Whatever the cause, it's important for all purveyors, whatever the size, to have management plans in place for water shortage situations
    - These must go beyond identifying stages to identifying the actions a purveyor must take, and by what department
- Many purveyors have significant flexibility in adapting to drought conditions through customer response; however, traditional drought response (including staged customer conservation) will become less effective over time due to demand hardening, as purveyors endeavor to comply with 20% (conservation) by 2020 targets
- Stakeholders have also conceptually identified a regional drought response as a desirable management strategy to consider in the future
    - Regional drought response would likely include: 1) the use of interties and shared storage locations to transfer water between CABY members, 2) sharing messaging strategies and printed materials, and 3) sharing equipment, such a water delivery trucks, to meet regional needs
    - This will be pursued by the CABY Water Work Group

1.4.2. Recycled Water

- Regional recycled water systems are already in use in some parts of the CABY Region
- This infrastructure is expensive, but can be paid for by new development fees and is a relatively drought-proof source (though supply can shrink as potable water use decreases)
- Stakeholder in the region are interested in the development of additional recycled water infrastructure to serve new urbanization and agricultural demands
    - This represents increased flexibility in supply development, and regional self-sufficiency
    - It can also save resources over time: both financial and natural
- There are regulatory and legal considerations in which CABY stakeholders have exhibited an interest
    - Being advocates for the streamlining of regulations for permitting recycled water projects
    - Pursuing the process of identifying locations where the sales of effluent may occur between producer and downstream users
- Where regional wastewater systems aren't available, it may be appropriate to facilitate the use of onsite gray water systems
    - Use of on-site recycled water systems (gray water) is not prevalent within the region, and local governments often lack policies and procedures to allow homeowners to install systems
    - Gray water systems need to be easy for the user, and less costly than the next alternative
    - Septic systems are efficient water recycling infrastructure, though regional sewer has a larger potential for overall recycled water – this could help purveyors to meet 20x2020 targets
    - Stakeholders will consider identifying functional and acceptable gray water system protocols for CABY Region homes that could be adopted by the many permitting entities in the region

1.5. Primary Issue: Water Transfers

- Water transfers can be completed both within the CABY Region and with outside organizations – these two possibilities represent very different ways of managing water and elicit very different responses from a variety of stakeholders
    - CABY stakeholders acknowledge that transfers will occur in the future, and want to be diligent as to how that happens and make intelligent decisions that benefit he region
- CABY stakeholders are interested in developing a consensus position regarding water transfers from the CABY region to outside entities
- Both financial and water resources are affected by this issue
    - There is a significant economic incentive to conserve water; this preserves it for sales/transfers
- Environmental transfers are a consideration under this issue, as well
- Stakeholder viewpoints are all over the map when it comes to discussions surrounding water policy questions of transfers, sales, Delta question, Area of Origin, diversion points and other issues – not from a point of disagreement or values, but because many participants don't approach the issue from a strategic perspective and aren't fully informed on the issue
    - There needs to be a shared stakeholder understanding regarding outside (State and federal) political threats to the region and the shared values held by CABY stakeholders for preserving in-region supply and self sufficiency
- Water carries a spiritual value for many Native American tribes' religious traditions
    - For some tribes, spiritual values associated with water resources prevent tribes from endorsing water transfers due to the tribal ethic against mixing two or more waters
    - This is sometimes due to historic tribal boundaries and the protocol associated with inter-tribal relations, and could also be due to biological reasons such as salmon "smelling" their home waters
    - CABY will attempt to honor these beliefs while maintaining expected levels of delivery and quality throughout the region by including Native American participants in the discussion

1.6. Primary Issue: Groundwater

- Groundwater resources in the CABY Region, while present in many areas, are extremely limited
- Much is unknown about groundwater resources within the region due largely to the fact that the underground geology is made up of unpredictable fractured rock systems
    - This also creates an unknown condition with water quality and contamination – because the system isn't known it would be difficult to identify the source of contamination were a well to become contaminated
- Historically, subdivisions that have been proposed in areas where municipal water delivery would have been impossible were allowed to create a groundwater system for residential water use

    - These systems are unreliable in many cases, and may dry up during periods of drought
    - Additional ground-water dependent development in areas adjacent to existing ground-water dependent development can cause significant impacts to the already developed area, making the resource less reliable
- Through greater "flashiness" in the hydrograph, climate change could potentially create a higher occurrence of drought
    - This could create a management challenge in the region regarding residences and small communities dependent upon groundwater resources which are intermittently or permanently not available
- Small developments dependent upon groundwater continue to be proposed, and it is in the interest of the region's planning entities and water purveyors to minimize developments that may incur significant impacts by being completely dependent upon groundwater resources (including severe long term shortages, drying wells, and becoming dependent upon trucked-in water)

2. Programmatic Area: Water Quality

- The issue of water quality is important to the region because:
    - There are major legacy issues affecting water quality and human and environmental health within the CABY Region
    - The CABY Region contains significant headwaters area important to the provision of clean, cool water for the region and for the state as a whole
    - In addition to legacy threats, current uses can sometimes endanger regional water quality, including non-system recreation activities and wastewater treatment (small- and large-scale)
- CABY will address this issue through:
    - Encouraging the use of proactive, "green" storm water management and low impact design; these are important development issues that can positively affect water quality at a relatively low additional cost
    - Education and outreach done through school, community, and organizational promotion efforts
- These issues won't be solved overnight, but they require partnerships and the synergies of collaborative planning and management

2.1. Primary Issue: Contamination

2.1.1. Legacy Mining Toxins

- Legacy mining toxins are a hazard to subsistence fishing communities as well as those communities whose drinking water is affected
- CABY stakeholders have made it a priority to map all abandoned mines and then prioritize identified mines for remediation
    - As resources become available, remediation should begin on a number of mines annually
- Legacy contaminants are of great concern within the CABY Region, affecting activities such as:
    - The availability of potable, healthy drinking water,

    - The use of native materials for cultural activities, including basket making and spiritual ceremonies,
    - Subsistence fishing, and
    - The overall health of the riparian environment and species depending on clean water for survival and propagation
- These legacy contaminants flow into the Central Valley and through the Delta, compounding the state's mercury challenge
- In the Combie Reservoir alone it is estimated that there are 150 pounds of mercury lodged in the sediments at the base of the dam
- Innovation is encouraged - contaminants may be removed through any means possible that maintain the integrity of the environment
- Stakeholders want to make every effort to identify all toxins taken out of the river – even by non-regulatory (private) processes

2.1.2. Urban Run-off and Abandoned Mine Land Run-off

- There are a variety of sources of water contamination in the region, and the CABY Region hosts 14 303(d) listed water bodies, listed for exotic species, mercury, bacteria, fecal coliform, pH, copper, sediment/siltation, zinc, and arsenic
- Contamination affects the health of aquatic species and recreational activities in the region
- Achieving water quality objectives for beneficial use will improve the quality of life for people throughout the region
- Because it is difficult to quantify the effect of a remediation project on a specific water body's level of contamination, the number of projects implemented is the gauge of success rather than the units of contamination remediated
- River systems are the focus due to their importance to native species and their role as providing refugia throughout the CABY Region

2.2. Primary Issue: Sedimentation Management

- Sediment transport is a natural and necessary function of river systems
- Most rivers in the region have had their natural sediment regimes significantly altered by land use practices, roads and dams
    - This includes both erosion beyond natural levels, as well as sediment trapping behind structures
- In disturbed landscapes, such as urban areas, rural areas altered by commercial development, and roaded areas, changes in the sediment regime can result in alteration of natural material, including the cementing of gravel bars and beaches, introductions of toxins into streambeds and riparian habitats, and nutrient loading of waterways resulting in algal blooms and low oxygen levels in streams and lakes
    - This can negatively affect water quality for the environment as well as for municipal use
- In rivers where dams have altered hydrologic regimes and/or prevent the downstream travel of heavier sediments and woody debris there can be a loss of spawning gravels, beaches, gravel bars, and floodplain soils, resulting in significant alteration and loss of riparian habitat, lands and channel function

- There are a variety of projects and approaches that are occurring to address these issues, including habitat restoration projects, road design improvements and removal, and changes in reservoir and hydro-system management as a result of cost analysis, relicensing requirements, and better understanding of ecosystem needs

2.3. Primary Issue: Wastewater Management

- Infrastructure condition and capacity, due to age and occasionally to the speed of regional population growth, is a challenge throughout the CABY Region; this includes both septic systems and wastewater treatment plants
- In some cases, new development has fueled the upgrade of wastewater infrastructure including, in El Dorado County, the funding for the development and continued operation of a recycled water system replacing about 8% of total deliveries
- In localized cases, poorly managed septic systems and non-system recreational uses can result in water body and drinking water contamination
    - This is not well-understood across the region and requires additional research and conversation
- Wastewater management is a challenge throughout rural mountainous counties, and the CABY stakeholders are interested in furthering a regional understanding of the issue in order to, in the future, create concrete, quantifiable objectives for addressing spills, leakage, and management

2.4. Primary Issue: Headwaters Protection

- Healthy headwaters are essential to preserve the freshwater resources of the CABY region and are an important piece in the continuous provision of cool, clear water to downstream users
- Healthy headwater streams are major sources of water and dissolved and suspended organic and inorganic constituents for the downstream ecosystems into which they flow
- The health of headwater streams is dependent upon land use practices and the condition of the watershed
- Source water areas providing most of the water throughout the western US are under threat from climate change
    - Headwaters provide a “reservoir capacity” that can increase the flexibility of water providers in dealing with fewer resources overall
- As the CABY Region population grows, the demand for water and other natural resources will increase – healthy headwaters are an integral part of providing for those future needs

2.5. Primary Issue: Temperature

- Appropriate water temperature is essential for the maintenance and continuity of native aquatic species as well as for economic and industrial purposes and uses
- Stream systems represent important temperature refugia for aquatic species in the face of climate change
- CABY Region lakes, reservoirs, and streams represent a cold water pool for lower streams and rivers (including Western Placer Creeks and Folsom Reservoir)

- ,Sream restoration efforts will include re-vegetation efforts and will emphasize shading, where appropriate, to preserve stream temperatures even as climate change projections include increased air temperature

3. Programmatic Area: Environment and Habitat

- Environment and habitat issues are important to the region because:
  - Stakeholders recognize humans as part of the natural system and part of CABY watersheds
  - There are a number of endemic and threatened and endangered species and habitats in the region
  - California's Sierra Nevada is an important ecological unit due to the diversity and number of endemic species found here
- CABY will address these issues through:
  - Comprehensive implementation project planning, including inter-watershed considerations (north-south) and headwaters-boundary planning (east-west); planning on a watershed level
  - The encouragement of healthy and sustainable economic prosperity while preserving the natural environment for a diversity of uses now and into the future
  - Innovative partnerships and funding mechanisms to maintain – and even improve – the current level of effort into the future

3.1. Primary Issue: Fisheries

3.1.1. Fish Passage

- There are significant physical barriers in (and just outside of) the CABY Region to anadromous and Sierra endemic fish species preventing them from reaching historic habitat and spawning areas
- There are some possibilities within the region to improve access to historic habitat, including Western Placer Creeks, the Cosumnes River, and the Yuba River
- Improved access would also necessitate the provision of suitable habitat: vegetated riparian corridors, adequate flow to maintain spawning and rearing habitat and temperatures, substrate materials suitable to use, and the absence of harmful contaminants at intolerable levels
- Habitat suitable for anadromous and/or fish will also usually be suitable for other aquatic biota
- Because of limited accessibility by anadromous fish to historic habitat up and down California's Central Valley (in the Sierra, Cascades, and in the Coastal Ranges), the potential for habitat in the CABY Region achieves even greater significance
- Stakeholders have exhibited one caveat to expanding habitat, and that is that this expansion may allow for greater mobility by aquatic invasive species
  - This will continue to be a consideration and a discussion for implementation projects addressing this objective

3.2. Primary Issue: Aquatic Biota

- Aquatic biota are dependent upon many of the other considerations and issues addressed in this section
- Instream flow, meadows restoration, and headwaters protection will help to preserve cooler temperatures, maintain summer base flow, minimize problems coming from contamination, and provide for a diverse habitat for the many species hosted by streams and rivers in the region
- The challenge of preserving the health of aquatic biota is compounded by the presence of invasive species
- Opening up streams for additional anadromous fish passage will help in the healthy and natural transport of sediment through the system and allow for navigation of larger lengths of streams and rivers by other species

3.3. Primary Issue: Instream Flow

- Adequate instream flow is essential for maintaining cool temperatures and for a healthy movement of sediment and nutrients in the system
    - Flow can help in diluting contaminants, including sediment, chemicals, and urban run-off
- Additional instream flow could contribute to enhanced anadromy within the region and in-region migration
- A minimum level of instream flow is required for boating and environmental benefits on regional rivers; this is largely controlled by FERC licenses
- The CABY Water Trust may play a role in the preservation of instream flows not already controlled by FERC licenses.
- Preserving instream flow will give waterways and water purveyors additional flexibility in the face of a changing climate
    - Healthy streams means that greater flexibility in diversions and/or transfers may be appropriate
    - Adequate flow and maintained temperature mean that additional environmental flows may not be necessary to maintain negotiated temperature standards

3.4. Primary Issue: Meadows

- Meadows are essential habitat for plants and animals alike
    - Wet meadows (as opposed to dry meadows) are the focus of this objective because of their positive effects on water resources and importance for aquatic habitat
    - Functioning meadows can preserve cool water temperatures and can maintain summer base flow – they act like a reservoir
- There are several organizations working on meadow restoration within the CABY stakeholder group
- While CABY doesn't have the large-scale meadow complexes present in other IRWM regions, regional resources do remain important to preserving base flow and temperature throughout the summer and fall
- Historic grazing practices often degraded the meadows; these historic impacts continue to have environmental consequences (such as increased erosion and reduced water

quality), though current management avoids these issues through the employment of best management practices
- Climate change may alter the species that make up vegetation bands in which CABY meadow areas are located – this could infringe on meadow habitat through the growth of perennial shrub species in meadow areas formerly dominated by herbaceous species.

3.5. Primary Issue: Fire and Fuels

- The CABY Region is at extreme risk of the occurrence of catastrophic wildfires
    - Mid-20th-century prevention of forest fires
    - High wildland-urban-interface population, so high economic risk, which complicates firefighting along that boundary, and increases the cost exponentially
- Catastrophic fire severely harms both human infrastructure (homes, utility lines, transportation routes) as well as high-quality habitat and diverse ecosystems
- Resource Conservation Districts throughout the planning area work with private landowners to implement best management practices to minimize fire risk on properties
- Catastrophic wildfire can create conditions in the forest that exacerbate habitat degradation and loss, including mass slumping, loss of sediment, and hydrophobic soil conditions
- The science of catastrophic fire prevention is well-understood, but the effort and expense essential to carry out these activities is beyond many organizations' capacity
    - Fuels management is expensive because of the equipment and labor necessary to do a good job
    - Research shows that a little bit of prevention in the form of fuels control can go a long way
    - 10,000 acres is just under 0.4% of the entire CABY Region, but could make a difference to the humans and animals spared in a catastrophic wildfire
- As climate change effects are felt, it's likely that the CABY Region will experience greater impacts from catastrophic fire due to warmer overall temperatures and either less overall precipitation or precipitation coming in more extreme events
- This is an objective that could benefit from a potential federal and/or statewide source water investment program
- CABY stakeholders have evaluated this issue as being so important that they decided it would be the focus for the initial climate change analysis (see Chapter 11,Climate Change)

3.6. Primary Issue: Invasive Species

3.6.1. Aquatic Invasive Species

- Aquatic invasive species (AIS) are a problem throughout the state; many were brought here through intercontinental oceanic vessels
- The key to avoiding their spread is the prevention of cross contamination by users, including boaters and fishermen
    - Public education is a key component of this issue

- The variety of land management agencies throughout the planning area can make management of infestations difficult – a regional plan of action is essential to successful control of AIS
- Communication between management agencies will enable managers to more quickly respond to potential infestations, closing the infested area and checking potential contamination vehicles at water bodies throughout the region

3.6.2. Terrestrial Invasive Species

- Terrestrial invasive species are ubiquitous throughout the planning region; CABY stakeholders have chosen to focus on plants because of their direct connection to water
- Terrestrial invasive species can:
    - Shade-out and/or outcompete native species
    - Completely change a habitat type and the cycles of growth and senescence, which in turn can affect the species composition present at any given location and affect fire behavior on that location
    - Change the amount of runoff reaching a stream or other water body
- Seeds of these invasives can be spread by animals (domestic and wild), human activity, vehicles, and even the wind
- Education is key for several reasons: 1) to help in the identification of invasive species, 2) to prevent the spread by controllable mechanisms, and 3) to ensure that invasive species are not available commercially
- It is in the interest of all stakeholders to discourage the introduction and spread of invasive species; the survey and control work is often done by volunteer groups, and can be combined with fire/fuels control activities

4. Programmatic Area: Climate Change

- The issue of climate change is important to the region because:
    - Climate change has the potential to affect all components of resource management
    - The CABY Region is at the convergence of two areas of climate change projections: the northern Sierra/Cascade and the southern Sierra, which complicates projecting the effects of climate change on the planning area
    - The region has already begun to experience some of what could be the effects of climate change, including drier winters, earlier spring melts, and warmer average temperatures
    - Some of the greatest vulnerabilities include the rich biodiversity present in the Sierra
- CABY will address this issue through:
    - Addressing the issue through the most practical, cost-effective, and accurate methods possible; stakeholders have assumed that one, or a combination, of four scenarios could play out in the region: warmer-wetter; warmer-drier; cooler-wetter; and/or cooler-drier
    - Stakeholders have identified that, while it's unknown how climate change will affect the region, it's probable that increased flexibility will be an important – even essential – tool in meeting that challenge

    - CABY's approach to climate change will include analysis of both human needs (water resources, economic effects) and environmental needs (instream flow, water temperature, and habitat corridors)
    -
    - Stakeholders are interested in identifying achievable strategies for dealing with the projected effects of climate change
- The CABY Climate Change effort
- CABY stakeholders have decided to focus on the climate effects on fire occurrence and severity and fuels management (see Chapter 11, Climate Change) for several reasons:
    - Fire is connected to many other issues, including habitat connectivity, species migration, and land use decisions – all of which will also be affected by climate change
    - Climate change effects are usually projected with a range of (sometimes conflicting) outcomes; because fire is already an issue within the CABY Region, stakeholders can feel confident that the vulnerabilities they identify and mitigation measures they select will not be "wasted effort", no matter what projection and outcome occurs
    - There is a lot of information on fire and fuels and how they're affected by climate change, which makes analysis feel more comprehensive and less like a "guessing game"
- After identifying vulnerabilities, the CABY Climate Change TAC will identify adaptation strategies to cope with these vulnerabilities
- These are expected to be cost-effective and easily implementable: the "low hanging fruit" of adaptive management
- Other important strategies for the CABY Region
- Alternative energy is a good investment for a variety of local government and business entities in the region, especially with financial incentives
- Small scale hydropower development is of interest to several entities
    - There are some regulatory hurdles for these projects (see "governance" objectives)
- Solar power has been implemented by local governments in the region, and there is interest in expanding it
- Solar and hydropower are "clean" energy sources from which the region can benefit economically, and the state can benefit from an emissions standpoint

5. Programmatic Area: Human-Landscape Interaction

- Human-landscape interaction is an important issue to the CABY Region because:
    - Stakeholders recognize humans as part of the natural system and part of CABY watersheds
    - Much of the landscapes in the CABY Region have been changed because of human actions – this has both positive and negative implications: humans denuded landscapes and destroyed rivers in their pursuit of gold in the late 1800s, but humans have also restored meadows and streams to ecological function, also improving water quality and supply for urban and agricultural uses

- CABY will address this issue through:
    - Managing the balance of the environmental, economic, and social elements of resource use in a sustainable way
    - A recognition and respect of the diverse uses of resources within the region balanced with the preservation of system flexibility and species and habitat diversity and functionality

5.1. Primary Issue: Habitat Alteration

- Many native ecosystems are under extreme pressure from human sources, including pressure from development, recreational activities, invasive species, and catastrophic fire events, all compounded by climate change
- The discussion surrounding this issue came about partially due to the large amounts of land converted from open space and agriculture to urban and transportation uses in the CABY Region
- It's also an issue related to a regional response to and in preparation for climate change – often land that's converted from its native state is land that would otherwise be essential in preserving the connectivity and wildlife corridors
    - CABY stakeholders hope that the work done in answer to this objective results in an identification of migration and movement corridors for wildlife and places of connectivity important to native species movement – both annual and in response to climate change
    - It is essential that habitat corridors be identified and preserved so that species have a way to migrate as the climate and habitats change
- Urban development and transportation corridors are usually considered permanent, so it's imperative to identify and preserve migration connectivity before these key locations get developed
- It is hoped that, through the achievement of the CABY Objectives, ecosystem integrity is protected and that the ecosystems essential to answering a variety of demands can continue to serve those needs

5.2. Primary Issue: Native American Uses

- Stakeholders recognize that there are traditional uses of resources within the CABY Region going back before the arrival of Europeans and the gold rush
    - Values include materials used for traditional crafts, spiritual practices, medicinal uses, and more
    - These species are often found in riparian areas
    - These traditional uses are often threatened by the destruction of habitat and/or the contamination of water resources
- The preservation of habitat is essential to preserving these uses and the traditions dependent on the availability of resources
- It may be important to preserve these areas without alerting the general population to the values of the resources on them – this will protect the integrity of the area

5.3. Primary Issue: Flooding

- Flooding is a problem in areas of historic floodwater confluence, and is often where development has occurred
- Flood risk can be exacerbated by the development of impermeable surfaces upstream, or the destruction of natural attenuation structures (natural flood plains, settling ponds, and infiltration basins)
- Living in a flood zone can result in mandatory flood insurance for people who may not be able to afford it
- Stakeholders are interested in passive flood management, including green infrastructure
    - This is due largely to the cost effectiveness of the measures and the ancillary benefits they provide (such as increased groundwater recharge)– they are less costly and solve the same problem as more costly, more infrastructure-intense solutions.

5.4. Primary Issue: Open Space

- Many inhabitants of the region are not born here, but were attracted to the region due to the rural, "natural" aesthetic
    - Preserving open space is essential to preserving the character of the region
    - This aesthetic is also a component in drawing tourism
- One of the best ways to preserve open space is through economic incentives, including conservation easements
- Permanent protection is essential because of the long-term planning that open space corridors imply, as well as the species that become dependent upon that resource (see "Habitat Alteration", above)

5.5. Primary Issue: Disadvantaged Communities

- The planning area is made up of a large number of disadvantaged communities, due largely to a difficult transition from the historic extraction-based economy
    - Challenges of disadvantaged communities can be similar to those of larger and more affluent areas (see "aging infrastructure" and "conservation" under the Water Supply section), but are felt more acutely and with fewer management resources
    - Drinking water quality is an important concern for these areas: it can be affected by inadequate system pressure (due to failing and/or inappropriately sized systems) and by out-of-date (or absent) treatment infrastructure
- While communities pursue alternative forms of economic development, the CABY Planning Committee would like to prioritize DAC projects to encourage further regional investment in these communities
- This policy extends to the staff and project team working to implement the CABY IRWMP; these employees and consultants will give additional effort to the process of identifying and developing DAC-area projects
- Water is a human right, and clean water and wastewater treatment are essential to a healthy, productive life

5.6. Primary Issue: Recreation

- Recreational activities – both outfitting and the sale of equipment and experiences – are a major economic driver in the region
- Forests within the CABY Region are known as "urban forests": they are within 100 miles of two metropolitan areas hosting at least 1 million people
- Greater recreational use in the region not only creates a robust economy, but it also builds political support for the restoration and preservation of the environment within the region, including meadow restoration, riparian areas along rafting runs, and hiking and equestrian trails
- In the interest of building and maintaining local economies, stakeholders encourage project development to include the consideration of recreation, both the potential for new activities and the enhancement of in-place activities

5.7. Primary Issue: Hydropower

- Hydropower is an important use of CABY resources, providing an emissions-free method of producing electricity and a substantial revenue stream that offsets operational costs of many water purveyors and their customers
- There are five major hydroelectric power producers active in the region, as well as multiple small-scale producers
- Stakeholders have noted the potential for small-scale hydropower development on pipes and canals throughout water purveyors' service areas
    - Because of the limited-to-no environmental damage that small hydro would create, and the potentially large benefit to the region of producing this power, stakeholders have identified this issue as important to the region
    - A potential limiting factor to small hydro development are issues related to regulatory barriers (see "Governance – Regulatory" for more information on this issue)
    - Small hydropower is a way to capture the potential energy of water ascending the west slope through existing pipelines and canals through the placement of turbines and generators along pipes and canals

5.8. Primary Issue: Agriculture

- Unique agricultural communities and experiences are an important component to CABY Region communities and economies
- Both "Apple Hill" in El Dorado County and "Placer Grown" in Placer County attract tourism and feed the community and the local economy
- The use of land resources for agricultural production helps in maintaining the rural nature of the region
- One of the best ways to preserve this agricultural land is through economic incentives, including conservation easements and financial support of their products
- New Irrigated Lands Regulatory Program surface and groundwater monitoring requirements are threatening the viability of agriculture in the Region; these are one size fits all regulations that were developed with large, high intensity valley agricultural operations in mind and are not appropriate for the low intensity agriculture occurring in much the region nor for the geology of the region located outside the managed valley groundwater basins

5.9. Primary Issue: Sustainable Economy/Self Sufficient Communities

- CABY stakeholders desire to support regional project and business development through financial means
- This support could result in small grants and/or micro-loans
- Projects making use of these funds would need to focus on resource management activities, such as timber management, fire and fuels control, agriculture, recreation, energy production, and/or other efforts deemed important to the region by the CABY stakeholders
- The CABY RWMG (non-profit) would likely manage these funds
- The funds could potentially come from anywhere, including CABY stakeholder organizations, foundation grants, and/or community development funds

5.10. Primary Issue: Governance

5.10.1. Political

- Political capital within the CABY Planning Committee is an important resource to maintain for ongoing organizational support
- Much of this support can be developed and maintained through active and persistent education of and outreach to the management staff and Boards of participating organizations
- Stakeholders support the consistent outreach of the CABY executive director or designated alternate (CABY representative of that organization) through annual presentations to the Board and/or management staff
- The CABY staff and/or project team will create outreach materials updated as needed for use by presenters
- The CABY staff will also be responsible for tracking organizational participation

5.10.2. Legislative

- Because of the rural nature of the Sierra, and it being the source water area for approximately 60% of California's water supply, it's important to maintain its profile in the State legislature and to ensure that all participants are aware of legislative activities affecting the region
- There is an annual Sierra Lobby Day at the Capitol (organized by the Sierra Fund) in which the CABY staff will participate
    - The CABY staff will alert stakeholders of this event and encourage participation
- It's important that the CABY agencies continue to be aware of legislative efforts with the potential to affect the region – positively and negatively
    - CABY staff will stay abreast of these issues through contact with local legislators and member organizations' Boards of Directors
    - When necessary, action will be taken based on input from the CABY Planning Committee and Coordinating Committee
    - Legislative issues will also be discussed with other Sierra-region IRWM groups through continued participation in the Sierra Water Workgroup

5.10.3. Regulatory

- Regulatory requirements – by the State and the federal governments – can increase the time it takes to develop and implement a project, as well as the cost
    - One of those regulations/laws important to the region (being a source water area) is the inability to maintain ownership of treated effluent if a natural waterway is used to convey the recycled to a willing buyer: in hilly terrain, the sale of recycled water to a downstream user is in many cases more cost effective than building infrastructure to store and pump water back up the hill to the customers that generated the wastewater
    - Irrigated Lands Regulatory Program regulations are also onerous and inappropriate for agriculture in many areas of the CABY region
    - Small hydropower development – regulation restrictions regarding onsite use – characterization of small hydro (baseload vs. non-peak vs. other (preferred)) – water-energy need is seasonally coincident
- Stakeholders advocate the development of a task force/committee to examine regulations relevant to projects implemented in the region and work to identify those that are conflicting and/or hindering implementation of the CABY IRWMP

6. Overarching Objectives

Overarching objectives are those topics that seem to come up with every discussion of specific issue-based objectives. These are components of the CABY planning process that will be considered for every program implemented and for every project concept.

6.1. Education and Outreach

- As identified in several issues above, education is an integral component to the preservation and restoration of CABY natural resources, and will be considered as a possible component for every project that CABY identifies for implementation

OV-1: Where possible, outreach and education will be integrated into all CABY projects and programs; this will include both school education and public and community outreach.

6.2. Financial Feasibility and Sustainability

- Stakeholders have identified this as an issue because of the large-scale planning it requires on both an organizational and a funding level
- Stakeholders will work to refine this issue through the development of a finance and organizational plan for the CABY entity, which will include goals and objectives for gauging success of implementation

As there is a section of the IRWMP that will address both short- and long-term financial feasibility of the IRWMP; stakeholders feel that it's not necessary to develop an additional objective to underscore this. In addition, the "sustainable economy/self-sufficient communities" objective also touches on the goals of the region regarding financial sustainability.

6.3. Data Analysis and Monitoring

- One of the benefits of the IRWMP process is the sharing of data and findings between organizations and entities
- In order to preserve and enhance this benefit, stakeholders have identified the sharing of data and continual development of the SWIM website as an integral component to IRWMP preparation and update as well as project implementation

6.4. Regional Planning and Land Use

- Water and land use are relate closely throughout the state, but with various levels of coordination
- Because of this fact, stakeholders have aspired to integrate and coordinate water management and land use planning decisions wherever possible (further discussed in the water-land use chapter)
- In addition, the emphasis of school and community education has risen to the surface as a priority with regard to land use issues of storm water management and low-impact design

Appendix G
Fire and Fuels

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

In May 2018, California Governor Brown issued Executive Order B-52-18 to support the state's resilience to wildfire and other climate impacts, address extensive tree mortality, increase forests' capacity for carbon capture, and improve forest and forest fire management. Wildfires of magnitude exacerbated by drought and other climate factors are impeding the state's efforts to mitigate GHGs - while bringing catastrophic effects on communities, wildlife, and watershed health. The Order committed $96 million in additional state funds toward: improving forest management and restoration; providing regulatory relief; reducing barriers for prescribed fire; boosting education and outreach to land owners; and for supporting wood products innovation. The California Forest Management Task Force was initiated with the purpose to:

Implement the Governor's Executive Order B-52-18 and the recommendations of the California Forest Carbon Plan.

- Strategically coordinate the state's investments in forest health.
- Expand and improve forest management to enhance forest health and resiliency.
- Minimize regulatory barriers for prescribed fire, forest health, and fuels reduction projects.
- Expand the use of prescribed fire across public and private ownership.
- Increase public education and awareness of the importance of forest health and resiliency to achieving California's long-term climate, watershed, wildlife, economic, and public health goals.
- Encourage capacity building in forested communities to support implementation.
- Incentivize innovations in the forest product and building industries to utilize material from forest health and fuel reduction projects.

In March 2019 Governor Newsom signed a State of Emergency Proclamation to confront the threats of wildfire in California and to expedite forest management projects that will protect 200 of California's most wildfire-vulnerable communities. This proclamation directed state agencies to:

- Implement the fuel reduction projects identified using the methodology outlined by the Department of Forestry and Fire Protection to determine which communities are at greatest risk of wildfire based on best available science and socioeconomic factors and to identify projects that would reduce the risk of catastrophic wildfire
- Ensure that the needed equipment and services to implement can be procured quickly and cost-effectively.
- Suspend some government codes, statutes, rules, regulations, and requirements as they apply to the priority fuels reduction projects, when necessary to undertake the projects within a rapid timeframe, that are subject to the jurisdiction of agencies within the California Environmental Protection Agency and the California Natural Resources Agency.

Within these statewide frameworks, local initiatives are being planned and implemented to enable small and large-scale landscape treatments to reduce fuel loads to protect communities

within the CABY region and protect watersheds essential to these communities and to California as the headwaters for much of the state.

Yuba Forest Network - Beginning in late 2019, the Yuba River watershed became home to two Forest Health Watershed Coordinators, hosted by SYRCL and the Camptonville Community Partnership, supporting multiple planning and implementation projects seeking to improve the health of the region's forests. To tie existing and future projects together into a cohesive strategy, one of their tasks is to build and facilitate a new watershed-wide stakeholder group to promote and implement forest health as well forest product projects throughout the watershed. Initial conversations with local stakeholders from late 2019 to early 2020 demonstrated an existing energy and capacity for forest health projects but lacking a large-scale cohesive strategy. One particular gap identified is the need for bringing together private landowners around unified projects. The new Yuba Forest Network aims to address this need for increased collaboration by connecting stakeholders, projects, and resources in order to accelerate the pace and scale of forest health projects across the region. In order to efficiently support and develop current and future cross-boundary forest health projects, the Yuba Forest Network is envisioned as a central networking hub to connect resources and practitioners across the watershed. The preliminary set of goals envisioned for the group includes:

- Develop a platform for sharing resources on permitting, contractors, project development, expertise, and monitoring protocol
- Host a calendar of forest health related events across the watershed
- Create a broadly accessible forest health stakeholder project map
- Support existing institutions to promote cross boundary collaboration
- Increase regional identity around Yuba Forests

Nevada County is working with CAL FIRE, The Fire Safe Council of Nevada County and local neighborhoods to complete the Ponderosa West Grass Valley Defense Zone – Fuel Break Project designed to protect approximately 3,000 residences in the Wildland Urban Interface communities of Lake Wildwood, Penn Valley, Rough and Ready and the City of Grass Valley. The area has not burned for over 100 years and fuels have been largely unmanaged. The project provides protection for critical infrastructure supporting state commerce, such as State Highway 20, power and water infrastructure, and various Nevada County facilities.

Nevada Irrigation District's Forest Management Program partners with CAL FIRE and other state agencies to reduce the density of fire fuels surrounding key watershed features such as reservoirs; around transportation, treatment and delivery infrastructure; near hydroelectric generation facilities; and in headwaters regions to create fuel breaks and increase the resiliency of these features from the effects of catastrophic wildfire. In addition, this forest management program manages understory fuels and large timber through selective thinning projects with the aim to increase spacing of large vegetation in the residual stand. These projects benefit forest health, disease and pest resistance, carbon sequestration rates, snowpack accumulation, groundwater infiltration and water yield into streams and basins, and the health and safety of adjoining communities to project locations. Nevada Irrigation District (NID) actively manages the watershed lands within its jurisdiction to address forest health concerns, climate change effects, extreme wildfire behavior, water availability, and safety. Specifically, NID has recently completed a shaded fuel break in the Deer Creek canyon on the west end of Scotts Flat Reservoir, thinned dense understory vegetation and hazard trees from campgrounds at Scotts Flat and Rollins Reservoirs, selectively thinned a shaded fuel break off of Magnolia Road for nearby community wildfire defense, and has completed the assessment phase of a headwaters

and montane meadow health and function restoration project in the headwaters of the Middle Yuba River, upstream of Jackson Meadows Reservoir.

In the extreme, wildfire causes loss of life, shelter, and livelihood. Emergency preparedness, the creation of defensible space, landowner assistance programs, fuels reduction efforts, and knowledge of evacuation routes all decrease the likelihood that fire will end in tragedy. Providing education and access to these tools and techniques is a key goal of the Firewise Communities USA program. Nevada County has more Firewise Communities than any other county in California, yet the vast majority of these are located in affluent residential enclaves. Communities with the fewest economic and social resources, including Spanish-speaking residents, are thus at greatest risk for loss in the event of wildfire. The Sierra Fund has initiated outreach to disadvantaged communities (DACs) in Nevada County to increase equal access to fire planning and prevention resources by identifying DACs in high fire severity zones and conducting language appropriate outreach and education to build the capacity of these communities to become fire-ready.

MC1 Modeling

The California Climate Change Center's "Climate Scenarios" project, initiated in 2005 in response to then Governor Schwarzenegger's Executive Order S-3-05, analyzes potential climate change impacts on vegetation changes throughout the state, using the US Forest Service's MC1 model forced with lower (B1) and medium-high (A2) emissions scenarios. MC1 is a dynamic vegetation model (DGVM) with three components, including: 1) a simulation of plant type mixtures and vegetation types; 2) a description of the movement of carbon, nitrogen, and water through ecosystems; and 3) fire disturbance. The scenarios used for this work (B1 and A2) and the models feeding the climate forcing (GFDL and PCM1) are the same ones used in the state's Cal Adapt modeling scenarios. (Lennihan, 2008)

The CABY Climate TAC judged the MC1 model to be a useful one for the region for two main reasons: 1) it would build on information already collected regarding fire occurrence and vegetation change within the CABY region, and 2) large scale vegetation change can be analyzed from a general perspective, allowing diverse stakeholders to talk about overarching management and adaptation strategies. The MC1 vegetation types are listed in Table 1.

MC1 Vegetation Type	Regional Examples
Boreal Conifer Forest	Lodgepole Pine forest, Whitebark Pine forest
C3 Grasslands	Valley grassland
C4 Grasslands	Desert grassland
Continental Temperate Coniferous Forest	Mixed conifer forest, Ponderosa Pine forest
Mediterranean Shrubland	Chamise chaparral
Temperate Arid Shrubland	Sagebrush steppe
Temperate Conifer Savanna	Canyon Live Oak woodland
Temperate Mixed Xeromorphic Woodland	Blue Oak woodland
Warm Temperate/Subtropical Mixed Forest	Douglas Fir/Tanoak forest, Ponderosa Pine-Black Oak forest, Tanoak-Madrone-Oak forest

Table 1. MC1 Vegetation Community Types

The MC1 model simulates the potential mixture of evergreen needle-leaf, evergreen broadleaf, and deciduous broadleaf trees, as well as C3 and C4 grasses. The mixture is evaluated at each annual time-step as a function of predicted annual minimum temperature and predicted growing season precipitation. The C3/C4 grass mixture is determined by reference to their relative potential productivity during the three warmest consecutive months.

Perennial grasses can be classified as either C3 or C4 plants. These terms refer to the different pathways that plants use to capture carbon dioxide during photosynthesis. These differences are important because the two pathways are also associated with different growth requirements: C3 plants are adapted to cool season establishment and growth in either wet or dry environments, and C4 plants are more adapted to warm or hot seasonal conditions under moist or dry environments. C3 species also tend to generate less bulk than C4 species, but the C3 feed quality is often higher.

All future scenarios project an increase in the number and severity of fires, but the change becomes more significant toward the end of the century (Lenihan, 2008). The future scenarios modeled for the CABY Climate TAC show an increase in and general upslope movement of the warm temperate/subtropical mixed forest. This is largely displacing the boreal conifer forest, which is less tolerant of heat and drought. The temperate mixed xeromorphic woodland moves upslope from the foothills just outside of the western edge of the CABY region, further into the region (displacing the warm temperate/subtropical mixed forest, which is also moving upslope). In addition, the vegetation communities at the highest elevations in the CABY region become more complex in terms of variety and generally drier, moving to temperate arid and/or Mediterranean shrubland, expanded xeromorphic woodland, and C3 grasslands.

The figures below on the following pages show these predicted changes. The data corroborate the information obtained by literature review: warmer conditions and more highly variable hydrology indicate the movement of different habitats and biomes upslope, as well as an increase in total biomass.

Fire and Fuels Vulnerabilities

Increased wildfire risk and severity are vulnerabilities throughout the Sierra Nevada (Westerling, 2008). Catastrophic wildfire in particular is projected to become more frequent and more severe in the coming decades. All analyses completed for fire occurrence and severity into the future predict more fires and greater severity (Bryant, 2009; Fried, 2004; Lenihan, 2006; McKenzie, 2004; Westerling, 2008). These are the same data used for the Cal Adapt fire risk modeling. Increased fire occurrence and severity will secondarily affect other areas of vulnerability, as noted below.

Increased Fire Risk

- Higher air temperatures in general will speed up spring melt, lengthening the fire season and drying vegetation out more quickly, creating greater fire risk (McKenzie, 2004; Miller, 1999; Running, 2006; Taylor, 2009).
- Increases are expected throughout the century in the number of fires and proportion of those that are high severity for both high- and low-emissions scenarios (Bryant, 2009; Westerling, 2008).
- On inter-annual and shorter time scales, climate variability affects the flammability of live and dead forest vegetation (Westerling, 2006).

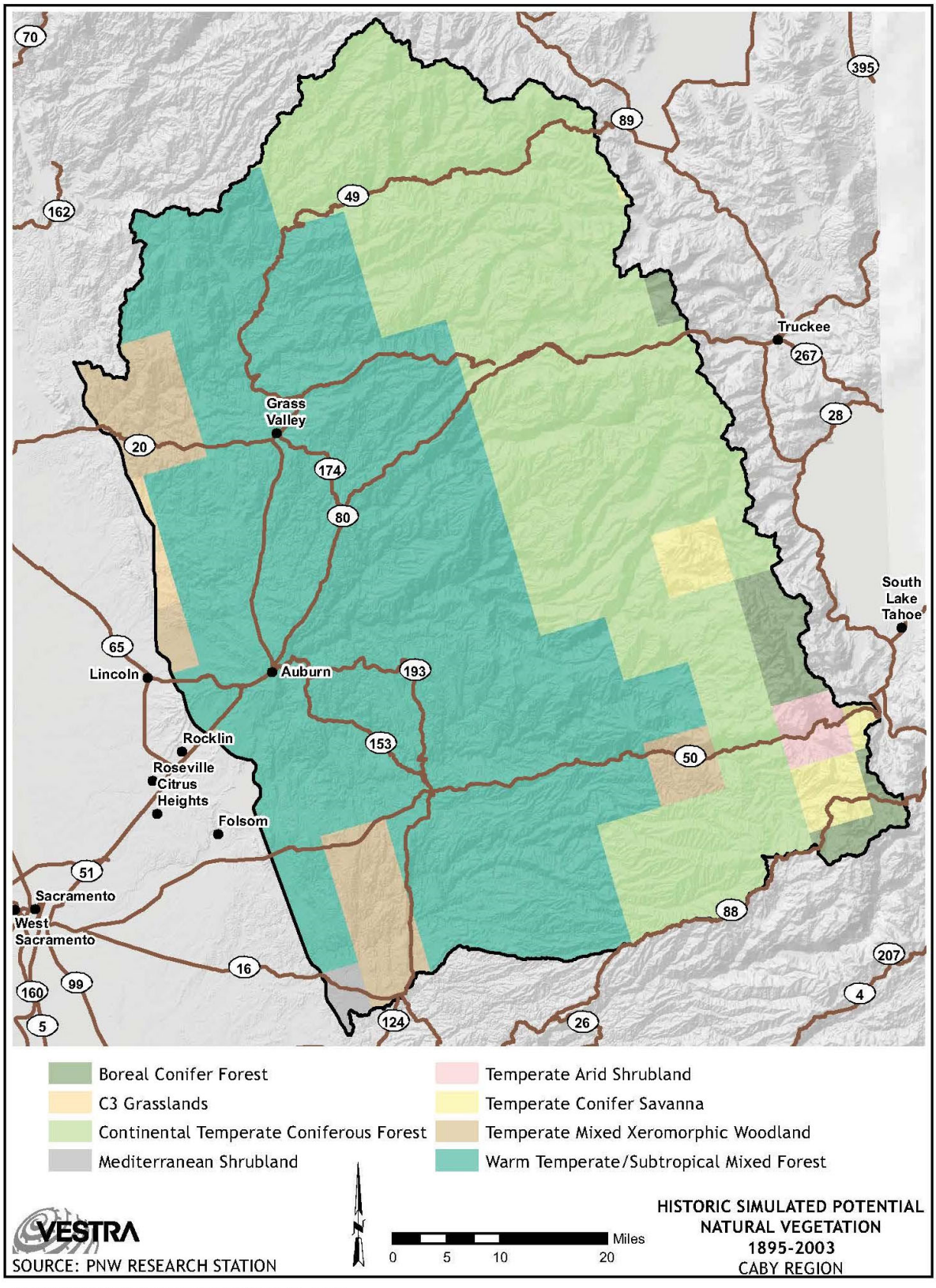

Figure 1. Historical simulated potential natural vegetation from 1895-2003.

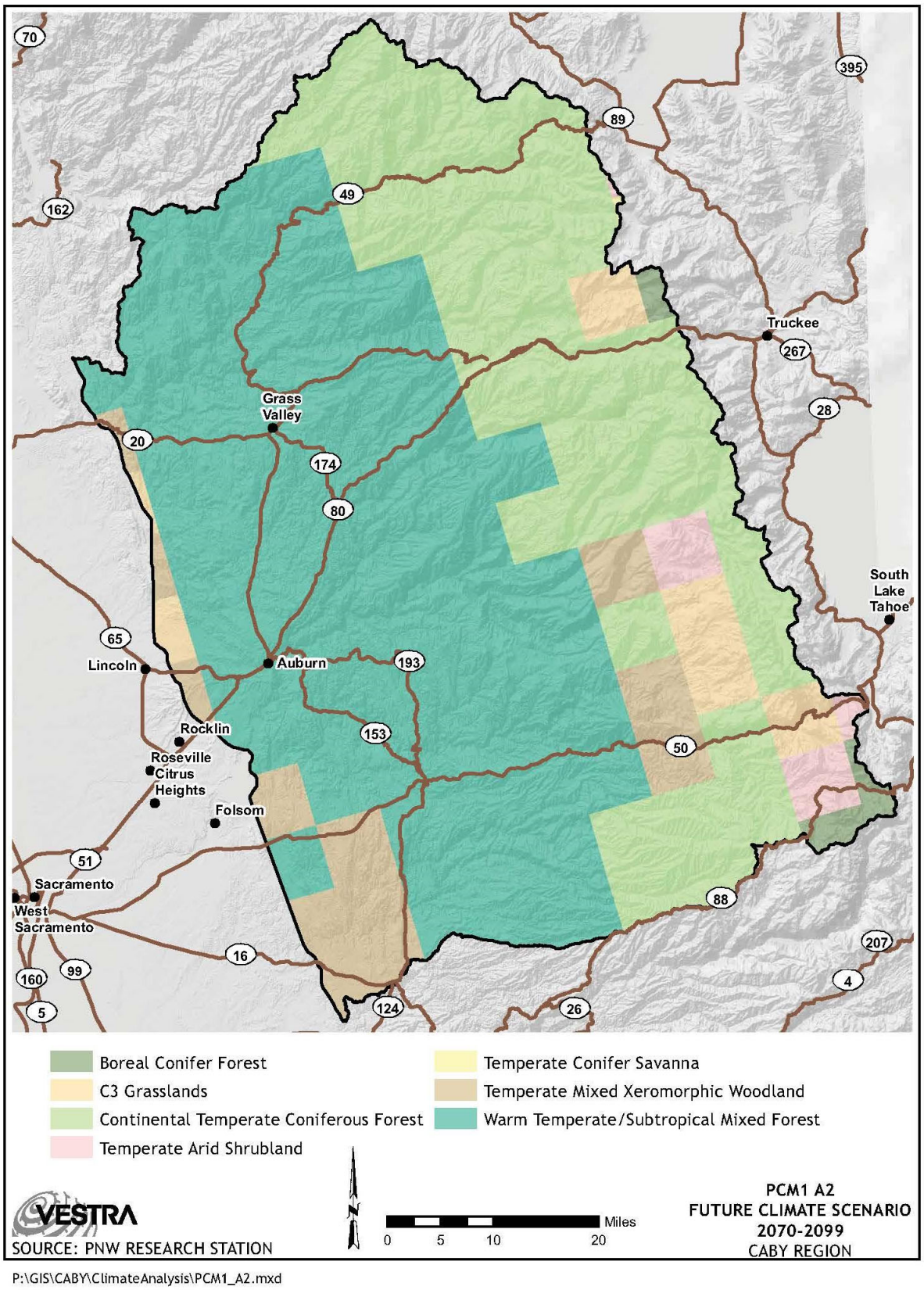

Figure 2. PCM1 A2 future climate scenario 2070-2099.

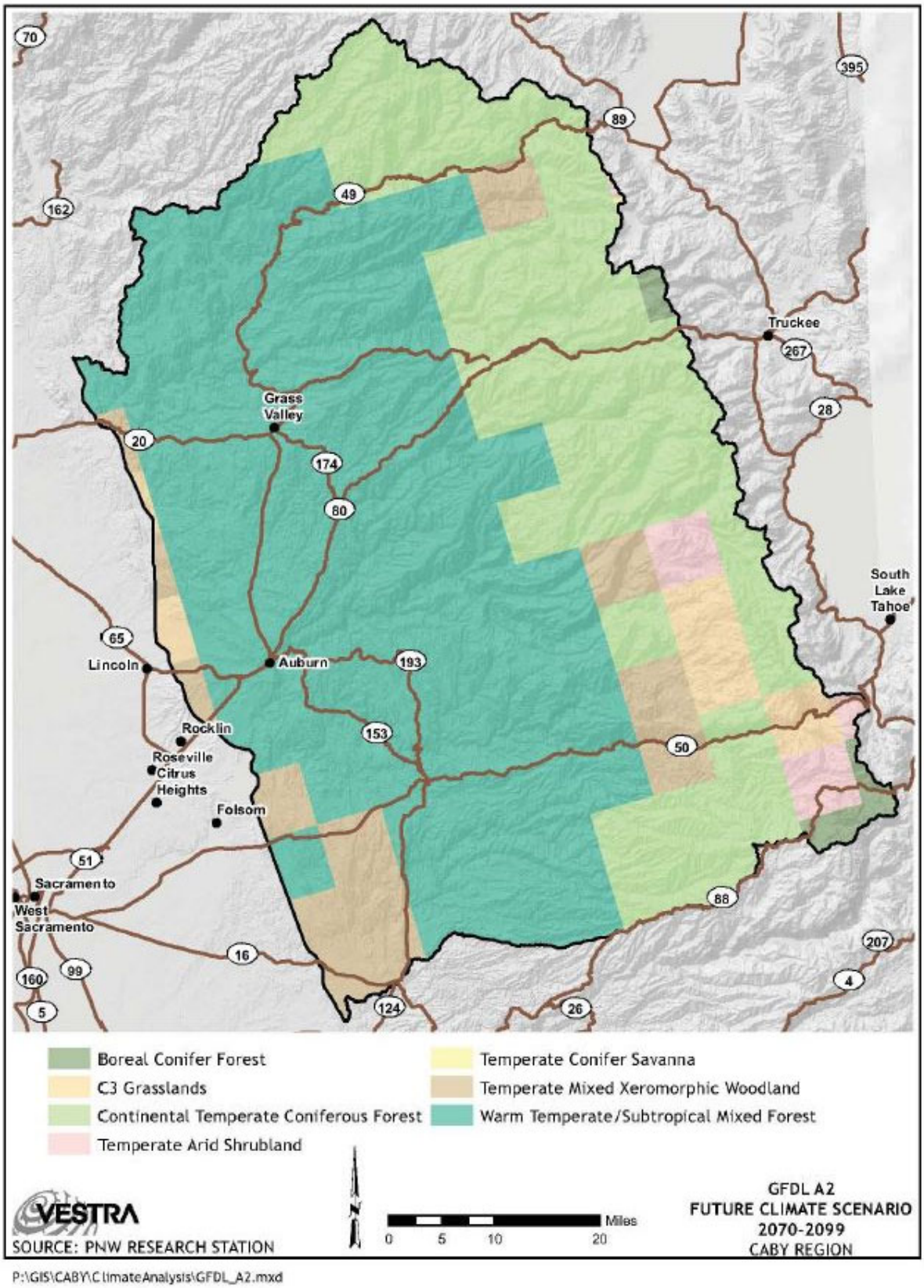

Figure 3. GFDL A2 future climate scenario 2070-2099.

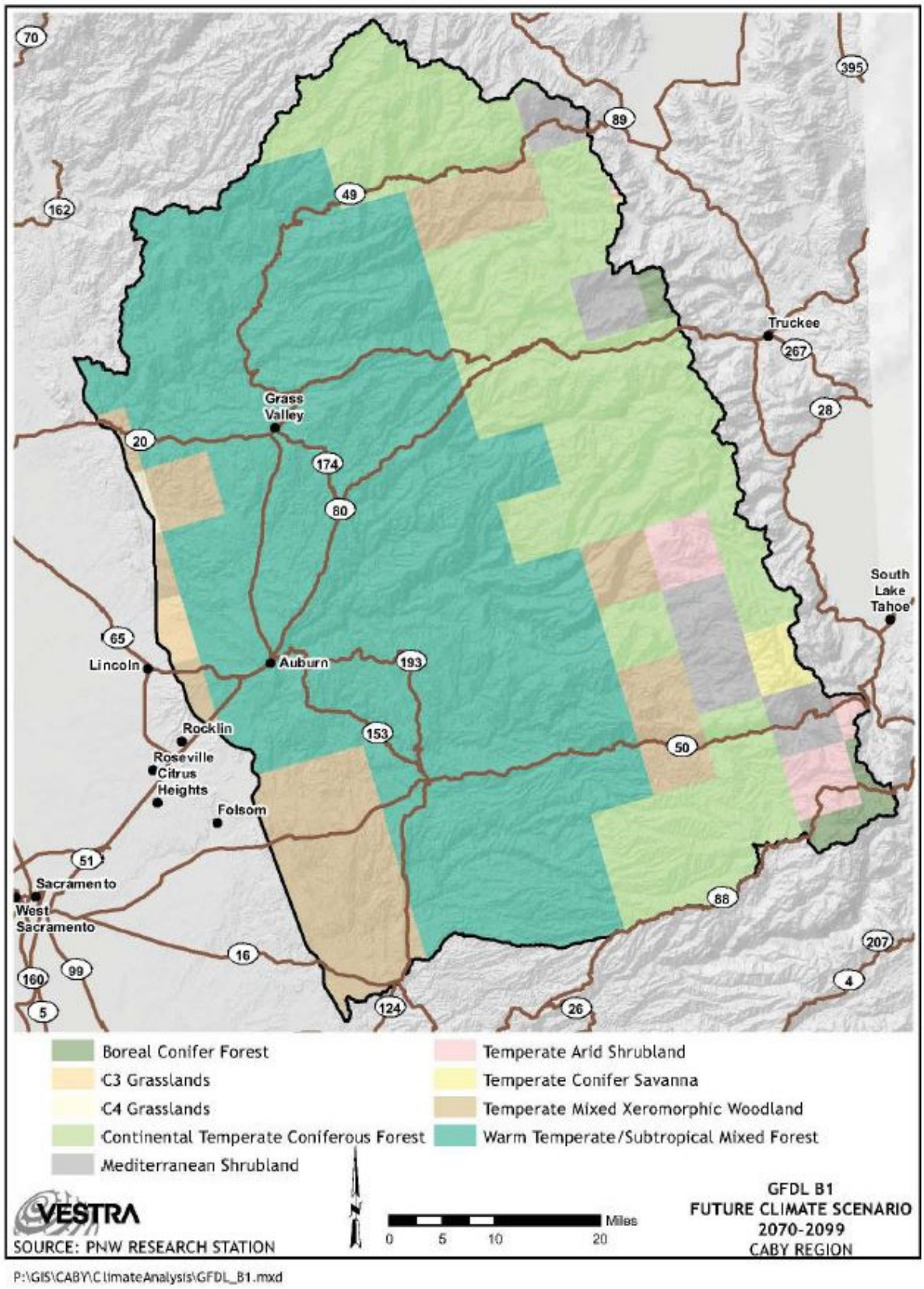

Figure 4. GFDL B1 future climate scenario 2070-2099.

Greater Fuel Loads

- Years with widespread fires, historically, are often preceded by wet years (Taylor, 2005). These wet years feed greater vegetation growth, especially in the understory.
- Invasive species, which often populate disturbed areas quickly, may have a competitive advantage over native species; this often results in a higher, more readily flammable fuel load (Brooks, 2004).
- Drought years may increase the fuel loads because of a greater occurrence of insects and disease that kill trees and in turn contribute to fuel loads.

Secondary Effects of Increased Fire Activity

Changes in Vegetation Community Makeup

- Fire may be more important and have more effect on vegetation change that primary climate change outcome, which can be positive or negative (Flannigan, 2000)
- Increased fire severity will both amplify and accelerate the ecological impacts of climatic change (Flannigan, 2000).
- Because trees can survive from decades to centuries and take years to become established, climate-change impacts are expressed in forests, in part, through alterations in disturbance regimes (Dale 2001).
- Increases in species dependent upon early-successional habitat (due to greater disturbance by forest fires) will have greater success (McKenzie, 2004).
- Invasive species are often more shallow-rooted and quick-lived, which can be a contributing factor to mass wasting events and excessive sedimentation in general (TetraTech EC, Inc., 2007).
- Drought years may increase the vulnerability of the tree population to insects and disease, and the lower occurrence of extended freezing periods in the winter will allow greater insect survivability.
- “[Lennihan et al]... estimated that under all climate change scenarios, forests and other types of vegetation will migrate to higher elevations as warmer temperatures make those areas more suitable for survival. For example, with higher temperatures, the area of alpine and subalpine forests will be reduced as evergreen forests and shrublands migrate to higher altitudes. They estimated that if it gets wetter, forests would expand in northern California and grasslands would expand in southern California. If it gets drier, areas of grasslands would increase across the state. Both wetter and drier scenarios resulted in increases in carbon storage (biomass) in California vegetation of between 3% and 6%. Wetter conditions generally allow for more biomass. Under drier conditions, grasslands, which store a relatively high amount of carbon below ground, expand.
- Lenihan et al. found that the frequency and the size of fires would increase under most scenarios; however, the change is not significant until the latter part of the century. The drier scenarios result in more frequent fires and more area consumed by fires. The wetter scenarios result in fires of greater intensity than those in the dry scenarios because more fuel (vegetation) would grow.
- The vegetation changes projected with MC1 model indicate a generally higher threat (decrease in habitat) to boreal conifer forest, largely found at the highest elevations.

Effects on Animal Species

- Stream temperature has shown to be moderately affected by heat radiation from fires- this may affect fish and other aquatic biota. Fish are particularly vulnerable to climate change because of their inability to monitor their own body temperature, as well as having movements that are constrained to streams: linear networks that are easily fragmented (Isaak, 2010).
- Climate-induced changes in fire behavior and frequency will affect species distribution, migration, and extinction (Flannigan, 2000).
- Animals and plants dependent upon boreal forests will likely become more imperiled because the warming trend will force them higher in elevation where habitat may be less suitable.

Fire Creates a New Species Equilibrium – Changes in the Forest Makeup

- Positive: could lead to increased adaptability when it comes to plant migration
- Negative: could lead to increased presence of invasive species
- Warmer, drier summers will produce more frequent, more extensive fires in first (early-successional) ecosystems, likely reducing both the extent and connectivity of late-successional refugia (established forest) (McKenzie, 2004).
- Severe fires can cause changes in the trophic structure, causing animals to prey on different trophic levels. In fish, this has led to increased mercury contamination (Kelly, 2006).
- Wildfire activity will accelerate the change in species' distributions because mortality from wildfire removes the existing vegetation and exposes the most climate-sensitive life stages (germination and sprouting) to the new climate (Fried, 2004).

Changes in Nutrient Cycling, Pollutant Transfer, and Carbon Balance

- Fire has been found to increase mercury, as well as nitrates, in forest water bodies; this could be attributed to sediment methylation of mercury bound to organic matter and in runoff (Kelly, 2006).
- Greater occurrence of fires feeds a negative feedback loop, putting greater amounts of carbon and particulates into the atmosphere (Westerling, 2006).
- If forests are used as a carbon sink (or for carbon offsets), it is possible that this would compete with objectives of forest harvest and/or fuels management (Hudiburg, 2009).
- Low-frequency, high-severity fire regime may result in more carbon storage than a high-frequency, low-severity regime—this is due largely to fractional combustion, a more inefficient method of burning, resulting in greater particulate matter (Campbell, 2011).

Social Costs of Increased Fire

- The expense of increases in fire occurrence and severity will need to be paid for-either at the front end through landscape-level forest/fuels management, or at the back end through extremely costly fire-fighting activities.
- The amount of burned property (in total area and in monetary value) in Northern CA increases substantially under global climate models' high-emissions scenarios due to greater fire risk. This is highly evident in Placer County (Westerling, 2008).

- Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects for regional business interests and local economies.
- CABY is characterized by two types of communities: incorporated cities along major transportation corridors that have pressurized fire flow capability and permanent fire departments, and small, rural, surrounded by forest service or oak grasslands, frequently isolated population centers with limited fire flow volunteer fire departments and limited ingress/egress. The incorporated communities have sufficient infrastructure and capacity to fight fires within their urban limits. Rural communities typically have very limited resources to fight fires within their service area. In both cases, catastrophic Wildland fires have the potential to surround, encroached into, or overwhelm local communities.

Adaptation Strategies for Fire and Fuels

National Forests throughout the country are working to assess the risks and adaptation strategies associated with climate change. Within the CABY Region, the Tahoe National Forest (TNF) is discussing climate change responses on a focused staff level. As a result of the Forest's proactive stance, TNF has taken climate variation into account in management activities, and has started the discussion among staff regarding potential changes in strategic planning areas. Advances in integrated planning processes may facilitate the incorporation of climate-related treatments into on-the-ground management activity; all forms of proactive management are already decreasing the number of situations where TNF must take crisis-reaction responses. Some of examples of these activities include:

- Fuel reduction projects: Strategies implemented to reduce fuels and minimize chances of catastrophic fires are increasing the adaptability and resilience of the TNF.
- Revegetation and silvicultural choices: In stand improvement projects and revegetation efforts, choices are being considered to favor or plant different species and species mixes. For instance, where appropriate and based on anticipated changes, white fir could be favored over red fir, pines would be preferentially harvested at high elevations over fir, and species would be shifted upslope within seed transfer guides.
- Managing for process: TNF staff is also using available opportunities to manage for process rather than structure or composition in proposed projects; for example, those involving succession after fires, where novel mixes of species and spacing may reflect natural dynamic processes of adaptation.

The TAC also included the following adaptation strategies gleaned from its data and information analysis:

Decrease the fuel load (selective harvest vs. prescribed fire)

- Strategic forest treatment has an effective, positive impact on forest fire effects (Strom, 2007): It increases resilience to longer fire seasons and bark beetle outbreaks (Flannigan, 2000).
- Implement fuels management/reduction in watersheds where a high vulnerability exists to critical water sources.
- Where possible, mix selective harvest and prescribed fire to best mimic natural forest management (Schwilk, 2009) o Selective harvest can also enhance hydrology (Bales, 2011).

- Moving beyond stand level treatments to landscape-level strategies using a mix of methods should improve overall fuels management effectiveness (Stephens, 2009).

Forest management and runoff enhancement

- Forest management practices affect soil absorption rates. Maintaining a forest at full ecological function recharges groundwater and provides for more resiliencies region-wide Improving and decommissioning roads and installing culverts prepares watershed for more extreme weather events
- Selective harvest can aid in both fuel load management and enhanced hydrology (Bales, 2011).
- Allow more naturally-triggered burns to be managed in the wildland areas.
- Do very strategic and selective fuels management to protect areas vulnerable to a larger and less controllable wildfires.
- These smaller forest fires may force changes in species makeup, which could be
- beneficial if species are able to adapt quickly enough (Flannigan, 2000) o Protecting late-successional habitats is important for species dependent upon those areas (McKenzie, 2004).
- Forests and streams are tightly linked through the transfer of materials and energy that influence habitat structure (large wood and sediment), food webs and trophic dynamics (nutrients and organic carbon supply), water quality and temperature (riparian shade), and other ecological processes and functions (Rieman, 2010).
- Enhancing and widening riparian corridors and preventing habitat fragmentation maximizes connectivity, promotes biodiversity, and improves water quality.

Changes to migration corridors, species makeup, and carbon balance from management activities

- Fire is a catalyst for vegetation change (Flannigan, 2000).
- Forest fires may force a change in species makeup, which could be beneficial if species movement is able to adapt quickly enough (Flannigan, 2000).
- Aggressively removing non-native invasive plant species (NNIPS) strengthens forest
- defenses as higher CO2 levels and potentially longer growing seasons favor faster-growing NNIPS.
- Maintaining fish access to higher-elevation, cooler streams and rivers is an essential component of maintaining populations (Isaak, 2010).
- Species dependent upon late-succession habitat may founder with greater and more severe fire occurrence (McKenzie, 2004).

Coordination between/within management agencies

- The National Association of State Foresters recommend that climate change be included in the national fire plan (NASF, 2007).
- Coordinate between management agencies and levels to better address clear management goals (Reiman, 2010). Steps to more successfully integrate the management of forests, fires, watersheds, and native fishes into regional and project-scale planning should include communication among disciplinary scientists with a clear definition of management goals.

Collaboration on the identification of quantifiable objectives

- The translation of goals to objectives within the contexts and constraints of the target system is important; the integration of terrestrial and aquatic objectives on a physical level is essential to identify opportunities for synergistic and successful solutions (Rieman, 2010).
- Work with forest managers to offer a forum that can find ways to manage the forests collaboratively, such as landscape-level fuels management (rather than stand-specific); this results in a greater overall fuels management effectiveness (Stephens, 2009).

Replanting the forest with fire-tolerant species

- Planting selected tree species and genotypes with relatively high oleoresin could limit insect outbreaks, thereby preserving the forest's resistance to fire and extreme weather events such as windstorms (Dale, 2001).
- Oleoresin is strongly influenced by internal tree water balance (Mason, 1971), so it's likely that additional research is needed.
- Work with private forest management entities to target replanting areas with species which are fire-tolerant and –resistant (Dale, 2001; Mason, 1971).
- Trees with thicker bark may be able to withstand the additional pressures of higher-severity fires and increases levels of insect infestations

Controlling invasive species

- The US Forest Service and other entities are researching bark beetle management (much of this research is happening in laboratories in California, by the Pacific Southwest Research Station); some actions could include the replanting of trees with greater resistance to beetle infestations.

Biomass utilization

- Continue to explore environmentally-acceptable and economically-feasible ways of producing and utilizing power from biomass
- Removal of trees which have succumbed to bark-beetle infestation to promote increased resilience within the residual stand, and promote natural revegetation of seedlings with natural adaptations showing resistance to beetle attack.

Appendix H
Climate Vulnerabilities and Adaptive Strategies

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

Vulnerabilities

Water Demand

- Major industries in the region requiring heating and cooling could be affected as average temperatures increase. This includes some commercial and institutional operations – hospitals, major office facilities, and industrial areas (major employment centers).
- Water use curtailment measures (water use efficiency) are effective in the CABY region when funded adequately. EID has implemented drought rates, proven to be effective in funding additional conservation outreach and education. However, as California's 2020 demand reduction targets are achieved, water use curtailment will be more difficult especially in areas that have already installed meters and implemented tiered commodity rate structures, as is the case in many areas of the CABY region.
- Instream flow requirements in the region could be affected by climate change. Instream flows have been negotiated through relicensing agreements and other regulatory processes for controlled streams, but FERC processes, that didn't take climate change into account, may not be sufficient to protect streams, or ensure adequate flow for humans or wildlife. Naturally flowing streams may be even more vulnerable drawdown during low flows.
- Seasonal water use (primarily recreational and agricultural use) could increase due to increasing temperatures and lower summer precipitation.
- While all crops are "climate sensitive," peaches, grapes, cherries, mandarin oranges, and berries are heat-sensitive crops grown in the region that can also be susceptible to unseasonable precipitation. Greater climate variation may negatively affect production of these crops, in particular. Climate change may also make some areas more suitable for crops not yet previously grown in the region.
- Regional groundwater supplies are not a source of purveyor supply in the region, but represent a significant resource used by individuals outside water service areas for residential potable water use.
- Long, non-intensive rainfall patterns are more effective at resupplying groundwater than short, intense rainfall events. These patterns may be affected by climate change as well.
- Local fractured geology makes groundwater resources particularly vulnerable to drying/drought.

Water Supply

- Climate change projections indicate that there will be less snowmelt to recharge streams and maintain a reliable water supply for people and wildlife through late summer and autumn, and the timing of water availability may threaten life cycles that have evolved in concert with the natural timing of snowmelt recession (Yarnell et al. 2010).
- In 2008, EID completed a Drought Preparedness Plan. During that process, EID modeled four potential future climate scenarios and an assessment of future supply reliability and projected shortages. When exposed to the range of plausible climate scenarios, there were occurrences projected when EID failed to either supply the amount of water that its customers expect under the fluctuating drought stage, or to meet the instream flow obligations it has agreed to in recent regulatory proceedings, depending on which use is given priority.

- A multi-year drought, especially one lasting more than two years, could create problems in carryover storage capacity. Agencies have drought plans and drought rates in place to stretch supply, and generally manage a two-year supply to accommodate short drought periods. However, some smaller agencies have limited or no carryover storage and must curtail demand even during mild drought periods. The intense drought of 1976-77 created supply shortages for all major CABY region water purveyors.
- While the CABY region is a contributor to Delta flows, it does not have access to Delta or Colorado River imports for its regional supply, although there are inter-basin transfers in the region, including one from the Tahoe Basin into EID's system. Source water areas may have adequate water for in-region use, export may be questionable. Conditions in some parts of the CABY region may be such that even in-region quantities are threatened.
- Area of Origin water rights are an important supply cornerstone for CABY stakeholders and will be important as the region looks at climate change effects throughout the state.

Infrastructure

- Hydrologic changes are projected to include altered flows, changes in seasonal flows (e.g., earlier runoff) and greater extremes in storm events. A greater rain:snow ratio is projected, and melt dates will likely be earlier, indicating a longer dry season. Some extreme events in the past have tested the capacity of regional infrastructure (such as near overtopping events in the floods of 1997), and it is likely that these extreme events will occur more often.
- Much of the region's infrastructure is either antiquated, in poor repair, or in the case of water delivery and storage, and flood flows, designed for historic flow regimes.
- As is the case throughout California, infrastructure used to manage and move water throughout the CABY region is sized and managed based on historic hydrology. The management strategies and rules in place for reservoir and other infrastructure operations are in direct relationship to this hydrologic history.
- Planning for longer-term drought is limited to historic extreme events. Extended duration of extremes due to climate is difficult to account for, which could compromise delivery capacity, customer capacity, and financial stability of water purveyors.
- Projected changes expose vulnerabilities in water agencies specific to delivery capacity, the number of customers an agency can serve, financial stability and planning, and even recreational potential for current and planned facilities. It will also affect how hydroelectric power is produced, a service provided by the three major water purveyors in the CABY region (EID, PCWA, and NID).
- Aquatic invasive species are not currently a problem in CABY's water supply infrastructure, however, it is possible that they could become an issue as climate change alters the region's water temperature and chemistry (pH and TDS).

Water Quality

- Beneficial uses designated in the CABY region could be more difficult to meet with climate change altering regional hydrology. (CABY's 303(d) listed water bodies can be found in Chapter 5, Region Description).
- All reservoirs are in forested areas that are susceptible to fire. Catastrophic fire around reservoirs coupled with precipitation events could cause increased sedimentation. Secondarily,

hydropower facilities could face challenges with increased sediment loads through decreased capacity in reservoirs and increased levels of wear on equipment. Increased water temperature could affect aesthetics of municipal supply.

- Water quality shifts occur in the CABY Region during extreme storm events, and these can sometimes affect treatment facility operation. Some treatment facilities are built to manage turbid storm waters, but not every facility is built in this way. For example, local municipal waste water treatment systems do not have adequate capacity to treat all storm water. Large precipitation events have periodically resulted in release of partially-treated sewage into receiving waters.
- Both sediment and increased acid mine pollutant release can be challenging pollutants for treatment facilities.
- Low flows' effect on diluting pollutants (assimilative capacity) is difficult to measure. There is a high level of streamflow augmentation and variation throughout the CABY region and many flow regimes mandated in the CABY Region are water-year-dependent**.**
- Increased water temperatures could increase levels of mercury methylation throughout the CABY region. This effect has not yet been studied but has been identified by the CABY PC as an issue for further investigation and potential modeling.
- Eutrophication can increase in summer and especially if exacerbated by low flows and higher water temperature.

Flooding

- Increased flood potential is projected under many climate scenarios because higher temperatures cause earlier snowmelt and an increase in the ratio of precipitation arriving in the form of rainfall vs snow. However higher-elevation snow levels may reduce the potential for winter floods because less snowpack may fall that can be mobilized. Peak daily flows are expected to increase even under scenarios with reduced precipitation overall.
- A lack of coordinated approach to flooding management and response exists throughout the CABY region and beyond.
- CABY is in need of a clearer definition of the flooding risk to all areas within FEMA mapping zones. This includes portions of most major and many minor cities and communities in the CABY region, including Nevada City, Auburn, and Placerville. Many communities were developed during the Gold Rush, and so are situated close to rivers and in canyons, which may be at higher risk of flooding.
- Extreme events could have a significant negative effect on the aging infrastructure throughout the region, including water supply, transportation, hydropower, recreation, and water treatment facilities.
- Catastrophic wildfires could result in devastating mass wasting events (connected with flood events) similar to the massive landslide that closed Highway 50 for 4 weeks in 1997. This landslide was a result of a fire event in the previous fire season combined with a historically high and intense rainfall event that winter. Similar events have occurred on the Middle Fork and North Fork of the Yuba River.
- More reliable gauging and telemetry on streams is needed to provide a few hours advance notice to developed areas in flood-prone zones.

Ecosystems and Habitats

- The Sierra Nevada is identified in its entirety as important refugia and vulnerable to climate change by the Endangered Species Coalition. This means that the region is particularly vulnerable to climate change, and represents a significant bio-region for plant and animal species survival. Timing of melt and water availability is just as important for habitats and species as it is for water supply for humans. This can have an effect on the blossom timing and may conflict with pollinator availability.
- Sedimentation vulnerability could increase with the higher potential for shorter, more intense storms. This could affect frog and fish reproductive cycles and habitat availability.
- Imperiled species, some of which only exist locally, could be affected by climate change. .
- Climate-sensitive populations of flora and fauna in the CABY region include: whitebark pine, vernal pool-dependent rare plant populations, populations that rely on wetlands or small ponds (such as the Pierce Wetland Area on the Tahoe National Forest) and pika, alpine chipmunks, Lahontan cutthroat trout.
- Quantified environmental flows are ubiquitous throughout the CABY Region. While these are mandated flow levels, extreme drought could still negatively affect stream habitats. In most cases, drought flows are defined in the mandate or license, but an extreme long-term drought could persist in lowering those flows past the defined levels. Increasing conflicts between human and environmental needs during drought and low-flow conditions brought on by climate change could further degrade wetland and riparian habitat, and in turn, species viability.
- Riparian and wetland communities, seeps and springs are often dependent upon groundwater resources. The geology of the area influences the groundwater level; habitats no longer having access to groundwater could diminish or disappear.
- Increasing temperatures overall, and especially higher temperatures at night and in winter, are expected to increase the population and distribution of bark beetle, increased occurrences of *phytophthora ramorum*, canker diseases, dwarf mistletoe, and root diseases (Kliejunas, 2011). It is likely that this will have a negative effect on the fire cycles within the forests of the CABY Region.
- Habitat is fragmented throughout the CABY Region: in the lower elevations by transportation corridors and urban development, and in the higher elevations primarily by highways 80 and 50.

Recreation

- The region depends upon defined aquatic conditions for some recreational activities, including whitewater rafting and boating on reservoirs. Most rafting flows have been set by FERC licenses, but projected low flows may not be sufficient to sustain current-day recreational pursuits/timing.
- Insufficient flows for boating and whitewater rafting due to climatic shifts could have negative financial effects on regional businesses and local economies.
- Forest infrastructure such as bridges, culverts, campgrounds, and roads may be damaged by increased variation in flows, while recreational game fish species may be negatively affected by diminished water quality.
- Forage for big game species may be affected by increased invasive species, but these species may benefit from milder winter temperatures and increased localized forage.

Hydropower

- PG&E has conducted an extensive study on changes in timing and type of precipitation to better predict the effect that these climate variations would have on hydroelectric generation. Freeman discusses current planning by PG&E to incorporate adaptive water management

strategies with the assumption that climate impacts on snowpack and early melt will "…*likely accelerate change in annual snowpack* [into the future]."[1]

- Reduced snowmelt from other sub-basins that cumulatively feed its northern and central California generation system cause PG&E[2] to anticipate that, "…*if climate change impacts on the diminishing snowpack continue, associated impacts of climate change to hydroelectric operations are likely to eventually occur and must be planned for in terms of developing additional adaptation alternatives.*"
- Energy needs have decreased on a per capita basis over the last several decades due to increases in the efficiencies of appliances and conservation. However, an increasing population indicates that energy use will grow in the future.
- Hydropower represents a significant source of electricity in the CABY region. As seasonal river flows shift, hydropower generation patterns may be affected. In addition, larger flows from more variable events and/or increased sedimentation could damage infrastructure, limiting availability for power production.

Socioeconomics

- More frequent drought, the drying effects at upper elevations from earlier snowmelt, potential variation in storm events, greater variability in temperatures and more intense storm events could potentially affect agriculture.
- CABY Region agriculture is primarily conducted on a smaller scale when compared with larger San Joaquin Valley or Monterey County farms. This niche market contributes a substantial portion to regional economies, but also provides for a valuable agro-tourism economy. The *California Adaptation Strategy* doesn't recognize agricultural commodities coming out of the CABY Region (such as wine grapes and apples in El Dorado County and mandarins in Placer County), but does comment in general terms on the temperature and precipitation changes that will most likely have an effect on agricultural outputs of all kinds throughout the CABY Region.
- Peaches, grapes, cherries, mandarin oranges, and berries are heat-sensitive crops that can also be susceptible to unseasonable precipitation.
- Non-irrigated agriculture – grazing and dryland hay – are vulnerable to projected climate changes.
- More frost-free and growing-degree days could benefit some crop production and local agricultural profits, and could affect the current crop mix.
- Reduced flows and groundwater recharge alongside increased demand in a warming climate could negatively affect agricultural water supply (Mehta et al. 2011; Regional Water Management Agency 2013).
- Irrigation inefficiencies reduce overall water supply, both for agriculture and other beneficial uses.

[1] Freeman, G. J. 2010. Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff. Western Snow Conference 78:107:118. Available from: http://www.sierrainstitute.us/ALMANOR/Freeman_Climate_Change_and_Snowmelt.pdf

[2] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G.Climate Change and CA's Diminishing Low-Elevatio.pdf

- Insufficient flows for boating and whitewater rafting due to climatic shifts could have serious financial effects for regional business interests and local economies**.**
- Costs for increases in fire occurrence and severity will need to be paid for, either through landscape-level forest/fuels management, or through fire-fighting activities.
- Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects on local economies.
- Incorporated communities have sufficient infrastructure and capacity to fight fires, while rural communities typically have very limited resources. Catastrophic wildfires have the potential to surround, encroach into, or overwhelm local communities.

Sea Level Rise

- Sea level rise is not a direct issue for the CABY region, but the indirect effect of a population influx from coastal areas affected by sea level rise (environmental refugees) could have an effect on regional land use patterns and requirements for potable water. Additionally, there is potential for the region to become a refuge for wildlife if other suitable habitat is lost to sea-level rise.
- The impact of sea level rise on the Delta is forcing the state to look upstream, for solutions, to water-producing regions, including CABY. This could lead to potential changes to infrastructure, operations, and demands on water rights in the CABY region because of the Delta's vulnerability to environmental change and water transfer capability.

General Adaptation Strategies

Water Demand

- Examine environmental needs in the face of a changed hydrologic regime
- Pursue sharing resources across the CABY region
- Identify opportunities for conjunctive use
- Invest in upgrading infrastructure to maximize efficiency and reduce waste
- Peak use can be lowered by using pricing strategies – this has been successful for water purveyors throughout the CABY region using a conservative baseline for indoor use and ascending block rates for outdoor use.
- Identify opportunities to sell water in or outside the CABY region in years where local supply exceeds local demand, for additional funds to be used within the CABY region
- Identify alternative crops that will grow well in a changed hydrologic cycle and temperature regime; consider use of drip irrigation and recycled water.
- Invest in distribution system interties and replacement of aged pipelines to maximize efficiency and reduce waste.
- Water agencies provide efficiency services to domestic, municipal and agricultural customers.
- Locate water "service stations" in areas where residential wells are likely to go dry

Water Supply

- Recruit and support more complete information on snowpack and hydrology, including real-time data tracking

- Examine forest management strategies to increase snowpack/water retention
- Increase the capacity of the landscape to retain water, replacing, in part, a decreased snowpack (e.g.: meadow restoration and soil conservation)
- Diversify storage opportunities to add system flexibility – think of "storage" as a network including snowpack, forest soils and constructed infrastructure.
- Invest in improved efficiency of existing water conveyance, distribution and storage systems
- Increase levels of water conservation among customers and the general public
- Continue to monitor water systems for aquatic invasive species (AIS)
- Educate small water-rights holders on potential effects of climate change and how the region might collaboratively respond
- Conduct leak detection, pipeline repair/replacement and meter calibration.
- Many CABY water agencies are participating in the USBR Sacramento-San Joaquin River Basin studies to evaluate storage needs and sites in the region, based on climate.
- Pursue additional water rights.
- Continue to evaluate options for enhanced water storage
- Explore and support opportunities for conjunctive use.
- - Where not already implemented, provide fee incentives for customers who meet residential conservation objectives
- - Implement groundwater management plan objectives
- - Consider changes in reservoir operations.
- -Add capacity to existing dams.
- -Invest with partner interests in improved hydrologic and meteorological monitoring of CABY watersheds.

Infrastructure

- Locate system interties where small systems and disadvantaged communities can more easily hook into a larger system's supply
- Locate water "service stations" in areas where residential wells are likely to go dry.
- Invest in upgrading infrastructure to maximize efficiency and reduce waste
- Invest in distribution system interties and replacement of aged pipelines to maximize efficiency and reduce waste
- Research and implement strategies to manage increased sedimentation rates in reservoirs
- Implement regional stormwater control infrastructure
- Expand treated and raw water infrastructure to underserved areas.
- Add infrastructure to facilitate conjunctive use
- Upgrade aged infrastructure to improve efficiency
- Add infrastructure to augment distribution and conveyance system efficiency and flexibility
- Increase existing water storage facility size
- Research and implement strategies to manage increased sedimentation rates in reservoirs.

Water Quality

- Increase the capacity of the landscape to absorb and filter water
- Implement a more intensive network of real-time water quality and water level tracking in order to identify when storm flows may be testing water treatment capacity and/or infrastructure

- Preserve and/or restore, where appropriate, riparian vegetation in order to control water temperature for aquatic biota
- Identify 303(d)-listed waters that may become more challenging to manage under future climate scenarios, and work with affected agencies to develop management strategies and identify improvement projects/actions that address near-term and future impacts.
- Identify places where the assimilative (dilution of contaminants) capacity of streams and rivers may be at risk and monitor those areas
- Implement regional storm water control infrastructure

Socioeconomics

- Climate change will need to be adapted to on an individual agricultural operator basis. On a policy level, protecting the agricultural land base and preserving a portion of the water supply to be dedicated to agriculture, no matter what the urban needs in the region, is important to provide farmers with the assurance that they need.
- Work with University of California Extension, local agricultural commissions and farm bureaus to identify potential changes in crop patterns to adapt to potential changes in climate.
- Increase efficiency of irrigation practices and systems.
- Explore opportunities for conjunctive use of water supplies
- Potential climatic changes are expected to shift forest types and species mixtures within the watershed. The changing conditions may continue to render forests susceptible to insect invasion and fire, which may in turn create a greater need for thinning.
- Enact strategic forest management: It increases resiliency to longer fire seasons and bark beetle outbreaks (Flannigan 2000).
- Implement fuels management/reduction in watersheds where a high vulnerability exists to critical water sources. Where possible, mix selective harvest and prescribed fire to best mimic natural forest management (Schwilk 2009).
- Maintaining a forest at full ecological function recharges groundwater and provides for more resiliencies region-wide.
- Use integrated pest management on terrestrial noxious weed species, grazing treatments; revegetation; and monitoring to improve water quality and habitat
- Continue to explore environmentally acceptable and economically feasible ways of producing and using power from biomass.
- Participate in statewide pest detection programs. While the dispersed growing area does not provide an easy way for invasive and destructive pests to migrate, it is close to the State border and hosts two major national freeways going east-west across the Sierra Nevada.

Sea Level Rise

- Actively participate in regional discussions focused on modifications of source-water systems that may be proposed to protect the Delta from the impacts of t sea-level rise.
- Monitor changes in development patterns and water use from areas affected by sea level rise to prepare for potential impacts to the CABY region over time.

Flooding

- Prepare and coordinate for events that happen (traditionally every 5-20 years) in order to be ready to manage and respond to these events at greater frequency

- Improve the reliability and accessibility of gauging and telemetry on streams and rivers upstream from flood-prone areas during flood events.
- Work within the CABY region membership (water and land use agencies) as well as with relevant State agencies to identify better flood management practices, including data tracking and communication and updated land use policies (development patterns, attenuation, and infiltration)
- Identify risk areas for mass slumping and target fuels management efforts
- Continue to update flood maps for communities in the region as additional management strategies are implemented and more updated information becomes available
- Work with agencies to identify infrastructure at risk from extreme events, gauge the storm event which would cause catastrophe, and identify probabilities associated with those events; prioritize repairs and armoring based on this information
- Increase infiltration rates in urban areas to combat localized flooding (implement low impact design principles)
- Improve or decommission roads to reduce flooding impacts during large storms

Ecosystem and Habitat Vulnerability

- Reduce the impact of existing stressors (e.g.: unhealthy levels of sedimentation or invasive species)
- Maintain/improve resiliency of the forest
- Sustain and promote fundamental ecological functions/services (e.g.: soil quality and nutrient cycling, hydrologic cycling, and riparian zones)
- Maintain/enhance species and structural diversity and the redundancy of ecosystem types across a landscape
- Create a list of all climate-sensitive populations of flora and fauna in the CABY region and identify potential adaptation strategies that stakeholders could help to implement; assess those strategies for cost, risk, and benefit and prioritize based on the outcome
- Maintain/create refugia, for at-risk populations or unique sites
- Enhance genetic diversity, potentially including an introduction or enhancement of genotypes better adapted to future conditions (such as trees with higher levels of oleoresin)
- Monitor the spring melt dates, bud burst dates, and pollinator availability
- Identify and prioritize habitat corridors essential to wildlife migration
- Work with major transportation providers throughout the region to ensure adequate ecosystem permeability and wildlife passage of major roadways – particularly 4-lane roadways
- Monitor and quantify the rate of mercury methylation
- Plant trees for carbon sequestration/storage

Recreation

- Identify opportunities to adjust to changing hydrology, if necessary, to maintain recreational opportunities.
- Identify and develop recreation enhancement plans responsive to changing conditions.
- Assess public agency road inventories for hot spots of sediment delivery and correct; conduct bridge and culvert inventory to replace undersized or failing infrastructure; reassess flood risk and establish recreational facilities out of potentially elevated peak flows

- Augment water storage infrastructure to provide recreational values while meeting other beneficial uses.
- Use improved modeling, forecasting and communication tools to facilitate recreational use of water resources

Hydropower and Alternative Energy Development

- Identify the opportunities for the development of solar and wind energy projects to ensure multiple benefits to the region, and also benefit habitat, wildlife, and agricultural uses (grazing opportunities).
- Increase the diversity of hydropower projects (e.g., micro-hydro, small hydro, or pumped storage), particularly those which have little or no negative instream consequences
- Invest in continued efficiencies in hydropower generation by upgrading equipment and operations.
- Explore and fund small hydropower generation opportunities in existing water and wastewater conveyance systems.
- Hydrogeneration managers may increase storage in the winter in anticipation of critical summer needs and to add flexibility to operational capability.

General

- Integrate terrestrial and aquatic objectives, habitat and urban-area objectives, and management agencies from all parts of the CABY region to better develop (and then address) quantifiable objectives and opportunities for synergistic solutions (Reiman, 2010)
- Diversify and examine/analyze finance options for funding effective watershed management
- Recognize that water management is only part of a comprehensive response to climate change and implement Integrated Resource Management by communicating regularly with land use, transportation, human health, education, environmental, and economic-focused agencies
- Increase the CABY region's ability to act as a carbon sink by implementing more active forest management with the goal of sequestration

Additional Models and Climate Guidance

WEAP Modeling and Status

WEAP has been used as a water management modeling system. However, some stakeholders use different models. In the CABY Region some initial reticence to WEAP arose because it was felt that the model did not robustly model the stream flow with impoundments in the system. As with all models, working with the model is necessary to make the adjustments necessary to get closer to accuracy. In addition to model tweaks, there is some reluctance on the part of agencies using alternative modeling (primarily water agencies) to address another modeling project. Through conversation within the TAC and the PC, these stakeholders agree that a region-wide model would be helpful in assessing general regional effects of climate change and looking at adaptation strategies as a region. However, continued work with the WEAP model will necessitate a robust discussion within the CABY membership regarding the costs, benefits, and potential options as far as modeling opportunities go.

The Bureau of Reclamation

The Bureau of Reclamation has completed substantial work on the topic of climate change and water management. Their 2009 document, "Addressing Climate Change in Long-Term Planning and Management" (published by the US Army Corps of Engineers (USACE), describes contemporary (2009) perspectives of Reclamation and USACE on their technical capabilities for incorporating climate change information into longer-term water resources planning. It also outlines and discusses planning capability gaps as they relate to the planning frameworks, and how those gaps might be bridged. This work includes consideration of infrastructure safety and flood risk reduction, demand estimates based on climate projections (including temperature and overall changes in precipitation), and operational constraints (such as infrastructure capacity). Much of this work does not affect the CABY Region directly, but the way in which the Bureau moves in developing its response (adaptation) to climate change will likely have an effect on the water management and policies affecting the region.

Affecting or having a potentially relevant outcome to the CABY Region include:

- During 2011, a study on the Sacramento-San Joaquin Basins was initiated that will address climate change concerns in this major river basin (more information on the basin studies can be found here: http://www.usbr.gov/climate/SECURE/factsheets/sacramento-sanjoaquin.html).
- The Bureau awarded several WaterSMART Program climate tool matching grants that will benefit climate change assessment and adaptation strategy planning capabilities. These include grants to the Desert Research Institute to develop tools to better simulate the effects of global climate changes in the Sierra Nevada region, as well as improvements in methods of quantifying agricultural water needs (more information on this research project can be found here: http://www.usbr.gov/WaterSMART/bsp/).
- Climate Risk Assessments completed throughout the western United States will establish a foundation for more in-depth analyses and the development of adaptation options through basin studies, operations planning, and other activities (more information may be found on these assessments here: http://www.usbr.gov/WaterSMART/wcra/index.html).

Soil Water Assessment Tool (SWAT)

The SWAT model was developed to predict the effects of management decisions and includes consideration of hydrology, weather, sedimentation, soil temperature, crop growth, nutrients, pesticides and agricultural management, all in the context of climate change (Arnold, 2005). This model includes a groundwater flow component, multi-layer soil profiles, a daily time step, and is developed for basins of several thousand square miles. It was created and is run out of Texas A&M University.[1] The model has been used internationally for agricultural (both for crop water needs and for BMP implementation assessment), watershed management, and water quality management plan assessment, and applications within the US have focused on the impacts of land use change and management and climate change on water supply and water quality.

Water Utility Climate Alliance (WUCA): Options for Improving Climate Modeling to Assist Water Utility Planning for Climate Change (2009)[1]

This white paper was produced by WUCA in 2009 and reviews modeling options, weaknesses, considerations, and possible future paths for water agencies in their consideration of climate change – essentially a paper describing investment options. There is an in-depth identification of options for improving modeling with the objective of having more useful and reliable output. The paper points out that even with improvements in downscaling and GCM assumptions, however, it's likely that uncertainty will persist, emphasizing a future where agencies must increasingly adapt to changing conditions.

World Bank: Water and Climate Change: Understanding the Risks and making Climate-Smart Investments (2009)

This document reviews climate change effects specifically on water resources. It identifies evidence that climate change is already occurring and discusses uncertainties in projected change and what water managers and investors can do in response to these findings. The next steps identified for this financial institution, which could easily be applied to CABY Region member entities, include: 1) continue to strengthen the analytical foundation, 2) incorporate hydrologic variability and climate resiliency considerations into decision-making, and 3) strengthen organizational expertise regarding climate change effects on hydrology. The second step indicates a potential change in policy for entities wanting to ensure that climate resiliency is always a consideration in project implementation. All components of these recommendations indicate that record-keeping and project monitoring are an essential step in understanding what the future holds, what resiliency and adaptive management means, and ensuring successful adaptation to a changing climate.

CNRA: California Adaptation Strategy and Adaptation Planning Guide

In 2009 the CNRA put out the California Adaptation Strategy (CAS) to to provide a multi-sector mitigation and adaptation strategies. The document provides several recommendations for the state as a whole; one of them identifies a necessity for change in how the state as a whole manages its water. CABY stakeholders acknowledge that this must include the way that individual purveyors, and even individual citizens, manage their own water resources, including actions such as addressing rule curves for dams to manage changing hydrologic patterns, increasing demand- and supply-based conservation, and assessing small communities throughout the region for vulnerability to flooding. Another key finding relevant to the CABY Region is avoiding development in areas that are difficult to protect from projected effects of climate change, including those areas affected greatly by catastrophic wildfire. The CAS also identified the need to track vulnerable land and aquatic habitats and communities, something CABY stakeholders have had as a priority since 2007. Many of the strategies discussed in the CAS are incorporated into the adaptation strategies. While the Planning Guide document remains in draft form at this time, it is anticipated to provide considerable assistance to CABY members in the discussion, development, and implementation of adaptation policies.

Intergovernmental Panel on Climate Change (IPCC): Assessment Report 5 (2014)[1]

The IPCC puts out a periodic assessment of the current state of climate change knowledge and modeling advances. The most recent report, AR5, was released in 2014. The document reviews the advances in modeling of atmospheric, ocean, terrestrial, and other processes, as well as an evaluation of large-scale climate variability and extreme events. The document addresses observed changes in climate and their causes, future climate change effects, risks and impacts of climate change, future pathways for adaptation, mitigation and sustainable development, and adaptation and mitigation.

Appendix I
Evaluation of Economic Feasibility

Integrated Regional Water Management Plan
Cosumnes, American, Bear and Yuba (CABY) Region

As part of its Integrated Regional Water Management (IRWM) program, the California Department of Water Resources (DWR) has outlined a set of standards that groups must define and follow as they set up an IRWM Plan. DWR provides guidance on what these standards should look like, but offers some flexibility for groups to define what best serves their geographical, cultural, and procedural context. One of the standards requires that an IRWM Plan contain a process or processes to select projects for inclusion in the IRWM Plan (Standard 6. Project Review Process). At a minimum, the process must address a list of factors that DWR considers important in a transparent and technically useful review. These factors are outlined in detail in Appendix C of the *Guidelines for Integrated Regional Water Management*, which DWR most recently issued in November 2012.

Among the review factors that a project review process should employ when considering projects for inclusion in the IRWM Plan is *Factor H. Economic Feasibility*:

> ***H. Economic Feasibility***
>
> *As part of the project review process, the economic feasibility of a project should be considered. DWR's "Draft Economic Analysis Guidebook" (Guidebook), published in January 2008, outlines methods for economic analysis for water resources planning and can be downloaded from the link found in Appendix A.*
>
> *A preliminary economic analysis must be included as part of the criteria in the project selection process based upon an original assessment of the proposed project or studies conducted within the past five years and updated to most current data available. Either a cost-effectiveness or benefit-cost analysis may be used for the preliminary assessment depending on the nature of the project. Both of these methods are outlined in Chapter 3 of the Guidebook. For example, a cost-effectiveness analysis may be preferable for habitat restoration projects for which it is difficult to assign monetary benefits. The chosen method of analysis must include the types of benefits and types of costs including capital costs, O&M costs, and potential adverse effects to others from the project, described in the Guidebook (See Guidebook pages 14 and 22).*

DWR Rationale for Factor H: Economic Feasibility

Conversations with DWR staff indicate that, under this review standard, the guidelines stipulate that economic feasibility to "be a part of how the region evaluates projects." However, DWR staff further indicted that the department doesn't "want to dictate how regions chose to use the economic information." Furtherm staff was clear that DWR "won't hold [IRWM Plans] to a specific methodology," and specifically, a project-level benefit-cost or cost-effectiveness analysis is not required to satisfy Factor H.

Economic Feasibility Review Questions

Background

There are a wide variety of challenges that IRWM Plan groups have had with developing economic feasibility criteria for use during the early review process that brings projects into the IRWM Plan. These challenges include:

- Lack of quantifiable information about the project's benefits and costs at the early stage of development they're in when they're accepted into the IRWM Plan.
- Lack of resources among project proponents to develop robust information at the level needed to conduct any kind of comprehensive economic analysis.
- Lack of sophistication among project proponents to complete a quantified assessment of the economic feasibility of their projects.

With this in mind the following streamlined approach that is simpler than a full benefit-cost or cost-effectiveness analysis will be applied to future project-level evaluations as part of the project selection process. Because other factors focus on project costs, these questions focus on economic benefits.

This simplified set of criteria, firmly grounded in standard economic practice, is considered to satisfy the Factor H review standard. Specifically, the questions shown below would:

- Rely on preliminary information that is readily available to project proponents at a conceptual project design phase.
- Emphasize qualitative versus quantitative assessments.
- Help project proponents and IRWM Plan managers begin to think about strategies to address the more detailed economic analysis required for the Implementation Grant application.

Economic Feasibility Review Questions

Types of Economic Benefits of the Project

This series of questions is designed to identify the types of benefits arising from projects that may be economically meaningful, and potentially quantifiable using market or non-market techniques.

Is the project likely to make an investment in physical capital (e.g., will the project include permanent improvements to water delivery infrastructure, stormwater control infrastructure, or wastewater infrastructure?)
Is the project likely to make an investment in natural capital (e.g., will the project make ultimately self-sustaining improvements in natural habitats and ecosystems?)
Is the project likely to make an investment in human capital (e.g., will the project provide training or education that significantly builds the knowledge and skills of people?)
Is the project likely to make an investment in social capital (e.g., will the project bring groups together to solve problems, encourage new relationships to develop, or help people better understand and comply with rules and regulations?)

Evidence of Demand for the Project

This series of questions is designed to clarify whether there is demand for the project's effects, which is necessary to demonstrate the benefits described above are likely to materialize in an economically meaningful way.

Will the project produce effects or outcomes that address documented problems related to scarcity of a resource?
Is the project likely to or create or enhance features (e.g., a trail or natural area) for which there are no nearby substitutes?
Is the project likely to result in a reduced risk of loss of life or damage to property?

Is the project likely to result in a reduced risk of disruption in critical services (e.g., water service, fire protection, emergency response, etc.)?
Is the project likely to result in new information or initial actions required to complete a larger project that would yield more, longer-term, or more widespread benefits?

Distribution of Economic Benefits of the Project

This series of questions is designed to clarify how the benefits of the project are distributed across populations, geography, and time. Broader distribution is not necessarily better from an economic perspective, but these factors are important to consider.

Is the project likely to produce benefits that are distributed widely across many people, or concentrated among a distinct group of people?
Is the project likely to produce benefits that will continue to accrue over a long period of time, or are the benefits likely to primarily occur over a limited time period or in the short term (e.g., does the project produce changes that are self-sustaining, or changes that are short-lived or need continued investment to maintain)?
Is the project likely to produce benefits that materialize across a wide geography, or concentrated in one location (e.g., are the benefits limited to the project site, do they have downstream consequences, do they reach across multiple watersheds?)

How to Use These Questions in a Review

These questions do not yield a quantifiable score to assign to prospective projects. They do, however, provide IRWM Plan managers with information they may use to consider the economic feasibility in the project selection process, which is what DWR staff intended for Factor H to achieve. IWRM Plan managers can use the answers provided for each question to assess projects in several ways:

- Have the project proponents thought about the economic dimensions of their project's effects, and are they able to articulate them? (The more robust the answers to these questions, the more likely a project is likely to score well in the Implementation Grant process.)
- Does the project produce a wide range of potentially quantifiable or economically meaningful effects, or a more narrow or limited set of effects? (If the answer to many of these questions is "no" or blank, it's possible--though not certain--that an economic analysis of the project won't score well.