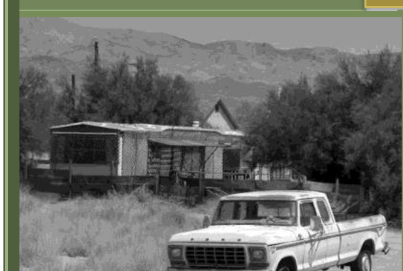
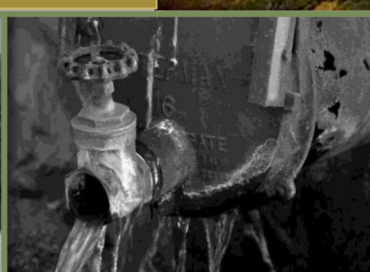
Inyo-Mono
Integrated Regional Water Management Plan
2019 Update





Adopted September 25, 2019

Prepared by: Holly Alpert, Ph.D.; Rick Kattelmann, Ph.D.; Mark Drew, Ph. D.; Janet Hatfield; Heather Crall, J.D.; and Allison Dodds

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Executive Summary

To say that the Eastern Sierra region of California is unique is to understate its features and beauty. High mountain peaks, low-elevation valleys, conifer forests, Great Basin sagebrush steppe, and arid deserts are but some of the remarkable landscapes of this region. Paiute and Shoshone peoples have inhabited the region for thousands of years. One hundred years ago, Los Angeles engineers and politicians recognized that the water resources of the Owens Valley could help a budding city grow into one of the major metropolises of the world. Today, the region depends on recreation-based tourism to drive its economy. The rich and varied natural resources of the Eastern Sierra provide ample opportunity for diverse activities such as hiking, skiing, cycling, snowmobiling, fishing, and boating.

At the heart of it all is water. Water has played and continues to play an infamous role in the region's story. Once used only locally by indigenous peoples, farmers, ranchers, and local communities, the water resources of much of the Eastern Sierra are now shared with a distant city. And what was once a unique situation of exporting and transporting water great distances is now observed throughout California and the western United States. The movement of water has been and continues to be a source of cultural and political conflict. But moving forward, we must use collaboration, instead of conflict, as the model through which we plan for and manage our limited water resources. Only in this way will we ensure that our water is distributed in an equitable manner, is of a high quality, and is used to support and enhance both human communities and ecosystems.

This document is a reflection of that new collaborative model. The Inyo-Mono IRWM Phase II Plan Update 2019 is a result of more than eleven years of public meetings and open, transparent communication among stakeholders about important water related issues faced by the region. Written largely by the Inyo-Mono IRWM Program Office staff, the content of this Plan has been reviewed, vetted, and approved by the Inyo-Mono Regional Water Management Group (RWMG) as a document that represents the Group's current thinking about water resources management in eastern California. While the Plan contains general descriptive information about the region's physical, cultural, and economic attributes; the governance and other activities of the Inyo-Mono RWMG; and current water-related project needs of the region, it also puts forth a vision for water planning now and into the future. The Inyo-Mono IRWM Phase II Plan is very much a living document; it will be updated and modified as necessary to reflect the most current statewide priorities and regional needs. Indeed, we hope that this Plan will serve as a primary reference for anyone wanting to learn about water resources in the Inyo-Mono region. We intend that this document will be used by state-level water planners and legislators, as well as by local water-related stakeholders, decision-makers, and the general public.

Acknowledgements

The authors would like to recognize and thank the Members of the Inyo-Mono Regional Water Management Group. Without their vision and commitment, this Plan and Program would not exist. The 41 Members of the Inyo-Mono RWMG are:

- Amargosa Conservancy
- Amargosa Opera House and Hotel
- Big Pine Community Services District
- Big Pine Paiute Tribe of the Owens Valley
- Birchim Community Services District
- Bishop Paiute Tribe
- Bureau of Land Management – Bishop Office
- Bridgeport Indian Colony
- Bridgeport Public Utilities District
- California Trout
- Central Sierra Resource Conservation & Development
- City of Bishop
- Crowley Lake Mutual Water Company
- Crystal Crag Water and Development Association
- Desert Mountain Resource Conservation & Development
- Eastern Kern County Resource Conservation District
- Eastern Sierra Audubon
- Eastern Sierra Community Service District
- Eastern Sierra Land Trust
- Eastern Sierra Unified School District
- Fort Independence Tribe
- Indian Wells Valley Cooperative Groundwater Management Group
- Indian Wells Valley Water District
- Inyo County
- June Lake Public Utilities District
- Keeler Community Service District
- Lone Pine Paiute –Shoshone Reservation
- Lundy Mutual Water Company
- Mammoth Community Water District
- Mono County
- Mono County Resource Conservation District
- Mono Lake Committee
- Owens Valley Committee
- Owens Valley Groundwater Authority
- Owens Valley Indian Water Commission
- Round Valley Joint Elementary School District
- Sierra Club Range of Light Group
- Town of Mammoth Lakes
- U.S. Forest Service
- Wheeler Crest Community Services District
- WRAMP Foundation

We also want to thank RWMG Members who reviewed individual Plan chapters, especially Irene Yamashita of Mammoth Community Water District and Pete Pumphrey of Eastern Sierra Audubon. We appreciate your efforts on the Plan despite busy schedules.

The RWMG is grateful for funding received by the Sierra Nevada Conservancy and the Department of Water Resources to support the planning and project implementation phases of the Inyo-Mono IRWM Program.

On behalf of the Inyo-Mono RWMG, we want to thank California Trout. This organization provided financial and staff resources since the inception of the IRWM Program in 2008. The staff and RWMG are grateful for the organization's support and recognize that the Program's successes would not have been possible without California Trout's support.

Finally, we would like to thank all those who have provided emotional, moral, and financial support to the Inyo-Mono Integrated Regional Water Management Program and who are committed to securing and providing the necessary resources to support the families, communities, and ecosystems in our remote but beloved corner of California.

Plan Adoption Resolution

A RESOLUTION OF THE INYO-MONO REGIONAL WATER MANAGEMENT GROUP APPROVING THE "INYO-MONO INTEGRATED REGIONAL WATER MANAGEMENT PLAN – PHASE II, UPDATE 2019" AND AUTHORIZING HOLLY ALPERT, PROGRAM DIRECTOR, TO SIGN THE PLAN AND SUBMIT IT TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES

WHEREAS, by Memorandum of Understanding ("MOU"), a broad array of governments, agencies, and organizations created the Inyo-Mono Regional Water Management Group ("Group"); and

WHEREAS, the Group prepared and approved an Integrated Region Water Management Plan – Phase I in 2010; and

WHEREAS, staff and representatives of the Group have prepared the "Inyo-Mono Integrated Regional Water Management Plan—Phase II, Update 2019" ("Phase II Plan") and,

WHEREAS, this version of the Phase II Plan is consistent with the 2016 IRWM Plan Guidelines released by DWR, and it addresses the major water-related issues and needs of the Inyo-Mono planning region;

THEREFORE, BE IT RESOLVED THAT in accordance with the provisions of the MOU, the Members of the Group, acting through the Members' designated representatives to the RWMG, hereby approve the Phase II Plan, Update 2019, and direct the Group's Program Director, Holly Alpert, to sign this Phase II Plan Adoption Resolution and to submit the Phase II Plan, Update 2019, to DWR.

Passed and adopted this 25th day of September 2019, by consensus of a quorum of the Inyo-Mono Regional Water Management Group.

SIGNED:

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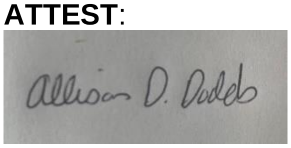
Holly Alpert
Program Director, Inyo-Mono Integrated Regional Water Management Program

ATTEST:



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Allison Dodds
Disadvantaged Communities Coordinator, Inyo-Mono Integrated Regional Water Management Program

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Acronyms and Abbreviations

Admin. Committee: Administrative Committee

AF(Y): Acre-feet (per year)

BCSD: Biased-Corrected Spatial Downscaling

BLM: Bureau of Land Management

CASGEM: California Statewide Groundwater Elevation Monitoring

CAT: Climate Action Team

CDEC: California Data Exchange Center

CEDEN: California Environmental Data Exchange Center

CEIC: California Environmental Information Catalog

CEQA: California Environmental Quality Act

CERES: California Environmental Resources Evaluation System

CMIP3: Coupled Model Intercomparison Project Phase 3

CRWA: California Rural Water Association

CWC: California Water Code

DAC: Disadvantaged community

DMP: Data Management Plan

DWR: California Department of Water Resources

ECWA: Eastern California Water Association

EIR: Environmental Impact Report

EPA: Environmental Protection Agency

ESRI: Environmental Systems Research Institute

FGDC: Federal Geographic Data Committee

GCM: General Circulation Model

GHG: Greenhouse Gas

GSA: Groundwater Sustainability Agency

GSP: Groundwater Sustainability Plan

GWP: Global Warming Potential

HUC: Hydrologic Unit Code

ICLEI: International Council for Local Environmental Initiatives

Inyo-Mono IRWM(P): Inyo-Mono Integrated Regional Water Management (Plan/Program)

Inyo-Mono RWMG: Inyo-Mono Regional Water Management Group

IPCC: Intergovernmental Panel on Climate Change

IRWIS: Integrated Regional Water Information Systems

IWVWD: Indian Wells Valley Water District

JLPUD: June Lake Public Utilities District

LAA: Los Angeles Aqueduct

LADWP: Los Angeles Department of Water and Power

LAFCO: Local Agency Formation Commission

MCL: Maximum Contaminant Load

MCWD: Mammoth Community Water District

MHI: Median Household Income

MOU: Memorandum of Understanding

NEPA: National Environmental Policy Act

NPS: National Park Service

NWIS: National Water Information System (USGS)

Prop. 84: California Proposition 84 (2006)

Prop. 1: California Proposition 1 (2014)

PSP: Proposal Solicitation Package

RAP: Region Acceptance Process

RCM: Regional Climate Model

RWMG: Regional Water Management Group

RWQCB : Regional Water Quality Control Board

SGMA: Sustainable Groundwater Management Act

SRES: Special Report Emissions Scenario

SWAMP: Surface Ambient Water Monitoring Program

SWE: Snow Water Equivalent

SWRCB: State Water Resources Control Board

(California)

TMDL: Total Maximum Daily Load

USDA: United States Department of Agriculture

USDI: United States Department of the Interior

USFS: United States Forest Service

UWMP: Urban Water Management Plan

WDL: Water Data Library (DWR)

WRCP: World Climate Research Programme

Chapter 1 : IRWM Program Development Process

1.1 History, Purpose, and Status of State of California IRWM Program

1.1.1 History

In the Implementation Plan of the California Water Plan Update 2009, the first objective listed is to "promote, improve, and expand integrated regional water management to create and build on partnerships that are essential for California water resources planning, sustainable watershed and floodplain management, and increasing regional self-sufficiency." State-level water managers in California began to recognize the need for local- and regional-scale water planning in the late 1990s. Over the past decade, California has made significant steps in implementing Integrated Regional Water Management (IRWM). In 2002, voters passed Proposition 50, which developed the Integrated Regional Water Management Grant Program as a joint effort between the California Department of Water Resources (DWR) and the State Water Resources Control Board (SWRCB). Proposition 50 provided competitive grant funding through the IRWM Program for projects that protected communities from drought, protected and improved water quality, and reduced dependence on imported water. Approximately $380 million were made available through two rounds of funding.

Subsequently, voters passed Proposition 84 and Proposition 1E in 2006. These propositions created additional funding through the IRWM Grant Program for projects that assist local agencies to meet the long-term water needs of the State, including delivery of safe drinking water and protection of water quality and the environment. To be eligible for this funding, projects and project sponsors must be involved in a Regional Water Management Group (RWMG) that has adopted an IRWM Plan.

In 2014, voters approved Proposition 1 – the Water Quality, Supply, and Infrastructure Improvement Act of 2014. Proposition 1, Chapter 7 Regional Water Security, Climate and Drought Preparedness (Water Code § 79740 – 79748) funding is intended to improve regional water self-reliance security and adapt to the effects on water supply arising out of climate change. Prop. 1 allocated $510 million to IRWM statewide.

1.1.2 Purpose

The IRWM Program is intended to promote and implement integrated regional water management to ensure sustainable water uses, reliable water supplies, improved water quality, environmental stewardship, efficient urban development, sustainable agriculture, and a strong economy. This planning and implementation framework is intended to comprehensively and concurrently address challenges of water supply, water quality, flood management, and ecosystem protection. It also implements integrated solutions through a collaborative multipartner process that includes water managers; Native American tribes; non-governmental organizations; federal, State, and local government agencies; and disadvantaged communities. IRWM is a portfolio approach for determining the appropriate mix of water-related resource management strategies, water quality actions, and steps to enhance environmental stewardship for the planning region. The goal is to provide long-term, high-quality, and reliable water supplies for all users at the lowest reasonable cost and with highest possible benefits for economic development, environmental quality, and other societal objectives (CA Water Plan Update, 2009).

Specifically, the purpose of Proposition 1 is to assist water infrastructure systems adapt to climate change; provide incentives for water agencies throughout each watershed to collaborate in managing the region's water resources and setting regional priorities for water infrastructure; and improve regional water self-reliance, while reducing reliance on the Sacramento-San Joaquin Delta.

1.1.3 Status

Work done through the IRWM Program prior to the passage of Prop. 1 (2014) was largely funded through Propositions 50, 84, and 1E, though stakeholders and practitioners in individual IRWM regions contribute a significant amount of funding to the implementation of the program. These propositions have provided three types of grants: planning grants, intended to support the development and revision of IRWM Plans; disadvantaged community grants, which encouraged the engagement and involvement of DACs in the IRWM process; and implementation grants, which fund project construction. Proposition 1 continues this structure and has so far provided planning grants and DAC involvement grants. Implementation funding is forthcoming. It is uncertain what funding will be available for IRWM regions after Prop. 1. Long-term program operations funding continues to be a concern for most IRWM regions.

Eighty-two percent of California's land area is included in an IRWM effort, up from 54% during the Prop. 50 funding rounds. Similarly, 98% of California's population is now included in an IRWM region, slightly up from 94% during Proposition 50. In 2009 the Department of Water Resources administered the first round of a Region Acceptance Process (RAP), in which IRWM regions submitted applications to have their boundaries approved by DWR. In 2009, 46 regions submitted applications and 41 were approved. An additional eleven regions were approved through the second RAP round in 2011, some of which had not been approved (or were conditionally approved) during the first round.

1.2 Statewide Priorities for IRWM Program

DWR's IRWM Grant Program encourages development of integrated regional strategies for management of water resources by providing funding through competitive grants. Eligible projects must implement IRWM plans that meet the requirements of Section 75026 of Proposition 84. As required, IRWM plans should identify and address the major water-related objectives and conflicts within the region, consider all resource management strategies identified in the California Water Plan Update, and use an integrated, multi-benefit approach for project selection and design. Plans shall include performance measures and monitoring plans to document progress toward meeting Plan objectives. Projects that may be funded pursuant to this section must be consistent with an adopted IRWM Plan or its functional equivalent as defined in the Department's Proposition 84 IRWM Guidelines. Furthermore, funding preference will be given to projects that address the following Program Preferences:

- Leverage Funds – Give priority to projects that leverage private, federal, or local funding or produce the greatest public benefit.
- Employ New or Innovative Technology or Practices – Give special consideration to projects that employ new or innovative technology or practices, including decision support tools that support the integration of multiple jurisdictions, including, but not limited to, water supply, flood control, land use, and sanitation.
- Implement IRWM Plans with Greater Watershed Coverage – Give priority to projects in IRWM Plans that cover the greater portion of the watershed.
- Multiple Benefits – Give special consideration to projects that achieve multiple benefits.
- Address Statewide priorities specific to the IRWM Grant Program (based on California Water Action Plan 2016 Update) (2019 Integrated Regional Water Management Program Guidelines ["Guidelines"], p.6):
  - Make conservation a California way of life
  - Increase regional self-reliance and integrated water management across all levels of government
  - Achieve the co-equal goals for the Delta
  - Protect and restore important ecosystems
  - Manage and prepare for dry periods
  - Expand water storage capacity and improve groundwater management
  - Provide safe water for all communities
  - Increase flood protection
  - Increase operational and regulatory efficiency
  - Identify sustainable and integrated financing opportunities

1.3 Inyo-Mono Regional Water Management Group

1.3.1 History and Funding

The Integrated Regional Water Management planning process was initiated in the central-eastern region of California in early 2008 in response to funding opportunities provided by Proposition 84. The initial group consisted of about 15 stakeholders, and at early meetings, the group recognized the benefits of having a multiple-agency and multiple-purpose perspective, and that water resource needs in eastern California are highly interconnected and require a broad and integrated approach. Thus, the Inyo-Mono Regional Water Management Group was born.

The Inyo-Mono RWMG received a project launch grant from the Sierra Nevada Conservancy in 2008. This grant allowed for the hiring of a Project Assistant, the involvement of a meeting facilitator, and the recruitment of a grantwriter for the first round of Prop. 84 Planning Grants. This grant was frozen at the end of 2008 due to statewide budget concerns, which meant the discontinuation of meeting facilitation and grantwriting assistance. The RWMG pushed ahead nonetheless and prepared an application for the 2009 Region Acceptance Process. This process resulted in the unconditional approval from DWR of the Inyo-Mono regional boundaries and an affirmation of the overall planning process being employed by the RWMG.

Because funding remained limited, the RWMG prepared a Round 1 Planning Grant application in-house. This application was submitted in September 2010 and was fully funded by DWR. This funding provided support for the ongoing operations of the RWMG as well as an opportunity to revise the Phase I IRWM Plan prepared by the RWMG in late 2010. It was recognized that the Phase I Plan only minimally addressed some of the Plan Standards required by DWR in order to be eligible to apply for a Round 1 Implementation Grant. The RWMG submitted a Round 1 Implementation Grant proposal in early 2011 that contained 15 projects and requested just over $4 million in grant funding. The preliminary funding recommendations provided no funding for the Inyo-Mono application; however, after working with DWR during the public comment process, the region eventually received $1,075,000. This funding allowed seven on-the-ground projects to be implemented throughout the region (see Chapter 9). The Inyo-Mono Program was awarded a second Planning Grant in 2012 to support updating this IRWM Plan to meet enhanced Plan standards and to match evolving regional priorities. The grant also supported ongoing operations of the Program as well as three discrete planning studies (see Chapter 9). This grant concluded in May 2016.

An additional funding opportunity was made available from DWR in 2010 to identify, engage, and work with disadvantaged communities (DACs). As a region that contains a large number of DACs, the Inyo-Mono RWMG recognized the opportunity and worked to secure one of five available grants. Funding from this grant was made available in 2011, and work on the project was completed in early 2015. Additional DAC grant money was secured in 2012 to supplement and enhance the work being done through the original grant.

The Inyo-Mono IRWM Program submitted an application for Prop. 84 Round 2 Implementation funding in early 2013. The application consisted of four projects, three of which were located in DACs and/or tribes, and requested $2.2 million in grant funding. This funding was not awarded. After this funding round, the Inyo-Mono IRWM Program coordinated with the other IRWM regions of the Lahontan Funding Area to find a way to agree on a funding split within the funding region so that every region has access to some funding and grants are not awarded competitively. The IRWM regions agreed to try a pre-determined allocation for the final round of Prop. 84 Implementation funding. The Program again applied for project funding through the Prop. 84 2015 Implementation funding round and was awarded the full amount requested – just over $1.8 million. This funding is supporting six projects in the region.

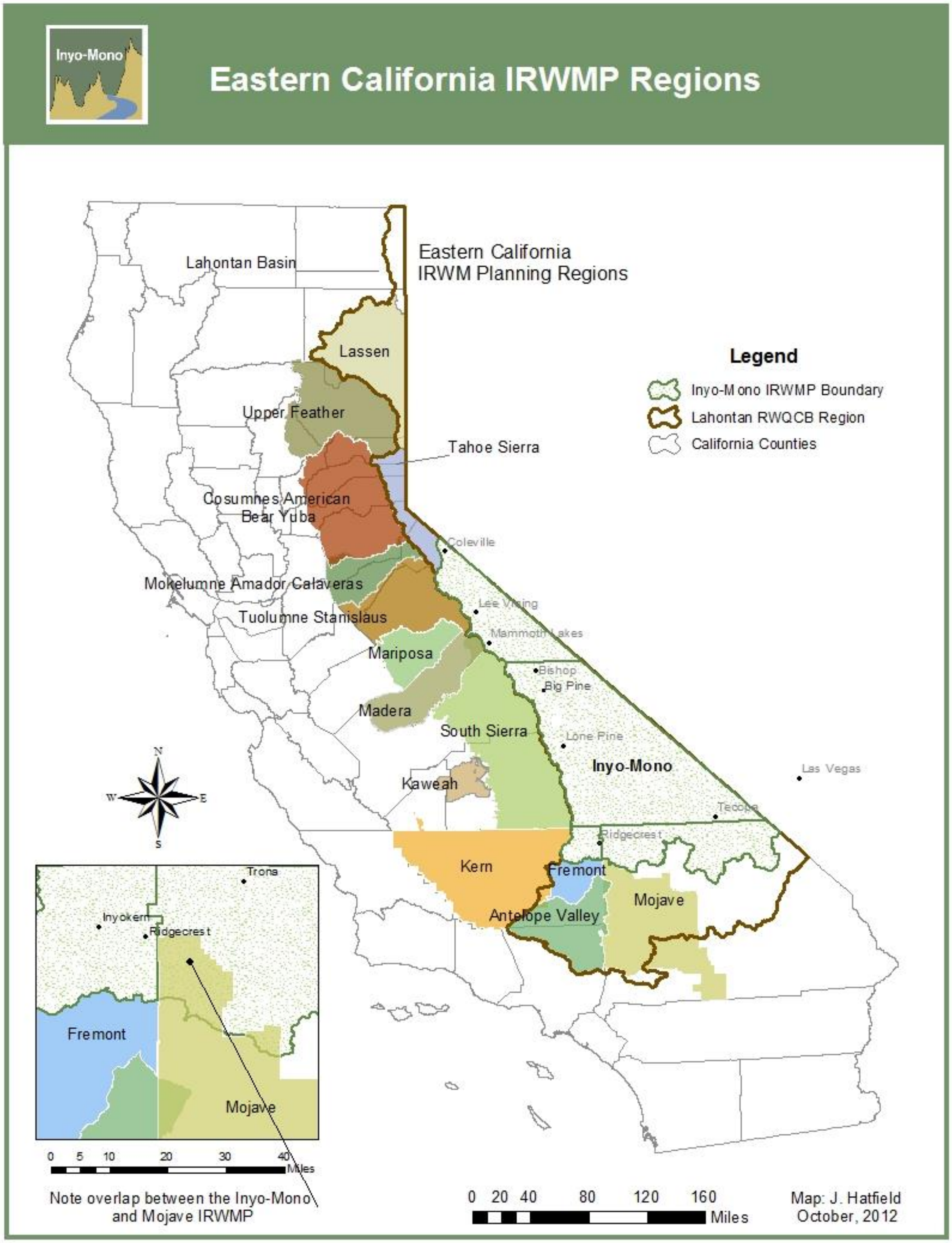
Proposition 1 Disadvantaged Community Involvement grants became available in 2017, and the Inyo-Mono IRWM Program (through California Rural Water Association) was awarded $466,000 in early 2018 to implement a three-year project.

See Chapter 9 for more information on financing the Inyo-Mono IRWM Program.

1.3.2 IRWM Planning Regions relative to the Inyo-Mono region

One of the first tasks of the initial stakeholder group was to determine the boundaries of the planning region. After considerable discussion and input from many parties, the boundaries were drawn as depicted in Figure 1-1 (see also Chapter 2). Because there was some overlap between the Inyo-Mono IRWM planning region and other IRWM planning regions, the Inyo-Mono RWMG initiated conversations with neighboring regions to discuss and agree upon shared boundaries and areas of overlap (see Chapters 6 and 8 for further discussion of this topic).

Figure 1-1: Boundaries of Eastern California IRWM Planning regions



1.3.3 Composition and Structure

The Inyo-Mono IRWM Program consists of a main group (RWMG), an advisory committee (Administrative Committee), paid staff, and ad-hoc working committees. The RWMG is the largest and most inclusive group and is the main decision-making body for the Inyo-Mono IRWM planning and implementation processes. The RWMG has been organized as a non-binding, non-regulatory, voluntary entity governed by a Memorandum of Understanding (MOU; more information on governance can be found in Chapter 5). Signatories to the MOU are considered “Members” of the RWMG and can participate in the decision-making process. There is no monetary requirement for Members, and Members may leave the RWMG at any time. During the pre-planning phase of the IRWM Program, 28 RWMG participants signed an initial MOU which described the governance structure and provided "ground rules" that defined roles and responsibilities, stakeholder engagement, and decision-making for the RWMG. A substantially revised MOU was developed in the first half of 2010 to govern the group in the planning and implementation phases of the IRWM planning process. This MOU took effect November 15, 2010. Since that time, minor revisions have been made to the planning/implementation MOU. The RWMG will continue to revise and/or amend the MOU as necessary. As of the writing of this Plan, there were 41 signatories to the planning/implementation MOU. A list of the current signatories can be found in Chapter 5, as well as in the Acknowlegements section at the beginning of this document. All organizations involved with the IRWM Program, regardless of membership in the RWMG, as well as members of the public, are welcome to attend RWMG meetings and provide input on decisions. The RWMG meets in-person at various locations within the planning area approximately once per month and always provides a conference call option for Members and others who cannot attend in person, given the large size of the region.

The Inyo-Mono RWMG is comprised of a broad array of stakeholders from throughout Inyo and Mono Counties as well as stakeholders from northern San Bernardino and Kern Counties, including agencies with statutory authority over water (see Chapter 5). Those entities involved represent interests ranging from federal, state, and local government; resource and water agencies; non-profit and conservation organizations; American Indian tribal organizations; educational organizations; business interests; agriculture and ranching groups; and individuals having vested interests in how water is managed in eastern California. In addition to those entities that are Members of the RWMG and/or regularly participate in the planning process, there is a large number of organizations and individuals who are on the Inyo-Mono RWMG contact list and regularly receive updates and notices of meetings. Some of these entities have been regular participants in the past but do not currently participate at a high level. Other entities have had little contact with the RWMG or Program Office but wish to stay informed of issues being addressed by the RWMG. In total, more than 200 people, representing 96 organizations, are included in the Inyo-Mono contact list (Table 1-1).

Table 1-1: Inyo-Mono IRWM Program organizations contact list

Inyo-Mono IRWM Program Contact List Organizations		
▪ Amargosa Conservancy	▪ Eastern Sierra Land Trust	▪ Mono Lake Committee
▪ Amargosa Opera House and Hotel	▪ Eastern Sierra Unified School District	▪ Mountain Meadows Mutual Water District
▪ Aspendell Mutual Water Company	▪ Fort Independence – Amalgamated Reservation	▪ National Park Service: Devils Postpile National Monument
▪ Benton Paiute Reservation	▪ Friends of the Inyo	▪ National Park Service: Death Valley National Park
▪ Big Pine CSD	▪ High Sierra Energy Foundation	▪ Natural Resource Conservation Service - Bishop Office
▪ Big Pine Paiute Tribe of the Owens Valley	▪ Hot Creek Ranch	▪ Natural Resource Conservation Service - Minden Office
▪ Birchim CSD	▪ Humboldt-Toiyabe National Forest	▪ Owens Valley Committee
▪ Bishop Paiute Tribe	▪ Independence Civic Club	▪ Owens Valley Indian Water Commission
▪ Breeze-Martin Consulting	▪ Indian Wells Valley Cooperative Groundwater Management Group	▪ Lahontan Regional Water Quality Control Board
▪ Bridgeport Indian Colony	▪ Indian Wells Valley Water District	▪ Round Valley Joint Elementary School District
▪ Bridgeport PUD	▪ Inland Aquaculture Group	▪ Sierra Club, Toiyabe Chapter, Range of Light Group
▪ Bridgeport Ranchers Association	▪ Inyo County	▪ Sierra East Homeowners Association
▪ Bristlecone Media	▪ Inyo Mono Farm Bureau	▪ Sierra Nevada Alliance
▪ Bureau of Land Management – Bishop Office	▪ Inyo National Forest/U.S. Forest Service	▪ Sierra Nevada Conservancy
▪ California Department of Fish and Wildlife	▪ Inyo/Mono Agricultural Commissioner's Office	▪ Sierra Watershed Progressive
▪ California Department Water Resources	▪ Inyokern CSD	▪ Small Inyo/Mono water systems
▪ California Native Plant Society - Bristlecone Chapter	▪ June Lake Advocates	▪ Snow Survey Associates
▪ California Rural Water Association	▪ June Lake PUD	▪ South Tahoe PUD
▪ California State Lands Commission	▪ Keeler CSD	▪ Southern Sierra IRWM Program
▪ California Trout	▪ Kern County Water Agency	▪ TEAM Engineering
▪ Center for Collaborative Policy	▪ L.A. Department of Water and Power – Bishop Office	▪ Timbisha-Shoshone Tribe of Death Valley
▪ Central Nevada Regional Water Authority	▪ Lee Vining PUD	▪ Town of Mammoth Lakes
▪ Central Sierra Resource Conservation & Development Council	▪ Lone Pine Paiute-Shoshone Reservation	▪ U.S. Bureau of Reclamation
▪ City of Bishop	▪ Lower Rock Creek Mutual Water Company	▪ U.S. Fish and Wildlife Service

Inyo-Mono IRWM Program Contact List Organizations		
▪ Crowley Lake Mutual Water Company	▪ Lundy Mutual Water Company	▪ Valentine Eastern Sierra University of California Natural Reserve
▪ Crystal Crag Water & Development Association	▪ Mammoth Community Water District	▪ Virginia Lakes Mutual Water Company
▪ Death Valley National Park	▪ Mammoth Lakes Trails and Public Access	▪ Wheeler Crest CSD
▪ Desert Fishes Council	▪ Mammoth Mountain Ski Area	▪ Eastern Sierra Community Service District
▪ Desert Mountain Resource Conservation & Development	▪ Marine Corps Mountain Warfare Training Center	▪ Mono County RCD
▪ Eastern Kern County RCD	▪ Mariposa County Resource Conservation District	▪ Mono County
▪ Eastern Sierra Audubon Society		

During the project launch phase, a Coordinating Committee served as an advisory or steering group for the Planning Committee (which is now known as the RWMG), Program Office, and working committees, and was comprised of a subset of Planning Committee Members. Starting November 15, 2010, an Administrative (Admin.) Committee took over the roles and responsibilities of the Coordinating Committee. The Admin. Committee consists of six RWMG Members that serve on a voluntary basis. Membership on the Admin. Committee rotates through the RWMG. Each year, three new Admin. Committee members are appointed, so that each Admin. Committee member will serve for two years, thus providing continuity among years. More information on the composition and the role of the Admin. Committee can be found in Chapter 5.

Specialized ad-hoc working committees made up of RWMG participants are established as needed to perform functions, develop programs, and work through concepts (such as organizational structure, internal project ranking processes, etc.). Working committees deliver products to the RWMG and the Administrative Committee for approval and/or adoption.

Finally, the Inyo-Mono IRWM Program Office staff consists of varying numbers of people based on available funding and workload. The Program Office staff is tasked with the overall coordination and day-to-day operations of the IRWM Program as well as conducting and overseeing the work of active grants. Staff duties include grantwriting, grant administration, research, outreach, data management, GIS, meeting planning and facilitation, communicating with RWMG Members and participants, participating in Statewide IRWM meetings, and Plan writing. At this time, all staff members are part-time employees of the California Rural Water Association and are locally-based, from Bishop to Mammoth Lakes, CA.,

1.3.4 Purpose, Mission, and Vision

The purpose of the Inyo-Mono IRWM Program is to foster coordination, collaboration, and communication among water-related stakeholders in the region for the purpose of developing water management strategies and projects that will benefit multiple entities and enhance water supply, water quality, and watershed health. Specific objectives and resource management strategies derived from the purpose are presented in Chapter 7.

After a visioning exercise undertaken in early 2010, the following mission and vision statements were adopted by the RWMG:

> ***Mission:*** *To identify, study, prioritize, and act on regional water issues so as to protect and enhance our environment and economy. Working together, we create and implement a regional water management plan that complements applicable local, state, tribal, and federal policies and regulations and promotes innovative solutions for our region's needs.*
>
> ***Vision:*** *Our vision is a landscape that is ecologically, socially, and economically resilient. As diverse stakeholders, we identify and work toward our common goals. We achieve a broad-based perspective that benefits our regional ecosystems and human communities by combining our interests, knowledge, expertise and approaches. We strive to have every voice heard within our region and our collective voice heard in the state and nation.*

1.3.5 Communication, Meetings, and Workshops

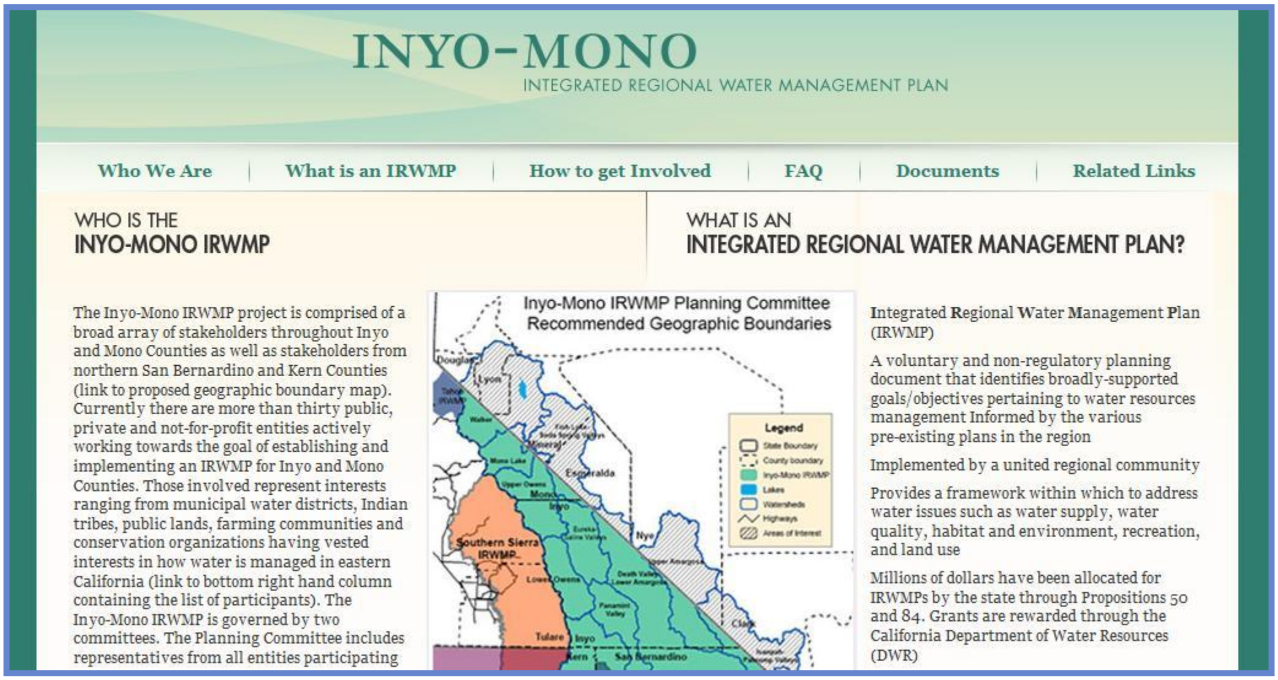
Communication with the RWMG primarily takes place through email. Notices and agendas for upcoming RWMG meetings are sent to all people on the email contact list, as are meeting summaries and any other relevant information about the Inyo-Mono IRWM process or issues related to water planning/management in the region. In addition, Program Office staff is available by phone and by email for questions and information requests. When warranted, staff will travel within the region, to Sacramento, or to other IRWM regions to meet with stakeholders, members of the public, and DWR officials. The project website (www.inyo-monowater.org) has become an increasingly visible and important tool for sharing information with current Members and reaching out to new stakeholders. On this website, visitors can find topics such as introductory information about the Inyo-Mono IRWM Program, member organizations, meeting summaries and other important documents, upcoming relevant events, and links to other IRWM groups (see next section for more information). Because of the rural nature of the Inyo-Mono region, Internet access can be unreliable, and it has been necessary at times to reach people through other means (such as phone, U.S. mail, in- person, etc.).

RWMG meetings are typically held every other month or once per quarter. Meetings take place throughout the region, although attendance is highest when meetings are held in Bishop or Mammoth Lakes. A call-in option is available during all RWMG meetings for those who cannot or prefer not to attend in person. Administrative Committee meetings are typically held via conference call, as are working committee meetings, though there is always an in-person option. All RWMG and Admin. Committee meetings are open to the public and meeting notices and agendas are posted to the Inyo-Mono IRWM Program website as well as in public locations and newspapers throughout the region. All Inyo-Mono IRWM Program meetings are held in accordance with the Ralph M. Brown Act.

1.3.6 Website

The initial Inyo-Mono IRWM Program website (www.inyo-monowater.org) was launched in 2008 as part of the project launch grant through the Sierra Nevada Conservancy. This website provided general information about the IRWM Program and also more specific information on the history, composition, and activities of the Inyo-Mono RWMG. There was also an events calendar and a documents page where users could access meeting summaries and other documents relevant to the IRWM process. The general theme of this first website is depicted in Figure 1-2.

Figure 1-2: Inyo-Mono IRWM Program original website homepage



In 2011, the Inyo-Mono IRWM Program website was overhauled (Figure 1-3). This new website contains all the information from the initial website and adds a substantial amount of additional content and functionality. More capacity was built into the website to house specific project information, a documents library, mapping capabilities, a news feed, and log-in pages for controlling secure content. In addition to the e-mail contact list, the website has become a primary tool for communicating with the RWMG. New stakeholders and members of the public are also directed to the website as a way to introduce the IRWM planning concept and provide basic information about the Inyo-Mono RWMG and its processes. The website is maintained by Program Office staff, and the content is continuously being updated and improved. The staff will continue to add content and functionality as needs arise.

Figure 1-3: Homepage of updated Inyo-Mono IRWM Program website

1.3.7 Public Involvement and Outreach

Any member of the public who is interested in water issues within the Inyo-Mono planning region is welcome to participate in the Inyo-Mono IRWM Program. Initial outreach in 2008 was primarily directed towards informing major water-related stakeholders in the region and inviting them to be part of the process. More recent outreach has targeted any entity or individual in the region working on or interested in regional water planning or management, especially those within designated disadvantaged communities and tribal communities, with the intent being to assess needs and bring needed resources to the region. Since the start of the IRWM Program, staff and other stakeholder volunteers have attended various community meetings throughout the planning region in order to identify additional stakeholders, provide basic information about the Inyo-Mono IRWM Program and related funding opportunities, and learn about water issues and concerns from those living and working in the planning region. In these meetings, Program Office staff also emphasizes that the goal of the IRWM Program is to increase local participation in water management issues and provide a more unified voice in California water planning. A primary goal of the most recent outreach efforts has been to identify and reach out to the more remote and rural communities within the region. Because of the size of the region, it has been difficult to reach every potentially affected stakeholder or community. However, it has been the priority of the Inyo-Mono RWMG from the beginning to maintain an open, transparent, and inclusive process, and public outreach efforts have been fundamental to the success of the Program. At all times, Inyo-Mono RWMG meetings have been open to the public, and notices of the meetings are publicly available on the website, on the Facebook page (https://www.facebook.com/pages/Inyo-Mono-Integrated-Regional-Water-Management-Group/287154034655884), in local media outlets, and at public locations throughout the region. More information on the Program's outreach activities can be found in Chapter 6.

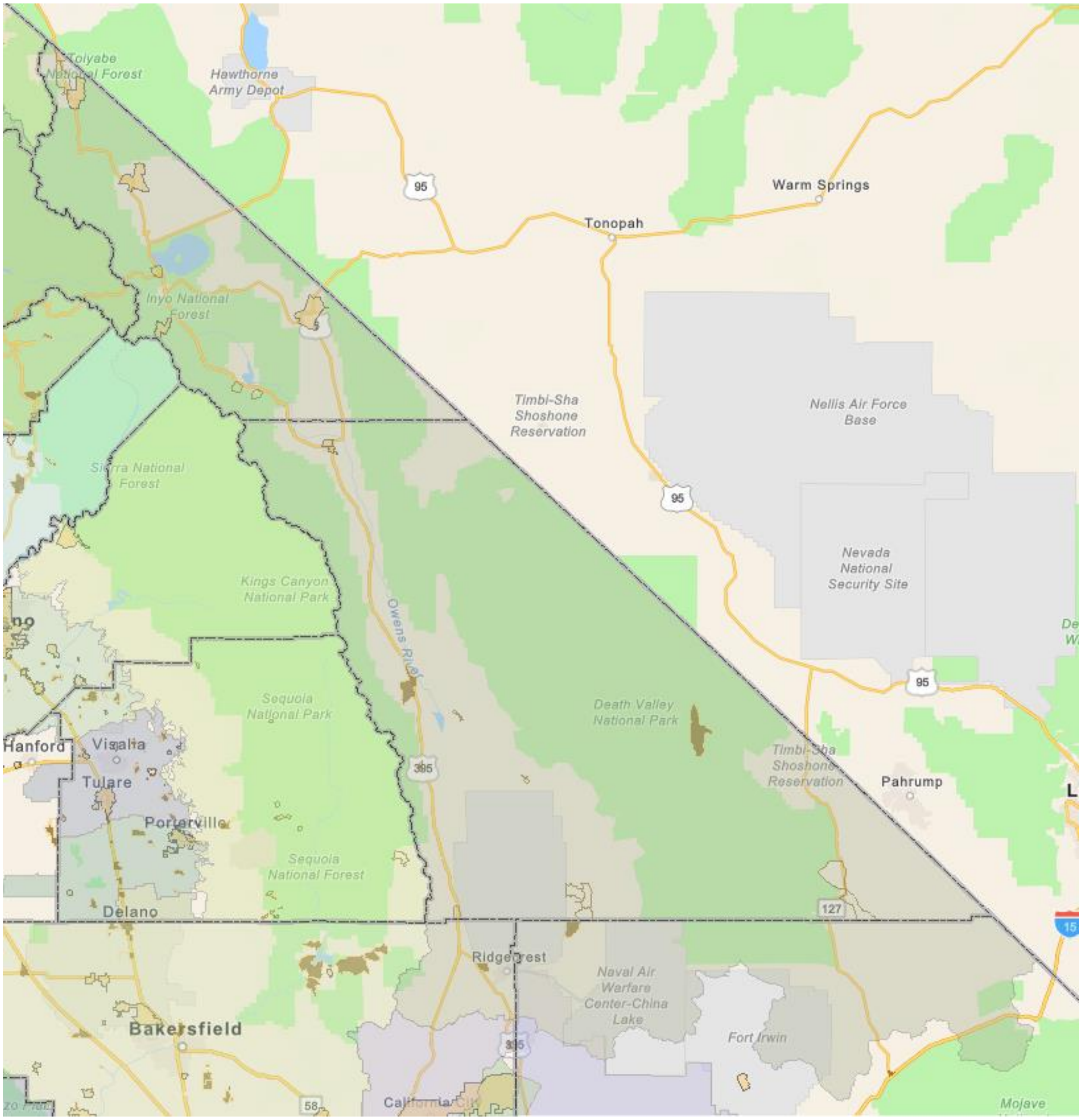
1.3.8 Disadvantaged Communities and Native American Indian Tribes

From the beginning of the Inyo-Mono IRWM planning process in early 2008, the RWMG prioritized outreach to and engagement of disadvantaged communities (DACs) and tribes. It was quickly recognized that because of the rural and remote nature of the region, there would likely be a large number of DACs. Indeed, it was discovered that all of Inyo County (the second largest county in California) is a DAC according to its median household income (see below). As described below, DACs in the Inyo-Mono planning region include towns and unincorporated communities in Inyo, Mono, San Bernardino, and Kern Counties, as well as federally-recognized and non-federally-recognized American Indian tribes.

A disadvantaged community is defined by California statute as a community with an annual median household income (MHI) that is less than 80% of the statewide annual MHI (Assembly Bill 1747 [2003]). MHI data were not made available at the community level from the 2010 U.S. Census; instead, 2006-2010 American Community Survey (ACS) data were used to perform an initial identification of DACs within the Inyo-Mono region (http://www.census.gov/acs/www/about_the_survey/american_community_survey/). American Community Survey data are now the standard for identifying DACs within an IRWM region. Because of the remote and rural nature of the Inyo-Mono region, as well as its sparsely-distributed and often small population centers, neither U.S. Census nor ACS data are available for all communities in the region. Thus, the number of identified DACs in the Inyo-Mono region is likely underestimated. Locations of DACs in the Inyo-Mono region identified using ACS data are shown in Figure 1-4.

Through the Prop. 84 DAC grant from DWR, the Inyo-Mono RWMG investigated developing a set of metrics that could be used to define and identify DACs that are not dependent on inconsistent data sources. No one indicator or set of indicators was found to be comprehensively applicable to all DACs. However, this work helped lead to the State's development of "economically-distressed areas", which is an identification of disadvantage that is based on income but also takes into account financial hardship, unemployment, and population density (2019 Guidelines, p. 27).

Figure 1-4: Disadvantaged Communities of the Inyo-Mono Region (shaded; DACs show up as outlines or yellow polygons; SDACs show up as brown polygons)



The statewide annual MHI in California based on the 2012-2016 ACS is $63,783. Communities with annual MHIs less than $51,026 are considered disadvantaged communities by the AB 1747 definition. Using this definition, the entirety of both Inyo and Kern Counties are disadvantaged based on county-wide MHI estimates (Table 1-2). Based on the 2012-2016 ACS data, the MHI for the whole of Inyo County is $47,278, which is below the statewide 80% of MHI threshold. Eighteen communities in Inyo County qualify as disadvantaged using the current definition. All of the American Indian Reservations in Inyo County qualify as disadvantaged communities. The population of the disadvantaged communities in Inyo County is at least 11,300 (some population data are not available; see Table 1-2), representing 62% of the total county population. A further classification is for severely disadvantaged communities, with 5-year MHI averages of $38,270 and below. At least five communities are SDACs, including several of the Native American Indian reservations.

The MHI for Mono County is $58,937, which is higher than Inyo County but still below the statewide MHI. Twelve communities in Mono County qualify as disadvantaged, accounting for at least 26% (more than 3,700 people; not all population data are available) of the total population of Mono County. The proportion of population residing in DACs in Mono County has increased markedly in the past few years. All American Indian Reservations in Mono County qualify as DACs. At least two communities are SDACs. In addition, there are "pockets" of disadvantage within more wealthy communities that do not officially qualify as DACs. For example, parts of the town of Mammoth Lakes house lower-income workers, many of whom are Latino. The Inyo-Mono RWMG is working to determine how best to identify these pockets and bring resources to them.

MHI estimates for Mono and San Bernardino Counties are approximately $8,000 and $3,000, respectively, above the statewide 80% MHI threshold. Previous analyses showed San Bernardino County to be farther above the 80% DAC threshold. The Kern County MHI is $49,788, which is also below the DAC MHI threshold. A very small portion of Kern County is located within the Inyo-Mono planning region; however, two communities qualify as disadvantaged, representing 3,766 people.

Similarly, a small portion of northern San Bernardino County is located within the Inyo-Mono planning region. The MHI for San Bernardino County is $54,469, which is higher than the DAC threshold but still below the statewide MHI. This figure is also smaller than the previous analysis using 2006-2010 ACS data. Within the Inyo-Mono portion of San Bernardino County, one community is considered disadvantaged (and is also an SDAC), representing 1,582 people.

In total, just over 20,000 people live in disadvantaged communities in the Inyo-Mono region. Given the small population of the region, this represents approximately one-third of the overall population, yet still may not adequately represent the disadvantaged nature of some communities within the region. The work that took place through the Prop. 84 DAC grant attempted to more accurately portray the definition of "disadvantaged" for rural, remote, mountainous, and/or headwaters regions. This work on DAC metrics can be found in the DAC white paper, which is linked on the Inyo-Mono website: http://inyo-monowater.org/inyo-mono-irwm-plan-2/dac/findings/.

As described above, the Inyo-Mono RWMG secured funding from DWR in 2011 specifically for DAC outreach and engagement. Through this funding, one-on-one and public meetings were held throughout the region with the intention of engaging with as many DACs in the area as possible while at the same time gathering information about DAC water-related needs and determining how to best bring resources to these communities. The RWMG has recognized that the success of the IRWM planning effort in the region cannot be fully realized without the participation of DACs. Indeed, inclusion of DACs into the process helps to provide a stronger voice in support of the needs of rural communities. Results from this work were provided to DWR and other state water agencies, along with recommendations, to help them develop DAC-specific programs and policies. These pilot projects provided the basis for the disadvantaged community involvement program in the 2014 Proposition 1 water bond. In 2017, the Inyo-Mono RWMG received a second DAC involvement grant.

It was also recognized early on that it would be imperative to have tribal involvement in the RWMG as there are several federally-recognized (and a few non-federally-recognized) tribes in the area that contribute significantly to the economy and culture of the region and have been involved in regional water issues for centuries. Targeted outreach efforts yielded good results, and all tribes in the region but two are signatories to the Inyo-Mono MOU. The Inyo-Mono RWMG recognizes area tribes as sovereign entities and as such encourages RWMG Member organizations that are government agencies to coordinate with tribes on a government-to-government basis.

Median household income data also change over time, and for communities with small populations, a change of a few households moving into or out of the community can shift the MHI above or below the threshold. One way of verifying DAC status is through a median household income survey, which is performed by an independent organization and can more accurately develop an MHI estimate than the Census data give. Median household income surveys can also focus on a specific community or service area instead of being bound by Census geographies.

Table 1-2: Disadvantaged communities in the Inyo-Mono IRWM planning region
(based on 2012-2016 5-year American Community Survey data *(unless otherwise noted); *indicates severely disadvantaged community)*

Community *(As recognized by the U.S. Census Bureau)*	Population	Annual Median Household Income
Inyo County	***18,326[1]***	***$47,278***
Big Pine Paiute Reservation of the Owens Valley	544	$32,778*
City of Bishop	3,832	$40,182
Bishop Paiute Tribe	1,657[2]	$41,050
Cartago CDP	25	Not available[3]
Darwin CDP	35	Not available
Dixon Lane-Meadow Creek CDP	2,524	$48,611
Fort Independence Tribe	75	$43,750
Furnace Creek CDP	178	$29,279*
Homewood Canyon CDP	22	Not available
Keeler CDP	29	Not available
Lone Pine CDP	1,967	$35,347*
Lone Pine Paiute-Shoshone Reservation	237	$30,625*
Pearsonville CDP	27	Not available
Shoshone CDP	17	Not available

Community (As recognized by the U.S. Census Bureau)	Population	Annual Median Household Income
Tecopa	133	Not available
Timbisha-Shoshone Reservation	31	$28,750*
Trona	6	Not available
Valley Wells CDP	Not available	Not available
Kern County	***871,337***	***$49,788***
China Lake Acres	2,090	$38,229*
Inyokern	1,676	$31,925[6]
Mono County	***14,051***	***$58,937***
Aspen Springs CDP	58	Not available
Benton CDP	352	$38,333
Benton Paiute Reservation	145	$38,750
Bridgeport CDP	890	$49,776
Bridgeport Indian Colony	79	$26,875*
Coleville CDP	197	Not available
June Lake CDP	631	$50,298
Lee Vining CDP	89	Not available
McGee Creek CDP	65	Not available
Topaz CDP	180	Not available
Walker CDP	780	$45,119
Woodfords Community of the Washoe Tribe[4]	262	$30,833*
San Bernardino County	***2,106,754***	***$54,469***
Searles Valley[5]	1,582	$37,344*

[1]Overall population numbers for counties may be slightly different from numbers referenced in other sections of the Plan due to differences between 2010 Census and 2006-2010 ACS data.
[2]2013-2017 ACS estimate
[3]Communities with MHI listed as "Not available" are listed as DACs based on their DAC designation using DWR's DAC mapping tool: http://www.water.ca.gov/irwm/grants/resourceslinks.cfm
[4]Woodfords Community is a branch of the Washoe Tribe located in CA though headquartered outside of the Inyo-Mono IRWM region.
[5]Consists of the communities of Argus, Trona, Pioneer Point, and Searles Valley, CA
[6]Inyokern received an MHI survey in 2018-2019 that demonstrated its DAC status

1.4 Principal Water-Related Concerns and Issues in the Inyo-Mono Region

Through the process of working with RWMG Members, participants, and other water-related stakeholders in the region, and through extensive outreach to the communities of the Inyo-Mono planning region, three principal categories of water issues have been identified. Many other issues exist in the region, but these three categories stand out as themes impacting the entire region.

Water Quality: *Many communities in the Inyo-Mono planning region primarily depend on groundwater as their potable water supply. Due to the chemical composition and weathering processes of the granitic bedrock that underlies much of the region, natural contaminants are commonly found in surface water and groundwater sources - primarily arsenic and uranium. As a result, water systems in many communities within the planning region regularly exceed state and federal maximum contaminant levels; however, because of the limited resources of many of these rural communities, they are unable to bring their drinking water sources into compliance. Such water quality issues are truly region-wide, from Coleville in the north of the region to Keeler near the center and Tecopa in the southeast corner. Several communities rely on expensive bottled water as their primary source of drinking water.*

Water Infrastructure: *Several communities have identified concerns about old, outdated, and/or poor-quality water infrastructure. These problems include pipes, tanks, wells, diversion structures, and underground mainlines. Poor or failing water infrastructure results in substantial water loss, degraded water quality, and inadequate fire-fighting capabilities. Even though the planning region encompasses a wide variety of landscapes and ecosystems, both water infrastructure and fire water storage concerns are found throughout the region.*

Institutional/Human Capacity: *Although capacity is not directly a water issue, the RWMG has come to see limited capacity and resources as a major obstacle to improving water quality, water supply, and watershed health in the region. Throughout the region, representatives from communities, particularly those that are small and/or disadvantaged, have expressed the need for both technical and financial resources to address water resources concerns. Many of these communities lack the expertise necessary to develop engineering plans, conduct environmental review, write grant proposals, and implement projects, nor do they have the financial resources to hire expensive outside contractors to support these activities. Furthermore, many communities have expressed concern that even after a project is built, they often cannot find the resources to operate and maintain the project, and quality and project longevity may be compromised as a result.*

1.5 Approach and Relation to Other Planning Efforts within the Region

The Inyo-Mono IRWM Plan is not a legally binding document; however, many of the member organizations and other stakeholders must adhere to various other plans, policies, and regulations that govern water management in the region. Therefore, it is necessary to know of and understand these documents as the Inyo-Mono RWMG develops and implements water resource projects. Planning documents that have been completed and/or implemented before the start of or during the process of the Inyo-Mono IRWM Program are introduced and discussed in Chapter 11. The RWMG relies on the knowledge and community involvement of its Members and participants to stay informed about new or ongoing planning efforts. If possible, Program Office staff attends stakeholder meetings or otherwise communicates with other planning entities to (1) stay updated about the planning effort and (2) to provide input on behalf of the RWMG, if warranted. The relationship of the Inyo-Mono IRWM Plan to other planning efforts in the region is further discussed in Chapters 8 and 11.

1.6 Coordination with Other IRWM Programs

Throughout the planning process, RWMG participants and Program Office staff have communicated and coordinated regularly with other IRWM planning regions in the State. During the launch phase, coordination with adjacent and neighboring IRWM planning regions was essential to ensure agreement regarding common boundaries, overlapping boundaries between proposed IRWM planning regions, and gaps between existing and proposed IRWM planning regions. An initial meeting among neighboring IRWM planning regions took place in 2008 to begin a focused dialogue amongst the various IRWM planning regions specific to boundary issues. During the initial meeting, those participating agreed that further coordination should take place. This communication resulted in a series of Letters of Agreement between neighboring IRWM planning regions that then became part of each region's Region Acceptance Process application. The entities included in these letters of agreement were: Tahoe-Sierra IRWM Program, Southern Sierra IRWM Program, Antelope Valley IRWM Program, Mojave IRWM Program, and Kern County (Figure 1-1). At times, Madera and Mariposa Counties were also included in these boundary discussions, although the formation of IRWM Programs in their areas was not finalized at the time. Another goal of this outreach to neighboring regions was to lay the groundwork for future collaboration on shared water resource issues.

More recently, conversations took place among the six IRWM regional groups of the Lahontan Funding Area regarding allocation of the remaining Proposition 84 funds. (http://www.water.ca.gov/irwm/grants/docs/FundingAreaContacts/FA%20factsheetrev1.pdf) An informal agreement was developed to split the remaining funds using a formula that accounts for equal allocation, population distribution, and IRWM region land area. This agreement was presented to DWR ahead of the final Prop. 84 Implementation funding round and was used to guide applications and determine grant awards. Likewise, for Proposition 1 funds, the Lahontan Funding Area IRWM groups have agreed on an allocation and will use this split to guide funding applications. The six regions communicate regularly, and Inyo-Mono Program Office staff is serving as a point of contact and coordination for the whole funding area.

Meetings with neighboring IRWM groups allowed the Inyo-Mono IRWM planning region to learn how other IRWM planning regions formed, invited and involved stakeholders, wrote IRWM Plans, and implemented projects. Program Office staff has used contacts from other IRWM planning regions throughout California, particularly those at advanced stages of IRWM planning, for advice and input. Likewise, after eleven years of development and practice, the Inyo-Mono IRWM Program has now become a resource for "younger" programs as they develop their governance, outreach processes, and Plans. The Inyo-Mono RWMG has also begun to look for possibilities of collaborative projects with neighboring IRWM planning regions.

The Inyo-Mono RWMG and Program Office staff have participated in a number of other efforts involving IRWM regions in various parts of California. Program Office staff regularly participates in the IRWM Roundtable of Regions meetings. This informal group provides an excellent venue for sharing information among IRWM Programs, receiving updates from DWR, and providing feedback about the statewide IRWM Program. The Inyo-Mono RWMG also participates in the Sierra Water Workgroup (SWWG), which is a consortium of IRWM groups in the Sierra Nevada. This group seeks to raise the profile of the Sierra in statewide water policy as well as to provide a forum for Sierra IRWM Programs to share information and resources.

1.7 Integration of Stakeholders and Institutions

The eleven years of RWMG meetings, outreach efforts, and daily operations of the Inyo-Mono IRWM Program have resulted in a truly grassroots, bottom-up, integrated approach to water planning. The composition of the RWMG is unparalleled anywhere else in the region, and indeed, the State, and reflects the open, transparent, and inclusive nature of the Inyo-Mono IRWM process. The RWMG membership includes town and county government agencies; federal, state, and regional resource agencies; American Indian tribes; small and large water purveyors; conservation organizations; private businesses; community advocacy organizations; and educational institutions (Chapter 5). Indeed, other multi-stakeholder efforts in the region, as well as other IRWM groups, have looked to the Inyo-Mono RWMG as a model of collaborative planning.

Integration of stakeholders and resources within the IRWM planning process has been formalized through the RWMG meetings that have been held since February 2008. At these meetings, representatives from disparate organizations, sometimes with conflicting opinions on water resources topics or representing very different areas within the larger region, come together to discuss IRWM and the future of water management in the Inyo-Mono region. It is expected that dialogue that takes place at the meeting will be transparent, open, and respectful. As a result of these ongoing meetings, water-related stakeholders that had not previously known each other now communicate about their needs and seek assistance from one another. For example, smaller water districts in the planning region have recognized that they can learn and draw experience from larger water districts, and in turn, larger districts have been willing to lend assistance. Another result of these ongoing meetings is that RWMG participants, while recognizing differences, have found that they share many common interests and concerns with respect to water and the challenges that stem from living in a rural, remote region. This commonality has created a larger sense of obligation and commitment to the planning process among the Members.

Integration of resources has also taken place through the sharing of information within the RWMG and on the Inyo-Mono website. At each RWMG meeting, there is an agenda item for announcements. This opportunity is utilized by RWMG Members and participants to share information about recent or upcoming events, current practices/efforts of their organization, and general water-related news relevant to the region. These announcements are captured in the meeting notes, which are shared with the entire RWMG contact list and are available on the website.

With the development of the upgraded website, capacity has been added for housing and sharing information and data. One goal of the Inyo-Mono website is to become a storehouse for relevant documents and information. The first example of achieving this goal is the creation of a documents library, which was used for the analysis of relevant planning documents in Chapter 11 and has now become an online resource for all interested users (http://inyo-monowater.org/resources/library/). The library is organized by geographical scale (i.e., federal, state, regional, etc.), and each document listed is hyper-linked to a PDF or a website where the document can be found. Another example is the combining of data and data sources discussed in Chapter 4. This effort is still in the early stages, but it is anticipated that this collecting and sharing of data sources will benefit many stakeholders in the region. Finally, the development of Geographic Information System capacity within the Inyo-Mono IRWM Program has greatly increased the integration and sharing of information. It is now possible to perform analyses and create depictions of large amounts of data in a user-friendly format. This capacity is enhanced by the inclusion of static maps and dynamic mapping tools on the Inyo-Mono website. Users can download individual maps or work within interactive mapping platforms to find the information they need (http://inyo-monowater.org/maps/). It is expected that the continued improvement of technology will allow for increasingly integrated efforts and the creation of additional tools to enhance water planning in the region.

It has been acknowledged by the RWMG that "integration" is a difficult concept to implement in a region as large and diverse as the Inyo-Mono. Some RWMG Members have argued that it is impossible to integrate stakeholders and processes from the northern part of the region with those in the southern reaches, or to integrate processes from the high-elevation mountains with the low-elevation deserts. Yet we know that there are common water issues and concerns throughout the region, as described earlier in this chapter. This hesitance to fully embrace the concept of integration has resulted in Members pursuing their own water projects in isolation, despite their participation in the larger RWMG. The goal moving forward is to begin to consider opportunities to integrate projects either by geography, by topic (e.g., water quality, aging infrastructure, etc.), or by Inyo-Mono objectives and/or resource management strategies (see Chapter 7), and to take advantage of the many potential benefits created by agencies and organizations working together in a collaborative manner.

1.8 Plan Development and Updating

1.8.1 Phase I vs. Phase II Plan and Updates

When the Inyo-Mono IRWM Program was initiated in early 2008, the RWMG intended to submit a Prop. 84 Planning Grant application to DWR in late 2008 or early 2009. Because of the budget constraints and the bond freeze in late 2008, the RWMG was not able to fulfill that goal. Instead, the RWMG decided to begin work on an initial Plan, without planning grant funds, so that it could be eligible for the first round of Prop. 84 Implementation grants. While all Prop. 84 Plan Standards were at least minimally addressed in the Phase I Plan, the RWMG desired to have an opportunity to more fully consider each Plan Standard and revise the Plan as necessary. The Phase I IRWM Plan was adopted in December 2010, just ahead of the Round 1 Implementation Grant deadline.

The Round 1 Planning Grant application focused on revising the Inyo-Mono Plan to be more comprehensive and to more fully meet the Prop. 84 IRWM Plan Standards. This document is largely a result of the 17 months of Round 1 Planning Grant work and is considered the Phase II

Plan. Updated Prop. 84 IRWM Program Guidelines and Plan Standards were released in 2012, and the Round 2 Planning Grant application was submitted and awarded based on the expectation that the Plan would be updated to meet the revised standards. Subsequently, DWR determined that in order to be eligible to continue receiving funds through Prop. 84 Implementation Grants, IRWM Plans would need to immediately be updated to 2012 Plan Standards. The Inyo-Mono IRWM Plan was updated in 2014 with the aim of quickly and adequately meeting 2012 Plan Standards. The current document is an update to meet 2016 Plan Standards ahead of receiving Prop. 1 Implementation funding.

1.8.2 Future Plan Revisions

The Inyo-Mono IRWM Plan will opened for revisions and updates as necessary every two years, beginning two years after the adoption of the Phase II Plan. The full process for revising and adding projects to the Inyo-Mono IRWM Plan is discussed in detail in Chapter 5.

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Chapter 2 : Region Description

2.1 Overview and Boundaries

The Inyo-Mono IRWM planning region is not exactly what most Americans picture when they think of California. Located east of the Sierra Nevada, the region is isolated from the population, economic activity, politics, and even precipitation of much of California. The region is characterized by very low population density compared to most of the state and vast open spaces. Except for the steep mountain front immediately east of the Sierra Nevada crest, the region is arid, with portions classified as hyper-arid. However, snowmelt runoff from the Sierra Nevada flows into some parts of the region with little direct precipitation. Water from the three largest rivers of the region is largely exported to Nevada and southern California. Consequently, limited water supplies as well as a low proportion of private land ownership have constrained local land use and human settlement. The towns and communities of the region are located either where water was available or where some other exploitable resource outweighed concerns about water supply. Many of the small water systems serving communities of the region suffer from "dis-economies of small-scale" where the tiny customer base is insufficient to meet basic technical, financial and managerial needs to maintain the system. Limited economic opportunities, particularly in tribal communities, further compound the difficulties of building and operating residential water delivery systems to a standard that most Californians take for granted.

Diversity is a key descriptor of the physical geography of the Inyo-Mono IRWM planning region. The area includes the topographically highest and lowest points of California (and the contiguous United States), places with the highest summer temperatures in the country (Death Valley) and occasionally the lowest winter temperatures in the country (Bodie), deep winter snowpacks along the Sierra Nevada crest, and entire years without rainfall in some of the desert portions. These extremes are within a couple of hundred miles of each other.

2.1.1 Explanation of Regional IRWM Boundary

The Inyo-Mono IRWM planning region covers a large area of the central California portion of the western Great Basin. The planning region consists of several large watersheds with internal drainage and no natural outlet to an ocean. The principal river basins or watersheds of the planning area include (from north to south): West Walker River, East Walker River, Mono Basin, Owens River, Amargosa River and Death Valley, Panamint Valley, and Indian Wells Valley. Several other closed basins are included in the southern portion of the planning area.

The vast area of the Inyo-Mono planning region (about 11 percent of California's total area) seemed acceptable when initially determining the extent of the region. Besides the geographic position as the western portion of the Great Basin, the region's residents have long self-identified their home as "the eastern Sierra" or "eastern California". Because of their common geographic isolation away from the larger cities and urban areas of California, Mono and Inyo Counties have developed a regional identity. This "eastern Sierra Nevada" region is well established in a variety of matters such as economic interdependencies, logistics for regional transportation, practicalities for recreation, marketing for tourism, public lands administration, and export of water. In addition, hydrologic boundaries were an obvious determining factor for including the principal watersheds that drain the east side of the Sierra Nevada south of the Carson River basin (which was previously included in the Tahoe-Sierra planning region). The geographical extent of Inyo County into the northern Mojave Desert led to inclusion of several large closed basins wholly or partially within Inyo County. In turn, the watershed boundaries of those basins required including small portions of Kern and San Bernardino counties.

The hydrologic linkages and similar water issues throughout the region enable many opportunities for integrated approaches to water resources management. Indeed, we are learning that what DWR has termed the "maximum opportunity for integration" may occur at the level of county government. Both Inyo and Mono Counties may hold the key to facilitating technical, managerial, and financial assistance to the economically disadvantaged as well as tiny communities throughout the planning region.

Boundaries of the Inyo-Mono IRWM planning region enclose Inyo and Mono Counties, northern portions of San Bernardino County and the northeastern corner of Kern County (Figure 1-1). In the northwest, the Inyo-Mono IRWM planning region boundary follows the divide between Alpine and Mono county jurisdictions. On the western edge, the Inyo-Mono IRWM regional boundary follows the crest of the Sierra Nevada and jurisdictional borders of Mono and Inyo Counties with Tuolumne, Mariposa, Madera, Fresno, Tulare and Kern counties. The southwestern boundary also follows the crest of the Sierra Nevada in Inyo County plus a small portion of Kern County. To the south and southeast, the planning region follows watershed boundaries that share more common water resource issues with Inyo County than with other watersheds in Kern and San Bernardino counties. These watersheds include Indian Wells, Searles, Upper Amargosa, Death Valley/Lower Amargosa, Pahrump-Ivanpah, and Panamint Valleys. The east side of the planning area follows the California-Nevada state line. The Nevada side of the watersheds shared by California and Nevada is recognized as an area sharing water resources issues with the Inyo-Mono IRWM planning region and is included in the Inyo-Mono IRWM planning area as an "Area of Interest." Thus, within California, except for the southern boundary where watersheds extend into Kern and San Bernardino Counties, the Inyo-Mono IRWM planning region boundaries are delineated by both watershed and jurisdictional lines. The planning region is wholly contained within the Regional Water Quality Control Board Region 6 (Lahontan) boundaries. Because there is no way to adequately summarize the Water Quality

Control Plan for the Lahontan Region (2005) in this document, it is incorporated by reference (http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml).

Inyo County, which makes up most of the Inyo-Mono planning region, is the second largest county in California in total area (10,140 square miles) but has a comparatively small population of about 18,550. Mono County covers approximately 3,100 square miles and has a population of about 14,200 (2010 Census). The region is generally rural and sparsely settled with residents concentrated in and around communities such as Bishop, Ridgecrest, Independence, Big Pine, Lone Pine, Bridgeport, June Lake, and Mammoth Lakes. Primary land uses include livestock grazing (mostly on federally-owned and City of Los Angeles-owned lands), agriculture, and recreation. With the possible exception of industrial-scale solar power development, few major changes in land use and a population growth rate much less than that of the state average are anticipated over this plan's twenty-year planning horizon.

2.1.2 Neighboring / Overlapping IRWM Region Boundaries

Several IRWM planning groups adjoin (or nearly adjoin) the Inyo-Mono region on the west side of the crest of the Sierra Nevada (north to south: Stanislaus–Tuolumne, Yosemite-Mariposa, Madera, Southern Sierra, and Kern County). The Tahoe-Sierra IRWM planning region meets the northern extent of the Inyo–Mono region along the watershed divide between the Carson and Walker river basins. The Mokelumne–Amador–Calaveras IRWM planning region does not share a boundary with the Inyo–Mono IRWM region, but it is close to the northern part of our region. The Mojave IRWM planning region and Inyo–Mono IRWM region share a portion of the Indian Wells–Searles basin within northern San Bernardino County. The Antelope Valley IRWM planning region is within 20 miles of the southern extent of the Inyo–Mono IRWM region in Kern County. The Fremont Basin IRWM planning region was recently formed and shares part of the southern border of the Inyo-Mono planning region. The geographic relationships of the neighboring IRWM regions with the Inyo–Mono IRWM region are illustrated in Figure 1-1.

Most of the neighboring IRWM regions have adopted plans several years ago and have updated those plans at least once. Inyo-Mono Program staff has kept in touch with members of neighboring groups through informal contacts as well as at the Sierra Water Summit and DWR conferences. Instead of providing a snapshot of neighboring efforts as of 2019, links to the primary websites of neighboring IRWM groups are available Table 2-1 below.

Table 2-1: Links to neighboring region websites

Links to neighboring regions *(arrayed from north to south)*	
Tahoe-Sierra	http://tahoesierrairwm.com/
Mokelumne–Amador–Calaveras	http://www.umrwa.org/irwm.html
Tuolumne- Stanislaus	https://tstan-irwma.org/
Yosemite-Mariposa	https://mcrcd.sharepoint.com/Documents/_Y-M%20IRWM%20Plan_07-14%20-%20Part%201%20of%203.pdf
Madera	http://www.maderacountywater.com/regional-water-management-group/

Southern Sierra	http://www.southernsierrarwmg.org/
Kern County	http://www.kernirwmp.com/
Fremont Basin	https://www.californiacity-ca.gov/CC/index.php/fremont-basin-irwm
Mojave	http://www.mywaterplan.com/
Antelope Valley	http://www.avwaterplan.org/

2.1.3 Description of Watersheds, Groundwater Basins and Water Systems

Major drainage systems in the region are the Walker, Owens, and Amargosa river systems. The Walker River system flows from the eastern slope of the Sierra Nevada into Nevada where it terminates at Walker Lake. Prior to the construction of the Los Angeles Aqueduct, the Owens River historically terminated at Owens Lake; presently, the Los Angeles Aqueduct is the sole means by which runoff from the region can drain to the Pacific Ocean. The headwaters of the Amargosa River are in Nevada, from which it flows into California, terminating in Death Valley. Numerous other internally drained basins exist wholly or mostly within the region, including Mono, Saline, Eureka, Deep Springs, Indian Wells, Panamint, and Searles Valleys. Naturally occurring perennial lakes are uncommon except at high elevations in the Sierra Nevada and in the adjacent valleys receiving runoff from the eastern slope of the Sierra Nevada. The largest natural lake in the region is Mono Lake. Historically, a large lake existed at Owens Lake; however, irrigation for agriculture, drought, and diversions from tributaries to the Owens River and the Owens River itself resulted in the lake declining to a small brine pool in the 1920s and 1930s. Surface water is rare and ephemeral in the arid desert basins south and east of Owens Valley.

The Inyo-Mono IRWM region is comprised of 12-18 large hydrographic units or major watersheds, depending on how certain basins are lumped together in the watershed-delineation schemes of the U.S. Geological Survey and Calwater (Tables 2-2, 2-3, and 2-4). The Calwater basins are illustrated in Figure 1-1.

Table 2-2: Inyo-Mono IRWM region watersheds based on USGS HUC designation

USGS Hydrologic Unit Code	Watershed Name
16050301	East Walker
16050302	West Walker
16060010	Fish Lake – Soda Springs Valleys
18090101	Mono Lake
18090102	Crowley Lake
18090103	Owens Lake
18090201	Eureka - Saline Valleys
18090202	Upper Amargosa

18090203	Death Valley - Lower Amargosa
18090204	Panamint Valley
18090205	Indian Wells - Searles Valleys
16060015	Ivanpah - Pahrump Valleys

Table 2-3: Inyo-Mono IRWM region watersheds based on Calwater designation

Calwater Code	Watershed Name	Calwater Code	Watershed Name
121 8630	East Walker River	142 9609	Amargosa
122 8631	West Walker River	143 9610	Pahrump
134 9601	Mono	144 9611	Mesquite
135 9602	Adobe	146 9613	Owlshead
136 9603	Owens	153 9620	Ballarat
137 9604	Fish Lake	154 9621	Trona
138 9605	Deep Springs	155 9622	Coso
139 9606	Eureka	156 9623	Upper Cactus
140 9607	Saline	157 9624	Indian Wells
141 9608	Race Track		

Table 2-4: Correspondence between USGS and Calwater naming conventions

USGS HUC	Calwater
East Walker	East Walker River
West Walker	West Walker River
Fish Lake – Soda Springs	Fish Lake
Mono Lake	Mono
Mono Lake	Adobe
Crowley Lake	Owens
Owens Lake	Owens
Eureka-Saline	Deep Springs
Eureka-Saline	Eureka
Eureka-Saline	Saline
Eureka-Saline	Racetrack
Upper Amargosa	Amargosa
Death Valley – Lower Amargosa	Amargosa
Death Valley – Lower Amargosa	Owlshead

Panamint Valley	Ballarat
Indian Wells – Searles	Trona
Indian Wells – Searles	Coso
Indian Wells – Searles	Upper Cactus
Indian Wells – Searles	Indian Wells
Ivanpah - Pahrump	Pahrump
Ivanpah - Pahrump	Mesquite

The only hydrographic units that are not entirely included in the IRWM planning region are those that cross the Nevada border. The other units are fully contained in the planning region and largely define the rationale for the extent of the planning region. Although the inclusion of areas in southeast Inyo County, northern San Bernardino County, and northeastern Kern County was debated due to the remote nature of the region, it was decided by the RWMG that it was logical to include all of Inyo County yet still make the boundary watershed-based (thus including parts of San Bernardino and Kern Counties). These watersheds include Indian Wells Valley, Searles, Upper Amargosa, Death Valley/Lower Amargosa, Pahrump-Ivanpah, and Panamint Valley. A similar debate and resolution occurred for the northern part of the region in the East Walker River and West Walker River units.

The Inyo-Mono IRWM planning region not only reflects watershed boundaries but areas of common water management history and interest as well. All the water in the western portion of our region, east of the Sierra Nevada crest, flows east into water bodies that are important for fisheries, stream habitat, recreation, and water supply for communities in Nevada, southern California, and the planning region itself. The watersheds in the south of the planning region share common issues such as low population density, rural water management, large tracts of federal land, an arid climate, and complex topography. One of the larger hydrographic units in the planning region is the Owens, which spans two counties and provides water to the Los Angeles Aqueduct (LAA) and the four million residents of Los Angeles. Through the Los Angeles Department of Water and Power (LADWP), the City of Los Angeles is one of the participants in Inyo-Mono RWMG meetings, but is not yet a signatory to the IRWM group. The Inyo-Mono IRWM region boundaries include all water-related infrastructure associated with the source waters of the LAA.

Numerous groundwater basins underlie the region, and include Antelope Valley, Bridgeport Valley, Mono Basin, Long Valley, Owens Valley, Mojave, Indian Wells and Searles Valleys, and California Valley Groundwater Basins. California DWR Bulletin 118 groundwater basin areas are shown on Figure 2-1 and listed in Table 2-4. Inyo and Mono Counties have not adopted Groundwater Management Plans, which use existing government bodies and authorities to proactively monitor and manage groundwater resource issues. Instead, the counties have groundwater ordinances in place, which employ land-use planning and police powers of locally elected county boards to manage groundwater resources. Inyo County has a groundwater management agreement with the City of Los Angeles. The Mammoth Community Water District completed a groundwater management plan for the Mammoth Basin watershed in July 2005. More recent efforts responding to the California Statewide Groundwater Elevation Monitoring (CASGEM) requirements are discussed in Chapter 4.

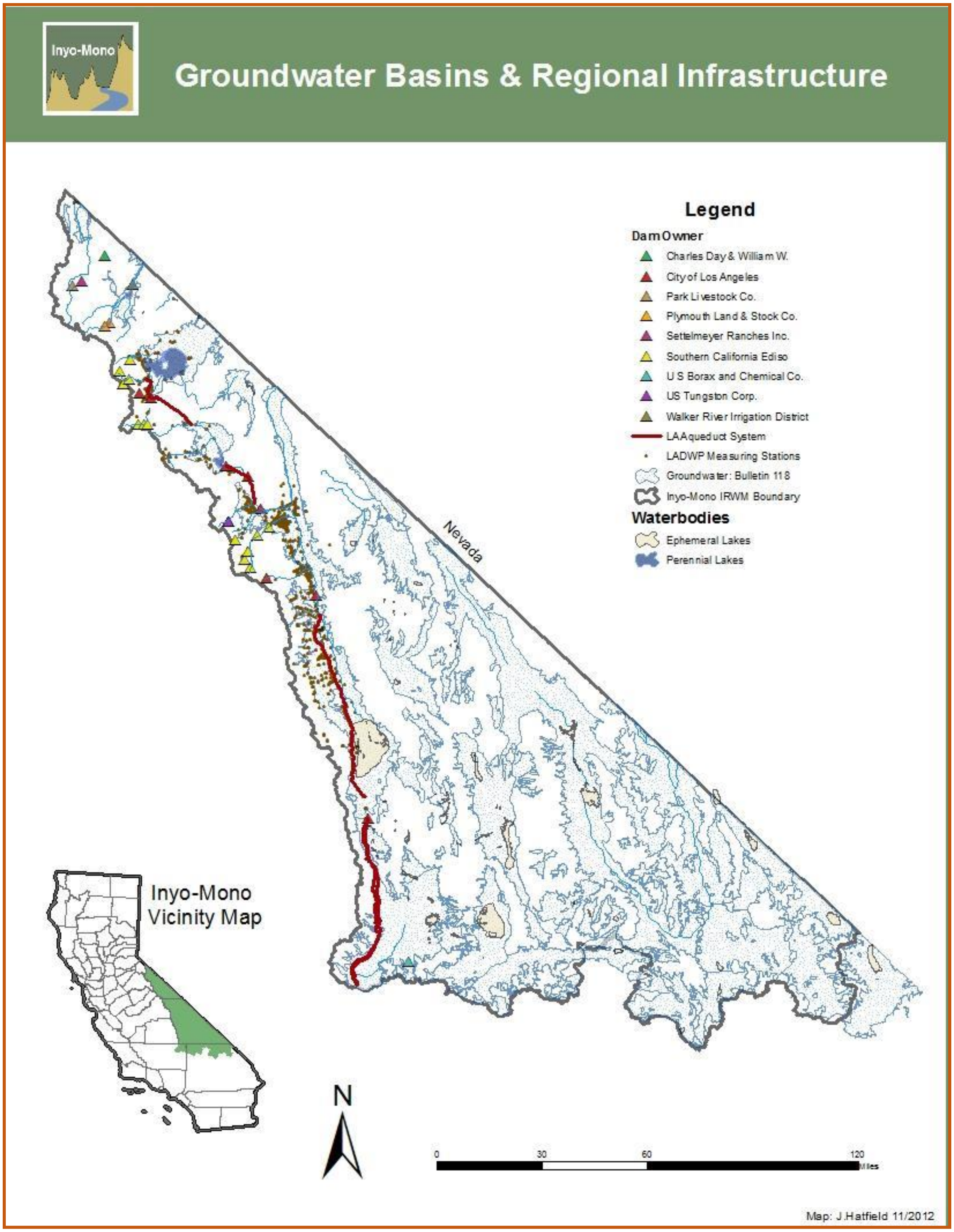
The Inyo-Mono region became involved in California's Sustainable Groundwater Management Act (SGMA) processes in 2015 and prepared a report in anticipation of SGMA work in the region (Kattelmann, 2015) and included as an appendix to this plan.

Table 2-5: DWR Bulletin 118 Groundwater basins in the Inyo-Mono planning region

Basin Number	Basin Name	Basin Number	Basin Name
6-7	Antelope Valley	6-55	Coso Valley
6-8	Bridgeport Valley	6-56	Rose Valley
6-9	Mono Valley	6-57	Darwin Valley
6-10	Adobe Lake Valley	6-58	Panamint Valley
6-11	Long Valley	6-61	Cameo Area
6-12	Owens Valley	6-62	Race Track Valley
6-13	Black Springs Valley	6-63	Hidden Valley
6-14	Fish Lake Valley	6-64	Marble Canyon Area
6-15	Deep Springs Valley	6-65	Cottonwood Spring Area
6-16	Eureka Valley	6-66	Lee Flat
6-17	Saline Valley	6-68	Santa Rosa Flat
6-18	Death Valley	6-70	Cactus Flat
6-19	Wingate Valley	6-71	Lost Lake Valley
6-20	Middle Amargosa Valley	6-72	Coles Flat
6-21	Lower Kingston Valley	6-73	Wild Horse Mesa Area
6-22	Upper Kingston Valley	6-74	Harrisburg Flats
6-23	Riggs Valley	6-75	Wildrose Canyon
6-24	Red Pass Valley	6-76	Brown Mountain Valley
6-25	Bicycle Valley	6-77	Grass Valley
6-26	Avawatz Valley	6-78	Denning Spring Valley
6-27	Leach Valley	6-79	California Valley
6-28	Pahrump Valley	6-80	Middle Park Canyon
6-29	Mesquite Valley	6-81	Butte Valley
6-30	Ivanpah Valley	6-82	Spring Canyon Valley

Basin Number	Basin Name	Basin Number	Basin Name
6-34	Silver Lake Valley	6-84	Greenwater Valley
6-35	Cronise Valley	6-85	Gold Valley
6-49	Superior Valley	6-86	Rhodes Hill Area
6-50	Cuddeback Valley	6-88	Owl Lake Valley
6-51	Pilot Knob Valley	6-105	Slinkard Valley
6-52	Searles Valley	6-106	Little Antelope Valley
6-53	Salt Wells Valley	6-107	Sweetwater Flat
6-54	Indian Wells Valley		

Figure 2-1: DWR Bulletin 118 groundwater basins of the planning region



2.1.4 Major Water Systems

Water storage and transfers in the Inyo-Mono IRWM planning area are dominated by the Los Angeles (LA) Aqueduct system. All other water engineering within the area is minor by comparison. The project involves extensive infrastructure (Figure 2-1) and vast land holdings (Figure 2-2). Major components of the Los Angeles Department of Water and Power (LADWP) water export and power generation system include a series of diversions and a tunnel for exporting water from the Mono Basin to the Owens River headwaters; the Crowley Lake reservoir in Long Valley; diversions in the Owens River Gorge for power generation; hydropower generation on Big Pine, Division, and Cottonwood Creeks; the Tinemaha, Pleasant Valley, and Haiwee Reservoirs; extensive groundwater pumping capacity; and the Los Angeles Aqueduct (Figure 2-1). Los Angeles' land and water ownership and extensive infrastructure along the east slope of the Sierra link many water management issues in the Inyo-Mono IRWM planning region.

Within the Mono Basin, the LADWP constructed diversion works on the main tributaries to Mono Lake (except for Mill Creek), a dam creating Grant Lake, and a tunnel to the Upper Owens watershed. Diversions out of the Mono Basin began in 1941 and greatly increased following completion of the second aqueduct in the Owens Valley in 1970. Diversions were halted by court order from 1989 to 1994. Starting in 1995, diversions up to 16,000 acre-feet per year resumed under California State Water Resources Control Board Decision 1631

Southern California Edison operates a series of dams and powerhouses on Mill Creek, Lee Vining Creek, Rush Creek, and Bishop Creek. The Mammoth Community Water District diverts surface water from Mammoth Creek when daily flow exceeds SWRCB habitat requirements. MCWD pumps groundwater within the community to meet demand when surface water is insufficient.

In the upper Owens River watershed (commonly defined as upstream of the Owens Gorge), Crowley Lake was created by construction of Long Valley dam in the early 1940s. The reservoir is the main storage within the LA Aqueduct system and has a capacity of 183,000 acre-feet. At the other end of the Owens Gorge, Pleasant Valley Reservoir was built in 1955 to modulate flows released from the hydroelectric facilities in the Owens Gorge. This reservoir can store up to 3,825 acre-feet.

Combined water exports from the Owens Valley to Los Angeles vary greatly from year to year, with an average of about 363,000 acre-feet per year between 1970 and 2009 (LADWP, 2009). Over the past decade, the average export amount has dropped to about 211,000 AF (based on planned operations from annual reports, such as LADWP, 2019). Since the dry period of 1987 to 1992, exports have been well below that average in most years. Between 2000 and 2011, export volumes have been as low as 110,000 AF in 2007 and above the 40-year average in 2005, 2006, and 2011 (Harrington, 2009; LADWP, 2011a).

LADWP provides water for different uses within the Owens Valley such as irrigation, livestock watering, recreation, wildlife, environmental enhancement and mitigation (with respect to groundwater pumping) projects, the Lower Owens River Project, and an extensive dust abatement project on the Owens Lake playa that currently relies heavily on shallow flooding to control dust. Water use by LADWP within the Owens Valley in the 2011-12 runoff year was estimated to be 202,000 AF (LADWP, 2011a). In 2019, LADWP planned to use 17,400 AF for the Lower Owens River Project, 10,700 AF for enhancement and mitigation projects, and 7,900 AF for recreation and wildlife (LADWP, 2019). An estimate was not available for Owens Lake dust abatement in the 2019 report.

At the northern end of the Inyo-Mono IRWM region, both the West Walker and East Walker Rivers have been developed for irrigation. Stream diversions, canals, and distribution ditches have irrigated Antelope and Bridgeport valleys for more than a century. In the 1920s, the Walker River Irrigation District constructed reservoirs on both the West Walker and East Walker Rivers. Although water stored in Topaz and Bridgeport reservoirs is exported from the stateline-defined watersheds included for the Inyo-Mono IRWM planning area, that water is applied to irrigation within the Walker River Basin, downstream of the state border in Nevada.

2.1.5 Description of Internal Boundaries

Political Boundaries

The Inyo-Mono IRWM region includes Inyo and Mono counties in their entirety and small portions of Kern and San Bernardino counties (Figure 1-1). Ridgecrest, Bishop, and Mammoth Lakes are the only incorporated cities or towns in the region and have residential populations of about 29,000; 3,900; and 8,200; respectively.

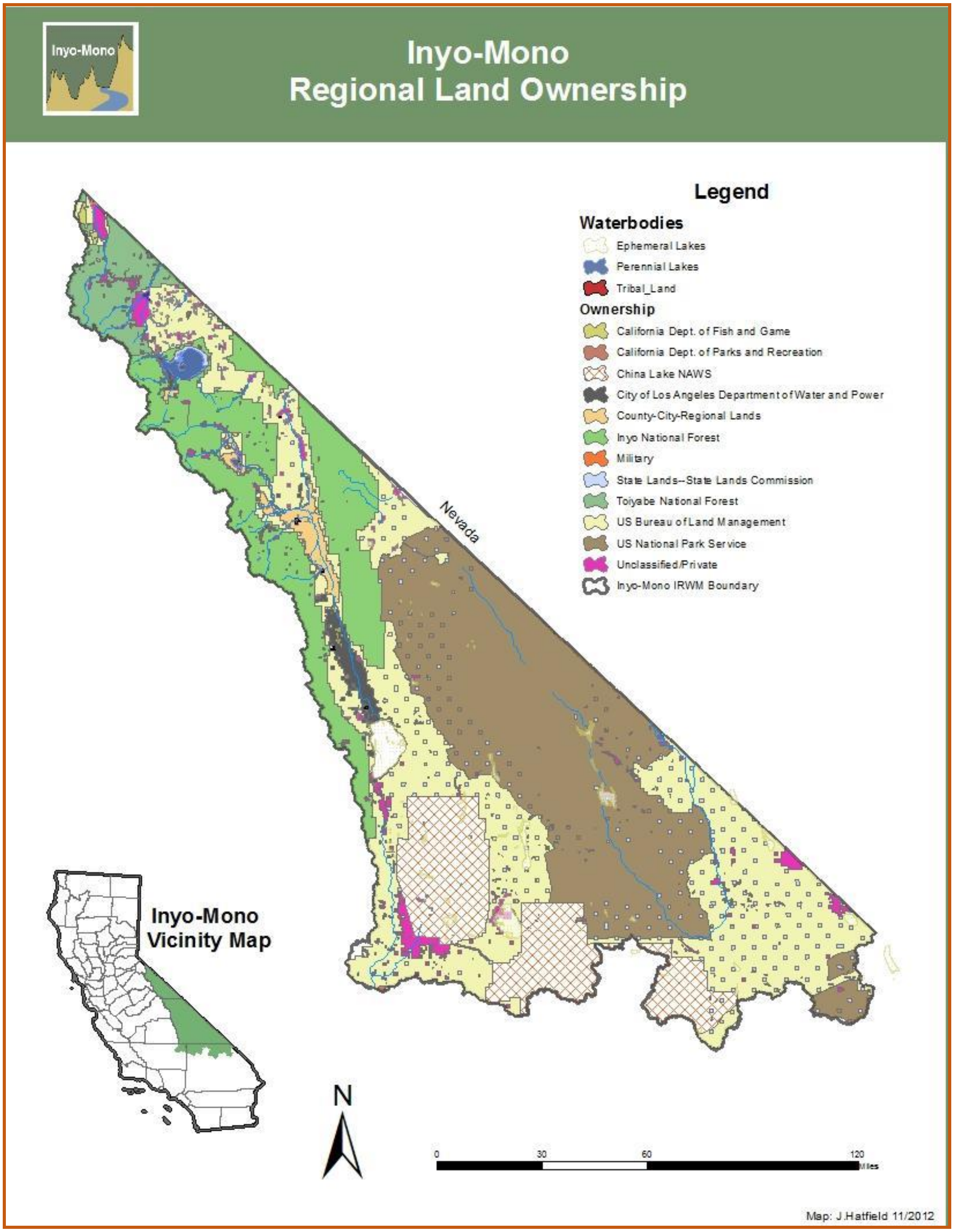
Land Ownership and Administrative Boundaries

Almost all the Inyo-Mono IRWM region is public land administered by agencies including USDI-Bureau of Land Management, USDI-National Park Service, USDA-Forest Service, Department of Defense, Los Angeles Department of Water and Power, California State Lands Commission, California Department of Fish and Wildlife, and California Department of Parks and Recreation. Compared to other parts of California, there is remarkably little private or tribal land. The general ownership patterns are illustrated in Figure 2-2. Figure 2-2 also shows the locations of the two cities (Ridgecrest and Bishop), one town (Mammoth Lakes), and some of the small communities (north to south: Coleville, Bridgeport, Lee Vining, Benton, Tom's Place, Laws, Big Pine, Independence, Lone Pine, Keeler, Death Valley, Cartago, Olancha, Shoshone, Tecopa, Trona, and Inyokern).

Several dozen small water districts and other water purveyors (if aggregated) cover less than one percent of the area of the Inyo-Mono IRWM region (Figure 2-1). Most of these entities have considerable financial and operational difficulties related to their small scale and modest customer base. The Indian Wells Water District dwarfs the other districts in size and population served (approximately 30,000 people). The Mammoth Community Water District and the Indian

Wells Valley Water District are the only two urban water management districts (serving more than 3,000 connections) in the region.

Figure 2-2: Land ownership of the Inyo-Mono planning region



2.2 Descriptive Geography

With respect to climate and hydrology, the Inyo-Mono region can be split into two broad zones: eastern Sierra Nevada and northern Mojave Desert. Much of the description that follows in this section generalizes conditions within these two zones. The northern part of the Inyo-Mono region (West Walker, East Walker, Mono, and Owens watersheds) is the eastern Sierra Nevada zone. The southern and southeastern portions of the planning area (Indian Wells Valley, Searles, Upper Amargosa, Death Valley/Lower Amargosa, Pahrump-Ivanpah, and Panamint Valley watersheds) are the northern Mojave Desert zone. Largely because of the far-greater availability of water resources in the eastern Sierra Nevada zone, there is a correspondingly greater amount of information available for the watersheds in the eastern Sierra Nevada zone than those in the northern Mojave Desert zone.

Much of the otherwise uncited information in this section is excerpted from assessments of four watersheds in Mono County (Kattelmann, 2007a, 2007b, 2007c; Kattelmann and Johnson, 2012). Because of these sources, there is an obvious bias toward Mono County. This bias results simply from the availability of information. The comparatively small amount of relevant information about the northern Mojave Desert portion of the planning area is reflected in the small proportion of text devoted to the southern area.

2.2.1 Climate and Potential for Climatic Change

The climate of a region can be considered to be the "average" weather as well as the extremes over some period of time. We are usually limited to the historical period and then often only a few decades during which some systematic measurements of precipitation and temperature were made and recorded. The term "normal" is a convention that typically includes only the past 30 years, although within the region, the Los Angeles Department of Water and Power uses a 50 year average. Similar to the warnings that accompany a financial investment prospectus, we should remember that past climate is no guarantee of future conditions. Nevertheless, recent climate is the best indicator we have of what to expect in the near future. Where inferences are available regarding prehistoric climate, such information is valuable to suggest the range of extremes that are possible in a given region.

Most of the eastern Sierra Nevada region is subject to the Mediterranean-type climate of California, characterized by wet, cool winters and warm, dry summers, and is subject to the orographic rain-shadow effect of being on the lee side of the Sierra Nevada with respect to the prevailing southwest-to-northeast storm direction. An exception to the general rain-shadow pattern occurs when small storms travel south from eastern Oregon into Nevada and then produce upslope flow and orographic lifting on the eastern slope of the Sierra Nevada. Storms typically begin to affect California in October and November and occur at irregular intervals through March in most years. An average of 15 to 20 discrete storms affects central California each winter. Intervals of clear, cool weather lasting one to several days separate these storms, although an extended dry period of three to six weeks occurs in many winters. December, January, and February tend to be the months of greatest precipitation. Storm frequency and intensity typically decrease in April and May, although a few significant storms can occur during the spring. Rain/snow levels of 5,000 to 7,000 feet are typical for most winter storms. The amount of precipitation has been highly variable from storm to storm and from year to year. The term “atmospheric river” has become popular recently, even though the concept has been well known by meteorologists for decades. Storms with so-called atmospheric rivers are a significant influence on the Inyo-Mono region and can account for large proportions of the total precipitation in some winters.

Summers tend to be dry and warm because of the dominance of high pressure and the absence of a storm track through California during the summer months. Convective thunderstorms occasionally develop when adequate moisture enters the region. When the "Arizona monsoon" pattern delivers moist air far enough west and north, significant thunderstorms can occur each afternoon and evening for several days at a time in the eastern Sierra Nevada.

Precipitation is greatest in the headwater areas just east of the Sierra Nevada crest. There is a steeply declining gradient in precipitation with distance east from the crest. This rain-shadow effect is largely due to the descent of air in the lee of the crest, which causes warming and evaporation of clouds (Powell and Klieforth, 2000). The areas immediately east of the crest also benefit from wind-driven carryover of precipitation that resulted from the lifting and cooling on the west side of the Sierra Nevada and some wind transport of snow initially deposited west of the crest. Precipitation increases again as air rises up the various ranges on the western edge of the Basin and Range geologic province (*e.g.,* Sweetwater Mountains, Bodie Hills, Glass Mountains, White-Inyo Mountains).

Annual precipitation measured at a few automated sites and inferred from snowpack measurements has mean values exceeding 30 inches per year above 9,000 feet in the Sierra Nevada and tends to decline from north to south. Annual precipitation amounts decline rapidly to the east of the crest with average amounts of 8 to 12 inches in Antelope Valley, 9 inches at Bridgeport, 8 to 15 inches around Mono Lake, 10 inches at Long Valley Dam, and 5 inches at Bishop.

The water equivalence of the snowpack (the depth of water at a point if the snowpack is melted) is measured at about 400 locations throughout the snow zone of California by the Department of Water Resources and cooperating agencies. These measurements are made near the beginning of each month in the winter to supply data for forecasting the amount of snowmelt runoff in streams between April and July. Measurements taken near the beginning of April have been found to approximate the peak accumulation of the snowpack. On average, storms contribute little additional snowfall after April 1, and snowmelt begins to deplete the water storage of the snowpack in early April. Therefore, the April 1 snow survey measurements have been used in many hydrologic studies as a proxy for the season-long accumulation of precipitation in mountain areas where almost all of the precipitation falls as snow and accumulates throughout the winter (the caveat being that some snow melts and sublimates during the winter, thereby reducing the April 1 snowpack). For example, the Mammoth Pass snow course has a continuous record of 91 years (1928 to current [2019]). The long-term April 1 (peak accumulation) average at this site is 42 inches, with a minimum in 1977 of 8.6 inches and a maximum in 1969 of 86.5 inches. Long-term averages of April 1 snow water equivalence from snow courses in the major river basins range from 17 to 51 inches in the West Walker, 18 to 39 inches in the East Walker, 27 to 34 inches in the Mono Basin, 11 to 42 inches in the Upper Owens, and 10 to 31 inches in the Owens south of Crowley Lake. These values are only indicative of precipitation in the highest portions of the respective watersheds just east of the crest of the Sierra Nevada.

Over the roughly nine decades that snow surveys have been conducted in the eastern Sierra Nevada, at least some of the snow courses show an increase in peak accumulation in recent decades compared to earlier decades. For example, the average of "April 1" snow water equivalence was greater in the second half of the record (28") than the first half of the record (25") at the Tioga Pass snow course in the Lee Vining Creek watershed, which has been measured since 1926.

Following a very wet year in 2011, the region received well-below-average amounts of precipitation during the drought of 2012-2016. The winters of 2017 and 2019 were remarkably wet, with the intervening year of 2018 critically dry except for storms in March that provided more than half of the year's precipitation. The past decade has been a dramatic example of the variability of precipitation in the region.

The northern Mojave desert zone is characterized by minimal rainfall and great variability in what rainfall does occur. The few precipitation measuring stations in the zone show average annual amounts of only a few inches: 2.4 inches at Furnace Creek in Death Valley, 4.1 inches at Trona, 4.8 inches at Inyokern, 6.7 inches at Mojave, and 6.9 inches at Randsburg (source: http://usclimatedata.com). At a U.S. Geological Survey research station in the upper Amargosa watershed (in Nevada, downstream of Beatty), annual precipitation averaged 4.4 inches from 1981 to 2005 and ranged from 0.14 inches to 8.9 inches (Johnson, et al., 2007). Although the bulk of a year's precipitation tends to fall during the winter months, summer thunderstorms can contribute significant quantities of water to isolated areas every few years. In general, summer precipitation tends to be a greater proportion of the annual total in the eastern part of the Mojave zone (Hereford, et al., 2003). The sparse array of precipitation gages cannot capture any indication of the variability of rainfall over the desert zone, but measured rainfall in individual summer seasons varied from 0 to 5 inches (Hereford, et al., 2003). Geomorphic evidence, such as debris flows in some canyons but not adjacent ones, suggests how rainfall exceeding

average yearly amounts can occur in a few hours in small areas. Conversely, several months may pass without any rainfall in a particular area.

Within the Indian Wells Valley watershed, average annual precipitation varies from 5 to 10 inches per year, with less than 5 inches per year in the Ridgecrest/China Lake area and in the El Paso Mountains to the south, up to about 6 inches per year in the Argus Range to the east and the Coso Range to the north, and up to about 10 inches per year in the Sierra Nevada (Indian Wells Valley Water District 2002, cited by Couch, et al., 2003). Most of the precipitation occurs between October and March, with a typical peak in January.

Analysis of all available precipitation records from stations in the Mojave Desert (Hereford, et al., 2003) demonstrated substantial variation throughout the 20th century. There appear to have been some persistent patterns in precipitation during the past century: 1893-1904 was relatively dry, 1905-1941 was relatively wet, 1942-1975 was mostly dry, and 1976-1998 was the wettest portion of the century (Hereford, et al., 2003).

Throughout the region, air temperatures vary markedly both seasonally and daily. There is also considerable variation among years for any given day, making averages a poor descriptor (Howald, 2000a). Records of air temperature are even more limited than those of precipitation or snowpack water storage. The small amounts of water vapor in the air and the absence of large water bodies allow the air temperature to fluctuate greatly between day and night compared to more humid parts of the country.

Data from a few stations within the eastern Sierra Nevada portion of the Inyo-Mono planning area illustrate the general air-temperature regime. Parts of the East Walker River watershed are well-known as cold spots in California. Bridgeport and Bodie are occasionally in the winter-season news as the coldest locations in the nation when the upper Midwest is unusually warm. Over the past century at the Bridgeport climate station, the average annual maximum temperature was 62°F and the average annual minimum temperature was 24°F. The recorded extremes at Bridgeport have been 96°F and -37°F (California Department of Water Resources, 1992). At Bodie, the average annual maximum temperature was 56°F and the average annual minimum temperature was 19°F (Western Regional Climate Center at http://www.wrcc.dri.edu).

The mean temperature at Cain Ranch, the station in the Mono Basin with the longest record of air temperature, from 1931 through 1979, was 43ºF with a maximum of 94ºF and a minimum of -18ºF (LADWP, 1987). Two sites in and near Lee Vining have monitored air temperature for the periods 1950-88 and 1988-2005. The averages from these sites are remarkably close with an average maximum of about 62ºF and an average minimum of about 34ºF (data from Western Regional Climate Center: http://www.wrcc.dri.edu).

A description of air temperatures at Valentine Camp in Mammoth Lakes (Howald, 2000a) provides some insight into the temperature regime of the mid-elevation forest zone. During summer, mean daily maxima ranged between 65°F and 80°F and mean daily minima ranged between 40°F and 50°F. Nighttime low temperatures, especially at ground level, can drop below 32°F at any time of year, although rarely for more than a few hours on even the coldest summer nights. Radiational heat loss in meadows and cold air drainage from surrounding uplands can result in locally low nighttime temperatures. This cold air pooling during periods of low wind is a feature unique to topographically-complex areas. The forest canopy maintains warmer temperatures among the trees. During winter, mean daily maxima ranged between 35°F and 45°F, and mean daily minima ranged between 15°F and 25°F. However, on many winter days, air temperatures do not rise above 32°F. In some winters, minimum air temperatures can drop to about -20°F during outbreaks of polar air (Howald, 2000a).

At the Sierra Nevada Aquatic Research Laboratory on Convict Creek south of Mammoth Lakes, average annual air temperatures from 1988 to 1998 ranged from 40°F to 45°F, with a mean of 43°F. The mean summer air temperature was 59°F, and the mean winter temperature was 19°F. Maximum temperatures in summer ranged from 73°F to 85°F, with summer minimum temperatures between 32°F and 43°F. July and August are typically the only frost-free months, although frost may occur at any time of the year. Winter diurnal temperature fluctuations are less than in summer. Daytime high temperatures ranged from 30°F to 52°F, and nighttime lows ranged from 0°F to 23°F.

Table 2-6: Air temperature (°F) for several stations in the northern Mojave Desert zone

	Monthly Maximum		**Monthly Minimum**		**Annual Average**	
Site	Winter	Summer	Winter	Summer	Maximum	Minimum
Haiwee	**53**	**92**	**30**	**63**	**73**	**46**
Inyokern	**61**	**99**	**32**	**65**	**81**	**47**
Trona	**61**	**102**	**34**	**70**	**81**	**52**
Randsburg	**55**	**96**	**36**	**66**	**75**	**51**
Wildrose RS	**53**	**93**	**31**	**62**	**72**	**45**
Death Valley	**67**	**114**	**41**	**85**	**91**	**62**

***Source*: http://www.wrcc.dri.edu**

Water loss to the atmosphere is a large component of the annual water balance of watersheds in arid environments. Because of low atmospheric humidity, abundant solar radiation, high air temperatures, and moderate wind speeds, there is great potential for large amounts of water to evaporate throughout the Inyo-Mono planning area, especially in the northern Mojave Desert zone. However, water is usually not available to be evaporated; therefore, actual evapotranspiration (evaporation from open water and soils plus transpiration from plants) is a limited fraction of potential evapotranspiration at the watershed scale.

Potential evapotranspiration as estimated from water loss in evaporation pans exceeds 100 inches per year at two sites in the northern Mojave Desert zone. At Mojave from 1948 to 2005, the average water loss is 112 inches per year, with a monthly high in July of 17 inches. At Death Valley from 1961 to 2005, the average annual amount is 140 inches. At this site, the maximum monthly amount is 21 inches in July (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html).

Actual evapotranspiration has been estimated in a few studies within the Inyo-Mono planning area. In the Mammoth Creek watershed, actual evapotranspiration was estimated to average 13 inches over the watershed area (California Department of Water Resources, 1973). In the Mono Basin, Vorster (1985) estimated an average growing season evapotranspiration rate of 24 inches. In the Bridgeport Valley, annual evapotranspiration has been estimated as about 29 inches (Lopes and Allander, 2009). Evapotranspiration in the Antelope Valley area was estimated as 33,000 AF from agriculture and 3,600 AF from phreatophytes (Glancy, 1971).

Significant water loss occurs where water is available, principally from lakes and from phreatophytes (plants with roots accessing the local water table and dependent on groundwater). Evaporation from the larger natural lakes in the Inyo-Mono planning area has been estimated in a few studies. Open water evaporation from Mono Lake was estimated at about 40-45 inches per year in several studies through the 1960s and at 39 inches per year by the Los Angeles Department of Water and Power (1984). An estimate of 48 inches per year (apparently derived from a 1992 modeling study) was used in an EIR water balance (Jones and Stokes Associates, 1993a: Appendix A). Evaporation from June Lake has been estimated as 38 inches per year (California Department of Water Resources, 1981). Open-water evaporation from lakes above 9,000 feet has been estimated at about 20-25 inches per year, and is limited by ice cover.

Evaporation has also been estimated from some of the region's reservoirs. The average annual total loss at Topaz Lake has been about 69 inches. At Bridgeport Reservoir, with winter ice cover, the average loss has been estimated at 43 inches (Lopes and Allander, 2009). Average annual evaporation from Grant Lake, which also has winter ice cover, has been variously estimated at 26, 36, and 43 inches (Lee, 1969; Los Angeles Department of Water and Power, 1987). Evaporation has been measured by the LADWP at the Long Valley dam during ice-free months with evaporation pans both in the lake and on shore. The pan located on land had an average loss from eight non-freezing months of 41 inches, and the floating pan lost an average of 52 inches over nine non-freezing months (from the same year; Jones and Stokes Associates, 1993a: table 3A-4).

A major study in 2018 and 2019 outside of the region at Lake Powell, conducted by the Desert Research Institute and U.S. Bureau of Reclamation, has potential to improve understanding of evaporation from open water in the Great Basin environment.

Although water managers would like climate and other environmental conditions to remain "stationary" over time so that measurements in the recent past can indicate what to expect in the future, we are well aware that conditions do change over time. Paleohydrologic studies suggest that both severe floods and extended droughts have occurred in the Inyo-Mono planning area and can certainly happen again. In addition to natural climatic variability, human-induced changes in the atmosphere have the potential to alter future climatic conditions in the area.

The most recent glacial advance peaked about 3,000 years ago (Minnich, 2007). Several lines of vegetation evidence also suggest that period was wetter and cooler than periods before and after. The climate also cooled and had relatively high precipitation during the so-called Little Ice Age, between roughly 1300 and 1800 (Minnich, 2007; USDA-Forest Service, 2011).

Evidence of severe and persistent drought in prehistoric times has been found in the northern part of the planning area, indicating periods of 140 to 220 years with very little precipitation (Stine, 1994). Dozens of Jeffrey pine (*Pinus jeffreyi*) stumps are rooted in the main channel of the West Walker River upstream of Walker. These trees could survive in that location only if streamflow was so low that the roots of the trees were not submerged for more than a few weeks each year. Radiocarbon dating of the wood showed that an older group of trees was alive between about AD 900 and 1100 and another set of trees grew in the bottom of the channel between about AD 1210 and 1350 (Stine, 1994). The channel is narrow and stable enough that changes in the location of the channel cannot explain the presence of the stumps. The age of the trees in the West Walker River corresponds to the age of other old stumps found in Tenaya Lake and near Mono Lake, suggesting that dry conditions during the same periods allowed establishment of trees in other locations in the region (Stine, 1994). In modern times, the period of 1928 through 1934 is regarded as an extended drought within the Walker River basin.

Records of streamflow in the Owens Valley since the 1920s allow comparison of flood peaks over time. There appears to be a cluster of relatively extreme events in the 1970s and 1980s (Kattelmann, 1992). Five of the largest eight to eleven snowmelt floods (in terms of volume) occurred from 1978 to 1986. Five of the smallest thirteen or fourteen snowmelt floods occurred from 1987 to 1991. Instantaneous peak flows show similar clustering. For example, in Rock Creek, four of the ten largest annual floods and three of the six smallest annual floods happened in the 1980s. Such events support theories developed by some climatologists that because of an observed shift in hemispheric flow patterns, extreme events are becoming more common in North America.

As global temperatures continue to rise as a result of anthropogenic increases in atmospheric greenhouse gases, changes in the climate of the Sierra Nevada can be expected. A wide variety of reports issued in the past decade suggest regional temperatures will rise, precipitation will decline, there will be more rain and less snowfall, there will be a smaller snowpack, the snowpack will begin to melt earlier, and the snowpack will melt faster. However, the situation and the underlying physical processes are not quite so simple. For example, snowmelt in the Sierra Nevada has surprisingly little direct response to air temperature. Solar radiation input to the snow surface is a far more important factor in energy exchange (and therefore, snowmelt) than processes involving the temperature of the air. Water managers relying on the water resources of the planning area need to anticipate the possibility of changes in climate and hydrology compared to the recent past, but should not assume that the common predictions of less snow are the only reasonable scenario (see also Chapter 3).

Under various global climate change scenarios, California is likely to see average annual temperatures rise by 4°F to 6°F in the next century, assuming actions are taken to reduce emissions of greenhouse gases. If no such changes are made, a “higher-emissions scenario” projects statewide temperature averages in California 7°F to 10.5°F higher. The range of figures comes from two models whose projections were summarized by the Union of Concerned Scientists in 2004. A theory suggests that high-elevation areas, such as the upper portions of the eastern Sierra Nevada, may warm more rapidly than regions as a whole.

The Department of Water Resources estimates that a 3ºF temperature increase could mean an 11% decrease in annual statewide water supply. Under the coolest climate change projections, there could be a loss of about 5 million acre-feet/year in snowpack water statewide. In the eastern Sierra Nevada, the snowpack would not be affected as much as in lower-elevation watersheds of the western slope because most of the heavy snowpack zone in the eastern Sierra Nevada watersheds is at higher elevations (above 8,500 feet) that would still receive mostly snow except under severe warming scenarios. There are also predictions of greater cloudiness in the Sierra Nevada under a warmer climate. However, clouds can either cool an area by blocking sunlight or keep it warm, functioning as a blanket in cold weather. There is uncertainty about how the effects of clouds might play out.

Under various scenarios, it is possible that the glaciers and permanent snowfields of the eastern Sierra Nevada will disappear by mid-century. For example, the Dana Glacier in the headwaters of Lee Vining Creek has already shrunk dramatically since the late 1800s.

Impacts of climate change are already being observed in the region, particularly through increasing precipitation extremes. The past decade alone has seen one of the most pervasive droughts in the region (2012-2016) and three of the wettest winters on record (2010-2011, 2016-2017, 2018-2019). Such extremes influence the primary drivers of the economy of the eastern Sierra – tourism, recreation, and agriculture. Other expected impacts of climate change are summarized below and detailed in Chapter 3.

<u>Water Supply</u>

Surface Water Hydrology

- Direct changes in seasonality and amount of precipitation are still uncertain
- The proportion of rain (vs. snow) falling in winter will increase, particularly at elevations that are currently near the freezing line
- Snowpack amounts will decrease, as will April 1 snow water equivalent
- Snowmelt will occur earlier in the spring, leading to advanced runoff and peak streamflow

- Increased hydrological extremes
- Increased evapotranspiration

Groundwater Hydrology

- Potential impacts are poorly understood
- Changes in snowmelt timing and amount could impact nature of groundwater recharge
- Natural interannual variability resulting from El Nino Southern Oscillation and Pacific Decadal Oscillation may be larger drivers of groundwater recharge
- Increase evapotranspiration will likely decrease the amount of water available for recharge

<u>Water Demand</u>

- Water users are likely to increasingly turn to groundwater as surface water supplies become increasingly variable and possibly scarce
- Longer, warmer summers could increase demand for landscape irrigation
- Demand for water exports may increase as Los Angeles faces uncertain supplies from other sources

<u>Water Quality</u>

- Changes in recreation and grazing practices resulting from climate change could alter timing and amount of pollutants entering regional water bodies
- Changes in streamflow, particularly lower streamflow in the summer, can result in increased water temperature and changes to other aspects important for aquatic ecosystem functioning, such as dissolved oxygen and pH
- Additional groundwater pumping may result in unexpected movement or appearance of contaminants
- One water system has already seen an increase in uranium in its source water as lake levels dropped during the 2012-2016 drought

<u>Flooding</u>

- Increased winter rain can lead to rain-on-snow events, which have proven to have significant impacts in Mammoth Lakes and the Tri-Valley area
- Precipitation extremes (both individual events and runoff from large snowpacks) have resulted in flooding in several Inyo-Mono communities, especially along the 395 corridor
- Changes in monsoonal activity could impact summer flooding occurrence

<u>Terrestrial and Aquatic Ecosystems</u>

- Changes in species' distributions (up or downslope, higher or lower latitudes) will result in novel species assemblages and impacts to ecosystem processes
- Risk of more frequent, larger, and higher-intensity wildfires in the region could lead to

changes in vegetation and stream channels

- Changes in temperature and water availability will stress some species and favor other species
- Changes in hydrology could impact parameters (temperature, dissolved oxygen, pH, turbidity) affecting aquatic and riparian ecosystems

2.2.2 Topography, Geology, and Soils

Topography

The geology and land-forms of the Inyo-Mono IRWM planning area are difficult to characterize because of the diversity of the region. One of the few consistent traits is that the entire region is within the Great Basin – all watersheds have internal drainage with no natural outlets to an ocean. Therefore, there is a sense of hydrologic isolation of each of the component watersheds. This region lacks the natural hydrologic connectivity of IRWM groups organized by river basin. Again, it is useful to separate the region into an eastern Sierra Nevada zone and a northern Mojave Desert zone.

The eastern Sierra Nevada zone spans the border between two major geologic provinces: the Sierra Nevada and the Basin and Range. The earth's crust in this region has been stretched apart, leaving a series of alternating mountain ranges and valleys. The mountain slopes tend to be quite steep with relatively little horizontal distance separating points differing in elevation by thousands of feet. The intervening valleys tend to be comparatively level and are composed mostly of materials eroded from the adjacent mountain slopes.

The crest of the Sierra Nevada is the western edge of the planning area and is largely above 10,000 feet in elevation. The crest includes much terrain above 12,000 feet and a few summits above 14,000 feet. The lowest parts of the crest (8,000 to 9,000 feet) are in the northwestern part of the West Walker River watershed, and the highest elevations are found west of Lone Pine and Big Pine. The steepest slopes in the region tend to be near the crest. At the extreme, small areas of the mountain front are vertical, and many areas along the mountains require technical climbing skills for travel. Slopes trend toward lower gradients with distance from the Sierra Nevada crest.

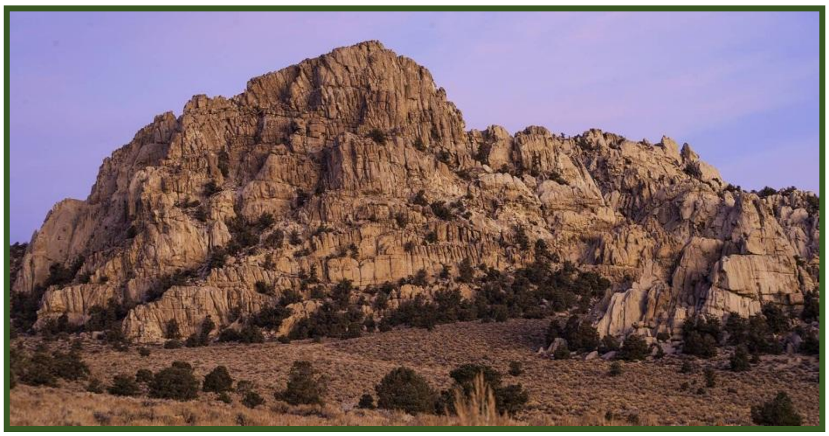
To the east of the Sierra Nevada are several broad valleys: (from north to south) Slinkard Valley (6,550 to 5,750 feet), Antelope Valley (5,600 to 5,000 feet), Bridgeport Valley (6,750 to 6,450 feet), Mono Valley and Mono Lake (6,700 to 6,380 feet), Long Valley (7,000 to 6,750 feet), Round Valley (4,900 to 4,400 feet), and Owens Valley (4,300 to 3,550 feet). There is a second group of intermontane valleys north of Owens Valley: Adobe, Benton, Hammil, and Chalfant.

To the east of the main valleys, the terrain rises in a series of north-south oriented mountain ranges, which are the westernmost ranges of the Basin and Range geologic province. The larger of these ranges include the Sweetwater Mountains, Bodie Hills, Glass Mountains, and White-Inyo Mountains. These ranges also have steep topography and rise to between 10,000 and 14,000 feet.

The northern Mojave Desert zone is also part of the Basin and Range geologic province with steep mountain slopes and broad valleys between the ranges. The principal valleys are Saline Valley, Eureka Valley, Death Valley, Rose Valley, Panamint Valley, and Indian Wells Valley. The eastern slope of the southern Sierra Nevada defines the western extent of this southern zone. Among the main mountain ranges in this part of the Inyo-Mono planning area are the southern portion of the White-Inyo Mountains, Panamint Range, Grapevine Mountains, Funeral Mountains, Argus Range, Black Mountains, Greenwater Range, Slate Mountains, Owlshead Mountains, and Lava Mountains. Telescope Peak in the Panamint Range is the high point at 11,049 feet. Less than 20 miles to the east from Telescope Peak is the lowest topographic point in the nation at Badwater, about 282 feet below sea level.

Geology

The geology of each watershed influences many of the characteristics of water between its entry via precipitation and departure as streamflow or evaporation back into the atmosphere. There may also be a relatively small amount of water that leaves some watersheds as deep groundwater outflow -- obviously influenced by geology as well. Some of the important influences of geology with respect to hydrologic processes include serving as the parent material for soils, which in turn controls whether water remains on the surface or penetrates into the ground; storage and transport of water below the surface; chemical reactions and contributions of chemical substances to the water; potential for erosion and mass movement of soil and rocks; formation and control of stream channels; and substrate for vegetation, which removes much of the water stored in the soil.



Geology of the eastern Sierra Nevada zone is well described in a wide variety of sources (*e.g.,* Hill, 1975; Bailey, et al., 1976; Whitney, 1979; Lipshie, 1979 and 2001; Rinehart, 2003), and only a basic summary that relates to hydrology is included here. This zone occupies the junction of the Sierra Nevada and Basin and Range geologic provinces. The basic form of the main watersheds is a result of the uplift (and tilt to the west) of the Sierra Nevada relative to the valleys lying to the east of the range. The form of the upper Owens River watershed was further determined by the formation of the Long Valley caldera by a massive volcanic eruption about 760,000 years ago (Bailey, et al., 1976). Subsequent volcanic activity, earthquakes, erosion and deposition by glaciers, and stream channel processes have contributed to the present-day landscape. Glacial till from eight to twelve glacial advances covers much of the elevation zone between 6,500 and 8,000 feet near the main creeks from the Sierra Nevada.

A variety of rock types occupies the surface and the subsurface zones of the watersheds. Granitic rock of the Sierra Nevada batholith is exposed along the Sierra Nevada front in many places. Metamorphosed sedimentary and volcanic rocks are found on top of the granitic rock in places where erosion did not reach the granitic rock, such as Laurel, Convict, and McGee creeks. Volcanic rocks such as andesite, basalt, and the rhyolitic Bishop tuff (fused ash from the Long Valley caldera eruption with an average thickness of 500 feet [Gilbert, 1938]) are found above the older metamorphic and granitic rocks as well.

The northern Mojave Desert portion of the planning area is mostly composed of sedimentary and meta-sedimentary rock that formed from sediments deposited in shallow coastal waters and tidal flats. Volcanic activity and intrusive magma added basalts, rhyolites, and granitic rocks in localized areas. About 14 million years ago, the area started to be pulled apart by crustal movements, which resulted in a series of uplifted and tilted mountain ranges with valleys in between.

These various rock types have been further rearranged by the numerous faults in the area. The area beneath the town of Mammoth Lakes is particularly complex: interleaved layers of volcanic materials, glacial till, and stream deposits that are further stirred up by faulting. Volcanic processes have also formed many of the uplands throughout the eastern Sierra Nevada zone, such as the Bodie Hills, Anchorite Hills, Cowtrack Mountains, Glass Mountains, Mono Craters, Volcanic Tablelands, Crater Mountain, and Red Mountain.

The intermontane valleys initially formed as down-dropped fault blocks and subsequently filled with sediment transported from the adjacent mountain ranges. Sediment from glacial erosion, mass movements, surface processes, and channel erosion has filled the valleys to depths of hundreds of feet. The Owens Valley has some areas with up to 7,500 feet of alluvial fill. These sediment-filled depressions contain significant groundwater resources as water has filled the pore space between the sediment particles.

The magnitude 6 earthquake of May, 1980, in Long Valley prompted a great deal of local geological research. Dozens of scientific papers have provided a detailed understanding of the geologic history, structure, and activity of the Long Valley caldera (a roughly elliptical volcanic-tectonic depression measuring 18 miles from east to west and 10 miles from north to south). Some of this work is quite relevant to understanding groundwater storage, movement, chemistry, and interactions with surface flows.

The volcanic activity also creates a geothermal energy resource that is directly tied in with the groundwater system. The heat source for various hot springs, fumaroles, and hydrothermal alteration zones is presumed to originate from magma chambers at depths of a few thousand feet. Groundwater is warmed by heat rising from such areas and by water circulating from deep fractures. The presence of hot water at relatively shallow depths causes problems for municipal/domestic water production that seeks to avoid hot water with a high mineral content but provides the opportunity to extract heat for generation of electricity. The development of geothermal energy near the junction of U.S. Highway 395 and State Route 203 led to the creation of the Long Valley Hydrologic Advisory Committee, a technical group that monitors wells, springs, and streams down-gradient of the geothermal plant for signs of any changes that might be related to the geothermal development. Another large-scale geothermal generating facility is located at Coso, between Haiwee Reservoir and Little Lake.

Over geologic time, hot water circulation has contributed to concentrations of economically valuable minerals in many parts of the planning area. Prospecting for gold and silver occurred almost everywhere except in granitic rocks and lake sediments. Mines around Bodie were the most successful in the region. There were also substantial mining operations in Lundy Canyon, Mammoth Lakes, Onion Valley, Cerro Gordo, and Panamint City. Pine Creek, west of Bishop, was the location of one of the world's largest tungsten mines for several decades.

During the Pleistocene geologic epoch (2.6 million to 12,000 years ago), the Inyo-Mono planning area had a much wetter climate and abundant runoff. The water formed a series of huge lakes that covered many of the intermontane valleys. Lake Russell filled the Mono Basin to a depth about 700 feet above the present Mono Lake. Water from Owens Lake overflowed to the south and formed Fossil Falls enroute to China Lake. The ancestral Amargosa River formed Lake Tecopa and filled much of Death Valley with Lake Manly. Panamint Lake and Searles Lake were also enormous bodies of water during the Pleistocene.

After the climate became much drier, the water evaporated and left vast mineral deposits behind on the lakebeds. Various salts, most importantly borax, were mined from these playa deposits during the late 1800s. Some operations, such as on the west shore of Owens Lake, continued until recent times.

Soils

Soils of the various watersheds throughout the planning area have formed from the underlying geologic parent material and consequently vary with the rock types as well as the localized moisture regime and weathering situation, biological influences, slope position and erosion potential, and time period for soil development. Most of the soils throughout the planning area tend to be shallow, coarse-textured, and poorly developed. The most common texture class is probably gravelly loam. Soils found on steeper slopes tend to be shallow, loose, and unconsolidated, whereas soils found on relatively level areas in meadows and other alluvial deposits tend to be deeper, better developed, and less prone to erosion. Because many areas have very young parent materials, only a few hundred to a few thousand years in age, soils tend to be incompletely developed with minimal stratification.

Throughout the eastern Sierra Nevada zone, the soils at lower elevations are generally derived from granitic and volcanic parent material and are sandy loams and decomposed granite. Soil depth ranges from very shallow with lots of rocks to deep alluvium in the valleys (Thomas, 1984). At higher elevations, soil depths range from a few inches to 3 or 4 feet. Sandy loam is the most common texture, but rock content is commonly up to 35 percent, especially on steeper slopes. Water retention tends to be low and decreases when rock occupies a greater proportion of the volume (Thomas, 1984).

Soils on steeper mountain slopes are generally somewhat excessively to excessively drained, coarse-textured, and shallow. Soils that formed on the foothills are well to excessively drained, are shallow to moderately deep, and generally have coarse-textured surfaces with some having coarse-to-fine- textured subsoils. Soils developed on the high terraces are well to moderately well drained on nearly level to sloping terrain. Soils developed on low terraces are somewhat poorly to poorly drained on nearly level terrain. Most terrace soils lie above a heavy textured subsoil with a variety of surface textures. Soils on alluvial fans include well- to excessively-drained soils except where groundwater is present (Mono County Resource Conservation District, 1990).

Soils on floodplains are generally loamy and sandy in texture, and are deep to moderately deep with coarse-textured subsoils. Drainage is somewhat poor to very poor, and soils are eroded by past and present channels of the rivers. Soils formed in topographic depressions are generally clayey throughout and have high organic matter content. These soils also exhibit poor drainage conditions (Mono County Resource Conservation District, 1990). Soils on the valley flats are the best developed and most productive soils in the region. Such soils have allowed productive agriculture in the Antelope Valley, Bridgeport Valley, and Owens Valley for more than a century.

Within the once-proposed Sherwin Ski Area, which is somewhat representative of portions of the eastern slope of the Sierra Nevada, soils were limited to topographic benches, isolated pockets, and lower-angle swales (Inyo National Forest, 1988). On these low-angle portions of the terrain, soils up to 2 feet thick were noted, and organic layers of several inches depth were found in pocket meadows. Water holding capacity was less than 4 inches. Where thin soils were present on steep slopes, they tended to be highly erodible, especially if disturbed (Inyo National Forest, 1988).

In the valleys once occupied by Pleistocene Lakes, as the water level dropped, salts accumulated in the more recent sediments, particularly on the gently sloping gradients. Soils derived from these sediments tend to have high salt content. In addition, salts and alkali affect many areas of poorly and very poorly drained soils on the floodplains, basins, and low terraces (Mono County Resource Conservation District, 1990).

The greatest potential for soil erosion occurs with sandy soils on steep slopes where water may flow over the surface and entrain soil particles. Areas where vegetation has been removed and soils mechanically compacted (*e.g,* roads, trails, construction sites, off-road vehicle routes) are much more subject to erosion than undisturbed areas. Wind erosion of exposed soils can be significant during high-wind events.

2.2.3 Upland and Riparian Vegetation

Upland Vegetation

Distribution and type of vegetation throughout the Inyo-Mono IRWM planning area are dependent on soils, moisture availability, air and soil temperature, and sunlight. Different vegetation communities tend to be associated with elevation zones because of the combination of environmental factors favoring different plants species. Slope aspect can also play a major role in plant distribution with greater moisture stress on south-facing slopes than on shaded north-facing slopes. The declining gradient in precipitation from west to east results in a rapid transition in vegetation -- from conifer forests in the Sierra Nevada to open woodlands in the hills to sagebrush scrub in the valleys just east of the Sierra Nevada (California Department of Water Resources, 1992). In the northern Mojave Desert zone, water availability also controls the composition and distribution of plant communities. Although trees can survive at elevations above 6,000 feet if sufficient moisture is available, most of the northern Mojave Desert zone is dominated by drought-tolerant shrubs.

At the Sierra Nevada crest on the western margin of the planning area, vegetation cover is sparse with the most wind-exposed locations nearly barren. In more protected locations, grasses, forbs, dwarf shrubs, and even a few whitebark pine (*Pinus albicaulis*) can be found. Moving downslope, the numbers of species and individual plants increase. In addition to the

whitebark pine, mountain hemlock (*Tsuga mertensiana*) and western white pine (*Pinus monticola*) account for the tree species in the subalpine zone, which extends down to about 9,000 feet in the eastern Sierra Nevada watersheds. These trees merge into the red fir (*Abies magnifica*)-lodgepole pine (*Pinus contorta* ssp. *murrayana*) forest. The density of trees and the litter layer of accumulated needles are much greater here than among the scattered subalpine trees. The red fir-lodgepole pine forest merges into the Jeffrey pine (*Pinus jeffreyi*) forest at about 7,500 to 8,000 feet. Some white fir (*Abies concolor*) can be found among the Jeffrey pines. Western juniper (*Juniperus occidentalis* var*. occidentalis*) are also scattered in the east-side forests. Aspen (*Populus tremuloides*) clones are found where soil moisture is high and along creeks (USDA-Forest Service, 2004).

As in most other parts of the Sierra Nevada, decades of fire suppression have markedly changed the composition and density of the mixed conifer forest of the eastern Sierra Nevada. Dense stands of white fir and Jeffrey pine have taken over the former open stands of large Jeffrey pine that were maintained by relatively frequent low-intensity fires (Lucich, 2004). Conifers have also entered former aspen groves and reduced regeneration of aspen (Lucich, 2004).

At upper elevations in the eastern Sierra Nevada zone, shrub communities are comprised of tobacco brush (*Ceanothus velutinus*) and chokecherry (*Prunus emarginatus*). At lower elevations, the brush community is mostly sagebrush (*Artemesia tridentata*), bitterbrush (*Purshia tridentata*), mountain mahogany (*Cercocarpus ledifolius*) and snowberry (*Symphoricarpus albus*) (USDA-Forest Service, 1988).

The lower slopes of the Sierra Nevada (below 6,000 feet) are largely covered by a sagebrush (*Artemisia tridentata*) community, intermingled with meadows and some curlleaf mountain mahogany (*Cercocarpus ledifolius*). Typical species of the sagebrush community include bitterbrush (*Purshia tridentata*), rabbitbrush (*Ericameria* spp.), wheatgrass (*Agropyron* spp.), bluegrass (*Poa* spp.), wild-rye (*Elymus glaucus*), needle-grass (*Stipa* spp.), and June grass (*Koelaria cristata*) (Thomas, 1984).

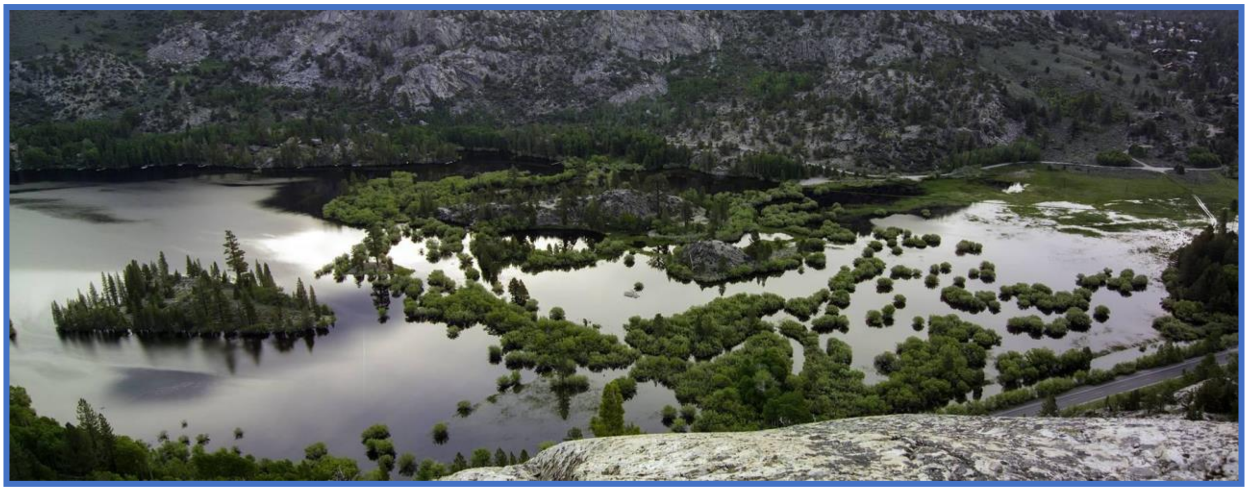
In the eastern ranges of the northern portion of the planning area, the main plant community is pinyon-juniper (*Pinus monophylla*, *Juniperus scopulorum*) woodland. Bitterbrush and sagebrush dominate the forest understory. The grass composition is similar to that of the lower-elevation Sierra Nevada front to the west (Thomas, 1984).

The vegetation at the lower elevations of the West Walker River basin (5,000 to 7,000 feet) has changed substantially since the 1860s from bunchgrass range to bitterbrush and sagebrush (*e.g.,* Thomas, 1984). Prior to the arrival of Euroamericans in the mid-19th century, portions of the West Walker River basin below and between the coniferous forest stands were primarily habitat for pronghorn and desert bighorn sheep. As overgrazing by thousands of domestic sheep during the late 1800s and early 1900s removed the bunchgrass, brush species became established. Consequently, the bighorn sheep and pronghorn left the area, and mule deer moved in, taking advantage of the browse species (Thomas, 1984). The native grasses, sedges, and rushes of the meadows were also converted to alfalfa and other forage species.

Plant communities of the northern Mojave Desert zone are completely different than those of the eastern Sierra Nevada zone because of the severely limited availability of water in the desert. Only plants able to survive high temperatures, low humidity, little soil water, and saline soils (in some places) are found in the northern Mojave Desert zone. The upper portions of the desert ranges receive several times more precipitation than the surrounding lowlands and are able to support pinyon-juniper woodlands above 6,000 to 7,000 feet (Tweed and Davis, 2003). Limber pine (*Pinus flexilis*) and bristlecone pine (*Pinus longaeva*) grow above 9,000 feet in the southern part of the White-Inyo Mountains and Panamint Mountains. Joshua trees (*Yucca brevifolia*) occur below the pinyon-juniper woodlands at about 4,000 to 6,000 feet (Ingram, 2008). At successively lower elevations and correspondingly drier sites, a wide variety of drought-tolerant shrubs are found. Common plants include sagebrush (*Artemisia tridentata*), rabbitbrush (*Ericameria nauseosus*), burrobush (*Ambrosia dumosa*), brittlebush (*Encelia farinosa*), creosote bush (*Larrea tridentata*), and mesquite (*Prosopis* spp.) (Tweed and Davis, 2003). Several cactus species (about 14) grow in the northern Mojave Desert zone and are well adapted to the arid conditions (Ingram, 2008). They tend to be more abundant in the eastern portion that has greater summer rainfall (Rowlands, 1995).

Riparian Areas and Wetlands

Riparian zones are the areas bordering streams, springs, and lakes that provide a transition from aquatic to terrestrial environments. In arid regions, such as the Inyo-Mono IRWM planning area, riparian areas and the water body they surround are the most ecologically important portions of a watershed. The presence of water allows much life to thrive close to the stream course that would otherwise not exist. As streams rise and fall, the lower parts of the riparian corridor may be inundated for days to weeks. Soil moisture is much higher within the riparian zone than farther up slope and is often saturated close to the stream. Plants within riparian corridors are adapted to the high soil moisture and occasional submergence. Depending on the nature of the soils, topography, and the stream, the riparian zone may be narrow or wide and have an abrupt or gradual transition to upland vegetation (Swanson, et al., 1982; Gregory, et al., 1991; Kattelmann and Embury, 1996).



Riparian areas are considered to be among the most ecologically valuable natural communities because they provide significantly greater water, food resources, habitat, and favorable microclimates than other parts of the landscape. The extra water alone leads to greater plant growth and diversity of species in riparian areas compared to other areas. The enhanced plant productivity, greater species richness, availability of water and prey, and cooler summer temperatures of riparian areas draws wildlife in greater numbers than in drier areas. Below the forest margin in the eastern Sierra Nevada, riparian areas are a dramatic change from the surrounding sagebrush scrub. In arid lands, streams, springs, and riparian zones are especially critical.

Streams and their adjacent riparian lands allow for the transport of water, sediment, food resources, seeds, and organic matter (Vannote, et al., 1980). Riparian corridors act as "highways" for plants and animals between natural communities that are stratified with elevation. The continuity of riparian corridors is one of their most important attributes. If the upstream-downstream connection is interrupted by a dam, road, or other development, the ecological value of the riparian system is greatly diminished.

In watersheds of the eastern Sierra Nevada, riparian corridors along the major creeks cross through several upland vegetation communities in just a few miles because of the steep topography. In the headwater areas, typical riparian vegetation includes lodgepole pine (*Pinus contorta* spp. *murrayana*), aspen (*Populus tremuloides*), mountain alder (*Alnus incana* spp. *tenuifolia*), currant (*Ribes* sp.), and willow (*Salix* sp.). Jeffrey pine (*Pinus jeffreyi*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and wild rose (*Rosa woodsii*) are present in some of the mid-elevation canyons. At elevations between the glacial moraines and the valley floor, water birch (*Betula occidentalis*), Fremont cottonwood (*Populus fremontii*), and other species of willow add to the mix (Howald, 2000a and 2000b).

Along the streams of the eastern Sierra Nevada, riparian environments offer critical resources for a large, though unknown, fraction of insect and other animal species. For some, the riparian zone is primary habitat. For other species, the riparian resources of water, food, higher humidity and cooler summer temperatures, shade, and cover are used on occasion. Insects are more abundant near streams and are an important food for fish, amphibians, birds, and mammals. Open water and moist soils are both critical for amphibians. Almost all species of salamanders, frogs, and toads native to the Sierra Nevada spend much of their life cycles in riparian zones (Jennings, 1996). Birds tend to be far more numerous and diverse in riparian zones than in drier parts of the watershed. Most mammals at least visit riparian areas occasionally to take advantage of resources that are less available elsewhere in the watershed. The mammal most obviously dependent on the riparian zone is the beaver.

Riparian areas are fundamentally limited to the margins of streams, springs, creeks, and lakes. With their restricted width (generally tens of feet on either side of a stream, wider along flatter portions of the principal streams), riparian areas occupy very a small portion of the landscape. An evaluation of proposed hydroelectric projects in the eastern Sierra Nevada considered riparian zones to cover less than one percent of the surface area of their watersheds (Federal Energy Regulatory Commission, 1986).

Most of the riparian corridors at the higher-elevation portions of the Humboldt-Toiyabe and Inyo National Forests are relatively undisturbed (except by historical grazing), but many of the riparian areas in lower valleys have been changed by road construction, overgrazing, groundwater pumping, dams, water exports, and recreation. Some of the principal paved roads of the region follow streams for many miles and are often within the riparian zone. Forest roads are within the riparian zone in hundreds of places within the two National Forests of the eastern Sierra Nevada.

Although very important in their limited extent where they exist, there are few riparian areas within the northern Mojave Desert zone. Most are very short segments along channels downslope from springs and seeps that may only be tens to hundreds of feet in length. The Amargosa River canyon south of Tecopa is the best example of an extensive riparian area in the northern Mojave Desert zone. Due to the presence of cooler and wetter conditions and better soil, many washes support greater plant and animal diversity and productivity than the surrounding uplands, and the BLM has begun closing roads in washes in order to protect these biological resources.

Wetlands are areas that are flooded with water for enough of each year to determine how the soil develops and what types of plants and animals can live in that area. They are often called marshes, swamps, or bogs. The critical factor is that the soil is saturated with water for at least a portion of the year. This saturation of the soil leads to the development of particular soil types and favors plants that are adapted to soils lacking air in the pores for a portion of the year. The federal Clean Water Act defines the term wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

General acceptance of the ecological values of wetlands has occurred relatively recently (National Research Council, 1995). Drainage and deliberate destruction of wetlands were widely accepted practices until the mid-1970s. California has lost a greater fraction of its wetlands than any other state. Only about 9 percent of the original wetlands (454,000 acres out of about 5 million acres) remain in California (National Research Council, 1992). The recognition of the importance of the small fraction remaining has led to a variety of regulatory efforts to minimize the further loss of wetlands. The relatively recent concept of wetlands as valuable to nature and the public at large has generated conflicts with individuals who own wetlands and do not see any personal benefit.

The largest areas of wetlands in the region are flood-irrigated lands in Antelope Valley, Little Antelope Valley, Bridgeport Valley, and Long Valley. Most of these areas would not be classified as wetlands without the artificial application of water for more than a century. Wetlands in much of Mono County have been inventoried and described in a project of the Lahontan Regional Water Quality Control Board and U.C. Santa Cruz in the 1990s (e.g., Curry, 1996).

The primary loss of wetlands in the upper Owens River watershed occurred with the filling of the Long Valley dam in 1940. A natural dam at the top of the Owens Gorge, caused by the relative rise of the Volcanic Tableland fault block (Lee, 1906), led to the low gradient of the Owens River through Long Valley and consequent conditions that favored wetlands along the river channel (Smeltzer and Kondolf, 1999). USGS topographic maps made circa 1913 during the studies by Charles H. Lee show more than 4,000 acres of wetlands within Long Valley (Smeltzer and Kondolf, 1999, esp. figure 20).

Within Inyo County, the primary wetlands occur in topographically flat portions of the Owens Valley where springs and seeps bring water to the surface. Wetlands that are important for wildlife are found at Fish Slough (e.g., Jayko, 2010), north of Bishop, and near the Lower Owens River. Flow from the spring complex supplying Fish Slough has been declining steadily since records began in the late 1960s, and the source areas for the water remained uncertain for the past few decades. Recently, results of geochemical investigations have offered some information about the multiple sources of the water and possible effects from groundwater extraction in the Tri-Valley area (Zdon, et al., 2019). Within the northern Mojave Desert zone, locally important wetlands include: Grimshaw Lake near Tecopa, Saratoga Springs in southern Death Valley, Saline Valley marshlands at foot of Inyo Mountains, Salt Creek and Cottonball Marsh north of Furnace Creek, and Warm Sulphur Springs at Ballarat in Panamint Valley. Several inventories and studies of springs have been conducted in Inyo County (e.g., King and Bredehoeft, 1999; Sada and Herbst, 2001; SGI, 2011; and Steinkampf and Werrell, 1998).

In addition to the obvious wetlands of the Owens Valley, there are several plant communities that transitional between wetland and upland vegetation types. Plants associated with these communities tend to produce roots that can be 4 to 7 feet long and can access a shallow water table where and when available. Such communities include alkali meadow, Nevada saltbush meadow, rabbitbrush meadow, desert sink scrub, greasewood scrub, and shadscale scrub (e.g., Groeneveld and Or, 1994; Elmore, et al., 2003).

Alpine and sub-alpine meadows also provide many ecosystem services for humans and wildlife yet have been damaged and degraded throughout much of the Sierra Nevada (e.g., Kattelmann and Embury, 1996; Stillwater Sciences, 2012; Viers, et al., 2013). These wetland ecosystems store and filter water that is diverted downstream for human uses; they provide high-quality habitat for invertebrate, birds, and mammals; and they can serve as indicators of past climatic and fire conditions as well as future changes in the climate. Mountain meadows are particularly critical habitat for birds, both for those species that are meadow-dependent and those that live in adjacent forests but obtain food and water from the meadows (Graber, 1996). Individual meadows throughout the mountain range have been inundated by reservoirs, intentionally drained and converted to other land uses, reduced by road construction, and altered by a variety of particular uses. However, a remarkably widespread suite of changes resulted from the range-wide overgrazing of the late 1800s. The removal of vegetation, compaction of meadow soils, and trampling of streambanks from vast numbers of sheep and cattle in the 19th century triggered a series of hydrologic and geomorphic consequences that have left a large fraction of Sierra Nevada meadows with deeply incised channels, lowered water tables, and changes in vegetation composition.

The majority of montane meadows in the Inyo-Mono planning region are found on the Inyo and Humboldt-Toiyabe National Forests. An inventory that was referenced in the Forest Plan of the Inyo National Forest (1998) indicated that 90 percent of the wet meadows on the Forest were damaged or threatened with damage by accelerated erosion. The majority of the meadow area on the Inyo National Forest is just west of the Inyo-Mono planning region on Kern Plateau, within the Southern Sierra planning region. Within the Inyo-Mono region portion of the Inyo National Forest, montane meadows can be found in the upper reaches of most watersheds tributary to the Owens River. Some of the larger meadows that have road access, such as Horseshoe Meadows and Snowcreek Meadow (Windy Flats on older maps), have a variety of impacts. Most of the smaller meadows at high elevations are relatively remote and are within the John Muir Wilderness Area. In the northern part of the Inyo-Mono planning region, montane meadows are mostly found on the Humboldt-Toiyabe National Forest and within the Hoover Wilderness Area. A few meadow areas are contained within “critical aquatic refuges”, such as Kirkwood Lake, Koenig, Wolf Creek, Silver Creek, and Summit Meadow refuges (USDA-Forest Service, 2004). The largest montane meadows in the West Walker River watershed are Pickel

Meadow and Leavitt Meadow, which were overgrazed in the 1800s and currently receive considerable recreation use because of their proximity to State Route 108.

2.2.4 Invasive Weeds

The term weed is typically used to describe any plant that is unwanted and grows and spreads aggressively. The term noxious weed describes an invasive unwanted non-native plant and refers to weeds that can infest large areas or cause economic and ecological damage to an area (USDA-Forest Service, 2004). The USDA-Natural Resources Conservation Service maintains a list of federally- and state-designated noxious weed species (http://plants.usda.gov/java/noxiousDriver#federal). In general, the Inyo-Mono region has thus far remained relatively free of major week infestations, but as visitations to the area increase, there will be an increased risk of significant alterations to native ecosystems. Already, as described below, tamarisk and cheatgrass pose major threats to the region.

At higher elevations, several invasive weeds have been identified, but a detailed description is beyond the scope of this plan. At lower elevations, invasive plants are even more aggressive and have caused widespread problems. Tamarisk or salt cedar (*Tamarix* spp.), a listed noxious weed, has invaded riparian zones, areas with high water tables, and water spreading basins below about 7,000 feet. It readily crowds out most beneficial riparian shrubs and trees and uses large amounts of water because of its ability to establish deep roots that extend below the water table adjacent to streams. In the Mono Basin, tamarisk is established at levels currently under control (due to an interagency effort) along the lower reaches of Rush and Lee Vining Creeks. Tamarisk has become well established along the lower Owens River and is being treated by the Inyo County Water Department and Los Angeles Department of Water and Power. In the northern Mojave Desert zone, tamarisk removes much of the scarce water from springs and ephemeral stream channels that would otherwise benefit many plants and animals.

Perennial pepperweed (*Lepidium latifolium*) is of increasing concern in the region because of tendency to contribute to erosion of streambanks and the sides of ditches and canals, its tendency to develop monocultures, as well as its aggressive invasive nature and resistance to control. As another example, cheatgrass (*Bromus tectorum*) has been found to produce between 400 and 3400 lbs of vegetative matter per acre (depending on irrigation, soil, etc.), reduces soil moisture several inches below soil surfaces before native plants begin germinating, tends to increase fire frequency and severity, and is affecting pollinator populations and predator-prey relationships on the east slopes of the Sierra Nevada. Other invasive plants, such as woolly mullein (*Verbascum thapsus*), Russian thistle (*Salsola* sp.), Russian olive (*Elaeagnus angustifolia*), and knapweed (*Centaurea* spp.) also have serious implications for terrestrial and aquatic ecosystems. Several other problematic species are targeted by property owners, agencies, and a group formed to combat invasive weeds.

Most of the eastern Sierra Nevada zone of the Inyo-Mono IRWM planning area is covered by the Eastern Sierra Weed Management Area, a consortium of land management agencies and other entities formed in 1998. The mission of this group is the control and eradication of noxious weeds through integrated management activities. Members of the group include Inyo/Mono

Counties' Agricultural Commissioner's Office, Inyo County Water Department, California Department of Food and Agriculture, Los Angeles Department of Water and Power, Bureau of Land Management Bishop Field Office, Bureau of Land Management Desert District, Inyo National Forest, Humboldt-Toiyabe National Forest, Inyo/Mono Resource Conservation District, Inyo/Mono Counties' Cattleman's Association, Natural Resources Conservation Service, California Department of Forestry and Fire Protection, California Department of Transportation District 9, Bishop Paiute Tribe Environmental Office, and California Department of Parks and Recreation.

2.2.5 Role of Wildfire

Wildfires are a major watershed management issue as well as natural hazard within the eastern Sierra Nevada zone of the Inyo-Mono IRWM planning area. Wildfires are not much of a concern (except in localized areas and under unusual conditions) within the northern Mojave Desert zone because of the sparse vegetation.

Fire is a natural disturbance feature of the landscape. Prior to the 20th century, the primary cause of fire was lightning, coinciding with summer thunderstorms. When ignited at higher elevations, the fires were typically not large. Lower elevations experience fewer lightning ignitions, but the shrublands have the potential to burn more extensively and have in the past. Fire suppression policies were instituted in the early days of the National Forest System. With the near absence of wildfire in the past century, fuel loads in forest and shrublands far exceed natural levels. Therefore, modern fires are likely to be both intense and extensive.

Analyses of tree stumps and cores have suggested that pre-1900 intervals between wildfires were highly variable in the upper Owens River watershed. Before active fire suppression, fires occurred in the Jeffrey pine and mixed conifer stands about every 10 to 20 years on the average, and in red fir stands about every 30 years on the average (Millar, et al., 1996). Wildfires appear to have been low intensity in both pine and fir forests; however, the structure of some red fir stands indicates that stand-replacing fires occurred. The studies of fire history show that the size, frequency, and distribution of fires changed markedly with the beginning of suppression (Millar, et al., 1996).

In the high-elevation subalpine zone, wildfires are uncommon, infrequent, and usually limited to only a few trees. No large historical fires have been documented at elevations over 8,000 feet in the eastern Sierra Nevada zone. Fires intensities tend to be low, and large fires rarely develop. The subalpine zone tends to be cooler and wetter than areas at lower elevation. Forest structure is probably the closest to reference conditions in the subalpine zone because of the scarcity of fire. Most of the late successional forest stands are found at these higher elevations (USDA-Forest Service, 2004).

2.2.6 Fish and Wildlife

Fisheries

Fish, particularly trout, are a highly valued recreational resource of the streams of the eastern Sierra Nevada. Much of the tourism economy of the area is dependent on fishing. The streams and lakes of the region have hundreds of thousands of angler-days of use each season.

Introduced in the late 1800s, trout have become thoroughly integrated into the aquatic ecology of eastern Sierra Nevada watersheds, often at the expense of native fish and amphibians. The extent and numbers of non-native trout increased dramatically when aerial stocking of trout became widespread in the 1950s. Before the artificial stocking, most waters in the eastern Sierra Nevada did not contain trout, except for a few creeks that contained native Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) (Milliron, et al., 2004). Many strains of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*) have been planted in lakes and tributaries of the main rivers, and many of these trout have successfully spawned, producing "wild trout" progeny. The term "wild trout" is distinct from "native trout," which refers to trout that existed in streams prior to European settlement and have a defined natural range without human intervention (Milliron, et al., 2004).

The Lahontan cutthroat trout (*Oncorhyncus clarki henshawi*) is the prominent species of native fish in the Walker River basin. The original range of the Lahontan cutthroat trout has been reduced more than 90 percent by changes in streamflows, channel conditions, and overfishing (Knapp, 1996). Predation by, competition with, and hybridization with introduced trout have also greatly impacted the remaining groups of these fish (Gerstung, 1988). As the once huge population in Walker Lake has declined drastically with increasing salinity, efforts have begun to ensure survival of the species in streams of the upper watershed. When only a few isolated populations could be found, the Lahontan cutthroat trout was listed as endangered under the Endangered Species Act in 1970 and then reclassified as threatened in 1975. The fragmentation of habitat leading to the isolation of small groups of fish is a primary concern.

Native fishes of the Long Valley streams include Owens sucker (*Catostomus fumeiventris*), Owens tui chub (*Gila bicolor snyderi*), toikona tui chub (*Gila bicolor* subspecies), and speckled dace (*Rhynichthys osculus*) (Hubbs and Miller, 1948; Miller, 1973, Chen et al., 2007). The U.S. Fish and Wildlife Service (1998) recommended four "Conservation Areas" within Long Valley to help with recovery of Owens tui chub and Long Valley speckled dace: Little Hot Creek, Whitmore, Little Alkali, and Hot Creek. Within the Owens Valley, the Owens pupfish (*Cyprinodon radiosus*) was the primary native fish. However, the species was reduced to just two locations by 1934 and was thought to be extinct by 1948 (Pister, 1995). After a small population of surviving Owens pupfish was found in 1956, the California Department of Fish and Game, LADWP, and BLM cooperated in creating refuges for the species in the Fish Slough area north of Bishop. Introduced non-native fish, such as largemouth bass (*Micropterus salmoides*), remain a threat to the continued survival of the pupfish.

Fish introductions to the Owens River basin began in the late 1800s with Lahontan cutthroat trout from the Walker River and golden trout from the Kern River. Rainbow, brown, and eastern brook trout from hatcheries in other parts of California were first introduced in about 1900 (Pister, 1995). The Mount Whitney State Fish Hatchery, built in 1917, lead to significant fish rearing and stocking programs in waters of the eastern Sierra Nevada.

The upper Owens River through lower Long Valley, before the reservoir started filling in 1941, was regarded as a "superb stream fishery". The subsequent lake is also a highly productive fishery. The growth rates of rainbow trout and brown trout in Crowley Lake are among the highest ever recorded for a resident trout population in a mountain environment (Von Geldren, 1989). Crowley Lake's high productivity results in trout that gain from three to 40 times their stocked weight before harvest (Milliron, 1997).

In the northern Mojave Desert zone, there are a few isolated populations of pupfish that have remained after Lake Manly dried up. Four species and ten subspecies of pupfish are found in streams, springs, and wetlands of the northern Mojave (Tweed and Davis, 2003). Within California, these fish are located in the Amargosa River, Saratoga Springs, Salt Creek, and Cottonball Marsh.

Amphibians are assumed to be scattered throughout the Sierra Nevada watersheds, but have been depleted by introduced trout (e.g., Knapp and Matthews, 2000). The larger populations are found in waters without fish. Amphibian populations are also assumed to be declining in the eastern Sierra Nevada as is the case in most of the Sierra Nevada due to disease and predation (e.g., Jennings, 1996). In past decades, anecdotal accounts suggested that frogs and toads were very common, abundant, and widespread. During the 1980s, biologists began to note that amphibians were becoming relatively uncommon and detected diseases and deformities that have not been noticed or at least not widely described in the past. A recently identified disease, chytridiomycosis, caused by a fungal pathogen, appears to be spreading at an alarming rate and greatly reducing population size of some amphibian species (Rachowitz, et al., 2006). The principal amphibians of the eastern Sierra Nevada watersheds are Yosemite toad (*Bufo canorus*), mountain yellow-legged frog (*Rana muscosa*), and Pacific tree frog (*Hyla regilla*). Salamanders--including the poorly described Kern Plateau slender salamander (*Batrachoseps robustus,* imperiled) and a southern species of web-toed salamander (*Hydomantes platycephalus)*--are present in some areas as well. The Humboldt-Toiyabe National Forest has established several "critical aquatic refuges" to promote recovery of threatened amphibians. The Kirkwood Lake refuge was established for the mountain yellow-legged frog. It covers 840 acres at the higher elevations of the West Walker River watershed. Surveys of the refuge in 2000 found a total population of more than 10,000 frogs, among the heaviest concentrations in the Sierra Nevada. In addition to these frogs, Yosemite toad larvae were also found in this refuge in the 2000 survey. The Koenig Lake refuge was established for Yosemite toads. It includes 2000 acres in the Latopie, Koenig, and Leavitt lakes subwatersheds. Recent surveys found Yosemite toad tadpoles in the wetlands surrounding Koenig Lake and in unmapped ponds between Koenig and Latopie lakes (USDA-Forest Service, 2004). At the lower elevations surrounding

Mono Lake and in the Owens Valley, Great Basin spadefoot toads are common.

The Sierra Nevada yellow-legged frog and Northern Distinct Population Segment of the mountain yellow-legged frog were listed as endangered by the U.S. Fish and Wildlife Service in June 2014. The Yosemite toad was listed as threatened at the same time. During the decade prior to the actual listings under the Endangered Species Act, there was considerable concern and controversy within Inyo and Mono counties about the potential for the listings. The rumor mill generated fears that grazing, pack stock use, and recreational fishing could be severely constrained in any area deemed critical habitat for the amphibians. Although such actions now seem unlikely, recovery plans for these species are yet to be developed.

A few species of amphibians and reptiles eke out an existence at isolated springs and seeps in more arid reaches of the project area. These include the Panamint alligator lizard (*Elgaria panamintina*, threatened and in decline), the black toad (*Anaxyrus exsul*), threatened but apparently stable), the Inyo slender salamander (*Batrachoseps campi*, a California species of special concern), the Great Basin spadefoot toad (*Spea intermontana*), the red-spotted toad (*Bufo punctatus*), and the western toad (*Bufo boreas*).

Terrestrial Wildlife

In a watershed context, the animals that have the greatest impact on watershed processes are those largely unseen and unappreciated creatures that live below the soil surface and perform an immense amount of work in the soil. The activities of burrowing mammals, reptiles, insects, worms, and amphibians process organic matter and alter the physical structure of the upper part of the soil. Animals in the soil can have a huge effect on the pore space and structure of the soil and, consequently, on the infiltration capacity and water storage capacity of the soil. Human activities that impact soil organisms, such as excavation, compaction, vegetation removal, and pollution, can have secondary impacts on the water relations of the soil.

Animals that are traditionally considered as "wildlife" are primarily of interest in the watershed context with respect to riparian habitat. The eastern Sierra Nevada does not have any wildlife species with either the behavior (*e.g.,* bison) or numbers (*e.g.*, elk in Rocky Mountain National Park) to make substantial changes in soil properties, vegetation, or stream conditions to alter hydrologic response of the watershed. Nevertheless, all native species have ecological roles, and one could imagine some hydrologic consequences if the population of some species were drastically changed. Fish and wildlife habitat of the upper elevations of the Inyo-Mono IRWM planning area tends to be in excellent condition while the lower portion, below about 7,000 feet elevation, tends to be in less satisfactory condition (Inyo National Forest, 1988).

Most wildlife species are dependent on the riparian zone, at least occasionally, for water, food, or shelter. Changes in riparian and associated wetland vegetation composition, density, and continuity can have serious impacts on wildlife. In most of the Inyo-Mono IRWM planning area, the stream corridors are critically important because of the lack of water elsewhere in the landscape. Wildlife dependent on the creek water and riparian habitat include mule deer (*Odocoileus hemionus*), white-tailed jackrabbits (*Lepus townsendii*), Nuttall's cottontail (*Sylvilagus nuttallii)*, montane vole (*Microtus montanus*), mink (*Mustela vison*), Yosemite toad, and mountain yellow-legged frog. Many birds also use eastern Sierra Nevada riparian habitat, including mourning dove (*Zenaida macroura*), Sooty grouse (*Dendragapus fuliginosus*), band-tailed pigeon (*Columba fasciata*), red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), northern goshawk (*Accipiter gentilis*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamicensus)*. Kestrels (*Falco sparverius*), ravens (*Corvus corax*), goshawks (*Accipter gentilis*), red-tailed hawks (*Buteo jamaicensis*), prairie falcons (*Falco mexicanus*), and golden eagles (*Aquila chrysaetos*) also utilize riparian zones as part of their habitat.

Of the several wildlife species that use eastern Sierra Nevada riparian habitats for foraging, nesting, or cover, some are threatened or endangered or are of special concern. These species include the willow flycatcher (*Empidonax traillii*), greater sage grouse (*Centrocercus urophasianus*), peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), yellow warbler (*Dendronica petechia*), mountain beaver (*Aplodontia rufa*), and Inyo shrew (*Sorex tenellus*) (USDA Forest Service, 1989; California Department of Fish and Game, 1990). Long-distance migrant birds depend on riparian habitats as they travel through the arid Great Basin. The greater sage grouse within Mono County is currently the subject of considerable attention in a Nevada-California effort to avoid the species being listed under the Endangered Species Act (e.g., Casazza, et al., 2009). The Mojave population of desert tortoise is listed as threatened under the federal endangered species act, and the Fish and Wildlife Service updated its recovery plan for the population in 2011 (US Fish and Wildlife Service, 2011).

One species with direct hydrologic impacts is the beaver (*Castor canadensis*), with their dam-building behavior. Beaver were not known to exist in the Owens and Long valleys when EuroAmericans began settling the area. After World War II, there was a debate within the California Department of Fish and Game about the benefits and risks of introducing beaver. Within the West Walker River watershed, beaver were present along several streams in 1967: Little Walker River, West Walker River, Mill Creek, and Lost Cannon Creek (memo in CDFG files in Bishop office, no date). Beaver were introduced along Mill Creek in the Mono Basin by the Department of Fish and Game in the 1950s. The population thrives above Lundy Reservoir for nearly the entire length of upper Lundy Canyon and in recent years has been spreading to nearby creeks, including Wilson Creek, DeChambeau Creek, and Lee Vining Creek.

Mule deer (*Odocoileus hemionus*) are the most prominent big game species of the eastern Sierra Nevada. The West Walker deer herd is a significant wildlife resource within the basin and affects many land management decisions. The Round Valley deer herd is of similar importance between Bishop and Mammoth Lakes.

2.3 Social and Cultural Characteristics

2.3.1 Human History

As in most of California, the history of native peoples, Euro-American settlement, early land use, and water development has established the current socio-economic conditions in the Inyo-Mono planning region. Unlike most of California, the earlier history has had much greater relative influence than more recent events. Land allocations to federal land management agencies, the City of Los Angeles, and a relatively small number of large ranches were largely completed well before World War Two. The very small proportion of private land within the region has limited development, land-use change, and population growth in recent decades. For example, between 1970 and 2010, Inyo County's population grew by only 19 percent, compared to California's growth rate of 87 percent over that 40-year span. With the limited private land base and presumably fixed allocations of land, comparatively little growth or land-use change is anticipated within the Inyo-Mono planning region over a planning period of the next twenty years.

Pre-history

Native Americans of the Paiute and Washoe tribes lived in the Walker River basin for at least several hundred years. The tribes established settlements in valley bottoms along rivers and lakes. Smaller temporary settlements and campsites were occupied at higher elevations during warmer months and while on food gathering and trading forays. The Miwok from west central California also used the Sonora Pass area and crossed over Tioga Pass (USDA-Forest Service, 2004).

The North Mono Basin is the ancestral home to the Mono Lake Paiute (or Kuzedika Paiute) Indians and has been occupied continuously for the last 10,000 years. The population and geographical distribution of the native people of the Mono Basin is not known, but they survived upon the natural resources of the basin and traded surpluses with people to the west. After Euro-Americans arrived in the 1860s, logging deprived the Kudezika Paiute of pine nuts from pinyon pines and caterpillars from Jeffrey pines; sheep grazing damaged the meadows that were the source of seeds, roots, and bulbs; and hunting reduced the pronghorn, bighorn sheep, and sage grouse (Gaines, 1989).

The upper Owens River watershed was probably mostly occupied in the summer months by the Paiute people who could find more favorable year-round conditions in the Owens Valley or to the east. The persistent snowpack and low temperatures were likely to keep Native Americans out of the area during winter and early spring. However, there is some evidence for year-round occupancy of Long Valley, at least in the 1800s (Burton and Farrell, 1992). Presumably, there were good hunting opportunities in the watershed during the snow-free part of the year, and people from adjoining areas lived at the higher elevations during the summer. The Glass Mountains and Obsidian Dome provided high-quality obsidian for projectile points and tools. Volcanism, including ash falls as recently as 660 and 1,210 years ago (Wood, 1977), may have affected the vegetation, wildlife, and water of the upper Owens River watershed enough to limit Native American use of the area for periods of time (Hall, 1984).

Paiute people had villages near Owens Lake and presumably farther north in the Owens Valley for centuries. There is evidence of dams and irrigation canals on Bishop and Big Pine Creeks dating back about 1,000 years. At least two square miles of bottomlands were irrigated by these canals to enhance the growth of native vegetation (Steward, 1934; Lawton, et al., 1976).

In the northern Mojave desert zone, semi-nomadic people had camps near the receding Lake Manly for at least 10,000 years (Tweed and Davis, 2003). There is little archaeological evidence of habitation between 7,500 and 4,500 years ago when the region dried out. After the climate moderated somewhat about 4,500 years ago, the archaeological record indicates occupation of the area resumed. The Kawaiisu people lived in the Indian Wells and Panamint valleys and the foothills of the southeastern Sierra Nevada. Southern Paiutes lived in the vicinity of present-day Tecopa, and Western Shoshone lived in the most arid parts of the area, such as Saline and Death valleys. Villages near water sources were estimated to be occupied by about 50 to 60 people, and total population of the northern Mojave desert region was probably less than 1,000 people (Tweed and Davis, 2003).

1820-1855

Trappers, including Jedediah Smith and Joseph Walker, apparently crossed the lower Walker River basin in 1827 and 1833. The first Euro-Americans known to have visited the West Walker River basin were in the Bartelson-Bidwell party, who were the first overland emigrants to California. This group came through Antelope Valley in October 1841, and struggled over the Sierra Nevada somewhere north of Sonora Pass. The earliest exploration of the upper Owens River watershed by Euro-Americans is uncertain. LeRoy Vining began prospecting in the Mono Basin in 1852 or 1853.

In 1834, Joseph Walker descended into Indian Wells Valley from Walker Pass and may have entered the southern portion of Owens Valley. He was back in 1843, passing Owens Lake with a party of 50 emigrants before ascending Walker Pass (Tweed and Davis, 2003). John C. Fremont traveled through the Owens Valley in October of 1845 and named the lake, river, and valley for one of his guides, Richard Owens, who was not present during that part of the expedition (Chalfant, 1933).

Traveling west from the vicinity of present-day Las Vegas, a party led by Antonio Armijo followed part of the Amargosa River and passed through the southern end of Death Valley during the winter of 1829-30 (Tweed and Davis, 2003). This route later became known as the "Spanish Trail". In the autumn and winter of 1849, several parties of emigrants ventured into Death Valley and experienced great hardships. Not all members survived – leading to the eventual name of the valley.

1855-1900

Antelope Valley was settled in the late 1850s and began to produce hay for Carson City and Virginia City (Mono County Resource Conservation District, 1990). Irrigation ditches were soon constructed to expand the land under cultivation. In addition to hay fields and pastures, farmers in the valley grew beans, melons, corn, tomatoes, and berries and started orchards that produced apples, peaches, and plums.

Settlers moved into the Owens Valley during the 1850s. During the winter of 1861-62, the greatest floods of the historical period were observed throughout the Sierra Nevada. Although the upper Owens River watershed was probably unoccupied at the time, persistent rainfall intermixed with snow led to extreme flows in the streams entering the Owens Valley. At the peak of the floods, the Owens River was estimated to be one-fourth to one-half mile wide. The harsh winter and inundation of the Owens Valley led to violent conflicts over food between Paiutes and early white settlers (Chalfant, 1933).

Although gold was discovered near Bodie in 1859 and in Aurora in 1861, these mining areas did not take off until the late 1860s and early 1870s. The mining booms drew lots of travelers through the West Walker River and East Walker River watersheds and produced heavy demand for agricultural products from the rapidly growing farms of the Antelope and Bridgeport Valleys. N.B. Hunewill established a sawmill in Buckeye Canyon to supply lumber for Bodie. Sheep herding expanded in the uplands in response to the demand from the mining towns, and continued in large numbers into the early 1900s.

In the Mono Basin, prospecting led to towns in Lundy Canyon, upper Lee Vining Creek, and Rattlesnake Gulch. Farms and ranches in the basin supplied food to these gold-mining communities. Irrigation ditches were developed at that time to bring water from creeks to pastures and farm fields. LeRoy Vining operated a sawmill in Lee Vining canyon in the 1860s.

A group of prospectors continuing the search for the "Lost Cement Mine" in 1877 found a rich gold-silver vein in "Mineral Hill" or "Red Mountain" just east of Lake Mary (DeDecker, 1966). They called it the "Mammoth Vein" and organized the Lake mining district. Word of the new strike spread quickly, and miners rushed to the area. Mining camps were built nearby, including Mammoth City, Pine City, Mill City, and Mineral Park. The combined population in 1879 was thought to exceed 1,500 (DeDecker, 1966). A dam was constructed at Twin Lakes to supply hydro-mechanical power. The mining boom led to construction of a wagon road from Benton, a toll road up the Sherwin Grade from Bishop, and a toll trail from Oakhurst to supply beef cattle (DeDecker, 1966). The Mill City site has recently been treated to reduce leaching of mercury from mine tailings into Mammoth Creek (USDA-Forest Service, 2017).

During the mining boom, the Owens Valley became home to farmers and ranchers and had a population of several thousand people by the turn of the century (Irwin, 1991). Some Owens Valley ranchers drove cattle and sheep into the highlands of Long Valley and the upper Owens River area for summer and fall grazing in the 1880s (Burton and Farrell, 1992). There are no records of the extent or intensity of grazing for the first few decades. When the Inyo National Forest took over administration of the forested federal lands from the Sierra Timber Reserve in

1908, one of the first tasks was to control overgrazing (Millar, et al., 1996).

The mining town of Kearsarge in Onion Valley was destroyed by avalanches in 1864. Silver was discovered in 1865 at Cerro Gordo, east of Owens Lake. In 1872, the strongest earthquake in California's history devastated Lone Pine, which had about 250 residents at the time.

During the 1880s, borax and other minerals were mined from the playas at Searles, Panamint, Amargosa, and Death Valleys. In 1893, the U.S. Department of Agriculture's Death Valley Expedition published its report on the biological resources of Death Valley and adjacent areas.

1900-1930

Many of the farms and ranches of Antelope Valley were consolidated in the 1880s by cattle baron Thomas B. Rickey. By the turn of the century, Rickey's operations were using enough water that downstream ranchers in Smith and Mason valleys believed that their water rights were being infringed upon. In 1899, work began on Topaz Reservoir and was later completed by downstream water interests that formed the Walker River Irrigation District in 1919. Water storage began in 1921, and by May 1924, about 30,000 AF of water were stored in Topaz Reservoir (California Department of Water Resources, 1992).

As more people in southern California accumulated wealth and leisure time in the early 1900s, the eastern Sierra Nevada, including the Mammoth Lakes area, became a destination for summer recreation. An automobile trip from Los Angeles required about two and a half days in 1914. A paved road along the eastern escarpment of the Sierra Nevada (close to the present route of U.S. Highway 395) would not be completed until 1931 (Irwin, 1991).

Large-scale development of the water of the Owens River began in 1903 when the U.S. Reclamation Service began a study of water resources in the eastern Sierra Nevada. Establishment of the Inyo National Forest was apparently linked to potential water development (Martin, 1992). Watershed protection was proclaimed as the reason for creating the Inyo National Forest by President Theodore Roosevelt in May, 1907. After the lands were surveyed in 1905, one of the Forest Service employees wrote: "This addition will protect and regulate the water flow of the Owens River and its tributaries" and [the lands] "were set aside to protect the Owens River watershed, to protect the water supply of the City of Los Angeles" (Ayres, 1906; quoted in Martin, 1992).

The City of Los Angeles began acquiring land and water rights in the Owens Valley as well as performing initial engineering work for an aqueduct and storage facilities in the early 1900s. Construction began in 1908, and water was flowing through the completed aqueduct in 1913. During a dry period in the 1920s and early 1930s, Los Angeles completed approximately 170 new wells in the Owens Valley to supplement water exports via the first aqueduct using groundwater from underlying aquifers in the Owens Valley.

As railroads and roads expanded through the Northern Mojave Desert, development of the region's mineral wealth became more feasible. Lead and gypsum were mined near Tecopa. Several evaporite minerals were mined from Searles Lake. Salt was brought out of Saline valley via an aerial tramway. Talc was mined in the Amargosa Valley, Panamint Valley, and elsewhere in the region. Production of borax from Death Valley resumed after 1910 (Tweed and Davis, 2003).

1930-Present

The capacity of Topaz Reservoir was increased to about 60,000 acre-feet in 1937. The Marine Corps Mountain Warfare Training Center in Pickel Meadow was established in 1951.

Construction of the Mono Craters Tunnel and stream diversion works began in 1934, Grant Lake dam was enlarged in 1940, and water export from the Mono Basin began in 1941. Export capacity was increased in 1970 with completion of the second barrel of the Owens Valley aqueduct to Los Angeles. Several lawsuits regarding Mono Lake and tributary streams were settled in the 1980s, resulting in minimum flows for Rush and Lee Vining Creeks. In 1994, the State Water Resources Control Board issued decision D-1631, amending LADWP's water diversion licenses.

In 1932, the Los Angeles Department of Water and Power purchased Fred Eaton's ranch in Long Valley and began construction of the Long Valley dam. In the following years, the Department purchased other properties in Long Valley to secure water rights of the tributaries to the Owens River. After water from the Mono Basin began to flow through the tunnel in 1941, the upper Owens River served as a canal with extra flows averaging 50,000-100,000 acre-feet per year for the next 50 years. The Pleasant Valley Dam was constructed in 1957.

In 1970, Los Angeles completed its second aqueduct and filled it with 1) increased groundwater exports from the Owens Valley; 2) increased surface water exports from the Owens Valley (obtained from reductions in irrigation water previously supplied to Owens Valley ranchers), and 3) increased surface water diversions from the Mono Basin. The consequent groundwater pumping impacts to Owens Valley springs and ecosystems stimulated a series of legal actions that resulted in a joint groundwater management agreement for Inyo County in 1991, the partial rewatering of 62 miles of the lower Owens River in 2006, and several other environmental mitigation projects, some of which have not yet been completed. By the 1930s, Owens Lake was completely dry due to diversions.

Death Valley National Monument was established in 1933 and enlarged in 1937. Tourism gradually increased as roads were improved and facilities were built, initially with labor from the Civilian Conservation Corps. In 1994, Congress enacted the California Desert Protection Act, which changed the designation from Monument to Park and added 1.3 million acres. Death Valley National Park is now the largest of the national parks in the contiguous U.S. The California Desert Protection Act also directed that a study be conducted to locate a reservation for the Timbisha Shoshone tribe. In 2000, enactment of the Timbisha Land Act established a

300-acre reservation at Furnace Creek (Tweed and Davis, 2003). During World War Two, the U.S. Navy established the Inyo-Kern Naval Ordinance Test Station (now called the Naval Air Weapons Station at China Lake) in the Indian Wells Valley. The facility and adjacent city of Ridgecrest is by far the largest population center in the Inyo-Mono IRWMP planning area.

2.3.2 Land Use

As automobiles became more common, the driving public pushed for more roads and those roads, in turn, influenced land use. Growth accelerated after World War II and winter recreation began to be a potent economic force. The first chairlift at Mammoth Mountain Ski Area was installed in 1955. Twenty-five lifts were in service by the mid-1980s, and snowmaking equipment began to be installed in the early 1990s. In 2004, the resort recorded 1.5 million skier-days, second only to Vail ski area in Colorado.

The Town of Mammoth Lakes began to grow significantly in the late 1960s. In 1971, the Inyo National Forest plan stated that Mammoth Lakes was the "fastest growing community in the country" (Millar et al., 1996). The 1990 census reported a population for the town of 4,785. Another period of dramatic growth occurred in the late 1990s, with census results of 7,100 in 2000 and 8,200 in 2010.

The Inyo-Mono IRWM planning area is largely in public ownership for conservation and management of natural resources. Only about 1.7 percent of Inyo County is in private ownership, and there is only slightly more private land in Mono County. Outdoor recreation on public lands by visitors from outside the region drives the local economies. Agriculture is the dominant land use on private property in the area. About 71,000 acres of Mono County and 22,000 acres of Inyo County are under irrigation for alfalfa, miscellaneous hay, and irrigated pasture. Agricultural activities also occur on public land in the planning area. Land is also dedicated to military uses at the Naval Air Weapons Station at China Lake and Mountain Warfare Training Center east of Sonora Pass.

Recreation is a major land use and dominant economic force throughout the Inyo-Mono IRWM planning area because of the scenic beauty and high proportion of public land. The Inyo National Forest receives about ten million visitor-days of use per year. Recreation is also popular on lands of the Humboldt-Toiyabe National Forest, Bureau of Land Management, Death Valley National Park, and Los Angeles Department of Water and Power.

The Mammoth Mountain Ski Area is potentially the largest single source of sediment within the upper Owens River watershed. Mammoth Mountain has more than 30 ski lifts on a permit area of 3,200 acres with a design capacity of 19,000 skiers at one time. Ski areas have an inherent conflict between providing good skiing conditions with shallow snow and maintaining enough vegetation to minimize erosion. The steep slopes of ski runs also allow flowing water to apply sufficient force to readily dislodge soil particles. Besides these fundamental issues common to all ski areas, the pumice and poorly developed soils on Mammoth Mountain are prone to erosion once disturbed and stripped of vegetation. The ski area has an active erosion control program and has successfully established grasses on many of the ski runs. Most of the runoff from open ski runs is also channeled through sediment detention basins in an effort to reduce the movement of sediment beyond the ski area boundaries.

Compared to other parts of the Sierra Nevada, the potential for significantly increased erosion and sedimentation from off-highway vehicle (OHV) use is relatively small in the eastern Sierra Nevada because of the limited rainfall and snowmelt runoff. However, a critical exception to that statement occurs near and in water courses. When vehicles enter riparian areas and cross streams, there can be significant sediment movement, simply because of the presence of water. There have been anecdotal observations of OHV caused erosion in Glass and Deadman creeks in the past decade. The Inyo National Forest has attempted to address the problem through restricting vehicle use in the Glass/Hartley area. In some areas where vegetation has been damaged and soil has been disaggregated by OHV use, the potential for wind erosion of soil is significantly increased.

Grazing

There was a period of severe overgrazing in the late 1800s to early 1900s throughout the Sierra Nevada that resulted in widespread changes in vegetation cover and composition and active channel erosion. The northern portion of the planning area was assumed to have been impacted in a manner similar to the bulk of the mountain range. An estimated 200,000 head of sheep grazed the Walker River country around 1900 (USDA-Forest Service, 2004). The rangelands have been recovering ever since under less intense grazing pressure.

The upper Owens River watershed may not have been as severely overgrazed in the second half of the 19th century as many other parts of the Sierra Nevada because of the greater distance to markets and population centers. Although we know that Owens Valley ranchers drove livestock into Long Valley and beyond for summer and fall grazing in the 1880s (Burton and Farrell, 1992), there is little other documentation of the extent and intensity of grazing in the upper Owens watershed before 1900. When the first rangers of the Sierra Timber Reserve arrived in Mono County in 1903, their orders were to keep trespassing sheep out of the reserve (Millar, et al., 1996). Overgrazing apparently persisted through the 1940s. In 1944, the Inyo National Forest attempted to bring rangeland use, quantified by animal unit months (AUMs), closer to range productivity and resolve grazing damage to and conflicts with other resources (Millar, et al., 1996). Within six years of adopting that plan, grazing intensity on the whole forest had dropped by 40 percent.

The City of Los Angeles Department of Water and Power leases grazing rights on much of the land in the planning area. Riparian fencing projects for grazing and recreation management on tributaries to the Upper Owens River that were installed in the 1990s demonstrated considerable improvement in riparian conditions (Jellison and Dawson, 2003).

Agriculture and Forestry

In the northern portion of the region, agriculture, primarily cattle ranching, is the dominant land use in the broad Antelope and Bridgeport valleys. Pasture irrigation is the largest single use of agricultural water in Antelope Valley (DWR, 1992). Other areas of large-parcel private land include Little Antelope Valley and the Sonora Junction area. In the early 1970s, there were approximately 38 farms and ranches operating within the West Walker River watershed with a combined area of about 15,870 acres (USDA Nevada River Basin Survey Staff, 1975).

In the 19th century, agriculture was the most extensive land use in the Mono Basin and relied on water diverted from the creeks on the west side of the basin. By the 1890s, perhaps 4,000 acres were irrigated for both crops and pasture (Vorster, 1985). The amount of land under irrigation probably peaked at about 11,000 acres in 1929 (Harding, 1962; cited by Vorster, 1985). As the City of Los Angeles acquired land and water rights in the 1930s, the amount of land under cultivation in the Mono Basin decreased.

Irrigated agriculture in the Owens Valley was practiced for hundreds of years by the native Paiute people who constructed artificial channels to enhance the growth and volume of vegetative resources (Steward, 1934; Lawton, et al., 1976). Euro-Americans began to settle in the Owens Valley in the 1860s and rapidly cleared native vegetation to enable farming (Vorster, 1992). Irrigation canals were constructed, and more than 250 miles of canals and ditches were in place by 1890 (Babb, 1992). This extensive irrigation network allowed most of the average annual flow of the Owens River to be diverted and spread across tens of thousands of acres of cropland and pasture. By 1900, about 15,000 acres were cultivated and another 21,000 acres were intermittently irrigated for pasture (Vorster, 1992). By 1905, the diversion of water from the Owens River for irrigation had led to a 33-foot drop in the level of Owens Lake over the preceding 30 years. By 1913, in response to a few relatively-wet years and reduced irrigation on lands just purchased by the City of Los Angeles, the level of Owens Lake rose about 15 feet (Lee, 1915; Babb, 1992). As the City of Los Angeles acquired most of the land and water rights in the Owens Valley, agriculture declined rapidly. By the early 1990s, about 3,000 acres of alfalfa and other forage crops were irrigated along with about 8,000 acres of pasture, mostly under lease from the City of Los Angeles (Vorster, 1992).

The Walker River watersheds and the Mono Basin were major sources of lumber and fuel wood for the mines near Bodie and Aurora. A five-ton steamer was brought from San Francisco in 1879 to tow barges filled with lumber from Lee Vining Canyon across Mono Lake (Hart, 1996). Apparently, there were so few trees remaining near Lee Vining in the 1920s that lumber had to be brought from Mammoth and Bodie to build the school. In the early 1880s, a railroad was constructed on the east shore of the lake to transport lumber from Mono Mills, on the southeast side, toward Bodie. The logging camp at Mono Mills operated intermittently until 1917 (Hart, 1996).

Timber management on lands of the Inyo National Forest within the upper Owens River watershed has been a relatively small-scale activity compared to other national forests in the Sierra Nevada. Most of the harvesting has occurred in the Dry Creek, Deadman Creek, and Hartley Springs portion of the Glass Creek watershed on the west side of U.S. Highway 395 and the area northeast of Crestview. In the 1960s and 1970s, eight timber sales totaling about 60 million board feet were conducted in the watershed. These harvests removed large Jeffrey pines of high value per tree until about 30 percent to 40 percent of the large trees were cut. By the late 1960s, most of the forest east of the highway had been harvested in this manner, leaving half to two-thirds of the mature trees (Millar, et al., 1996). In 1979, the Inyo National Forest adopted a new plan for the area north of Mammoth Lakes that emphasized timber harvesting with only watershed consequences as a major constraint. Between 1979 and 1988, seven timber sales were harvested with about 30 million board feet of timber cut. As public and agency values shifted during the 1980s and 1990s, an old-growth forest management strategy was developed by the Inyo National Forest (USDA-Forest Service, 1992). During the 1990s wintertime logging was conducted over snow cover in order to protect soils. By 2000, logs were no longer being trucked north out of the area. Currently, most timber harvest is used locally for fuelwood and lumber.

Mining

Following the discovery of gold at Dogtown in the East Walker River watershed, in 1857, prospectors moved south into the Mono Basin and found gold in and near Rattlesnake Gulch in 1858 or 1859 (Fletcher, 1987). The first town in what was to become Mono County, Monoville, grew rapidly around the Mono Diggings. The miners needed water to work the placer deposits and soon built a ditch from Conway Summit to import water from Virginia Creek (DeDecker, 1966).

The headwaters of Lee Vining Creek and Mill Creek were extensively prospected and mined in the 1870s and 1880s. The Great Sierra Silver Mine and Bennettville were established in Mine Creek, a tributary to Lee Vining Creek, between 1878 and 1888. The efforts of hauling mining equipment from Lundy, building the Great Sierra Wagon Road (eventually part of the route of the Tioga Pass road) from the west, boring deep tunnels in hard rock, as well as living at 10,000 feet, made Bennettville and the Tioga Mining District legendary (DeDecker, 1966).

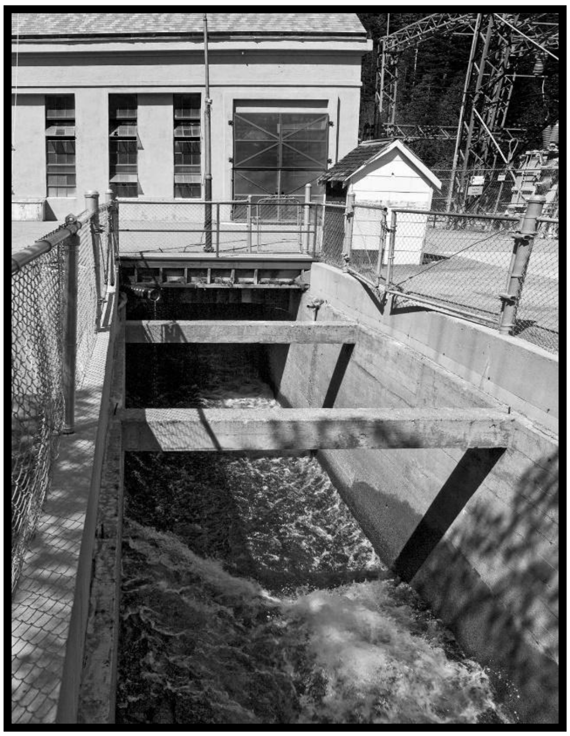
Mining began in the Mammoth Lakes basin in the 1870s and played out relatively quickly. Prospecting throughout the watershed led to active mining in a few locations, but none of the mines was particularly successful. Prospecting and mining occurred all along the eastern slope of the Sierra Nevada, often for short periods following the boom and bust of mineral strikes. For example, Kearsarge City, serving the mines above Independence, was briefly the largest community in Inyo County in the mid-1860s. Mining and processing activities that produced tungsten and molybdenum in Pine Creek were a rare exception to the short mining cycle and persisted for several decades (Kurtak, 1998).

Mining in the northern Mojave region began in the late 1860s and peaked quickly during the 1870s with successful silver mines at Cerro Gordo, Panamint City, Darwin, and Tecopa. Mining of various salts from the lakebeds and playas of the region followed the silver boom. Extraction of borax from Death Valley and Searles Lake was profitable until supply overwhelmed demand by 1888. Gypsum, table salt, talc, potash, and soda ash were profitably mined from China Ranch, Saline Valley, Searles Lake, and other deposits. Mining operations still continue at Searles Lake (Tweed and Davis, 2003) with more than 1.75 million tons of chemicals exported from the Trona processing plant in 2005.

Hydroelectric Generation

In 1893, a hydroelectric generating facility on Green Creek above the Bridgeport Valley began supplying alternating current to the Standard mill in Bodie.

Water from Mill Creek was diverted to generate hydroelectric power in the early years of the 20th century. In 1911, the 3 megawatt Lundy Project was completed by the Southern Sierra Power Company (Perrault, 1995). Construction of a dam raised the natural outlet of Lundy Lake 37 feet to an elevation of 7,803 feet (Stine, 1995). Lundy reservoir has a surface area of 130 acres and a usable capacity of about 3,800 AF (Perrault, 1995). The diversion to the Lundy powerhouse has a capacity of about 70 cfs. Southern California Edison assumed ownership and control of the hydroelectric facilities in 1962 as Federal Energy Regulatory Commission project 1390.



Regulation of the flows in Lee Vining Creek for hydroelectric generation began in 1921 (now FERC project 1388). Ellery, Tioga, and Saddlebag reservoirs in the headwaters of Lee Vining Creek have a combined storage capacity of 13,600 acre-feet. Much of the creek's flow is contained within a penstock between Ellery Lake (9,490 feet) and the Poole Powerhouse (7,840 feet). About 27,000 acre-feet of water flows through the powerhouse each year. The Lee Vining Creek project can generate up to 11 megawatts of electricity.

Between 1916 and 1925, dams were constructed to enlarge Agnew and Gem lakes and at Rush Creek Meadows to form Waugh Lake to allow storage and regulation of water for the 8.4 megawatt Rush Creek powerhouse near Silver Lake. Waugh, Gem, and Agnew reservoirs can store 4,980; 17,060; and 860 acre-feet, respectively, for Southern California Edison's FERC project 1389. The operating license was renewed in 1997. Seismic safety and leakage concerns led to major repairs of the dams during the past several years. Work to install a geomembrane to the upstream side of the Gem Lake dam began in 2007. The Waugh Lake dam at Rush Creek Meadows now has a geomembrane as well as an engineered notch (cut in the summer of 2018) to reduce the amount of water that can be stored in response to a FERC requirement limiting the amount of water that can stored behind the dam in the event of a high-magnitude earthquake.

Following the completion of the Long Valley dam, which regulates Crowley Lake, the LADWP constructed a series of penstocks and power houses downstream in the Owens Gorge. The system began operation in 1953, and the Owens River was effectively dried up within the Gorge. In 1991, an error in the operation of the system damaged a penstock, and water was released back into the natural channel. Once the river began to flow again, the total diversion could not legally resume under the state Fish and Game Code. Managed streamflow, riparian vegetation, and a trout fishery have been restored within the Owens Gorge. In 2019, a pumped storage scheme was proposed within the Owens Gorge, but the plan was withdrawn within a few months.

The Bishop Creek hydroelectric system diverts water from the south and middle forks of Bishop Creek and generates electricity at four powerhouses. The system began more than a century ago when the Nevada Power, Mining, and Milling Company began to transmit electricity from their Bishop Creek powerhouse to Goldfield and Tonopah in 1905. Over the following eight years, the Nevada-California Power Company constructed dams that formed South Lake and Lake Sabrina and built five powerhouses that utilized more than 3,500 feet of head. The original wood-stave pipe was replaced between 1949 and 1983 (JRP Historical Consulting Services and California Dept. of Transportation, 2000). The system is now operated by Southern California Edison under FERC license 1394. The total installed capacity of the Bishop Creek project is 26 megawatts.

LADWP operates hydroelectric facilities on Big Pine Creek, Division Creek, and Cottonwood Creek. The Division Creek powerplant was built in 1905 to supply electricity to help with construction of the aqueduct. In 2008, LADWP proposed the concept of a new hydroelectric plant at Tinemaha Reservoir.

Large-scale solar power projects were proposed on and near Owens Dry Lake in 2010, as well as within the Owens Valley and in more remote parts of southeast Inyo County. Potential corrosion from the alkaline lake bed eliminated Owens Dry lake itself from consideration.

Roads

Many of the roads in eastern Sierra Nevada watersheds have direct impacts on channels and riparian systems because the roads are built on floodplains, in the riparian zone, and/or make frequent crossings of the stream. The most obvious example is U.S. Highway 395 through Walker Canyon. Slopes disturbed by the road placement and construction were long-term sources of sediment to the West Walker River. This section of road was largely destroyed by the flood in January 1997. Portions of other paved roads are often adjacent to or cross major streams. Unpaved forest roads have many areas of contact with streams and riparian zones and are sources of sediment. GIS analyses by Mono County found that the West Walker River watershed contains more than 490 miles of mapped roads that cross streams in at least 380 places, and more than 38 miles of roads are within 100 feet of a stream. In the upper Owens River watershed, the total length of roads is about 1,750 miles, there are more than 1,200 stream crossings by roads, and more than 120 miles of road are within 100 feet of a stream.

Wild and Scenic River Status

The California Wild and Scenic Rivers Act of 1972 preserves designated rivers possessing “extraordinary scenic, recreational, fishery, or wildlife values” in their free-flowing condition. The act prohibits construction of dams, reservoirs, and most water diversion facilities on river segments included in the system (California Department of Water Resources, 1992). The major difference between the national and state acts is that if a river is designated wild and scenic under the state act, the Federal Energy Regulatory Agency can still issue a license to build a dam for hydropower generation on that river. Because of this difference, designation under the National Wild and Scenic Rivers Act (1968) affords enhanced protection (Horton, 1996).

The main channel of the West Walker River from the headwaters near Tower Lake to the confluence with Rock Creek near the town of Walker and Leavitt Creek downstream from Leavitt Falls were added to California's Wild and Scenic River System in 1989. The designated section includes about 33 river miles of the main stem and about 5 miles of the tributary Leavitt Creek (DWR, 1992).

A special provision of the California Wild and Scenic Rivers Act applies to the West Walker River because it is an interstate stream and a source of agricultural water and domestic water:

"The California Wild & Scenic Rivers Act does not prohibit the replacement of diversions or changes in the purpose of use, place of use, or point of diversion under existing water rights, except that no such replacement or change shall operate to increase the adverse effect, if any, of the preexisting diversion facility or place or purpose of use, upon the free-flowing condition and natural character of the stream, and no new diversion shall be constructed unless and until the Resources Secretary determines that the facility is needed to supply domestic water to the residents of any county through which the river or segment flows and that the facility will not adversely affect the free-flowing condition and natural character of the stream." (http://www.dot.ca.gov/ser/vol1/sec3/special/ch19wsriverschap19.htm#ch19WestWalker)

In 2009, federal Wild and Scenic River status was granted to the headwaters of the Owens River, including Glass Creek and Deadman Creek and portions of the Amargosa River.

Aquatic Conservation Areas

The Sierra Nevada Forest Plan Amendment (aka Sierra Nevada Framework) process of the USDA-Forest Service initiated a series of new aquatic conservation measures. The Humboldt-Toiyabe National Forest applied this management direction to the establishment of several "critical aquatic refuges." These refuges were identified in the Framework amendment as small watersheds that contain:

- known locations of threatened, endangered, or sensitive species
- highly vulnerable populations of native plant or animal species
- localized populations of rare native aquatic- or riparian-dependent plant or animal species

The primary management goal for critical aquatic refuges is to preserve, enhance, restore or connect habitats distributed across the landscape for sensitive or listed species to contribute to their viability and recovery (USDA-Forest Service, 2004).

2.3.3 Land Ownership and Interagency Cooperation

Land ownership in the Inyo-Mono region is primarily public (Figure 2-2). Approximately 94% of Mono County is publicly owned: 88% is owned by the federal government (US Forest Service, National Park Service, Bureau of Land Management, and Department of Defense), 6% by city and state governments, and the remaining 6% is privately owned. The City of Los Angeles owns about 63,000 acres of land in the southern portion of Mono County. Ninety-two percent of Inyo County is federally owned, about 2% is state-owned lands, and the City of Los Angeles owns approximately 4% of the land in Inyo County. The Shoshone and Paiute Indian tribes also own Reservations or Colonies throughout the region.

At the watershed level, a couple of examples from the northern portion of the region illustrate the prevalence of public land. More than 85% of the West Walker River watershed is in public ownership by the U.S. Forest Service, Bureau of Land Management, and the California Department of Fish and Wildlife for resource management purposes (USDA Nevada River Basin Survey Staff, 1975). More than 90 percent of the Mono Basin is USDA-Forest Service, Bureau of Land Management, or Los Angeles Department of Water and Power land. Since 1981, the California Department of Parks and Recreation has also been involved, following the creation of the Mono Lake Tufa State Reserve. The state reserve consists of approximately 6,000 acres of the shoreline of Mono Lake, including landscapes ranging from alkali flats to highly productive wetlands, and the bed and waters of the lake itself. The Inyo National Forest administers the Mono Basin National Forest Scenic Area, established by Congress in 1984. A management plan for the Scenic Area includes some provisions for private property within the boundaries. Mono County and the USDA-Forest Service have different land-use restrictions, both of which must be met by private landowners.

Land use planning within the Inyo-Mono IRWM region is fragmented with respect to the varied ownership of the land. Two federal agencies (U.S. Forest Service and Bureau of Land Management) and the LADWP administer most of the land area. Private land is subject to zoning and planning controls of the county governments or the three incorporated jurisdictions (Ridgecrest, Bishop, and Mammoth Lakes). Within Mono County, the Mono County Collaborative Planning Team has been somewhat successful in coordinating land use planning among the different agencies since its formation in 1996. Although information exchange has been its primary influence to date, there is great potential through this mechanism to affect general policies and decisions that have widespread consequences.

Part of the public land administered by the Bureau of Land Management, mostly in the vicinity of Crowley Lake, is covered by "watershed withdrawals" made by Congress and the President in the 1930s. The original purpose of these withdrawals was to prevent speculative homesteading in anticipation of acquisition by the City of Los Angeles. The particular status of these lands prevents their sale or exchange, may influence federal water rights appurtenant to these lands, and gives the BLM additional legal status with respect to any hydropower licenses within the designated area.

2.3.4 Demographics, Residential Development, and Economy

Tribal Communities

There are several tribal communities located throughout the Inyo-Mono Region. These communities are the remnants of a widespread Native American population that occupied much of the region prior to Euro-American contact in the mid-1800s. The following is a brief description of tribes and reservations in the region, listed from north to south:

The Washoe/Paiute Tribe of Antelope Valley does not currently have federally recognized status but operates a medical clinic and housing just north of Walker.

The Bridgeport Indian Colony has a federal reservation of 40 acres on the east side of Bridgeport. Although there are more than 100 tribal members enrolled, only about 20 live on the Colony.

Some members of the Mono Lake Paiutes (also known as Kutzadika'a or Kucadikadi) live in and near Lee Vining and are seeking federal recognition. Many members are currently enrolled in federally recognized Paiute, Washoe, Yokuts, Miwok, and Western Mono tribes.

The Utu Utu Gwaitu Paiute Tribe has a 467-acre federal reservation near Benton. The reservation was established in 1915 and currently has about 50 resident members of the tribe.

The Bishop Paiute Tribe has more than 2000 enrolled members and is the fifth largest Native American tribe in California. Since 1912, the Bishop Paiute Tribe has had a federal reservation of 877 acres adjacent to Bishop. About 1500 tribal members live on the reservation.

The Big Pine Band of Owens Valley Paiute Shoshone Indians is a federally recognized tribe. The tribe has more than 450 enrolled members. The Big Pine Reservation covers 279 acres adjacent to the town of Big Pine and was established in 1912.

The Fort Independence Indian Community of Paiute Indians is a federally recognized tribe. Its Fort Independence Reservation has an area of about 350 acres and was established in 1915.

The Paiute-Shoshone Indians of the Lone Pine Community is a federally recognized tribe with about 1400 enrolled members. About 350 tribal members live on the Lone Pine Indian Reservation that has an area of 237 acres. The reservation was established in 1939 through a land exchange between the U.S. Department of the Interior and the City of Los Angeles.

The Timbisha Shoshone Tribe was formally recognized in 1982, at which time the tribe's reservation, the Death Valley Indian Community near Furnace Creek, was established. During the preceding half-century, the tribe had a difficult relationship with the administration of Death Valley National Monument (now Park). The reservation covered only 40 acres in 1990, but the federal Timbisha Shoshone Homeland Act of 2000 returned 7,500 acres of ancestral lands to the tribe.

A few of the tribes in the region have collaborated on a long-term effort to secure water rights. The Owens Valley Indian Water Commission is a consortium of the Bishop, Big Pine, and Lone Pine Paiute Tribes that is involved with water rights, water and environmental protection, and education.

Other Communities

Compared to most of California, the Inyo-Mono IRWM region is very sparsely populated. Mono County has a population density of about four people per square mile, and Inyo County has only two people per square mile. The City of Ridgecrest within the small part of Kern County that is in the Inyo-Mono IRWM region constitutes about half of the total population of the region (27,616; 2010 Census).

Table 2-7: Population of Inyo and Mono Counties between 1970 and 2010

	1970	1980	1990	2000	2010
Inyo	15,571	17,895	18,281	17,945	18,546
Mono	4,016	8,577	9,956	12,853	14,202

The West Walker River watershed contains four communities: Walker, Coleville, Camp Antelope, and Topaz. The population of Antelope Valley was 574 in 1970 and 1,187 in 1980. The footprint of these communities is quite small. Similarly, in the East Walker River watershed, Bridgeport (county seat of Mono County) is the only community with much population (about 1,000). The economies of these basins are based on agriculture, tourism, government services, and the U.S. Marine Corps Mountain Warfare Training Center and its affiliated housing compound near Coleville.

There are three communities within the Mono Basin: June Lake, Lee Vining, and Mono City. Private property is limited outside these communities. Lee Vining has a population of about 350 people, includes about 20 businesses along U.S. Highway 395, and occupies about 30 acres. Mono City is a community of approximately 100 residents near the junction of U.S. Highway 395 and State Route 167. The year-round population of June Lake is about 650. The communities of Lee Vining and June Lake have economies focused on travelers and tourism. The June Mountain Ski Area attracts winter visitors. These communities serve as centers for hiking, mountain biking, fishing, camping, and skiing.

Mammoth Lakes is the largest community in the upper Owens River watershed, with an area of four square miles and a population of about 8,200. The peak population during holiday periods and busy weekends in 2005 was about 35,000. These large variations in population from day to day have created an unusual set of problems for planning and operations for water supply and sewage disposal as compared to municipalities with relatively stable water demand. The Mammoth Mountain Ski Area is a major driving force in the local economy and the largest employer in Mono County. Other tourism-dependent businesses constitute a significant fraction of economic activity. The recreational economy creates a variety of challenges regarding full-time employment, business opportunities, income disparities, availability of adequate housing, etc. (e.g., Clifford, 2002; Machado, 2019). Residential construction is an episodically important source of employment in southern Mono County.

Ranches along the upper Owens River have remained as relatively large undeveloped parcels, and a few upland areas with access to water along the old Highway 395 have been subdivided in the communities of Aspen Springs, Hilton Creek/Crowley Lake, McGee Creek, Long Valley, and Sunny Slopes. Beyond these communities and Mammoth Lakes, the upper Owens River watershed contains only a few scattered homes.

In the Owens Valley, the principal communities with their respective populations (where available) are Swall Meadows (250), Paradise, Rovana, Starlite, Aspendell, Bishop (4,000), Big Pine (1,400), Independence (600), Lone Pine (700), Keeler (<100), Cartago (110), and Olancha (130). North of Bishop, principal communities are Chalfant and Hammil (700 combined) and Benton and Benton Hot Springs (400 combined). People older than 64 constitute 20 percent or more of the population of the larger communities of the Owens Valley (versus 11 percent of California's population), which suggests that the area is favored by retirees, and a significant proportion of the valley's total income is from transfer payments. The Los Angeles Department of Water and Power is a major employer throughout the Owens Valley.

In the northern Mojave desert zone, the principal communities are Furnace Creek (50), Darwin (50), Trona, Ridgecrest (30,000), Inyokern (1,000), Shoshone (50), and Tecopa (100). Ridgecrest has a vastly greater impact on water resources than the smaller communities. The economy of Ridgecrest is fundamentally tied to the adjacent China Lake Naval Weapons Station.

2.4 Descriptive Hydrology

2.4.1 Runoff Generation and Water Balance

The eastern Sierra Nevada part of the Inyo-Mono IRWM planning area has a runoff pattern dominated by snowmelt from April through July that is typical of most Sierra Nevada rivers. A winter snowpack usually begins to accumulate in November at the higher elevations, attains maximum water storage in late March or early April, and then melts over the next 2-3 months. After several months of low discharge during autumn and winter, the streams begin to rise during April with the initial snowmelt and carry sustained high flows through May and into June. As the snowpack gets thinner and snow cover disappears from successively higher elevations, streamflow declines through summer and eventually reaches the minimal flows of autumn. For example, approximately 81 percent of the annual runoff of Mill Creek in the Mono Basin has been attributed to snowmelt, occurring from April through September, and the remaining 19 percent of the annual streamflow occurs as base flow from October through March (Perrault, 1995). Occasionally, a warm winter storm brings enough rainfall over enough of the watershed to raise streamflow for a few days. On rare occasions, these storms lead to significant rainfall and runoff that have generated the largest floods on record.

The northern Mojave Desert zone generates very little runoff, and that runoff is isolated in time and space. Occasional winter storms produce sufficient rainfall to generate runoff from overland flow or downslope water movement through soil layers to a nearby channel. Intense summer thunderstorms can also put a lot of water into channels in a short period of time, creating flash floods. Runoff is also produced by groundwater outflow at seeps and springs. Even where there is some runoff, it often infiltrates back into the bed of the channel not far from the source. Most of the time, most of the channels in the northern Mojave Desert are dry.

A water balance is a useful tool for understanding the various quantities of water involved in different parts of the hydrologic cycle within a particular watershed. Water balances basically show what fraction of incoming precipitation becomes runoff versus what fraction is lost to the atmosphere or adds to groundwater storage.

For example, a coarse water balance (starting with generated runoff from small tributaries) of the entire Walker River basin estimated that 184,700 AF of runoff enter the upper West Walker River and 1,000 AF evaporate before the river enters Antelope Valley. Within Antelope Valley, another 28,700 AF enter and 38,400 AF are lost to evapotranspiration (31,300 AF from irrigated fields, 2,800 AF from phreatophytes, and 4,300 AF from lake surfaces) for a net export from Topaz Lake of 174,000 AF (Carson River Basin Council of Governments, 1974).

A thorough water balance of part of the Owens Valley aquifer system showed how groundwater storage can change over a period of years before and after the second aqueduct to Los Angeles began operation *(Table 2-8; Hollett, et al., 1991; Danskin, 1998).*

Table 2-8: Water balance for part of the Owens Valley aquifer system for water years 1963-1969 and 1970-1984.

Average Annual Values (AF)		
Component	**WY 63-69**	**WY 70-84**
Precipitation	+2,000	+2,000
Evapotranspiration	-112,000	-72,000
Tributary streams	+106,000	+103,000
Mtn front non-stream recharge	+26,000	+26,000
Runoff from outcrops within fill	+1,000	+1,000
River & Aqueduct seepage	-16,000	-3,000
Spill gates	+6,000	+6,000
Lower Owens River	-5,000	-3,000
Lakes & reservoirs	+1,000	+1,000
Canals, ditches, & ponds	+32,000	+31,000
Irrigation and watering of stock	+18,000	+10,000

Pumped and flowing wells	-20,000	-98,000
Springs and seeps	-26,000	-6,000
Underflow into aquifer system	+4,000	+4,000
Underflow out of aquifer system	-10,000	-10,000
Total recharge	+196,000	+184,000
Total discharge	-189,000	-192,000
Change in groundwater storage	-7,000	+8,000

In this water balance, negative change in storage means water is entering groundwater storage and a positive change in storage means that groundwater is flowing out of storage. The terms are thoroughly explained in the cited reports. The summary is provided here just as an example of a water balance within the Owens Valley.

2.4.2 Streamflow Averages and Extremes

The eastern Sierra Nevada region, especially Owens River watershed, has an unusually high density of streamflow measuring stations, in part because of the high value of the water resources in the area. Streamflow in the eastern Sierra Nevada is highly variable over time, so information about the range in values and the time period considered is at least as important as averages. For example, even on an annual basis, the maximum annual volume for the East Walker River near Bridgeport over the 1926-2019 period of record was about 14 times the minimum annual volume: 321,000 AF in 1983 vs. 23,000 AF in 2015. This range of variability is also illustrated in the extremes in observed annual flow of some of the tributaries to the upper Owens River *(Table 2-9; Smith and Aceituno, 1987).*

Table 2-9: Annual flow for five upper Owens River tributaries (cfs)

Stream	Mean	Minimum	Maximum
Convict Creek	26	10	75
Glass Creek	8	2	20
Deadman Creek	6	2	20
Rock Creek	26	13	70
Upper Owens R.	30	15	70

Tributaries to the Owens River from the Sierra Nevada contribute significant volumes of water each year, primarily during the April through July snowmelt-runoff season. Only two streams on the east side of the Owens Valley have any appreciable flow: Coldwater Canyon and Silver Canyon Creek; however, these streams typically discharge less than 2,000 acre-feet/year. In the Inyo Range, Mazourka Creek (USGS station 10282480) was monitored between 1961 and 1972. No flow was recorded all days except during two brief periods in 1967 and 1969. During these periods, discharge peaked at more than 1,300 and 600 cfs, respectively (Hollett et al., 1991; Danskin 1998).

A few streams and rivers in the Inyo-Mono region have been measured for more than 80 years. Unfortunately, not all of the data are part of the public record available from the U.S. Geological Survey, and there are some gaps in the records. Nevertheless, the available record from several sites allows a look at the region's streamflow over most of the past century.

Beyond the dramatic variability from year to year mentioned above, an obvious question in light of our concern about climate change is whether there are any trends over time. With respect to annual volumes of runoff, the simple answer is no or perhaps not much, or if one wishes to crawl out on a limb, perhaps some indication of greater runoff in recent decades compared to the first decades of record. Plots of annual runoff by year do not show any major trends over the period of record. The inter-annual variability overwhelms any obvious change over the course of the measurements in all the streams examined. The greatest highs and lows substantially alter the average over a decade or two. A simple but robust method of detecting trends in a time-series is comparison of averages over multi-decade fractions (halves, thirds, or quarters) of the entire series. For example, this technique was used to illustrate that precipitation in Sacramento was more than 40 percent greater between 1978 and 2007 than between 1908 and 1937 (Climate Change Technical Advisory Group, 2015). Among the sample of streams in the Inyo-Mono region, average annual streamflow volumes were greater in the more recent half of the record than in the first half of the record in 6 of 7 cases. The exception was Rock Creek at Little Round Valley where the average for the recent half of 94 years was 0.5 percent less than the first half. The percentage increase of the recent half compared to the first half at the other sites was as follows: Independence Creek 13%, Big Pine Creek 5%, Pine Creek 14%, Convict Creek 8%, East Walker 7%, and West Walker 1%. For example, Big Pine Creek has been gaged since 1920, and the average annual volume for the first half of the record was 24,035 AF and for the second half of the record was 25,180 AF.

2.4.3 Droughts and Floods

As noted in the climate section, severe and persistent droughts occurred in the West Walker River watershed during AD 890-1110 and 1210-1350 (Stine, 1994). These dry periods had so little streamflow that Jeffrey pine trees grew on the bottom of the channel in the Walker River Canyon. Modern dry spells are short and wet by comparison.

During the past century, periods with well-below average precipitation in the West Walker River watershed occurred in 1924-25, 1928-34, 1960-61, 1976-77, 1988-92, and 2012-2016. Topaz reservoir was drained below its operating capacity at times during these dry years. Downstream in Nevada, the Walker River stopped flowing at the Wabuska stream gage in 1924-25 and 1931 (California Department of Water Resources, 1992).

Three serious multi-year droughts occurred in most of the region in the past century: 1923 through 1935 and 1987 through 1992 (Jones and Stokes Associates, 1993a: Appendix H) and 2012 through 2016. Streamflow was also much below average in 1976 and 1977. In addition to an occasional dry year, there have been six periods over the past century in which precipitation and resulting runoff in the upper Owens River were well below average for multiple years: 1928 to 1934, 1959 to 1961, 1976 to 1977, 1987 to 1992, 2000 to 2004, and 2012 to 2016. These periods did not correspond exactly with dry periods noted above for the West Walker River. For the Inyo-Mono region, as well as most of California, precipitation and streamflow were at their lowest measured values during 2015. Precipitation was also very low during 2018, but residual water from the very wet previous year helped maintain streamflow.

At the opposite extreme, floods are a basic attribute of channels in the eastern Sierra Nevada and northern Mojave Desert. Hydrologic and geomorphic processes that create alluvial channels tend to make the channel capacity adequate only to handle peak flows that happen with an average frequency of about 1.5 years (or a probability of about 0.67). Peak flows above the channel capacity spill out onto the floodplain and are termed floods. Routine floods rarely have much impact beyond continuing to shape the channel and its adjacent floodplain. However, every few years, various conditions combine to generate considerably larger floods that catch our attention. As the magnitude of floods increases, the frequency of such flows decreases. For example, a very large flood may occur only once in a century (on the average over a very long period of time). This average frequency (sometimes called a return period or recurrence interval) can also be expressed as a probability of occurrence in any given year (*e.g.,* a “one-hundred year flood” has a probability of 0.01 in a particular year).

In the West Walker River, damaging floods occurred in 1950, 1955, and 1997. Prior to the January 2, 1997, peak of about 12,500 cfs, the flood peak of record at the West Walker River near the Coleville gage was 6,500 cfs on December 11, 1937 (California Department of Water Resources, 1992). By contrast, in the adjacent East Walker River, the 1997 flood was only about one-third higher than the previous peak of record (1,910 cfs in 1997 vs. 1,390 cfs in 1963). Floods that cause widespread damage throughout an entire watershed are relatively uncommon. Types of floods in the northern portions of the planning region include winter rain floods, spring snowmelt floods, and localized floods often associated with summer thunderstorms.

Flood damage from the winter rainstorms is most significant in Antelope Valley where low-lying lands can be inundated in even relatively small rainstorms (California Department of Water Resources, 1992). Many lots in the community of Walker, especially between North River Lane and Meadow Drive, are within the 100-year flood plain of the West Walker River.

Snowmelt runoff in 2005 largely filled the channel of the West Walker River within Antelope Valley. In late May, water levels ranged between 8 and 9.2 feet at a gage where 9.0 feet is considered flood stage. Minor flooding was reported between Walker and Topaz. Snowmelt runoff again filled the West Walker River to near flood stage in May 2006, May 2011, May 2017, and June 2019.

In the Mono Basin, floods that were significant from a watershed management perspective occurred in 1967 and 1969 in Rush and Lee Vining creeks. These snowmelt floods of the late 1960s greatly eroded the channels and moved enormous amounts of sediment.

Within the Town of Mammoth Lakes, the 100-year (0.01 probability) peak flow in Mammoth

Creek was estimated at 550 cfs (Environmental Sciences Associates, 1984). Some houses adjacent to the Snowcreek Meadow and immediately downstream could get wet under extraordinary flood conditions, especially if debris jammed the bridges on Minaret and Old Mammoth roads.

An earlier analysis of streamflow variability in the eastern Sierra Nevada (Kattelmann, 2001) found that there have been clusters of dry years spread throughout the period of record, but a marked increase in high flows toward the recent part of the time-series. With the addition of another 15 years of data, there has been another multi-year drought (including the driest year on record) and more peak flows. The 2001 study reported "seven of the eight to eleven (depending on which stream) snowmelt floods (in terms of volume) since the 1920s have occurred since 1978" [through 1999]. In the years since that study, very large snowmelt floods occurred in 2005, 2006, 2010, 2011, 2017, and 2019. These events provide more evidence for an increasing tendency toward more extreme hydrological events in the past two to three decades compared to the first three-quarters of the 20th century.

Because of the large size of the Owens River watershed (425 mi^2 at Round Valley and 1,975 mi^2 at Big Pine) and its wide range of hydrologic conditions, flood peaks tend to be influenced by the relative timing of peaks in the tributary streams and areal distribution of runoff along with the total volume of water flowing in the main channel (Kattelmann, 1992). Therefore, the largest peak flows at one place along the river do not necessarily coincide with those at other sites along the channel. For example, the largest flood of record (December 12, 1937) on the Owens at Round Valley and Pleasant Valley was attenuated to a comparatively average event by the time it reached Big Pine and Lone Pine. Four floods exceeding twice the mean annual-flood at the gage near Big Pine have occurred during the past century. This index of flood activity is similar to the average for rivers of the western slope of the Sierra Nevada (Kattelmann, 1992). The Los Angeles Aqueduct has been significantly damaged by floods within the Owens Valley on at least four occasions: January 1943, October 1945, December 1966, and August 1989.

The Amargosa River floods in response to prolonged winter storms as well as intense rainfall during summer. Of the 33 annual peaks recorded at the gage at Tecopa, 20 occurred from July through October and 13 occurred from November through March. The flood of record on the Amargosa at the Tecopa gage was about 10,600 cfs on August 19, 1983. The second highest peak was about 5,000 cfs on February 26, 1969.

Local flooding from summer thunderstorms occurs throughout the region but is highly variable in time and space. During an active “Arizona monsoon” period in late July 2018, intense thunderstorms generated floods and debris flows that damaged roads in several areas of the Inyo-Mono region.

2.4.4 Groundwater

Groundwater resources are important throughout the Inyo-Mono IRWM planning area but are particularly valuable in the northern Mojave Desert zone where surface water is severely limited. Most of the aquifers that are pumped in the region are unconsolidated alluvial or lakebed deposits in the vicinity of major streams or Pleistocene lakes. Groundwater infrastructure is most developed in the Owens Valley and Indian Wells Valley. The California Department of Water Resources in its Bulletin 118 (2004) identified about 60 distinct groundwater basins within the Inyo-Mono IRWM planning area (Figure 2-1 and Table 2-5). None of these basins has sufficient data to calculate an adequate groundwater budget. A few of these basins are described below as examples of groundwater resources and use.

Within the West Walker River basin, groundwater is found in two relatively distinct portions of the hydrologic system. Some water is below the ground surface for short periods of time (hours to months) as it flows downslope toward a surface channel or one of the three groundwater basins. This shallow groundwater can be considered as the slow portion of the runoff generation, and most of it ends up as streamflow or is captured by plant roots and lost to the atmosphere. The second type of groundwater can be considered to be in long-term storage (years to centuries), either within fractured bedrock or in the deep groundwater basins of Antelope Valley, Little Antelope Valley, or Slinkard Valley. Alluvial sediments have accumulated to depths of dozens to hundreds of feet within these structural basins and have vast storage space in the pores between the particles. The estimated storage capacities of the groundwater basins of Antelope and Slinkard valleys are 160,000-170,000 and 72,000 AF, respectively (DWR, 1964). These estimates were based on a storage interval between 10 and 100 feet and a specific yield of 5 percent to 15 percent.

A recent report by the California Department of Water Resources contained a little information on groundwater levels within the Antelope Valley. Based on 85 well completion reports, depths ranged from 48-415 feet with an average of about 200 feet. As of now, there is no routine monitoring of well levels reported to the state (DWR, 2004) although that may change with the recent CASGEM reporting requirements. Agricultural irrigation is a significant contributor to groundwater recharge throughout the Antelope Valley. Water infiltrates from the canals, and a lot of applied water infiltrates below the root zone of crops (DWR, 1992).

Because of the lack of data about both the depth of the porous fill material in the Bridgeport Valley and its specific yield, guesses about the storage capacity of the Bridgeport Valley groundwater basin have ranged from 250,000 to 4,000,000 AF.

Groundwater in the Long Valley caldera portion of the upper Owens River watershed can be grouped into three basic categories: a relatively shallow cold-water system (less than 800 feet), a shallow thermal system, and a deep thermal system. The cooler waters are of excellent mineral quality while the warmer (> 80°F) waters have higher concentrations of dissolved solids

(USDA-Forest Service, 1994). More than 45 wells have been drilled in the Mammoth Lakes basin since 1976 (USDA-Forest Service, 1994). Out of the first 24 wells, only one yielded good quality water at pumping capacities greater than 200 gallons per minute (well #1, 600 gpm, 500 acre-feet yield). Most of this yield was believed to come from fractured volcanic rocks (Mammoth County Water District, 1981; Gram / Phillips, 1985). Additional wells drilled since 1987 have been more productive (Mammoth Community Water District, 2005).

The main aquifer for the warm springs at the Hot Creek fish hatchery is a fractured basalt flow (Lipshie, 1979). Materials filling the Long Valley caldera include interbedded volcanic rocks (lava flows and tuffs) and sedimentary deposits (lakebeds, stream deposits, and glacial outwash). Fractured lava flows tend to be more permeable than poorly sorted sediments, such as glacial materials (California Department of Water Resources, 1973:31-36). The overall circulation of shallow groundwater is from west to east. An order-of-magnitude estimate of the time required for groundwater to circulate through the system from recharge in the west to discharge at the hot springs along Hot Creek is 100 to 1,000 years (Lipshie, 1979).

The Owens Valley groundwater basin has a surface area of just over 1,000 square miles and a productive aquifer about 1,200 feet thick. Total storage capacity has been estimated to be between 30 and 35 million acre-feet (California Department of Water Resources, 2004). Between 1970 and 1990, groundwater pumping by the Los Angeles Department of Water and Power averaged 104,000 acre-feet per year in the Owens Valley. Since Los Angeles and Inyo County settled litigation over the second aqueduct in 1990, groundwater pumping has averaged 72,000 acre-feet per year. The water table within the city limits of Bishop is largely within ten feet of the surface (Nolte Associates, 2008a).

The Indian Wells Valley groundwater basin (DWR Bulletin-118 #6-54) has a surface area of approximately 600 square miles and is enclosed by the Sierra Nevada on the west, the Coso Range on the north, the Argus Range on the east, and the El Paso Mountains to the south (DWR, 2004). The average depth of basin fill sediments is about 2,000 feet, with more than 7,000 feet of fill in the western portion of the valley (Couch, et al., 2003). A near-surface aquifer that may have been contaminated in parts of the Naval Air Weapons Station at China Lake overlies a regional aquifer at depths of a few tens of feet to several hundred feet below ground surface. Clays deposited in the Pleistocene-age lakes that constitute much of the Indian Wells Valley groundwater basin form a barrier between the shallow and deep aquifers.

The regional aquifer has been extensively utilized to supply water for agriculture, the city of Ridgecrest, town of Inyokern, scattered residences, and the Naval Air Weapons Station at China Lake. The use of water for irrigation in the Indian Wells Valley dates back to an early alfalfa farm in about 1910. Current pumping for irrigation supports alfalfa and various field and orchard crops. In 2001, the largest producers of groundwater in the basin were the Indian Wells Valley Water District (production of approximately 8,400 acre-feet per year), private agricultural users (7,900 acre-feet per year), Naval Air Weapons Station at China Lake (2,800 acre-feet per year), and Searles Valley Minerals (2,700 acre-feet per year) (Couch, et al., 2003).

A large pumping depression is found in the vicinity of the Intermediate Well Field of the Indian Wells Valley Water District. Between 1921 and 1988, groundwater levels declined about 80 feet in this area (Indian Wells Valley Water District, 2002; cited by Couch, et al., 2003). Groundwater levels continue to decline at a rate of 1.0 to 1.5 feet per year near this well field and under Ridgecrest. This groundwater depression results from pumping of the District's water supply wells, agricultural wells, and private supply wells (Couch, et al., 2003).

Concern has been expressed regarding the sustainability of groundwater as a resource in the Indian Wells Valley. Groundwater production has decreased from about 30,000 acre-ft/yr in the mid-1980s to about 25,000 acre-ft/yr currently. Estimates of overdraft range between 16,000 and 29,000 acre-ft/yr. The primary limitations on quantifying the amount of overdraft are accurately determining recharge into the basin and quantifying well production, particularly from individual agricultural landowners. Groundwater flow directions and gradients are now primarily controlled by pumping from water supply wells (Couch, et al., 2003). A groundwater budget estimated that the volume of annual pumping is about twice the amount of recharge under 1985 conditions (Bean, 1989).

A cooperative groundwater management group began to plan for management of the aquifer system of the Indian Wells Valley more than a decade ago. The major users of groundwater in the valley - Indian Wells Valley Water District, Naval Air Weapons Station at China Lake, and Searles Valley Minerals - have prepared a plan with the goal of extending "the useful life of the groundwater resources to meet current and foreseeable user needs in the Valley" (Indian Wells Valley Cooperative Groundwater Management Group, 2006). Efforts under the Sustainable Groundwater Management Act built upon this initial plan.

2.4.5 Water Demand and Projections

The principal uses for water in the Inyo-Mono IRWM planning area are agriculture and export. A best guess for water applied to irrigated fields and pastures is 250,000 to 350,000 acre-feet per year, based on about 90,000 acres of irrigated land in the two counties and an average application of 3 to 4 feet of water per season. The applied amount varies from 2.4 feet in the Bridgeport Valley (Lopes and Allander, 2009) to about 5 feet on lower-elevation fields leased from LADWP. The quantity of surface and groundwater exported to Los Angeles is better known with an average of 363,000 acre-feet per year between 1970 and 2009 (LADWP, 2009). Over the past ten years, the average export amount has dropped to about 211,000 AF (based on planned aqueduct operations from annual reports, such as LADWP, 2019). Environmental water demands in the region are primarily related to LADWP mitigation programs. For example, in 2011, these uses amounted to about 95,000 AF for Owens Lake dust abatement, 16,500 AF for the Lower Owens River Project, 10,500 AF for enhancement and mitigation projects, and 10,400 AF for recreation and wildlife (LADWP, 2011a). In 2019, LADWP planned to use 17,400 AF for the Lower Owens River Project, 10,700 AF for enhancement and mitigation projects, and 7,900 AF for recreation and wildlife (LADWP, 2019). An estimate was not available for Owens Lake dust abatement in the 2019 report. Residential/commercial demands involve much smaller quantities of water because of the low population in the region. Industrial and military demand is very small outside of the Ridgecrest and China Lake area.

In rural parts of Mono County, households with extensive lawn and garden irrigation have used between 200 and 400 gallons per day per capita (Gram/Phillips Associates, 1980). Where outside watering is modest, per capita water use in Mono County is 125 to 150 gallons per day. A national survey of water use (Kenny, et al., 2009) suggested that average per capita use in Mono County is about 270 gallons per day. A different interpretation of presumably the same data produced a figure of 472 gallons per day (Sacramento Bee, 11/26/2008 – web page not currently active). Because very little land is available for development, significant population growth is not anticipated in Mono County, and domestic consumption totals should grow at relatively slow rates (less than 0.1 percent per year). Nevertheless, there could be local inadequacies in water supply because whatever growth occurs will be concentrated in relatively small areas.

Within the town of Mammoth Lakes, water demand grew rapidly until the past few years when it has declined in response to delivery of recycled water to a golf course, very significant water conservation, and reduction of leaks. Total water use within the town was 2,565 acre-feet in 1992; 2,641 acre-feet in 1995; 3,287 acre-feet in 2001; 3,421 acre-feet in 2005; 2,961 acre-feet in 2010; and 1,796 acre-feet in 2015 [during drought restrictions] (Mammoth Community Water District, 2005, 2011a, 2017). Based on the town's population of 8,200 in the 2010 census, annual water use of 2,169 acre-feet per year is equivalent to about 243 gal per day per capita. However, the town hosts a large transient population of recreational visitors, owners of second homes, and seasonal workers that account for a significant fraction of the water use (Kattelmann and Dawson, 1994; Mammoth Community Water District 2011a and 2017). In summer, much of the landscaping around housing units is irrigated regardless of occupancy and accounts for significant water demand. The town's current Urban Water Management Plan (Mammoth Community Water District, 2017) has dramatically decreased its projections of demand in the near future (compared to the 2010 plan). The 2015 urban water management plan (MCWD 2017 table 4-2) forecasts total water demand in 2020 at about 2,300 acre-feet per year and for 2030 at about 3,400 acre-feet per year.

In Bishop, average daily demand per capita between 1997 and 2006 ranged from 400 to 490 gallons per day (Nolte Associates, 2008a). A national survey of water use (Kenny, et al., 2009) suggested that average per capita use in Inyo County is about 470 gallons per day. A different interpretation of presumably the same data produced a figure of 439 gallons per day (Sacramento Bee, 11/26/2008 – web page not currently active). About 1.6 million gallons of water per day were supplied by the City of Bishop Department of Public Works in 2004. The maximum daily demand was 4 million gallons per day. About half the city's water use occurs from June through September. There is very little undeveloped private land within the boundaries of Bishop and therefore, little opportunity for growth and related increases in water demand. However, if vacant properties currently owned by LADWP within the Bishop city limits were to be made available and developed, then the average water demand at full build-out could rise to 5.7 million gallons per day (70 percent commercial and 30 percent residential) (Nolte Associates, 2008a).

Water demand within the Indian Wells Valley Water District has averaged about 8,800 acre-feet per year or about 280 gallons per day per capita. Potential increases in demand have been forecast in the Indian Wells Valley groundwater basin (Couch, et al., 2003). Although demand within the Indian Wells Valley Water District is anticipated to increase about 2 percent per year through 2020 and individual well use is forecast to increase about 1 percent per year, decreased demand by the Naval Air Weapons Station at China Lake and the Inyokern Community Services District results in a net increase in demand of only about 0.1 percent per year (Couch, et al., 2003).

Environmental water demand can be considered as either natural or regulatory. Evapotranspiration from lakes, soils, and native (or at least unmanaged) vegetation uses a large fraction of the precipitation that falls in the planning area – about half in high-elevation catchments and approaching 100 percent in low-elevation desert areas. In recent years, the term "environmental water demand" has also come to be used for managed water that is required to be used for some environmental benefit, such as a minimum instream flow to maintain fish and other aquatic species or sufficient water to support wetlands and riparian areas. As part of their water rights licenses, LADWP must now leave defined amounts of water in Mono Lake tributaries, and the Mammoth Community Water District does not divert water from Mammoth Creek when prescribed minimum flows are not met.

Water supplies for the Inyo-Mono IRWM region are forecast to remain largely as they are today: variable and uncertain. Water is not imported into the region, and there are no plans to do so. Political and legal action in the Walker River basin could eventually result in transfers of water out of irrigation to provide more water for Walker Lake. Proposed geothermal energy expansion near the community of Mammoth Lakes has the potential to alter groundwater flow and thereby impact water supplies for the town. Climate change has the potential to increase variability of precipitation, change the average amount of precipitation, increase the proportion of rainfall (versus snowfall), and alter the timing of snowmelt runoff. In the Indian Wells Valley, declining groundwater levels may increase pumping costs and thereby increase the cost of water supply.

2.4.6 Diversions, Storage, and Use

Water storage and transfers in the Inyo-Mono IRWM planning area are dominated by the Los Angeles Aqueduct system Major components of the LADWP water export and power generation system include a series of reservoirs and a tunnel for exporting water from the Mono Basin to the Owens River headwaters; the Crowley Lake reservoir in Long Valley; diversions in the Owens River Gorge for power generation; hydropower generation on Big Pine, Division, and Cottonwood Creeks; the Tinemaha, Pleasant Valley, and Haiwee Reservoirs; extensive groundwater pumping capacity, and the Los Angeles Aqueduct. Los Angeles' land and water ownership and extensive infrastructure along the east slope of the Sierra Nevada link many water management issues in the western part of the Inyo-Mono IRWM region and to other IRWM planning regions in southern California.

Within the Mono Basin, LADWP diverted as much as 134,600 acre-feet and as little as 15 acre-feet between 1941 and 1980. After the completion of the second aqueduct, LADWP diverted more than 100,000 acre-feet annually, except during 1976-77 drought (Hashimoto and Qasi, 1981). Diversions were halted by court order from 1989 to 1994. Starting in 1995, diversions up to 16,000 acre-feet per year resumed under SWRCB Decision 1631.

In the upper Owens River watershed, Crowley Lake was created by construction of Long Valley dam in the early 1940s. The reservoir is the main storage within the LA Aqueduct system and has a capacity of 183,000 acre-feet. At the other end of the Owens Gorge, Pleasant Valley Reservoir was built in 1955 to modulate flows released from the hydroelectric facilities in the Owens Gorge. This reservoir can store up to 3,825 acre-feet. Closer to the aqueduct intake, Tinemaha Reservoir stores up to 16,000 acre-feet.

LADWP also operates an extensive dust abatement project on the Owens Lake playa that relies heavily on shallow flooding to control dust. The dust abatement project currently budgets about 95,000 AFY and has used up to 75,800 AFY. LADWP also provides water for other uses within the Owens Valley that include irrigation, stockwater, enhancement and mitigation projects, the Lower Owens River Project, and recreation and wildlife projects. Water volume for all uses within the Owens Valley added up to about 202,000 AF in the 2011-12 runoff year (LADWP, 2011a).

The largest diversions from the West Walker River occur at the Nevada end of the state-boundary-defined watershed. In the northern portion of the Antelope Valley, water from the West Walker River is diverted into Topaz Reservoir, where it is stored for controlled release to irrigators downstream in Nevada. The Walker River Irrigation District created Topaz Lake by constructing a diversion and three-mile-long canal from the West Walker River into a small closed basin in 1921. A tunnel and canal release water back into the river on the Nevada side (DWR, 1992).

Within Antelope Valley, the West Walker River has been diverted into canals for local irrigation for more than a century. About 11 miles of the river are affected by these diversions, which can reduce the late-summer discharge to a series of marginally connected pools (Lahontan Regional Water Quality Control Board, 1975).

Upper and Lower Twin Lakes reservoirs on Robinson Creek were constructed around 1900 to regulate irrigation supplies for the Bridgeport Valley. The two reservoirs have a combined storage of 6,100 acre-feet and have water rights for refilling during the irrigation season. Bridgeport Reservoir was constructed in 1924 by the Walker River Irrigation District to store water for summer irrigation downstream in Smith and Mason Valleys. The reservoir has a storage capacity of about 44,000 acre-feet (California Department of Water Resources, 1992).

In the Mono basin, water from Mill Creek was diverted to generate hydroelectric power in the early years of the 20th century. The diversion to the Lundy powerhouse has a capacity of about 70 cfs. Regulation of the flows in Lee Vining Creek for hydroelectric generation began in 1921 (now FERC project 1388). Ellery, Tioga, and Saddlebag reservoirs in the headwaters of Lee Vining Creek have a combined storage capacity of 13,600 acre-feet. About 27,000 acre-feet of water pass through the powerhouse each year. Between 1916 and 1925, dams were constructed to enlarge Agnew and Gem lakes and at Rush Creek Meadows to form Waugh Lake to allow storage and regulation of water for the Rush Creek powerhouse near Silver Lake. Waugh, Gem, and Agnew reservoirs can store 4,980, 17,060, and 860 acre-feet, respectively, for Southern California Edison's FERC project 1389. There is a small dam on Walker Lake operated by LADWP that formerly was used to fill additional storage in May and was emptied in November. Due to extremely low flows that killed fish in Walker Creek below the dam during the May 2003 filling, the reservoir is now kept full year-round.

In the Mammoth Lakes basin, Lake Mary, Lake Mamie, and Twin Lakes are controlled by outlet structures, and their water levels change seasonally. The Mammoth Community Water District has appropriative water rights to 5 cfs or 2,760 acre-feet/year to divert water from Mammoth Creek (Lake Mary) subject to State licenses and permit conditions.

During a period of great interest in small hydroelectric projects in the eastern Sierra Nevada in the late 1970s and 1980s, the Department of Fish and Game compiled statistics about the proportion of average discharge diverted in each stream and the stream length affected by the upstream diversion on each stream (Shumway, 1985). The following table illustrates the effects of diversion of some example streams within the upper Owens River watershed:

Table 2-10: Diversion effects on streams in the upper Owens River watershed

Stream	Average discharge (acre feet)	% Diverted	Length affected/total (miles)
Convict	18,600	29	7.0/7.1
Crooked	9,100	63	1.1/1.4
Hilton	8,130	17	1.4/4.4
Laurel	6,180	27	4.0/4.7
Mammoth	21,900	38	8.4/11.6
McGee	22,400	29	5.4/6.6

O'Harrel Cyn	72	3	0.5/3.0
Sherwin	4,700	<1	1.0/1.7

The Bishop Creek hydroelectric system diverts water from the south and middle forks of Bishop Creek and generates electricity at four powerhouses. The system began more than a century ago when the Nevada Power, Mining, and Milling Company began to transmit electricity from their Bishop Creek powerhouse to Tonopah in 1905. During the following eight years, the Nevada-California Power Company constructed dams that formed South Lake and Lake Sabrina and built five powerhouses that utilized more than 3,500 feet of head. The system is now operated by Southern California Edison under FERC license 1394. Lake Sabrina and South Lake have storage capacities of about 7,500 and 12,500 acre-feet, respectively.

2.4.7 Water Suppliers

The following paragraphs describe a sample of the water suppliers in the region. Areas not otherwise mentioned have individual wells or other household supply or are served by mutual water companies with a small service population. The populations served by water systems within the planning area are summarized in Table 2-12.

Bridgeport Public Utilities District

The Bridgeport Public Utility District supplies water to the town (population 600) from two wells. In 1990, the total demand was about 243 acre-feet (DWR,1992). BPUD connections are not metered. BPUD also provides water to the Bridgeport Indian Colony reservation.

Lundy Mutual Water Company

The Mono City water system had 71 hookups as of August 2005, served by a community well and storage tank. The water use is not currently metered, and there is no chlorination on a regular basis. Annual water use is about 27 acre-feet with about half of that lost to the atmosphere (USDA-Forest Service, 2003). A member of the Mono City water board mentioned at the August 2000, Mono County planning commission meeting that the water system was "about maxed out."

Lee Vining Public Utility District

After World War II, the population of Lee Vining reached about 200, and the Lee Vining Public Utility District was formed. The district extended an existing supply pipe upstream above where there was any possibility of contamination from the Log Cabin Mine and built Mono County's first sewer system. The next upgrade was relocation of the intake to the forebay of the lower SCE powerhouse on Lee Vining Creek. In the 1950s, a 180,000-gallon storage tank was constructed on land provided by SCE, and investigations began of a spring as an alternative to the creek water. After the spring was developed and connected to the Lee Vining supply system, the town's residents no longer suffered a seasonal ailment, locally known as the "Lee Vining pip," that was thought to result from lodgepole pine pollen in the water supply from the creek. The spring continues to serve Lee Vining and has been a reliable water source for a half century. A second storage tank was added about a decade ago in order to meet summertime peak hourly demand. The Lee Vining water system is routinely inspected and tested by technicians from the June Lake PUD. Lee Vining PUD began adding chlorine to its system a few years ago to meet state requirements.

June Lake Public Utility District

The June Lake Public Utility District serves the June Lake Loop area. The boundaries include an area of approximately 1,720 acres of unincorporated residential, commercial and undeveloped land. The district provides water to three distinct areas: the Village, West Village and Down Canyon, as well as the outlying areas of Pine Cliff, Oh! Ridge, and June Lake Junction. Water is obtained from Snow Creek, June Lake, Fern Creek, and Yost Creek (Boyle Engineering Corporation, 2004).

Initial construction of the Village water system, including the Snow Creek diversion facility, occurred in the 1940s. In 1972, an intake from June Lake was added, along with a filtration plant and storage tank. All of the water was drawn from June Lake between 1975 and 1978. After the Snow Creek diversion and filtration plant were completed in 1978, Snow Creek became the primary water source, and June Lake water was only used in summer months (Triad/Holmes Associates, 2004).

Water demand in the entire service area corresponds to the number of visitors to the area. The water needs of the permanent population (about 700) constitute a relatively small portion of the total water demand. The visitor population can exceed 3,000 persons on weekends and holidays (Boyle Engineering Corporation, 2004). The annual demand in 2004 was about 143 acre-feet in the Village system and about 225 acre-feet in the Down Canyon system (ECO:LOGIC Consulting Engineers, 2006).

If the proposed Rodeo Grounds development is built, that area could be densely populated with accommodations for as many as 7,000 visitors and permanent residents. Estimation of potential water demands for the development at buildout assumed the average day demand for visitors would be 75 gallons per capita per day (gpcd) and 100 gpcd for permanent residents. A more recent study estimated the total annual demand for the proposed project as about 33 million gallons or about 102 acre-feet (ECO:LOGIC Consulting Engineers, 2006).

Mammoth Community Water District

Formed in 1957, the Mammoth County (now Community) Water District provides water and wastewater services to Mammoth Lakes. Until the mid-1970s, water diverted from Mammoth Creek was adequate to meet needs of up to 1,400 acre-feet/year. In 1978, the district obtained a permit from the State Water Resources Control Board to divert additional water. The permit includes several conditions that attempt to limit the impacts of the water diversion on the Mammoth Creek fishery. The District has also pursued groundwater well development, promotion of water conservation, system leakage repairs, and production of reclaimed water for irrigation. Although the resident population is currently about 8,200, instantaneous population on weekends and holidays often increases by up to four times for short periods. This high variability in demand is unusual among water supply utilities. The Mammoth Community Water District has applied the Town’s estimates of peak population numbers and transient occupancy rates to determine an “effective annual population” of 15,900 in 2015 to account for the variability in daily demand in its current Urban Water Management Plan (Mammoth Community Water District, 2011a and 2017).

Total water use (delivered plus unaccounted water) within the district was 2,565 acre-feet in 1992; 2,641 acre-feet in 1995; 3,287 acre-feet in 2001; 3,421 acre-feet in 2005; 2,691 acre-feet in 2010; and 1,796 acre-feet in 2015 (Mammoth Community Water District, 2005, 2011a, 2017). The District's most recent assessment determined that there is sufficient water from existing supplies and one new planned groundwater production well to meet demands under a range of water year types. The existing supplies and current use were quantified as a maximum of 2,760 acre-feet from surface water and 3,400 acre-feet from groundwater. A study for the district estimated that a total volume of 3,800 acre-feet could be pumped from groundwater within the Mammoth Basin (generally within town boundaries) without significant impacts to streams or springs within the basin (Wildermuth Environmental, Inc., 2003).

Communities of Southern Mono County

The communities of Hilton Creek/Crowley Lake, Sunny Slopes, Pinyon Ranch, Paradise, and portions of Swall Meadows rely on groundwater supplied by community service districts or mutual water companies. In the Hilton Creek/Crowley Lake community, water use in 1980 was estimated at approximately 150 gallons per capita per day. Based on the average population figures for Crowley Lake, the estimated total domestic water use in the service area was about 50 AF per year in 1980 and was projected to be 110 AF per year in 1998 (Gram/Phillips Associates, 1980). Another estimate of typical water-use in the area is 440 gallons per day (gpd) for a single-family residence (Triad Engineering, 1994). The equivalent per capita rate is 125 gpd, assuming an average household of 3.5 people. During the summer irrigation season, daily demands typically approach 1,350 gpd per household or three times the annual average (Triad Engineering, 1994).

Three studies of groundwater resource availability in the Hilton Creek/Crowley Lake community were reported for the Mountain Meadows Mutual Water Company (Triad Engineering, 1994):

Table 2-11: Groundwater availability in Hilton Creek/Crowley Lake

Groundwater Resource Availability in the Hilton Creek/Crowley Lake Community	
Slade and Blevins, 1979	25-30 acre-feet/year
Gram/Phillips, 1980	330 acre-feet/year
Kleinfelder, 1983	407 acre-feet/year

The eventual water system demand has been estimated at 160 acre-feet/year (Triad Engineering, 1994).

In the past few years, one of the principal wells for the Hilton Creek/Crowley Lake community has been found to contain excessive levels of naturally-occurring radionucleides.

City of Bishop

The City of Bishop Department of Public Works supplies water to all residents and businesses within the city limits that enclose about 1.8 mi^2. The basic infrastructure consists of three wells, a million-gallon storage tank, disinfection facility, and pipelines. The average daily demand per capita over the period 1997 through 2006 varied between 390 and 490 gallons per day (Nolte Associates, 2008a). In July 2019, the City of Bishop proposed a new rate structure that would lower fees for most users.

Because much of “greater Bishop” is outside of the official limits of the City of Bishop, other water agencies supply more water to more people than does the City of Bishop Department of Public Works. The larger water purveyors include the Bishop Paiute Tribe, Highland Mobile Home Park, Indian Creek / Westridge Community Services District, Meadowcreek Mutual Water Company, and Sierra Highlands Community Services District. A large section of west Bishop is served by individual wells for interior domestic use and an extensive ditch network for irrigation of landscaping. The ditch system is critical to recharging the local groundwater and requires careful management. For example, the drought of 2013-2014 resulted in dry ditches and a rapidly declining water table through March 2014. Then, the initial flush of water in the ditches during April and May replenished groundwater in a surprisingly fast manner and even led to flooding of some basements in west Bishop. The Bishop Creek Water Association attempts to coordinate activities involving the ditch system between Southern California Edison, LA Department of Water and Power, Bishop Paiute Tribe, and homeowners.

Communities of Southern Owens Valley

Water is supplied to Big Pine by the Big Pine Community Services District and Rolling Green Utilities, Inc. The Big Pine Paiute tribe has its own water system. Inyo County Public Works Department distributes water to the communities of Laws, Independence, and Lone Pine from an allotment supplied by LADWP under terms of the Long Term Water Agreement. The amount of the allocation was intended to encourage outdoor irrigation as mitigation for declining groundwater levels resulting from extraction via LADWP wells. This arrangement creates a situation perhaps unique in California in which residential water use is not under a conservation mandate and flat fee structure seems appropriate. The three systems combined serve about 900 people. The three systems are a classic example of long-deferred maintenance resulting in failures that are finally being addressed. For example, in 2017, more than 3,000 feet of the water main had to be replaced at a cost of about $200,000. The Cartago Mutual Water Company is the water supplier for Cartago.

The largest industrial water user in the Owens Valley is also a water exporter because its product is bottled water. The Crystal Geyser Roxane facility at Cartago on the west side of Owens dry lake pumps groundwater for bottling and has a design capacity of about 150 acre-feet per year (Quad Knopf, Inc., 2004).

Indian Wells Valley

In the largest population center of the Inyo-Mono IRWM region, the Indian Wells Valley Water District is the primary water supplier for the city of Ridgecrest. The District’s domestic water system consists of 12 well pumping plants, 9 booster pumping plants, 10 water storage reservoirs, and more than one million linear feet of transmission and distribution pipelines (Krieger & Stewart 1998). Recently, IWVWD constructed two arsenic treatment facilities to help alleviate the water quality issues of their pumped groundwater. Growth in the District's service area is forecast to increase from approximately 27,000 in 2000 to approximately 34,100 by 2020 (Indian Wells Valley Water District, 2002). Total groundwater pumping in the Indian Wells Valley by the District and other users is forecast to rise from 21,400 acre-feet per year in 2002 to about 22,900 acre-feet per year in 2020 (Couch, et al., 2003).

The Inyokern Community Services District serves approximately 420 households according to U.S. Census Bureau data for 2000. In 2001, the Inyokern Community Services District used 97 acre-feet/year of water. Water use has been steadily declining since the mid-1980s. This can be primarily attributed to reductions in the work force at NAWS China Lake.

Table 2-12: Principal water systems for Counties in the Inyo-Mono IRWM planning region

Mono County Public Water System Name	Population Served
AJ S MARKET	25
ARCULARIUS RANCH	35
BENTON COMMUNITY CENTER	25
BENTON SENIOR CITIZENS CTR	25
BENTON STATION	25
BIG BEND CAMPGROUND	70
BIG MEADOW CAMPGROUND	50
BIRCHIM COMMUNITY SERVICE DIST	130
BOOTLEG CAMPGROUND	315
BRIDGEPORT PUD	850
BRIDGEPORT RESERVOIR BOAT LNG	25
BROWN S OWENS RIVER CAMPGROUND	60
BUCKEYE CAMPGROUND	370
CAL TRANS - CRESTVIEW REST AREA	300
CAMP ANTELOPE	40
CHALFANT COMMUNITY CENTER	25

CHRIS FLAT CAMPGROUND	75
COLEVILLE HIGH SCHOOL	90
CONVICT LAKE CAMPGROUND	400
CROWLEY LAKE CAMPLAND	25
CROWLEY LAKE FISH CAMP	25
CROWLEY LAKE GENERAL STORE	25
CROWLEY LAKE MUT. WATER DIST.	250
CROWLEY LAKE PARK	25
CROWLEY LAKE TRAILER PARK	130
CROWLEY LAKE TRAILER PARK	130
CRYSTAL CRAG WATER & DEVELOP.	75
CSP - BODIE SHP	2,506
DOC & AL S	100
EAST FORK CAMPGROUND	200
EDNA BEAMAN ELEMENTARY SCHOOL	90
ELLERY LAKE CAMPGROUND	50
FRENCH CAMPGROUND	150
GRANT LAKE MARINA REST/STORE	130
GREEN CREEK CAMPGROUND	75
HISTORIC MONO INN	25
HOT CREEK HATCHERY	25
HOT CREEK RANCH	25
HUNEWILL GUEST RANCH	50
JUNE LAKE P.U.D.-DOWN CANYON	360
JUNE LAKE PUD VILLAGE	360
JUNE MTN. SKI AREA, STEW POT SLIM S	50
JUNE MTN. SKI AREA, STEW POT	500

SLIM S	
LEAVITT CAMPGROUND	110
LEE VINING PUD	350
LEE VINING RANGER STATION	25
LOG CABIN WILDERNESS CAMP	100
LOWER ROCK CREEK MUTUAL WATER CO.	200
LOWER SWALL MEADOWS WATER SYSTEM	40
LUNDY LAKE RESORT	70
LUNDY MUTUAL WATER COMPANY	70
MAMMOTH CWD	8,237
MAMMOTH LAKES AIRPORT	25
MAMMOTH LAKES BASIN	1,000
MAMMOTH MTN SKI AREA-OUTPOST 14	1,000
MCGEE CREEK CAMPGROUND	120
MCGEE CREEK MOBILE HOME PARK	20
MEADOWCLIFF RESORT	25
MONO LAKE COUNTY PARK	25
MONO VILLAGE REST./STORE	500
MOUNTAIN MEADOWS MWC	225
MOUNTAIN VIEW BARBECUE	25
OLD BRIDGEPORT RANGER STA. COMPOUND	25
PARADISE SHORES RV PARK	20
PINE GROVE CAMPGROUND	30
PINEGLADE ASSOCIATION	50
POKONOBE LODGE RES./STORE	100
POKONOBE LODGE REST./STORE	100

ROBINSON CREEK CAMPGROUND	680
ROCK CREEK LODGE	23
SADDLEBAG LAKE CAMPGROUND	100
SIERRA EAST HOME. ASSOC.	50
SONORA BRIDGE CAMPGROUND	50
TIOGA GAS MART	50
TIOGA LAKE CAMPGROUND	50
TIOGA PASS RESORT	100
TOM S PLACE	25
TOPAZ LAKE MOBILE HOME PARK	25
TOPAZ LAKE RV PARK	170
TRUMBULL LAKE CAMPGROUND	100
TUFF CAMPGROUND	80
TWIN LAKES ENT.	300
TWIN LAKES RESORT	100
TWIN LAKES STORE	50
USMC HOUSING - COLEVILLE	361
USMC/MTN WARFARE TRNG CTR - BRIDGEPORT	300
VIRGINIA CR. SETTLEMENT PARK	40
VIRGINIA LAKES MUTUAL WATER CO.	150
WALKER BURGER	25
WALKER COMMUNITY HALL AND PARK	25
WALKER RIVER RV & ESPRESSO BAR	25
WHITE MOUNTAIN ESTATES	50
WHITMORE BALLFIELDS	30
WHITMORE POOL	50

WILLOW SPRINGS MOTEL AND RV PK	60
WOODS LODGE	75
YMCA CAMP OF LOS ANGELES #1	150

Inyo County Public Water System Name	Population Served
Aberdeen Water System	150
Aspendell Mutual Water Company	60
Baker Creek Campground	100
Bernasconi Education Center	50
Big Pine Creek Campground	100
BIG PINE CSD	1,000
Big Trees Campground	50
Bird Industrial Complex	45
Bishop, City of	3,879
Bishop Country Club	400
Bishop Creek Lodge	58
Bishop Creek System	80
Bitterbrush Campground	100
Boulder Creek Trailer Park	50
Brookside Estates Mutual Water Company	45
Brookside Mobile Home Park	136
CAL TRANS - COSO JUNCTION	500
CAL TRANS - DIVISION CR.	300
Cardinal Village Resort	55
Cartago Mutual Water Company	132

CDF - OWENS VALLEY CONSERVATION CORP	250
Charles Brown Water Company	330
Comfort Inn	150
Control Gorge Power Plant	36
Coso Junction Ranch Store	1,000
CR Briggs Corporation	50
Crystal Geyser Bottling Plant	100
Darwin Community Service District	60
Death Valley Junction	200
DEATH VALLEY, SCOTTY S CASTLE	50
Deep Springs College	40
Delight s Hot Springs Resort	55
Diaz Lake Campground	4,000
Eastern Sierra College Center - Bishop	100
Eastern Sierra Regional Airport	50
Eastern Sierra Tri County Fair	100
Foothill Lone Pine Mobile Home Park	100
Four Jeffrey Campground	318
Glacier Lodge	50
Glenwood Mobile Estates	300
Gray s Meadow Campground	50
Gus Water	100
High Sierra Water Company	200
HIGHLAND MOBILE HOME PARK	900
Horseshoe Meadow Campground	70
Horton Creek Campground	50

INDIAN CREEK COMMUNITY SERVICE DISTRICT	1,000
INYO COUNTY PWD - INDEPENDENCE	574
INYO COUNTY PWD - LONE PINE	1,655
Katherina Muller Water System	250
Keeler Community Service District	180
Keeler Yard LADWP	70
Keough s Hot Springs	40
LADWP - INDEPENDENCE	586
LADWP - LONE PINE	1,118
Lake Sabrina Boat Landing	35
Laws Town Inyo County	30
Laws Town LADWP	30
Lone Pine Campground	45
MANZANAR NATIONAL HISTORIC SITE	298
Meadow Lake Apartments	35
MEADOWCREEK MUTUAL WATER COMPANY	640
Millpond Recreation Area	500
Mount Whitney Fish Hatchery	50
Mount Whitney Golf Club	100
Mountain View Trailer Court	25
North Lake Campground	30
North Lone Pine Mutual Water Company	70
NPS - DEATH VALLEY, FURNACE CR.	150
NPS - DEATH VALLEY, GRAPEVINE RS	25
NPS - DEATH VALLEY, MESQUITE SPRGS.	25
NPS - DEATH VALLEY, STOVEPIPE WELLS	30

NPS - DEATH VALLEY, WILDROSE CMPGD	35
NPS - DVNM - COW CR/NEVARES	125
NPS-DEATH VALLEY EMIGRANT REST AREA/CG	25
Olancha RV and MHP	30
Onion Valley Campground	25
Owens Valley Water Company	300
Palisade Glacier High School	50
Panamint Springs Resort	200
Parcher s Resort	45
Park West Mutual Water Company	200
Pearsonville Water System	100
Petite Pantry	100
Pine Creek Village	350
Pleasant Valley Campground	100
Primrose Lane Apartments	36
Ranch House Cafe	150
Ranch Road Estates Mutual Water Company	65
Rawson Creek Mutual Water Company	100
Rock Creek Lake Boat Dock & Group Camp	50
Rock Creek Lake Campground	210
Rock Creek Lakes Resort	56
Rocking K Ranch Estates Mutual Water Co.	30
ROLLING GREEN UTILITIES, INC.	800
Round Valley School	140
Sabrina Campground	30
Sage Flat Campground	28

SCE Bishop Creek Plant 4	45
Schober Lane Campground	150
Sierra Grande Estates Mutual Water Co.	200
SIERRA HIGHLAND CSD	500
Sierra North Community Service District	28
Starlite Community Service District	175
Sunland Village Mobile Home Park	42
Taboose Creek Campground	50
Tecopa Francis Elementary School	30
Tecopa Hot Springs Park	100
Tecopa Palms RV Park	50
Tuttle Creek Campground	50
Upper Sage Flat Campground	28
Valley Vista Mutual Water Company	75
Van Loon Water Association	30
White Mountain Research Station	45
Whitney Portal	500
Wilson Circle Mutual Water Company	100

Kern & San Bernardino County Water Systems	Population Served
Indian Wells Valley Water District	34,900
Naval Air Weapons Station China Lake	6,000
Inyokern CSD	984
East Inyokern Mutual Water	87
Searles Valley Minerals Operations, Inc.	2,300

(sources: EPA State Drinking Water Information Systems: http://iaspub.epa.gov/enviro/sdw_form_v2.create_page?state_abbr=CA and Environmental Working Group: http://www.ewg.org/tap-water/home and personal communication)

The above tables only include currently active public water systems. A complete list of water systems, both active and inactive, in the three counties is available from the California Department of Public Health's Drinking Water Information Clearinghouse website: (http://drinc.ca.gov/DWW/Maps/Map_Template.jsp).

2.4.8 Urban Runoff and Stormwater Management

Concerns about pollution from stormwater runoff from urban areas began to be raised in the 1950s and 1960s. The principal pollutants that can be expected in urban runoff include sediment, oils and grease, rubber compounds, nutrients, pesticides, bacteria and viruses, and metals. The materials that are likely to be found on streets, gutters, and parking lots typically get removed in the first flush of stormwater runoff. The concentration of these pollutants usually depends on the time since the previous storm, and intensity and amount of rainfall. The efficiency of the gutter and storm sewer system can greatly affect the size and timing of peak flows collected by the system.

Mammoth Lakes is the only community in Mono County with an engineered stormwater collection system. In 1984, only a few parts of the community of Mammoth Lakes had storm drains. Most of the town was drained by a combination of natural and constructed surface channels, which led to a variety of drainage problems (Brown and Caldwell, 1984). Up until the late 1980s, much of the runoff from the developed area flowed as sheet-flow to roads or flowed in unimproved channels or ditches to topographically lower channels. In 1976, a storm drain system was constructed for a portion of the town, which eventually discharged directly to Murphy Gulch (Brown and Caldwell, 1984).

In association with the Main Street storm drain, a 260,000 ft^3 siltation basin was constructed at the downstream end of the Murphy Gulch channel, approximately 1/4 mile above its junction with Mammoth Creek. Although the basin trapped a significant volume of silt and sediment each year, there was evidence that it did not capture enough of the sediment input. During peak runoff, sediment deposition efficiencies are drastically reduced (due to high flow-through velocities), resulting in visibly turbid effluent discharges. The old earth-fill dam was in relatively poor condition as of 1984, and there were signs of seepage on its downstream face (Brown and Caldwell, 1984). The drainage master plan proposed by Brown and Caldwell (1984) included construction of new storm sewers, capture of runoff that formerly went directly into Mammoth Creek, detention storage of runoff, additional local sediment retention basins, and reconstruction of the sediment retention basin in Murphy Gulch. The estimated capital cost was $18 million, and annual operating costs were estimated at $100,000 to $250,000 (Brown and Caldwell, 1984). In the early 1980s, about 1,600 acres of the town of Mammoth Lakes' area of four square miles (about 60 percent) were considered to be impervious (Environmental Sciences Associates, 1984). Summer rain events and winter rain-on-snow events can produce localized flooding in Mammoth Lakes, particularly within the lower-income neighborhoods. Funding from the Round 2 Prop. 84 Planning Grant was used to develop a stormwater master plan for Mammoth Lakes which was then subsequently converted into a Stormwater Resources Plan. That SRP has been incorporated and adopted into this IRWM Plan.

The Indian Wells Valley contends with its own stormwater, drainage, and flooding issues, primarily resulting from heavy rains during the summer monsoon season. Although there is anecdotal evidence as to the frequency and severity of these events, there is a need to better quantify such events to improve stormwater planning and management.

2.4.9 Wastewater Treatment and Disposal

The cities, towns, and larger communities of the planning region have wastewater collection and treatment systems, while smaller communities and isolated homes do not. In the north, residences and businesses in Coleville and Walker rely on septic tanks and leach fields for sewage disposal. There are concerns about effectiveness of some of these systems in areas with high water tables. The USMC Mountain Warfare Training Center has a 100,000 GPD package waste treatment plant and leach fields (Mono County, 1992).

The Lee Vining Public Utility District sewage system includes the main part of town, but not the SCE plant, the Mobil station or the Pumice Plant. Waste enters into a large community septic tank, which is pumped periodically. The effluent passes through the septic tank into sewage ponds located below the community center. Mono City, Conway Ranch, Lundy Canyon, and other scattered homes are on individual septic systems.

The June Lake Public Utility District provides sewerage service to three major service areas: June Lake Village, Down Canyon, and the U.S. Forest Service's Silver Lake Tract. Additional service is provided by contract to campgrounds and several parking facilities along the June Lake Loop (Boyle Engineering Corporation, 2005). Between 1995 and 2003, daily flow at the treatment plant ranged from 0.16 to 0.4 mgd with an average of 0.25 mgd. Based on an average daily water demand of 0.34 mgd, about three-quarters of the supplied water is returned to the sewer system. The remainder is presumably used for landscape irrigation. Average monthly flows ranged from 5.1 million gallons to 10.5 million gallons with an average of 7.6 million gallons. The projected average daily wastewater flow at buildout of the service area is 0.66 mgd (Boyle Engineering Corporation, 2005).

The primary wastewater treatment facility within the upper Owens River watershed serves the town of Mammoth Lakes (and cabins and campgrounds upstream of town) and is operated by the Mammoth Community Water District. An annual average of 1,500 acre-feet of water was treated at the facility between 1983 and 1997 (Bauer Environmental Services, 1998). In 2005, 2010, and 2015; 1,920; 1,430; and 1,083 acre-feet of water was treated at the facility, respectively, (Mammoth Community Water District 2011a and 2017). The disinfected secondary-treated effluent from the facility is piped several miles to the Laurel Ponds where it is discharged. The treated water percolates into the ground at this location or evaporates. The maintenance of Laurel Ponds to at least 18 acres of surface area is considered beneficial for waterfowl by the Inyo National Forest, which administers the site. The Mammoth Community

Water District completed a project to treat the wastewater to Title 22 standards for unrestricted irrigation use and serves reclaimed water to two local golf courses in the community. The Mammoth Lakes wastewater treatment plant is a permitted wastewater facility as are the treatment plants of the Hilton Creek Community Services District, Mammoth Mountain Ski Area, and Convict Lake campground.

In the mid-1970s, the community of Hilton Creek/Crowley Lake had an estimated population of about 300 and was served entirely by individual disposal systems consisting primarily of septic tanks and leach fields or leach pits. Because of the presence of adverse soil and groundwater conditions, these individual systems had abnormally high failure rates for many years. Many of the disposal systems were located less than 100 feet from surface waters or in areas of shallow groundwater. Percolation rates throughout the community area are quite high, which is typical for glacial outwash soils. About two-thirds of the residences and at least five commercial establishments in the community obtained their domestic water supplies from the direct diversion of the surface waters of Hilton Creek. Mono County health officials were aware of problems from at least 1966. A study prepared by the Lahontan RWQCB for the county in that year reported alarming coliform concentrations at sample points in natural surface streams as well as in private water supply systems. The report attributed the majority of this contamination to the use and misuse of septic tank / leach field sewage disposal systems. Water quality sampling and public health investigations in the vicinity of Hilton Creek indicated that the continued use of individual disposal systems posed significant health hazards and adverse water quality impacts. Mono County and the Lahontan RWQCB both adopted restrictions and prohibitions on the installation of new septic tank / leach field disposal systems within the Hilton Creek service area in 1976. Furthermore, the Lahontan RWQCB prohibited use of existing disposal methods after January 1, 1985, and recommended that a community sewerage system be constructed for the area (Gram/Phillips, 1977).

The communities of southern and eastern Mono County rely on septic tanks and leach fields for sewage disposal as do most of the smaller communities of Inyo County.

The City of Bishop Public Works Department provides sewer service to the central portion of Bishop. A gravity collection system routes sewage to the wastewater treatment plant east of town. The plant processes about 800,000 gallons per day and has a capacity of 1.6 million gallons per day. Average wastewater flow is forecast to be 4.7 million gallons per day if Bishop was fully built out, including lands currently owned by the Los Angeles Department of Water and Power within the city limits (Nolte Associates, 2008b). One week per month, the City's wastewater treatment plant also treats sewage from the Eastern Sierra Community Services District, which operates its own treatment plant the other three weeks per month.

Other agencies that provide wastewater collection, treatment, and disposal services in Inyo County include Big Pine Community Services District, East Independence Sanitary District, Lone Pine Community Services District, and Inyo County.

The City of Ridgecrest's wastewater treatment system collects, processes, and disposes domestic wastewater from the city of Ridgecrest and the Naval Air Weapons Station at China Lake. The treatment facility has a design capacity of 3.6 million gallons per day and was treating an average of 2.6 million gallons per day in 2000, or about 2,900 acre-feet per year. About one-third of the effluent evaporates, and the remainder percolates to groundwater (Provost &

Pritchard Consulting Group, 2015).

2.5 Water Quality

Compared to most of California, water throughout most of the Inyo-Mono IRWM planning area is of very high quality, simply because of the small population and high proportion of public lands. There are not many opportunities for contamination compared to parts of the state with high population, industries, and intense land uses. Many of the identified water-quality issues in the Inyo-Mono planning region result from naturally-occurring minerals.

The Lahontan RWQCB water body fact sheet for the West Walker River lists sedimentation, agricultural drainage, and water diversions as the primary water-quality problems in the West Walker River. The State of Nevada considers the water crossing the state line to not support beneficial uses because of excessive nutrient load. Similarly, the Lahontan RWQCB identified sedimentation, ammonia, fecal coliform, and metals as problems in the East Walker River. Bridgeport Reservoir has been known to have high nutrient loads and consequent excessive primary productivity for at least 20 years. The Lahontan RWQCB has established a "conditional waiver" program for the agricultural lands of the Bridgeport Valley as a means of cooperatively reducing discharge of nutrients and bacteria from the grazing lands.

The Lahontan Basin Plan of 1975 characterizes the waters of the Mono Basin as generally excellent in quality, with total dissolved solids (TDS) levels of less than 50 parts per million (ppm) in surface water and less than 100 ppm in groundwater. Surface water is ionically dominated by calcium carbonate and classified as soft. Heavy metal concentrations are below detectable limits or only present in trace amounts. Dissolved oxygen is at or near saturation. Coliform bacteria are below detectable limits in groundwater; surface waters were not analyzed for bacteria (Triad Engineering, 1987). Independent sampling by Lee (1969) in several Mono Basin streams including Mill and Wilson creeks found that the waters were calcium bicarbonate type and had TDS ranging from 31 to 81 ppm.

Water quality in the major tributaries (Lee Vining, Walker, Parker, and Rush creeks) is typical of eastern Sierra Nevada snowmelt runoff streams. This area is largely undeveloped and undisturbed above the LADWP diversion structures, except for recreation-residential developments near June Lake and on Rush and Walker creeks and recreational facilities on Lee Vining Creek and Mill Creek. Natural weathering and erosion processes are the main factors affecting water quality in these streams. A seasonal difference in quality between groundwater-fed baseflow and snowmelt runoff has been measured (Jones and Stokes Associates, 1993b).

The upper Owens River watershed is used as a water source for export to the city of Los Angeles. Although geologic sources contribute phosphates, arsenic, and other minerals to the water, the overall quality is still excellent and quite suitable for human consumption at its urban destination.

The first Basin Plan for the Lahontan Region (Lahontan RWQCB, 1975) mentioned that analyses of water entering Crowley Lake found excellent quality for constituents measured except for arsenic, which sometimes exceeds federal drinking water standards. Most environmental documents relating to parts of the watershed routinely cite excellent water quality in the area's streams that is suitable for all beneficial uses. The principal exception is Mammoth

Creek within and downstream of the town of Mammoth Lakes.

A major assessment of surface water quality in the Mammoth Creek watershed was conducted by a team of graduate students and faculty from UCLA in the summer of 1972 (Perrine, et al., 1973). This study judged the overall surface water quality to be excellent with respect to chemical constituents. One exception to the low chemical concentrations was relatively high concentrations of phosphorus that could contribute to excessive growth of aquatic plants, although natural sources were believed responsible. Fecal coliform bacteria counts in lower Mammoth Creek were high and believed to result from leaching from campground pit toilets in the Lakes Basin, septic systems in Old Mammoth, and pet waste. This study was conducted before the connection of the campgrounds and many of the houses in Old Mammoth to the sewer system. In 2019, the issue of pet waste in the Mammoth Creek watershed again received attention from articles and letters in the local press. Several of the groundwater production wells in the Mammoth Lakes basin contain unsafe levels of arsenic that had become problematic when water supplies were heavily dependent on groundwater contributions. The Mammoth Community Water District has implemented treatment and dilution procedures to address the arsenic issue.

Over the entire Inyo National Forest (lands in the upper Owens River watershed are not distinguished separately), 97 percent of the water flowing off the forest was judged to meet water quality objectives as of 1988. The remaining 3 percent contained excessive sediment (USDA-Forest Service, 1988).

Water samples from various tributaries to the Owens River have been analyzed by LADWP since the 1930s and 1940s. During the Mono Basin Environmental Impact Report process, these data were summarized along with a special water quality survey in 1991 by Jones and Stokes Associates (1993b). All except Hot Creek had low concentrations of minerals and nutrients.

Periodically, the State Water Resources Control Board submits a report on the quality of streams and lakes in California to the U.S. Environmental Protection Agency. Part of that report refers to section 303(d) of the federal Clean Water Act, which directs the states to identify priority water quality issues in individual water bodies. The following water bodies in the Inyo-Mono IRWM region were on the 2012 list:

Table 2-13: Impaired Water bodies in the Inyo-Mono planning region on the 303(d) list

Name	Pollutant
Amargosa River	Arsenic
Bodie Creek	Mercury
Bridgeport Reservoir	Nitrogen, phosphorus, sediment
Buckeye Creek	Fecal Coliform
Crowley Lake	Ammonia, dissolved oxygen

East Walker River above BP res.	Fecal Coliform
East Walker River below BP res.	Manganese, sediment, turbidity
Haiwee Reservoir	Copper
Hilton Creek	Dissolved oxygen
Mammoth Creek	TDS, mercury, manganese
Mesquite Springs	Arsenic, boron
Mono Lake	Salinity, TDS, chlorides
Pleasant Valley Reservoir	Organic enrichment, dissolved oxygen
Robinson Creek	Fecal Coliform
Rock Creek	TDS
Searles Lake	Salinity, TDS, chlorides, petroleum HC
Swauger Creek	Fecal coliform, phosphorus

2.5.1 Constituents: Measurements and Biological Indicators

Systematic sampling of water quality parameters has not occurred in the Inyo-Mono IRWM planning area. Therefore, our knowledge about region-wide water quality is based on irregular reporting of isolated sampling and analysis done sporadically over the past few decades.

Sediment

The Environmental Impact Statement for the Land and Resource Management Plan ("Forest Plan") of the Inyo National Forest (USDA-Forest Service, 1988:315) states that the "primary threat to water quality on the Inyo is sedimentation." The document indicates that the most significant sources of sediment are the ski areas and rangelands, particularly wet meadows, disturbed by historical overgrazing. In a subsequent section on cumulative effects that also addresses sources on private land, the Forest Plan states that suspended sediment in Mammoth Creek during spring-summer runoff increases ten-fold between the outlet of Twin Lakes and U.S. Highway 395.

Measurements of suspended sediment, turbidity, or bed load are not known to have been made within the Mono Basin until the past few years. A study of sediment budgets (R2 Resource Consultants, 2000) estimated about 13 acre-feet of sediment supply per year for Lee Vining Creek (range 3.0-2,770), about 0.9 acre-feet for Walker Creek (range 0.2-40), and about 3.8 acre-feet per year for Parker Creek (range 0.8-35). The various dams across Rush, Lee Vining, and Mill creeks have retained most of the sediment produced in the headwater areas and have increased channel scour below the dams to an unknown extent.

The June Mountain Ski Area was reported to produce "considerable sediment during peak runoff periods, causing a shutdown of water treatment systems for 30 days or more each year. Implementation of the [erosion prevention program] for the ski area has reduced these impacts over the past few years, and discharge will soon meet state requirements" (USDA-Forest Service, 1988).

The Inyo National Forest (1988b) has noted a significant increase in sediment and turbidity levels during peak runoff events in Mammoth Creek. These increases appear to be the result of disturbances in the developed area and the sensitivity of the local soils to disturbance. The impact of runoff from urban development is reflected in the increase in sediment and turbidity levels in Mammoth Creek as it flows through the town. Based on USFS data developed on Mammoth Creek at U.S. Highway 395 from October, 1981, to September, 1982, the total annual sediment discharge is estimated to be 5,100 tons or approximately 0.20 ton/acre of watershed. This sediment yield is one-third of the average for the Sierra Nevada (0.75 ton/acre) and one-tenth of the average for California (2 ton/acre) (Kattelmann, 1996).

Photo 3.31

Minerals

In the Mono Basin, limited water quality data suggest that the mineral content of the Mono Lake tributaries is very low and similar to other high quality Sierra Nevada streams. Concentrations of all minerals that were measured were low enough to rate as excellent drinking water quality (Jones and Stokes Associates, 1993b).

Total dissolved solids (TDS) were measured in samples collected from Mammoth Creek and some of the lakes in the Mammoth Lakes Basin during the summer of 1972 by the UCLA team and found to be generally less than 50 mg/l, with a couple of samples around 100 mg/l (Perrine, et al., 1973). Drinking water standards are about 500 mg/l for comparison. Measured concentrations of sodium, calcium, and magnesium were less than 10 mg/l. The Mammoth Community Water District has measured water from Lake Mary for various constituents since 1983. Values for TDS over this period have ranged from 10 to 50 mg/l with a mean of 31 mg/l.

Conductivity is often used as a proxy for TDS because it is relatively easy to measure. Specific conductance of water released from Grant Lake reservoir has been monitored by LADWP since 1934 and has ranged from 40 µS/cm to 100 µS/cm with an average of about 60 µS/cm (Jones and Stokes Associates, 1993b). Specific conductance was also measured for many years in Lee Vining Creek and found to range between 25 and 75 µS/cm.

Table 2-14: Spot measurements of conductivity made in various portions of the upper Owens River watershed during October 1985 by the Department of Fish and Game
(Deinstadt, et al., 1986)

Waterway	Conductivity (µS/cm)
Owens River	120, 130, 120, 170
Rock Creek	20, 25, 30, 20, 8
McGee Creek	40, 75, 70
Mammoth Creek	77, 85, 128, 108, 115, 35
Hot Creek	580
Laurel Creek	50
Sherwin Creek	20
Glass Creek	30

Table 2-15: Conductivity measurements by LADWP and Jones and Stokes Associates
(1993b)

Waterway	Conductivity (µS/cm)
Owens River at Big Springs	166-223
Owens River at Benton Crossing	295-560
Mammoth Creek	50-200
Hot Creek	200-650
Convict Creek	125-175
McGee Creek	56-175
Hilton Creek	24-62
Crooked Creek (1991 only)	43-128
Rock Creek	25-125

Nutrients

Nutrient loading is a major issue in the East Walker River basin. Bridgeport Reservoir is eutrophic and is afflicted with blooms of blue-green algae each summer. The Bridgeport Valley upstream of the reservoir is extensively grazed from June through September. Phosphorus and pathogen concentrations in tributaries to Bridgeport Reservoir, measured in April-June, 2000, increased significantly downstream of pastures (Horne, et al., 2003). However, biochemical processes in the wet soils of the pastures are converting and capturing most of the applied nitrogen (Horne, et al., 2003).

Limited sampling suggests very low concentrations of nutrients in streams of the Mono basin. The 1991 sampling of Grant Lake found only minimal concentrations of nitrogen and phosphorus, both in the lake and the outlet. Chlorophyll *a* values in Grant Lake reservoir ranged from 0.9 to 13.3 µg/l, with an average of 5.8 µg/l, indicating low nutrient status and consequent low biological productivity (Jones and Stokes Associates, 1993b).

A mix of historical water quality results reported by the Los Angeles Department of Water and Power (1984) included measurements of nitrate that ranged from 0 (below detection) to 2 mg/l. Besides that one value of 2 mg/l, all other reported values were 0.4 mg/l or less.

In June Lake, nutrient concentrations from limited sampling were quite low with combined nitrate plus nitrite concentrations below detection in three samples and 0.02 mg/l in a fourth sample. Ammonia was 0.03 mg/l or less. Orthophosphate was not detected, and total phosphorus concentrations were 0.02 mg/l or less (Brown, 1979). This study found that although nitrate plus nitrite was below detection limits in Gull Lake, concentrations of ammonia and orthophosphate were relatively high: up to 0.54 and 0.16 mg/l, respectively. Both nutrients were believed to be derived from anaerobic decomposition of algae and other organic matter in the near-bottom layers of the lake (Brown, 1979). The study hypothesized that nutrients released from the surrounding homes prior to the sewer system might contribute to the high fertility of Gull Lake (Brown, 1979).

In Silver Lake, nutrient concentrations were below detection limits except for total phosphorus concentrations of 0.01 and 0.02 in two samples. The study judged that there was a minor enrichment of Silver Lake from nutrients contributed by Gull Lake via Reversed Creek (Brown, 1979).

The 1994 samples from Rush Creek above Grant Lake (USGS station 10287400) and the Rush Creek power plant tailrace (USGS station 10287300) had the following results (concentrations in mg/L):

Table 2-16: Rush Creek nutrient concentrations as measured in 1994

Rush Creek Nutrient Concentrations	
Total nitrogen	< 0.05
Ammonia	0.01-0.02
Phosphorus	<0.01-0.02
Orthophosphate	<0.01

The nutrient budget of Crowley Lake has received greater attention than other parts of the Inyo-Mono IRWM planning area because of the eutrophic state of the reservoir. Almost all (96 percent) of the observed phosphorus loading to Crowley Lake comes from the Owens River, which only provides about half of the water input to the lake (Jellison and Dawson, 2003). The known sources for this phosphorus are Big Springs and numerous sites along Hot Creek.

The Owens River accounts for 79% of the nitrogen input to Crowley Lake and McGee Creek accounts for 13% (Jellison and Dawson, 2003). Ammonia, nitrate, and total nitrogen concentrations are relatively low in all other tributaries. Total nitrogen concentrations increased somewhat across the irrigated pastures of Convict and McGee creeks. This increase is about 6 percent of total nitrogen loading to Crowley Lake. Hot Creek fish hatchery contributes a significant amount of ammonia and total nitrogen to Hot Creek. The communities of Mammoth Lakes, McGee Creek, and Hilton Creek had little apparent effect on nutrient concentrations downstream (Jellison and Dawson, 2003). Three to four times more nitrogen leaves Crowley Lake than enters it, presumably because of nitrogen-fixing cyanobacteria (blue-green algae) in the lake.

Nitrate concentrations were measured in Mammoth Creek in the summer of 1972 by the UCLA team and were less than 0.5 mg/l in 99 percent of the samples (Perrine, et al., 1973). Phosphate concentrations were generally less than 0.1 mg/l, although a few samples were up to 0.3 mg/l.

There is potential, but no direct evidence, for contamination from excessive use of chemical fertilizers on gardens, lawns, and parks. Nutrients from fertilizers that are not incorporated in plant tissue can be leached from soils and enter local streams.

Metals

Mercury has been a concern in the Walker River basin after elevated concentrations of mercury were found in tui chub and common loons at Walker Lake. Recent sampling of water, sediment, and aquatic invertebrates suggests that the primary source areas are associated with the Bodie and Aurora mining districts in the Rough Creek watershed, which is part of the East Walker basin. Samples from the West Walker River had total mercury concentrations within the range of natural background amounts: 0.62 ng/L in the water and 8 to 44 ng/g in the sediment (Seiler, et al., 2004). By contrast, the East Walker River above the confluence with the West Walker had a total mercury concentration of about 60 ng/L in the water and more than 1,000 ng/g in the sediment. The greatest total-mercury concentration in sediment was found in the bed of Bodie Creek at 13,600 ng/g (Seiler, et al., 2004). The absence of major mining and milling operations in the West Walker watershed appears to have minimized mercury contamination in marked contrast to the adjacent Carson and East Walker rivers.

Trace element concentrations were frequently undetectable or very low in water at the Grant Lake reservoir outlet, but lead, zinc and boron were found in sediments in concentrations slightly higher than background (Jones and Stokes Associates, 1993b).

The 1994 samples from Rush Creek above Grant Lake (USGS station 10287400) found concentrations of boron between 10 and 20 mg/L, concentrations of iron between 12 and 24 mg/L, and concentration of manganese between 3 and 11 mg/L.

Metals, primarily arsenic and mercury, have been measured in the Crowley Lake water column and sediments (as has uranium more recently; Lahontan RWQCB, 1994). These substances are believed to originate from natural sources resulting from the particular chemical composition of the watershed's geology. Arsenic concentrations high enough to be a health concern for fish and humans have been measured in the upper Owens River below the confluence of Hot Creek as well as in Hot Creek itself (Ebasco

Environmental, et al., 1993). A detailed study of arsenic in Crowley Lake waters confirmed the geologic nature of the sources (Jellison, et al., 2003).

When the level of Crowley Lake fell rapidly in 1989, tributary streams eroded new channels in their deltas in response to the dropping base level. Large volumes of sediments were transported into deeper areas of the lake. Stirring up these sediment deposits also released mercury that had been in storage, and elevated mercury levels were found in water samples collected by LADWP at the dam in February 1990 (Milliron, 1997). Subsequent analyses of trout tissue found no detectable levels of mercury or other heavy metals (Milliron, 1997).

Arsenic has been found to be above the MCL (10 ppb) in several groundwater sources throughout the region. Arsenic is naturally-occurring in the region as a result of decomposing granitic bedrock. Elevated arsenic levels have been documented in locations as far apart as Bridgeport and Tecopa, and several locations between. Because arsenic occurrence is very location-specific and can vary over short distances, the only possible region-wide approach is to address the concern at each location. The presence of arsenic has impacted drinking water availability for several communities in the region. The Inyo-Mono IRWM Program has helped to support and implement solutions ranging from point-of-use treatment to centralized treatment feeding a distribution system to a community water kiosk with centralized treatment. Not all sources have been addressed, however. The Inyo-Mono IRWM Program will continue to work with individual communities with elevated arsenic in their drinking water in order to help bring resources to solve the problem.

Organics

In 1999, the June Lake Public Utility District tested all its water systems for various organic chemicals. Dichloromethane, an insecticide and industrial by-product, was detected in water from June Lake and Snow Creek in one sampling but not found again in follow-up tests (Boyle Engineering Corporation, 2004). No other records of analyses of organic contaminants for the Mono Basin were located.

Fuel spills from crashes of tanker trucks have contaminated Slinkard Creek and the East Walker River in recent years. Major clean-up operations were performed in both cases. Fuel spills may have occurred within the June Mountain Ski Area during slope grooming operations.

Monitoring wells at the Benton Crossing landfill have detected low concentrations (about one or two parts per billion) of three volatile organic compounds (Mono County Planning Department, 2004). Although the concentrations appear to be stable and well below the so-called maximum contaminant levels, a monitoring program reports results from sampling and analysis to the Lahontan Regional Water Quality Control Board.

Temperature

Temperatures of stream water are determined by the source of water (direct snowmelt runoff, overland flow, and seepage from soil and groundwater) and energy inputs (primarily solar radiation). Shading of the stream by terrain features and vegetation regulates the amount of solar energy received by the water. The volume of flow is also critical because a given amount of energy can raise the temperature of a large volume of water only a small amount but can raise the temperature of a small volume perhaps several degrees.

Herbst and Kane (2004) found that summer stream temperatures rarely exceeded 59°F in the control streams of their study within the West Walker River watershed. Summer temperatures of some of their treatment streams that had comparatively little riparian vegetation were well above 59°F. Maximum temperatures in their Poore Creek site exceeded 80°F in 2002.

Water temperature in the streams of the Mono Basin has been altered by water management activities. Water is stored in several reservoirs in the Mono Basin where the timing of the releases affects the volume of water in the stream, and the depth of the outlet determines whether warm surface water or deeper cool water enters the stream below the dam. The diversions for export greatly reduced flow and consequently raised temperatures below the diversions. Flow reductions also decreased the amount of riparian vegetation that provided shade to the streams.

Water temperatures were monitored at four locations on the upper Owens River between June 1 and September 30, 1991 (Ebasco Environmental, et al., 1993). The average temperatures, as well as the variation in daily temperature values, tended to increase downstream. Daily average temperatures ranged from 52°F to 65°F at the powerline crossing above Hot Creek and from 56°F to 72°F at Benton Crossing. Maximum temperatures ranged up to 80°F (Ebasco Environmental, et al., 1993).

Water temperatures in upper Mammoth Creek were measured during the summer of 1972 and found to be in the range of 54°F to 75°F and did not exceed 82°F. The daily temperature range varied within 2°F to 10°F (Perrine, et al., 1973).

Water temperatures in Hot Creek and Convict Creek apparently rise several degrees where warm irrigation return flow enters the creeks following flood irrigation of adjacent pastures.

Dissolved Oxygen

Limited sampling above and below Topaz Reservoir suggested that stratification of the stored water behind the dam results in less dissolved oxygen downstream of the reservoir than is present in the West Walker River upstream (Humberstone, 1999).

June Lake mixes twice a year, usually in May and October. In summer and winter, June Lake is stratified with dissolved oxygen near saturation (and therefore favorable to trout) only at middle depths during summer (Brown, 1979). Decomposition of organic matter, mainly algae, depletes the oxygen below about 50 feet in June Lake. In Gull Lake, dissolved oxygen was not present below 40 feet, and the lake was judged to be eutrophic with excessive algal productivity. Dissolved oxygen in Silver Lake was near saturation except for some depletion noted in a 1979 sample (Brown, 1979).

Dissolved oxygen levels in upper Mammoth Creek were measured in the summer of 1972 by the UCLA team and found to be 6 to 8 mg/l, a range quite suitable for trout and close to theoretical saturation at the ambient temperatures of the streams and lakes (Perrine, et al., 1973). This study also found biochemical oxygen demand in Mammoth Creek was quite low, almost always below 2 mg/l.

Dissolved oxygen was measured in Crowley Lake during August 1993 (when the lake was stratified), by the Department of Fish and Game. Below a depth of 33 to 43 feet, dissolved oxygen was only 2 mg/l (Milliron, 1997). Concentrations of dissolved oxygen between 3 to 5 mg/l restrict growth of trout, and levels below 3 mg/l can be lethal to trout after long exposure (Milliron, 1997).

Pathogens

The UCLA team measured concentrations of total coliform and fecal coliform bacteria in water samples from Mammoth Creek and lakes in the Lakes Basin during the summer of 1972. This study found a wide range of variability from 0 to 10,000 colonies per 100 ml for total coliform and 0 to 1,000 colonies per 100 ml for fecal coliform (Perrine, et al., 1973). Naturally occurring soil bacteria were believed to be the main constituent of the total coliform counts. The highest fecal coliform counts were found in lower Mammoth Creek and believed to result mainly from leaking septic systems in Old Mammoth and pet waste.

Most sites sampled by Setmire (1984) in upper Mammoth Creek had fecal coliform bacteria counts below 10 colonies per 100 ml. Mammoth Creek at U.S. Highway 395 had 250 colonies per 100 ml, and Hot Creek below the hatchery had more than 1,000 colonies per 100 ml (Setmire, 1984).

There have been anecdotal reports of bacterial contamination of the small channels over the Hilton Creek fan (Hilton Creek distributaries) by neighboring outhouses and septic systems. For example, a routine water sample within the Crowley Lake Mutual Water Company system tested positive for fecal coliform in November 2002 (Mammoth Times, 2002).

Bacterial contamination in the Bishop Creek as it approaches and flows through Bishop has been observed by the Lahontan Regional Water Quality Control Board through its Surface Water Ambient Monitoring Program (SWAMP) between 2011 and 2016. Bishop Creek was added to the 303(d) list in 2018 as impaired from fecal bacteria. The Regional Board will address the contamination issue under a new EPA watershed-based approach called a “Vision Project”
(https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/bishopcreek.html).

pH and Alkalinity

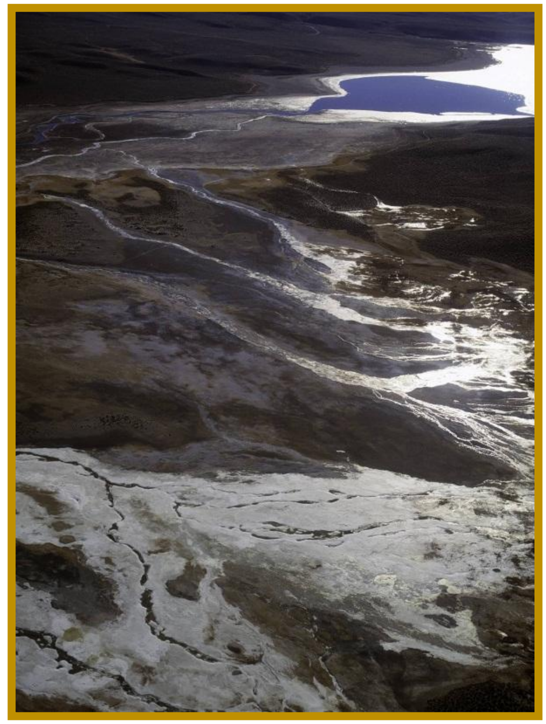
The pH of water is an index of the hydrogen ion concentration, which in turn causes water to be acidic or alkaline. A pH value of 7 is neutral, values less than 7 (increasing hydrogen ion concentration) are acidic, and values greater than 7 [to a maximum of 14] (decreasing hydrogen ion concentration) are alkaline. Lakes in the upper Owens River watershed had pH values averaging about 8.3 in an early survey. Slightly alkaline waters such as these lakes tend to have more plants and animals than neutral or acidic waters.

Alkalinity is a measure of the capacity of water to buffer changes in hydrogen ion concentration. Water with greater alkalinity is more resistant to changes in pH. Alkalinity depends on the amount of carbonate, bicarbonate, and hydroxide ions.

A study of Crystal Lake relating to acidic precipitation found that the pH of the lake was 6.7 to 6.1, and the acid-neutralizing capacity varied from 56 to 82 microequivalents per liter (µeq/l). Acid-neutralizing capacity declined rapidly during the snowmelt season as very pure runoff water entered the lake, and then slowly increased during the remainder of the year (Melack, et al., 1992).

Water imported from the Mono Basin lowered the alkalinity of the upper Owens River and consequently might have had some potential effects on the toxicity of naturally occurring metals.

2.5.2 Groundwater Quality



Boron, fluoride, and arsenic have been found in water from artesian wells near the center of Antelope Valley. Among five wells sampled in Antelope Valley, one had a concentration above a Maximum Contaminant Level for inorganics-primary, and two had a concentration above a Maximum Contaminant Level for radiological (DWR, 2004).

Occasional measurements of samples from wells and springs have been made over the years. For the Mammoth Creek watershed, the California Department of Water Resources (1973) reports TDS and electrical conductivity for several dozen wells and springs. TDS values ranged from 30 to 300 mg/l for cold water sources and 500 to 1,600 mg/l for geothermal sources. Electrical conductivity ranged from 60 to 400 micromhos/cm for cold water sources and between 500 and 2,300 for geothermal sources.

Water issuing from the Mammoth Mine adit had a TDS concentration of 95 mg/l, and a spring near the YMCA camp had an electrical conductivity of 50 micromhos/cm (DWR, 1973).

Some of the groundwater pumped by MCWD contains arsenic. After treatment, the average arsenic concentration in MCWD supplies is below the maximum contaminant levels (MCL). In April 2009, MCWD conducted a public notification when arsenic MCLs were exceeded. In 2009, the average arsenic level was 8.9 parts per billion, with a range of 0 to 33 ppb (I. Yamashita, personal communication). The drinking water standard for arsenic was changed from 50 ppb to 10 ppb in January 2006. MCWD has instituted changes to its pumping management and made improvements to its water treatment operations to meet the revised arsenic MCLs. MCWD received a Prop. 84 IRWM grant to profile one of its wells to limit its pumping of water high in arsenic and potentially blend higher-quality groundwater with water exceeding the arsenic MCL.

Some wells of the Indian Wells Valley Water District were known to produce water that contains arsenic at levels exceeding the maximum contaminant level of 10 ppb (Indian Wells Valley Water District, 2011). Treatment facilities to remove arsenic were constructed and operational in 2011.

Needs assessments throughout the Inyo-Mono region found arsenic to be a concern in water supplied by four systems (Aspendell Mutual Water Company, Benton Paiute Tribe, Keeler Community Services District, Darwin)

Arsenic in groundwater below the community of Tecopa prevented use as drinking water. The Inyo-Mono RWMG facilitated acquisition of State of California grant funding for a feasibility study and construction of a treatment facility and drinking water dispensing station for Tecopa that was completed in 2017.

Needs assessments throughout the Inyo-Mono region found nitrates to be a concern in water supplied by one system (Aspendell Mutual Water Company).

In recent years, the presence of uranium compounds at concentrations above drinking water standards has been identified in some community water supplies and private wells within the region. Trace amounts of uranium occur in some of the geological substrates of the area, and local groundwater partially reflects the chemical composition of materials in contact with the water. The extent and severity of the issue is uncertain as of 2019. The Environmental Health Department of the County of Mono is monitoring the situation.

Groundwater in the vicinity of the Benton Crossing landfill is monitored with a series of wells to detect any changes in groundwater quality resulting from materials leaching out of the landfill.

As of 1998, there were 12 known cases of leaking underground storage tanks (presumably gasoline or other volatile fuels) within the upper Owens watershed (Lahontan Regional Water Quality Control Board, 1998). A large gasoline spill occurred at the Mammoth Mountain garage facility on January 12, 1999 (Buckmelter, 2000). Approximately 7,500 gallons of gasoline entered the soil, and about a quarter of that amount was recovered within the first few months after the spill. A series of monitoring wells was installed to observe the plume within the groundwater.

Some overly generalized information on groundwater quality for Long Valley between 1994 and 2003 was tabulated in a recent report of the California Department of Water Resources (2004). Two of six public supply wells tested in Long Valley exceeded the maximum contaminant levels for radiological contaminants. All four of the public supply wells tested in Long Valley exceeded the maximum contaminant level for some inorganic secondary contaminant (chloride, copper, iron, manganese, silver, specific conductance, sulfate, total dissolved solids, or zinc).

One of the wells supplying water to the Mountain Meadows Mutual Water Company for part of the Hilton Creek/Crowley Lake community has had concentrations of uranium sufficiently high to be a matter of concern.

One of the first implementation projects of the Inyo-Mono RWMG was construction of an ion-exchange treatment facility at the Coleville High School to reduce the presence of uranium in the school’s drinking water.

During the 2012-2016 drought, June Lake, one of June Lake PUD’s surface water supplies, dropped considerably. As a result, uranium dissolving into the lake from granitic material became concentrated, causing this water source to exceed the uranium MCL. The Inyo-Mono IRWM Program provided a Prop. 84 grant to install a small ion exchange unit to remove uranium from this surface water source.

There are no known sources or occurrences of perchlorate or hexavalent chromium in the region. Hypothetically, there might be some presence of these substances at the China Lake Naval Air Weapons Station, but there is no unclassified information available.

2.5.3 Natural Sources of Constituents

Big Springs and Deadman Creek provide natural sources of phosphorus, which encourages abundant growth of aquatic plants in the upper Owens River and in Crowley Lake. Big Springs was found to be the primary source of phosphorus for Crowley Lake (Melack and Lesack, 1982). Hot Creek is the largest tributary to the upper Owens River and contributes additional nutrients as well as some heavy metals. Arsenic is found at high levels in some of the Hot Creek geothermal springs within the creek (Ebasco Environmental, et al., 1993).

2.5.4 Anthropogenic Sources of Constituents

A water quality modeling study demonstrated that reducing diversions from the West Walker River would improve water quality in the river as well as Walker River, largely by providing additional water for dilution of dissolved salts (Humberstone, 1999).

A recent study in the Bridgeport Valley (Elkins, 2002) may provide some indications about nutrient and fecal coliform pollution from livestock operations. Elkins (2002) found that:

1) more than half of the annual nitrogen and phosphorus loads to Bridgeport Reservoir were delivered by snowmelt runoff,
2) total inorganic nitrogen (nitrate and ammonia) was removed by biochemical processes in the saturated soils of the Bridgeport Valley,
3) water that remained in the channels and was not in contact with the soils retained any inorganic nitrogen already present,
4) dissolved organic nitrogen was the primary form of nitrogen entering Bridgeport Reservoir and was readily leached from manure and irrigated soils,
5) phosphorus was not retained by the soils and was readily transported on eroded soil particles,
6) fecal coliform from livestock manure appears to survive for months even in the cold temperatures of Bridgeport Valley and is readily transported in snowmelt runoff and irrigation return flow.

Unpaved roads are the principal source of sediments from human activities throughout the Sierra Nevada (Kattelmann, 1996). That situation is likely to be the case within the Inyo-Mono IRWM planning area as well, although grading for residential construction may be the main source in local areas, such as the town of Mammoth Lakes. Activities that remove vegetation and leaf litter, expose soil directly to rainfall and runoff, and compact soil greatly increase the potential for erosion. If the disturbance is near a stream channel, then there is a high likelihood that the eroded sediment will be transported into a stream rather than just relocated. The Mammoth Mountain Ski Area was also identified as a major source of human-caused sediment (USDA-Forest Service, 1988). However, erosion control efforts and sediment detention basins have presumably greatly reduced the amount of sediment leaving the ski area boundaries.

A variety of petroleum- and rubber-based materials are washed off paved roads into storm sewers and small channels. Nitrogen and phosphorus enter streams from several sources: leakage and failure of septic and sewage systems; overapplication of fertilizers on lawns, gardens, golf courses, and ski runs; release of some household cleaning products; and pet waste. Pathogenic bacteria, such as *E. coli*, enter surface waters from leakage and failure of septic and sewage systems, pet waste, livestock waste, human waste from recreationists, and indiscriminate flushing of RV waste tanks.

A standard septic system uses a septic tank and a leach field. If properly designed, installed well above the water table and in adequately draining soil, constructed, and operated, then a regular septic system is capable of nearly complete removal of fecal coliform bacteria, suspended solids, and biodegradable organic compounds (EDAW, 2005). The most critical factor in determining effectiveness of septic systems for treating the contaminants above is the time that leachate takes to travel between the leach lines and the water table. Deep soils that drain slowly allow for maximum biological processing of the wastewater. Unfortunately, in most soils, septic systems are relatively ineffective for removing nitrogen, pharmaceuticals, and other synthetic organic compounds (EDAW, 2005).

The State Water Resources Control Board is currently (2006) drafting new regulations to address septic systems, also known as on-site wastewater treatment systems (OWTS). California currently lacks statewide regulations or standards on septic systems, and practices vary greatly between regional water quality control boards and local jurisdictions. Depending on what criteria are ultimately adopted, the new regulations could result in greatly increased costs for on-site wastewater disposal or building moratoria in some areas.

2.6 Major Water-related Objectives and Conflicts

The objectives of the Inyo-Mono RWMG are thoroughly discussed in Chapter 7. Ongoing conflicts over water in the Inyo-Mono IRWM region as of 2019 are best seen in the context of historical water conflicts of the eastern Sierra Nevada.

Water-related conflicts in the Inyo-Mono IRWM region began soon after the arrival of Euro-American settlers in the 1850s. The most severe winter on record brought widespread flooding to the area in 1862. The scarcity of food and shelter amid the high water in the southern Owens Valley led to violent conflicts between native Paiutes and the new settlers (Chalfant, 1933; DeDecker, 1966).

As irrigation of fields and orchards throughout the Owens Valley grew rapidly in the late 1800s, discharge in the Owens River dropped dramatically and Owens Lake began to shrink. By 1890, about 250 miles of canals and ditches had been constructed with a combined capacity of about 1,200 cfs (exceeding flow the of Owens River much of the year). After the turn of the century, engineering plans, financing, deals for land and water rights, and construction were organized to move water from the Owens Valley to Los Angeles. With completion of the Los Angeles Aqueduct in 1913, water demand for export began to compete with water demand for local irrigation. From 1913 through 1922, the City of Los Angeles and Owens Valley irrigators apparently got along with an adequate distribution of water, largely because the intake for the aqueduct near Aberdeen was downstream of the principal agricultural areas of the valley (Vorster, 1992). An agreement was almost reached to guarantee water supplies to existing irrigated lands in 1913, but a legal challenge from a private citizen in Los Angeles disrupted the negotiations (Vorster, 1992). A series of dry years from 1921 through 1925 led to the City's effort of purchase additional land and water rights from 1923 through 1927. There is a wide range of accounts of the circumstances and practices of acquisition during that period (e.g, Chalfant, 1933; Hoffmann, 1981; Kahrl, 1982; Reisner, 1986; Smith and James, 1995). Despite much controversy surrounding the real-estate deals, actual prices paid for land and water rights in almost all cases were at least fair-market value and occasionally quite favorable to the sellers (Vorster, 1992; Libecap, 2007). Landless agricultural workers, especially Native Americans, lost work as cultivated acreage declined.

As growth accelerated in Los Angeles in the 1920s and 1930s, LADWP sought to increase its water supplies from the eastern Sierra Nevada. The City filed for appropriative water rights on streams in the Mono Basin, acquired streamside parcels in the Mono Basin, constructed diversion structures, built a dam forming Grant Lake reservoir, and tunneled through the Mono Craters to get water from the Mono Basin to the upper Owens River. Water began to flow through the Mono Craters Tunnel in 1941. Although initially considered in the 1920s, a second aqueduct was not designed until 1963 and completed in 1970. The resulting sixty percent increase in aqueduct capacity (480 cfs to 780 cfs) allowed for additional water exports from the Mono Basin, provided rationale to reduce irrigation of City-owned lands, and created an opportunity to export additional quantities of groundwater. All three activities had environmental consequences and led to strong objections from some eastern Sierra residents.

Inyo County filed a lawsuit in 1972 intended to force a reduction in groundwater extraction and export. The legal action used the new California Environmental Quality Act, and courts limited groundwater pumping by LADWP until an Environmental Impact Report was completed. While litigation proceeded in the courts, the county and city attempted to negotiate an agreement to meet the water needs of both regions (e.g, Smith and James, 1995). Focused primarily on groundwater management, the Inyo / LA Long Term Water Agreement provides the basis for resolving some of the conflicts over water allocation in the Owens Valley. A primary goal of the agreement was to "to avoid certain described decreases and changes in vegetation and to cause no significant effect on the environment which cannot be acceptably mitigated while providing a reliable supply of water for export to Los Angeles and for use in Inyo County." The agreement specifies baseline conditions for native phreatophytic vegetation, prescribes water supplies for irrigated areas, manages pumping according to soil water and vegetation conditions, provides for a number of mitigation projects, and puts in place technical and policy making committees (Harrington, 2012, personal communication).

The agreement also provided for the rewatering of the Owens River channel downstream of the primary intake for the Los Angeles Aqueduct. A 1997 Memorandum of Understanding expanded the scope and terms of the 62 mile-long "Lower Owens River Project" and provided for additional mitigation. Water was released into the channel in December, 2006, and flows are used to enhance the river's riparian corridor, improve wildlife habitat in the Blackrock and Delta Habitat Areas, and to maintain off-river lakes and ponds for recreation.

Although irrigation diversions had markedly reduced Owens River inflows to Owens Lake in the late 1800s and the lake's water level had dropped by about 33 feet between 1878 and 1905 (Lee, 1915), water export to Los Angeles beginning in 1913 completely diverted inflow from entering Owens Lake. By 1924, the lake was essentially gone, exposing over 60 square miles of lake bed and creating the largest monitored source of windblown dust (PM-10) in the United States. In 1987, the U.S. E.P.A. found that the southern Owens Valley was in violation, and subsequently in 1993, in "serious non-attainment" of PM-10 particulate matter air-quality standards. Because of the connection between removing the inflows to the lake and the consequent empty lakebed, the Great Basin Unified Air Pollution Control District, the California

Air Resources Board and the U.S. Environmental Protection Agency determined the City of Los Angeles is responsible for controlling the air pollution emissions from the dry lakebed. In 1998, the Great Basin Unified Air Pollution Control District and the City of Los Angeles entered into a memorandum of understanding to control dust emissions from the lakebed. Over the past decade, the City has expended over a half billion dollars and has recently applied up to 76,000 acre-feet of water per year to control dust (Great Basin Unified Air Pollution Control District, 2008; LADWP, 2011a). An Owens Lakebed Master Plan has been under development for several years to resolve issues such as continued dust control and water use, wildlife habitat, and possible solar power generation at Owens Lake. It was nearing completion as of 2019. The air pollution levels dropped about 90 percent between 2000 and 2009 as dust controls were implemented.

Following completion of the second aqueduct, export of water from the Mono Basin became a widely recognized controversy. When diversions out of the basin approximately doubled in 1970, the rate at which Mono Lake level dropped increased significantly, which resulted in increased salinity. In 1978, the Mono Lake Committee was formed with the initial goal of restoring Mono Lake back to the water level it had in 1976, which would limit some of the ecological consequences of diverting its tributary streams. The water diversion conflict in Mono County generated a large amount of press coverage and public attention. Inevitably, the issue entered the legal system. An initial suit, brought by the National Audubon Society, advanced relatively quickly on appeal to the California Supreme Court. The court's decision in February, 1983, found that the allocation of the waters of the Mono Basin needed to be reconsidered, based on public trust values. In autumn of 1984, another lawsuit based on a section of the California Fish and Game Code led to a decision to maintain flows below Grant Lake dam adequate to maintain the fishery that became reestablished during the big winters of 1982 and 1983. Further legal actions led to an injunction in 1991 to maintain the then-current lake level while the State Water Resources Control Board studied the diversions of water from the Mono Basin streams. In September, 1994, the Board issued its decision, amending the licenses so as to partially restore Mono Lake and its tributary streams (Hart, 1996).

Comparatively minor operational conflicts continue over the progress and form of Mono Basin stream restoration efforts. During the past two decades, a local controversy has ensued over the distribution of water between Mill Creek and Wilson Creek in the northwestern part of the basin. The matter is expected to be addressed through the hydropower relicensing process of the Federal Energy Regulatory Commission.

At the north end of the planning region, the long-term trade-off between irrigation and maintaining Walker Lake is the fundamental conflict over water. The dramatic decline in the level and volume of Walker Lake and the consequent increase in salinity and changes in the lake's fishery have attracted national attention. Between 1882 and 1994, as irrigation consumed water from the Walker River, the surface elevation of Walker Lake fell by about 140 feet and the volume decreased by about 75 percent (e.g., Sharpe, et al., 2008; Collopy and Thomas, 2010). Concentration of salts has increased five-fold over this period. Anecdotal accounts suggest that Lahontan cutthroat trout ceased to exist within Walker Lake during 2009 or 2010 (e.g., Gregory, 2011). The volume of water subject to appropriation through existing water rights is 40 percent greater than the average annual inflow to the lake. Most of the water that actually reaches the lake enters during major floods that exceed the upstream capacity of storage reservoirs. Although there is potential to improve water supplies by conjunctive use of groundwater and surface water and greater water conservation through ditch lining, upgrading distribution systems, and irrigation scheduling, the political will to acquire or alter water rights is lacking. Although the volume of water evaporated through irrigation on the California side of the stateline is small compared to that downstream in Nevada, opportunities for purchase or lease of water rights are being explored within the California portion of the basin.

The primary water issue within the upper Owens River watershed is supplying water for the town of Mammoth Lakes without adversely affecting aquatic habitat in Mammoth Creek or water quantity and/or temperature at the Hot Creek hatchery springs. This water supply concern has been a persistent issue since the 1970s and became more acute with the town's growth. In 2011, MCWD adopted a project described in an Environmental Impact Report identifying mean daily Mammoth Creek flow amounts that would restrict diversions for town water supply. These flow amounts are intended to protect the aquatic habitat of the creek. In addition, in 2010, the District updated its Urban Water Management Plan that evaluates current and projected water supplies under various water year scenarios and compares these supplies with projected town growth. The 2010 UWMP concluded that the development of one new groundwater well and maintaining water conservation efforts will result in adequate supplies for projected town growth. Since these reports were completed, the City of Los Angeles, through the Department of Water and Power, filed legal challenges to the UWMP and the District's EIR claiming senior water rights over the District's water right licenses and permit (Mammoth Community Water District, 2011b). These legal challenges generated uncertainties and controversies over supplying water to the town of Mammoth Lakes and the USFS recreational facilities in the Mammoth Lakes Basin. These matters were put aside in a Settlement Agreement between MCWD and LADWP in July 2013. MCWD's water rights licenses and permit allow the District to divert up to 2,760 acre-feet from Mammoth Creek each year, but actual diversions have been considerably less in recent years (Mammoth Community Water District, 2017).

The development of geothermal energy near the junction of U.S. Highway 395 and State Route 203 has long been a concern to the Mammoth Community Water District (MCWD) with respect to potential impacts on groundwater resources. Potential interactions between pumping for water supply for the town of Mammoth Lakes and pumping for hot water for electrical generation have not be closely monitored. As of 2014, MCWD was pumping about 2,000 acre-feet per year from the "coldwater" aquifer at depths of 400 to 700 feet below the surface. In at least parts of the Mammoth Creek watershed, there is a zone of relatively warm water below this coldwater aquifer. Beneath the warm zone, temperature continues to rise, and water hot enough to extract for geothermal energy production can be found.

A planned expansion of the geothermal energy facility, the Casa Diablo IV Geothermal Development project, will include 16 new wells that could extract 10,000 acre-feet of hot water per year. Current pumping for the geothermal plant is about 19,000 acre-feet. Almost all the proposed geothermal wells are closer to the town of Mammoth Lakes and the water supply wells than the existing geothermal wells. These new wells would pump hot water from depths of about 1,500 to 2,000 feet below the surface. Because of the complex geology and little drilling data about the nature of the rock between the coldwater aquifer and the geothermal aquifer, potential connections for water and heat between the two layers are unknown. Therefore, whether extraction of underlying hot water would have any impact on the overlying coldwater aquifer is also unknown. MCWD has requested that the geothermal developer install additional monitoring wells and have a mitigation plan in case impacts are detected in the future. In 2013, the MCWD filed a lawsuit against the Great Basin Unified Air Pollution Control District, which was in an odd position as the "lead agency" for considering (and eventually approving) the environmental impact report for the Casa Diablo IV expansion project. In late 2018, the MCWD settled its legal actions unsuccessfully despite costs of about $1.7 million (Benham, 2018).

The southeastern part of the Inyo-Mono region has been identified as a favorable location for solar power development. One project in the California portion of Pahrump Valley was in the California Energy Commission permitting process as of May 2012, and at least four other projects are in various stages of planning in the Nevada portion of the basin. Projects have also been proposed in the Middle Amargosa basin and Owens Valley. Water use by these projects depends on the power generation and cooling technology used, and because the southeastern part of the region has scant surface water, the water needs of these projects will be supplied with groundwater. Supplying large amounts of groundwater to projects in the southeastern part of the region may be problematic because the Nevada State Engineer has declared that the Pahrump basin is in overdraft.

Because of the lack of comprehensive data on the safe yield of the region's many isolated aquifers, new residential developments frequently face opposition based on the inadequacy of water supply data. Although the CEQA process addresses this issue and individual water availability analyses are performed, these studies are frequently viewed with skepticism by those within close proximity to the development, who fear their own water supplies will be impacted. Without major advances in localized groundwater data, this problem will likely continue. CASGEM reporting should provide much-needed information. The Sustainable Groundwater Management Act (SGMA) processes should ultimately improve management of the region's aquifers.

As noted above, the Indian Wells Valley has been in a state of critical overdraft for years, and significant reductions in water use will be necessary to stabilize the underlying water table. In 2018, rumors began circulating that Kern County might attempt some novel legal maneuvers to access water from Inyo and Mono Counties via LA Aqueduct (which crosses Kern County) as a source of water for Ridgecrest. Such rumors have generated a degree of suspicion among many Inyo County residents concerned about new demands for water from their county.

In the Mono Lake and Owens Rivers basins, about 460 miles out of 530 miles of streams are affected by water diversions (Inyo National Forest, 1987). During the 1980s, under the favorable conditions created by the Public Utilities Regulatory Policy Act, at least a dozen small-scale hydroelectric projects were proposed on streams of the eastern Sierra Nevada. None of those projects were built, although plans occasionally resurface (*e.g*, on Pine Creek).

In early 2019, two pumped storage facilities were proposed in the region: one connecting the upper Owens River to three small reservoirs proposed on Wheeler Crest above Swall Meadows and the second connecting the lower Owens River to one or more reservoirs in the White-Inyo Range. Local residents quickly voiced opposition to both projects. As of June 2019, both proposals were rejected on procedural grounds by the Federal Energy Regulatory Commission.

During and following the 2012-2016 drought, LADWP reconsidered its long-standing practice of irrigating grazing lands that it offers to ranching operations under a lease program in Mono and Inyo counties. The Department proposed reducing the amount of water for irrigation in Long Valley above Crowley Lake, and formalized a “project” with a CEQA Notice of Preparation in August 2018. Ranching lessees, local residents, and people concerned about potential impacts to sage grouse habitat objected to the proposed reductions. In response to the public outrage, Mono County filed legal actions and a technically-detailed response to the Notice of Preparation. The issue continued through the court system in 2019.

Historical conflicts over water resources in the Inyo-Mono region have centered on water exports, impacts on closed-basin lakes, and groundwater pumping. Current conflicts seem both milder in intensity as well as focused on other issues, such as water quality, community water supply, water conservation, and allocations supporting environmental benefits. Today, the level of controversy within the region seems greatly reduced compared to our history. Although disagreements certainly persist over water in such an arid region, there appears to be a greater willingness by most parties to attempt to resolve differences though negotiation and collaborative processes and avoid litigation. The Owens Lakebed Master Plan effort and the Inyo-Mono Regional Water Management Group are examples of this current direction. We anticipate further progress in collaborative water resources management over the twenty-year planning horizon of this plan.

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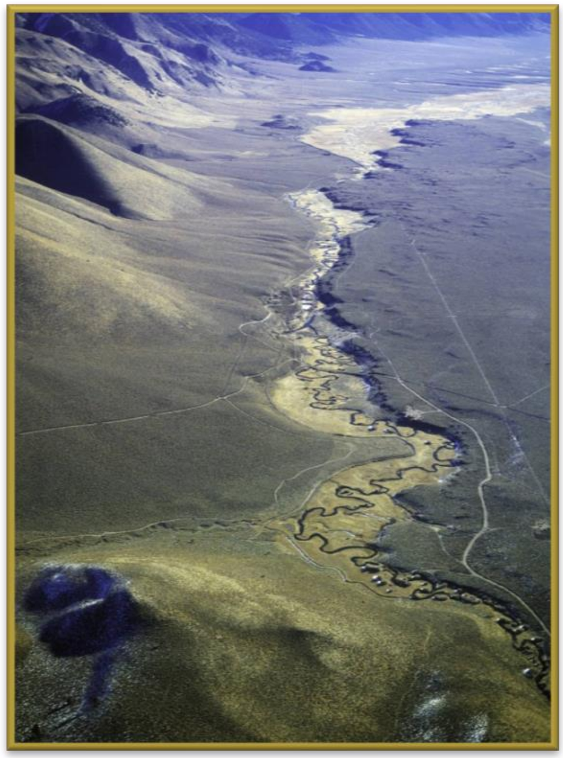
Chapter 3 : Climate Change

Introduction

Warming of the Earth's climate has become evident over the last several decades, though there is still debate over the anthropogenic (or man-made) contribution to climate change. The overwhelming consensus among climate scientists is that human-derived sources of greenhouse gases have at the very least sped up, or even caused, the observed warming in the last century. In the most recent report from the Intergovernmental Panel on Climate Change (IPCC), which is a body of international scientists and climate experts established by the United Nations, the authors state: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007).



In terms of managing water resources in a changing climate for a region as diverse and complex as the Inyo-Mono planning region, it is necessary to have access to information at scales that are meaningful for planning and decision-making. The Inyo-Mono IRWM process attempts to provide information at the appropriate scale. An additional challenge is that, given the remote and rural nature of the Inyo-Mono region, information regarding climate change impacts, greenhouse gas mitigation, and adaptation strategies originating from academic institutions, or State or federal agencies, is not always readily accessible. Thus, the Inyo-Mono RWMG is committed to improving availability of climate change-related information for water practitioners in the area, through the IRWM Plan, other targeted documents, and workshops. This chapter first presents information about expected climatic changes and their impacts on the Inyo-Mono IRWM region. Using this information, we then present a qualitative vulnerability analysis that demonstrates what aspects of the water management system in the Inyo-Mono region are the most vulnerable to climate change impacts. These vulnerabilities are prioritized, and the beginnings of a plan for data/information collection are presented. An examination of adaptation strategies presented in DWR's Managing an Uncertain Future is performed. We end with some first greenhouse gas emissions inventories performed for water systems in the region.

3.1 Climate Change Vulnerabilities and Impacts in the Inyo-Mono Region

Globally, air temperature has increased 1.3°F (0.7°C) over the last century (1906-2005) (IPCC 2007). This warming is not uniform, however. Polar regions are showing more warming than mid-latitude regions, at up to twice the global average rate in the last 100 years. High-elevation/mountainous regions are also experiencing increased warming. Trends in precipitation have also been observed, although not in consistent directions. Some areas, such as the Sahel, southern Africa, and parts of southern Asia have experienced decreased precipitation, while eastern North and South America and northern Europe have experienced increased precipitation. Other impacts related to these climatic changes include sea level rise, melting glaciers and polar ice caps, warming oceans, decreased snow cover, melting permafrost, droughts, and more extreme weather events. All of these changes are expected to continue, if not accelerate, in the coming decades.

While it is important to understand current global climatic trends, regional and local climatic changes are more pertinent to natural resources management, planning, and policymaking. It is possible to understand past climatic trends through observed data, where they are available. Yet in order to predict future climate, scientists must use models, which are inherently imperfect. General circulation models (GCMs) are most commonly used to incorporate information about greenhouse gas emissions and other elements of the atmosphere-ocean system. These models produce large-scale output based on grid cells on the order of several kilometers, which, in mountainous areas, is not a useful scale for natural resources planning and management. Efforts to downscale GCMs and to develop regional climate models (RCMs) have improved over the last few years, although there is criticism as to the accuracy of these smaller-scale representations.

Perhaps the most criticized part of using models to project future climate is the uncertainty inherent in these models. Each model contains different assumptions about the atmosphere-ocean system and parameterizes elements of the climate differently. Thus, each model delivers slightly different projections of future temperature, precipitation, and other climatic variables. To use just one model as an indication of future climate is problematic. Instead, the convention is to use an ensemble of several climate models to create a general picture of future climatic trends. In this way, the uncertainty of each model is accepted, but it does not prevent the use of climate models in climate change analyses.

One of the primary drivers of GCMs and RCMs are greenhouse gas (GHG) emissions scenarios. The IPCC has developed a set of possible future GHG emissions based on different scenarios of global population growth, economic growth, government regulations of GHGs, etc. (IPCC 2007). GCMs and RCMs incorporate these emissions scenarios to produce a suite of possible climatic changes.

In general, GCMs show good agreement with respect to temperature changes, showing long-term warming over the globe. There may be some exceptions to this warming. For instance, northern Europe, whose climate is moderated by the North Atlantic ocean circulation, may actually experience cooling if ocean currents slow. For California, there is strong consensus that temperatures will continue to increase in the coming century. Using two GCMs and two emissions scenarios, Hayhoe et al. (2004) found that summer temperatures are likely to increase more rapidly than winter temperatures (see also Cayan et al. 2008), and that the north and northeast portions of the state may warm more than the southwest portion. Furthermore, warming is expected to be greater further inland in California due to the moderating effects of the ocean on air temperature in the coastal regions (Cayan et al. 2008).

A regional climate modeling effort analyzed temperature and precipitation changes specifically for the ten California Department of Water Resources hydrologic regions (Snyder et al. 2004). The North Lahontan and South Lahontan regions (in which the Inyo-Mono planning region resides) exhibited larger temperature increases than the other hydrologic regions, particularly in winter months (Snyder et al. 2004). This difference is likely due to the high elevations in these regions as well as their inland locations.

Projected precipitation patterns are much less certain than projected changes in temperature. Despite widespread regional differences over the globe, high-latitude regions are expected to experience increased precipitation amounts, while sub-tropical regions are expected to dry (IPCC 2007). For California in general, the seasonal patterns of precipitation resulting from the Mediterranean-type climate are not expected to change (Cayan et al. 2008). Projections of changes in the magnitude of precipitation, however, are not as straightforward. While earlier projections of precipitation showed large increases by 2100, more recent projections show only slight increases or slight to moderate decreases (Cayan et al. 2008, Hayhoe et al. 2004). Thus, it is difficult to develop expectations of precipitation changes with much certainty. Models show that precipitation patterns will continue to exhibit considerable monthly, interannual, and interdecadal variability (Cayan et al. 2008, Hayhoe et al. 2004), which may serve to mask any medium-term change in precipitation trends.

Perhaps more significant for California water resources than direct changes in temperature and precipitation will be the impacts of these climatic changes to the hydrological cycle. In California, almost 75% of annual water resources originate and are stored in Sierra Nevada snowpack (DWR 2008). This natural reservoir captures and stores water in the winter, when it is least needed throughout the state, and slowly releases it in the spring and summer through snowmelt runoff and streamflow, when statewide precipitation is limiting. Climate change-induced alterations to the amount of snowpack and to the timing of snowmelt and streamflow can impact both the quantity and quality of water resources available to urban and agricultural users. Expected hydrologic changes specific to the Inyo-Mono region will be discussed throughout this chapter.

DWR, in conjunction with the U.S. EPA and the Army Corps of Engineers, released in late 2011 the *Climate Change Handbook for Regional Water Planning* (DWR, 2011). The analysis that follows is largely in step with the guidance provided in the handbook.

3.1.1 Region Characterization

Chapter 2 (Region Description) provides a thorough description of the Inyo-Mono planning region, including climate, hydrology, geography, watersheds and associated ecosystems, and water supplies and demands.

3.1.2 Climate Change Impacts

Water Supply

Surface Water Hydrology

When thinking about climate change impacts to water resources in the Inyo-Mono region, we are most concerned with changes to winter snowpack and spring snowmelt and runoff. As with other regions in California that depend on water supplies from the west slope of the Sierra Nevada, snow provides a natural water reservoir for eastern Sierra Nevada communities and for the water that is exported to Los Angeles. Although changes in the amount of snow and rain received each year could impact water supplies, the projected impact of warming temperatures on the timing of snowmelt and streamflow is more certain and therefore may be of greater immediate concern. For years, water operators have depended on a peak in runoff during the late spring or early summer and have developed their water operations protocols accordingly. Changes in this timing will require development of flexible water operations protocols and better forecasting tools.

Already, changes in snowmelt runoff timing have been observed in western North America (Stewart et al. 2004). Snowmelt-dominated peak streamflow has shifted 10-30 days earlier since 1948 in many parts of the western U.S. (Stewart et al. 2004). It is expected that this trend towards earlier peak streamflow will continue throughout the 21st century, with many rivers eventually exhibiting a peak streamflow 20-40 days earlier than the mid-20th century (Snyder et al. 2004, Stewart et al. 2004). Models show that these observed and projected changes in streamflow timing are most likely caused by warming air temperatures rather than by changes in precipitation amounts (Stewart et al. 2004).

Although changes to the timing of events may be predicted to create the largest impacts to water supplies, changes in the amount of snowpack and other forms of precipitation can also have effects. Snowpack is expected to decrease in most areas of the West, both because of increased winter rain and more winter snowmelt due to higher temperatures (Snyder et al. 2004). Increased incidence of rain-on-snow events can cause winter flooding and help to speed up snowmelt and streamflow. Already, observed April 1 snow water equivalent (SWE), which is commonly used as the benchmark for measuring the amount of water delivered during the winter, has declined throughout the West, although not uniformly so (Mote et al. 2005). For the second half of the 20th century, the largest losses in April 1 SWE occurred in Washington, Oregon, and northern California, while the southern Sierra Nevada actually exhibited an increase in April 1 SWE (Mote et al. 2005). For the future, overall decreases in SWE are expected to continue and may perhaps even accelerate (Mote et al. 2005).

It is expected that the largest decreases in SWE will occur at lower elevations in western mountain ranges where the temperature currently hovers around freezing and will most likely increase. In the Sierra Nevada, the northern extent of the range will likely experience more dramatic impacts than the southern end of the range, which is higher in elevation. This projection may bode well for the Inyo-Mono region, which reaches from the central to southern Sierra Nevada. A much greater proportion of the snow zone of the eastern slope of the Sierra Nevada is at relatively high elevation than that of the western slope. This greater proportion of watersheds at elevations above those most likely to be impacted by changes in freezing level may also moderate hydrologic impacts of rising temperatures.

It is also expected that winters will become shorter and summers will be longer. Whether this results in an overall net loss in precipitation is unknown, but we might expect that snowfall that used to arrive in the autumn and spring might be delivered as rain in the future. This extended growing season will also mean more plant growth, which will increase the plant water demand.

Although some of the hydrological resources in the Inyo-Mono region are among the most well-understood in California due to their importance to a major metropolitan area, compared to other areas of California and the West, relatively little work has been executed to understand how the hydrology of the region may change under future scenarios of climate change.

Looking back, a hydrologic modeling study was completed for the Mono Basin in the late 1980s/early 1990s ahead of the State Water Resources Control Board 1991 decision mandating the lake level for Mono Lake. This study was the last complete work performed in the Mono Basin. Similarly, in the early 1990s, the hydrology and geology of the Owens Valley was studied and documented by the U.S. Geological Survey. The hydrology continues to be monitored internally by the Inyo County Water Department and the Los Angeles Department of Water and Power.

Looking forward, there has been a small handful of studies examining potential climate change impacts to the Mono and Owens watersheds. In its 2011 Urban Water Management Plan, the Mammoth Community Water District specifically refers to using CalAdapt (http://cal-adapt.org/) to examine model results for temperature and snowpack for the Mammoth Lakes area and also considers qualitative impacts of climate change to its service area.

There are two published studies that model the impacts of climate change to the Mono and Owens watersheds in the Inyo-Mono region. The first (Costa-Cabral et al 2012) looks at both watersheds and focuses specifically on the impacts of changes in surface water to the Los Angeles Aqueduct. Using 16 GCMs and 2 SRES scenarios, they applied the Variable Infiltration Capacity (VIC) hydrology model to the Eastern Sierra watersheds feeding the Mono Basin and Owens Valley. They found that the timing of the hydrograph's center (roughly corresponding to the point at which half of the year's streamflow has been discharged) moves earlier in the year anywhere from 9 to 37 days. They also found an increased fraction of precipitation falling as rain vs. snow, reducing the volume of snowmelt, and that precipitation rather than temperature has the dominant influence on April 1 snow water equivalent in these watersheds.

Similarly, Ficklin et al (2012) performed a study limited to the Mono Basin, using the Soil and Water Assessment Tool hydrologic model. They found: an annual increase in evapotranspiration (which will exert the most influence on decreased streamflow); decreased annual streamflow of 15%; advanced peak snowmelt and runoff of one month; and decreased occurrence of wet hydrologic years/more frequent drought conditions. They also recognized the immense challenges that these changes pose for water management in the Mono Basin.

A modeling study that was conducted for 15 west-slope Sierra Nevada watersheds shows the need for a watershed-by-watershed approach when conducting climate change analysis (Null et al. 2010). They found geographical differences within the Sierra with respect to which hydrological changes will be most impactful. For example, their modeling exercise showed the northern Sierra Nevada to be most vulnerable to decreased mean annual flow, while the southern watersheds would be most vulnerable to changes in runoff timing, and the central watersheds to longer periods of flow reductions. Thus, impacts are heterogeneous among watersheds.

Therefore, while there are some relatively current hydrologic projections for two of the larger watersheds in the region, there is still a dearth of information for the remainder of the watersheds in the region, and virtually no information specific to any of the groundwater basins in the region (but see discussion of groundwater in Climate Change Impacts section).

Groundwater Hydrology

As important but much less known are the impacts of climate change to groundwater supply. It might be expected that altered streamflow amounts and/or timing could affect recharge to groundwater basins in the region, but there are presently few data to support that assumption. However, as surface water supplies become more variable and unpredictable, communities, landowners, and resource managers may increasingly turn to groundwater to make up water supply deficits.

Groundwater is a critical water supply source. Nationwide, 40% of the public water supply is derived from groundwater, and much of the rural population obtains their drinking water from domestic wells (USGS 2009). Although no percentages have ever been calculated for the Inyo-Mono region, anecdotally we know that most of the established water systems use groundwater as their supplies, and most residents not on a water system use their own domestic wells.

The potential impacts of climate change on groundwater are poorly understood, particularly for aquifers in the western U.S. As an indication of this lack of understanding, the recent Assessment of Climate Change in the Southwest United States (Garfin et al. 2013) contains little mention of groundwater. In the Agriculture and Ranching chapter of the Assessment, the report cites that from 1994 to 2008, the USDA Farm and Ranch Irrigation Survey showed that depth-to-groundwater in irrigation wells increased for all states but Nevada but does not attribute this increase to climatic or direct anthropogenic causes. Taylor et al (2012) concur that projections of climate change impacts on groundwater recharge are subject to a great deal of uncertainty and that groundwater needs to be explicitly represented in GCMs and hydrologic models.

Little information exists on the future of groundwater specific to the Inyo-Mono region, so instead we turn to geographical and temporal proxies to understand how climate change may impact regional groundwater supplies in the future. For example, researchers have used natural climate variability, such as El Niño/La Niña cycles, to understand climate's impact on groundwater in the Southwestern United States (Taylor et al 2012). Groundwater levels and recharge are partially controlled by the complex interactions of low-frequency climatic variability such as El Niño Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO; Kuss and Gurdak 2014). In Basin and Range aquifers, which characterize many of the aquifers of the Inyo-Mono planning region, climate variability on the time scale of PDO or greater than PDO is the leading mode of variability (Kuss and Gurdak 2014). However, in general, western U.S. aquifers may respond faster to ENSO events than to PDO variability, and ENSO is still a significant mode of variability observed in western aquifers (Kuss and Gurdak 2014). In fact, Scanlon et al. (2006) found that interannual climate variability related to El Niño results in recharge that is up to three times higher than periods related to La Niña in the Southwest.

Hanson et al (2006) studied the impacts of natural climate variability on four groundwater basins in the southwest, including two in California (one desert basin with implications for the Inyo-Mono – the Mojave). They found that the variability in the basins' hydrology is most closely associated with PDO-like components, particularly for the basins closest to the Pacific Ocean, but that groundwater levels also reflect shorter climatic variability periods such as ENSO and monsoons. In the Mojave basin, average annual base flows declined in the 1950s and 1960s, coincident with the negative phase of PDO starting in 1947. Taylor et al. (2012) argue, however, that increased winter precipitation such as during ENSO events yields increased evapotranspiration in desert basins through enhanced desert blooms, thus largely or entirely consuming any surplus recharge.

The climatic fingerprint on groundwater hydrology is complicated by non-climatic anthropogenic stressors. The USGS states "Human activities, such as groundwater pumping and resulting loss of storage and capture of natural discharge, are often on the same time scale as some climate variability and change, which makes it difficult to distinguish between human and climatic stresses on groundwater" (2009). Scanlon et al. (2006) and Taylor et al (2012) posit that groundwater recharge may be more sensitive to land use change than to climatic variability.

Then there are the impacts of the current climatic changes to the regional aquifers. Looking to the future, there has been some hydrologic modeling of groundwater response to climate change, but little work has been done specific to the Inyo-Mono region. One study pulled together information for eight groundwater basins in the western U.S., either from modeling exercises or from expert opinion, one of which was the Death Valley Regional Flow System (within the Inyo-Mono region; Meixner et al 2016). They found in southern aquifers, including Death Valley, a projected decline in recharge of 10-20%, but with a wide range of uncertainty. Part of this uncertainty comes from the lack of understanding of recharge resulting from mountain systems, which are important sources of groundwater in the West. Furthermore, snowpack and snowmelt in mountain systems are changing, which is further changing the character of recharge from these areas. In Death Valley, precipitation infiltration and mountain snowmelt comprise almost the entirety of groundwater recharge. Decreased recharge is expected due to decreased winter precipitation and decreased snowpack. Projected warmer temperatures, especially in the late spring and early summer, are expected to increase evapotranspiration, further reducing precipitation or snowmelt-driven recharge. However, there is some uncertainty in the future of the summer monsoon and the intensity of summer precipitation events.

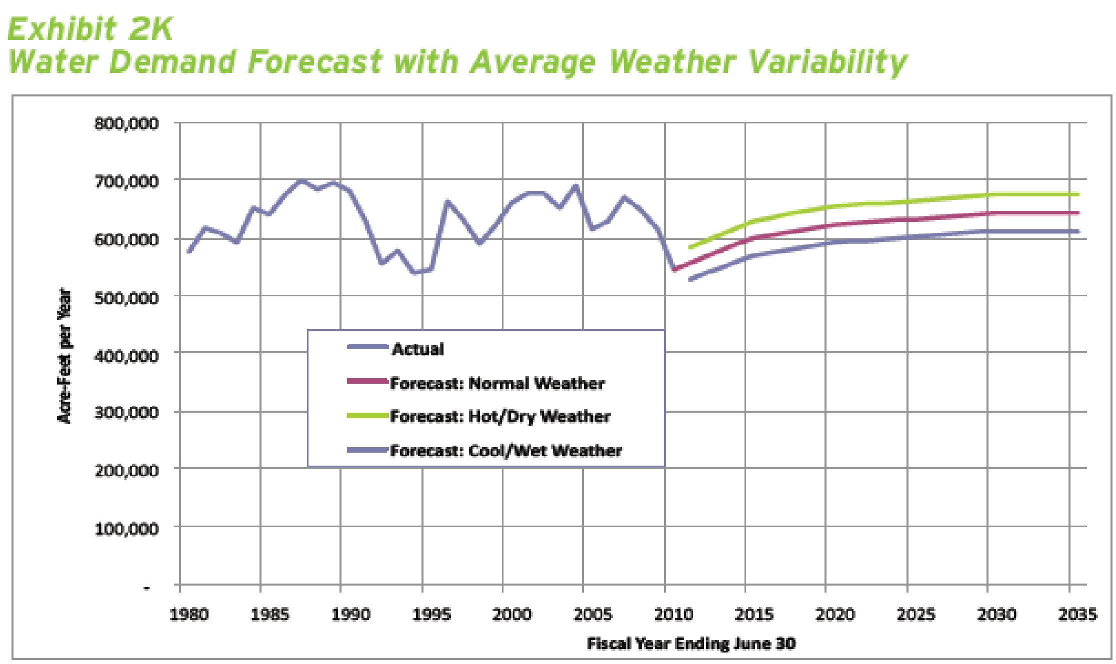
Although it is helpful to have climate impacts information from some analogous basins (e.g., low-elevation desert) in the West, not all of the basins in the Inyo-Mono region can be characterized as low-elevation desert basins. Additional studies are needed within the region to understand potential impacts of climate change on a smaller scale and in different climatic zones.

Water Demand

Because of the sparse population in the region, local water demand is not large. Demand does fluctuate seasonally to satisfy landscape irrigation and air conditioning needs (through the use of swamp coolers) in the summer. This seasonal demand could increase as summers become longer and warmer. Efforts to encourage native landscaping in communities throughout the region may help to mitigate some of this increase.

A second main source of water demand comes from the City of Los Angeles in the form of water exports from the Inyo-Mono region. The 2010 Los Angeles Department of Water and Power Urban Water Management Plan shows that, under average climate variability, overall water demand for the city is likely to increase slightly over the next 10-15 years and then level out around 2030 (LADWP, 2010; Figure 3-1). No analysis of demand under a changing climate is available. In general, it might be expected that demand from the Los Angeles Aqueduct will increase not only because of the expected increase in overall water demand, but because other sources used by the City, such as Colorado River water and State Water Project water, are likely to become increasingly unreliable.

Figure 3-1: Overall projected water demand for the City of Los Angeles through 2035



Demand for surface water vs. groundwater may change too. As surface water supplies become more variable (and perhaps more scarce), water managers and users will increasingly turn to groundwater to compensate for any supply deficiencies. This scenario is particularly plausible in the Owens Valley.

Water Quality

Currently, most anthropogenic problems related to surface water quality in the region come from roads, recreation, and grazing. While these activities do take place at high elevations, surface water quality high in the watersheds tends to be good. As high-elevation streams move downhill, anthropogenic impacts reduce the quality of the water. Climate change could impact water quality by intensifying summer recreation, which brings more visitors to the area than winter recreation. Longer growing seasons could also mean longer grazing seasons, and along with those, attendant impacts to water quality.

There are also naturally-occurring water quality contaminants in the region. These are mostly found in groundwater and largely occur as arsenic and uranium. Although there have been no known studies specific to impacts of climate change on groundwater quality in the region, altered recharge rates and amounts could impact the concentration of these substances in underlying aquifers. Additional groundwater pumping resulting from variable or unreliable surface water supplies may also increase the concentration of arsenic and uranium in the aquifer, depending on the mixing among layers. A current study in Mammoth Lakes by the Mammoth Community Water District will examine various layers of the underlying aquifer to determine if some sources are better than others, but the study will not be directly linked to climate change.

Flooding

Although the Inyo-Mono region does not experience flooding on the scale of the Sacramento-San Joaquin Delta or the Central Valley of California, localized flooding can be a major concern. Many communities on the Highway 395 corridor have experienced flooding from nearby streams and rivers, especially in years with large amounts of precipitation. In the Inyo-Mono region, flooding is typically a concern either (1) during rain-on-snow events in the winter or (2) during the spring snowmelt and runoff, although summertime flooding can occur as well. Some communities in the Inyo-Mono region have limited infrastructure to deal with large amounts of stormwater, which results in flooding. In the wildland areas of the region, flooding and erosion can become problematic especially after fire, and problems that originate upslope can affect downslope communities.

The more extreme weather events expected to accompany changes in the climate may have implications for flooding in the region. In particular, extremely large precipitation events or increased rain-on-snow events may be of concern. It is less clear whether the altered timing of snowmelt and streamflow will affect flooding in the region. The RWMG is working to better understand not only current flooding patterns and causes but also projections of future flooding.

Terrestrial and Aquatic Ecosystems

Impacts of a changing climate on terrestrial and aquatic ecosystems, and their living inhabitants, have been studied worldwide. From this research, some general principles have been established, although it is difficult to completely generalize as impacts are expected to differ ecosystem-to-ecosystem and even species-to-species.

One of the primary concerns related to climate change impacts on ecosystems is the movement of animal and plant species. If the climate in a species' current range changes to the point of being beyond that species' tolerance, the species must either adapt or move (Aitken et al. 2008). While some evidence of climate-related adaptation has surfaced, it has become more apparent that species are starting to move to more favorable climate regimes. This migration is particularly evident in mountainous and topographically-complex regions, such as the Inyo-Mono. As lower elevations warm, species may migrate to higher elevations in mountain ranges. This adjustment has already been observed in some bird species. Species may also shift their ranges north or south as the climate changes. However, direction of movement may not always be predictable. For example, while it is thought that most species in the Sierra Nevada will move up in elevation over time with a warming climate, some models show that, on the east side of the Sierra, the conifer forest could actually move down in elevation into the sagebrush steppe in certain scenarios of altered precipitation regimes (Lenihan et al. 2003).

Mobile animal species will have an easier time shifting their ranges than sessile plants. Plants will need to depend on seed dispersal and seedling establishment into habitat with more favorable climate. Furthermore, it is not expected that all species will move in the same direction – even species that currently reside in the same habitat or ecosystem. Such differences in movement will alter relationships among species and may create novel and unexpected consequences. For those species that are not able to migrate to more favorable conditions, local extirpation or even extinction may become a reality.

Climate change may favor some invasive plant and animal species, particularly if it places stress on their native competitors. Conversely, as species move, invasive species may encounter new competitors that are able to limit their spread. Again, such movement and interactions will vary by species and ecosystem. Although the Inyo-Mono region and adjacent Great Basin and Mojave deserts have been relatively free of invasive species, there are a few of considerable concern, including cheatgrass, red brome, quagga mussels, and zebra mussels.

Changes in hydrology may significantly impact aquatic ecosystems. Altered timing of streamflow and changes in flooding regimes are two physical changes that could impact these systems. Also, increased water temperature and associated impacts to other parameters such as dissolved oxygen, pH, and turbidity may affect fitness or survival of individuals and species. Given the importance of these aquatic systems to recreation, livelihoods, and the water supply of the region and distant urban areas, impacts to aquatic species are important to understand.

3.1.3 Climate Change Vulnerabilities

The Intergovernmental Panel on Climate Change defines vulnerability as "the degree to which a system is exposed to, susceptible to, and able to cope with and adapt to, the adverse effects of climate change." This section examines major vulnerabilities related to water resources following the categorized impacts of the previous section. The questions posed follow the guidance provided in the *Climate Change Handbook for Regional Water Planning* (2011).

Water Supply

1) ***Does a portion of the water supply in the region come from snowmelt?***

   Yes. All communities that utilize surface water originating from Sierra Nevada snowpack, and all communities that utilize groundwater recharged by infiltration of Sierra Nevada snowmelt, rely on snowmelt for water supply. This dependence on snowmelt includes both local communities and the City of Los Angeles.

2) ***Would the region have difficulty in storing carryover supply surpluses from year to year?***

   It depends. Given the sparsely-populated and rural nature of the region, there has not yet been a need for major water storage infrastructure. However, because of the Los Angeles Aqueduct, there is more storage in the region than might be expected. While currently, this infrastructure is only being used to store and convey water belonging to Los Angeles, there is potentially the capacity to use this infrastructure to help store surpluses from wet years for use by local communities. In other parts of the region outside of the Mono and Owens watersheds, new surface storage would need to be considered. Alternatively, water storage in underlying aquifers may prove to be a viable option, depending on changes in recharge rates, as several communities in the region are starting to look more seriously at conjunctive use. Yet small, rural water districts may have difficulty in finding increased storage capacity. Usually these water districts use small lakes or tanks to store water, and adding storage facilities is expensive.

3) Has the region faced a drought in the past during which it failed to meet local water demands?

There are several examples of inability to meet local water demands. First, the LADWP is required to provide irrigation water to its agricultural lessees. During the drought of 1976-1977, it sought to eliminate the supply of irrigation water so that it could meet the water needs for the City. Although it was not allowed to do so until adopting a water conservation plan, irrigation supplies were reduced during this time period.

During the 1988-1991 drought, the Mammoth Community Water District applied for emergency waivers to avoid requirements to comply with fishery bypass flows on Mammoth Creek in order to make more surface water available for community needs. In 2007 and 2012, both of which were drought years, MCWD instituted water restrictions on outdoor irrigation due to the lack of surface water availability and the necessity to use only groundwater.

In the Indian Wells Valley, communities are faced with perpetual drought conditions. The area receives, on average, less than four inches of rain per year. Thus, these communities fully rely on groundwater, which is being overdrafted at a rate of about 1.5 feet/year.

4) Does the region have invasive species management issues at water resources facilities, along conveyance structures, or in habitat areas?

Due to the remote nature of the region, the Inyo-Mono planning area thus far has been relatively free of aquatic invasive species. Quagga mussels have recently gained more attention in the area because of the problems they have created in nearby Lake Tahoe and the Colorado River basin. Checkpoints are set up each summer throughout the Eastern Sierra to help control the spread of this species and to educate visitors about their impacts. Thus far, however, quagga mussels have not created problems in the waterways or infrastructure of the region.

The presence of New Zealand mud snails in local fish hatcheries has limited the use of fish from infested hatcheries.

Tamarisk occurs along many natural and man-made waterways in the region and is becoming an ever-increasing threat throughout the West.

Water Demand

1) Are there major industries that require cooling/process water in the planning region?

The industrial water users in the region rely almost entirely on groundwater. Currently, there is a geothermal energy plant outside of Mammoth Lakes that pumps groundwater and moves it to their facility. They are currently looking to expand their plant and operations.

There is a water bottling facility near Cartago that utilizes groundwater. Of concern to some stakeholders in the region are the many solar developments being proposed for the desert in southeast Inyo County and beyond. These facilities would require some amount of water, which would mostly be extracted from underlying aquifers. Finally, Coso Operating Company operates a wet-cooled geothermal plant in the Coso Range between Rose Valley and Coso Valley. Currently, this facility is injecting 4,800 AFY of groundwater from Rose Valley into the geothermal field to slow or reverse the depletion of fluids from the geothermal reservoir.

2) ***Does water use vary by more than 50% seasonally in parts of the region?***

Yes. Water use in communities within the Inyo-Mono region increases substantially in the summer, primarily for landscape and air conditioning purposes. Also, water for agricultural irrigation is highly seasonal and increases in the spring and summer. Finally, water use for dust abatement on Owens dry lakebed is greatest in the winter and spring.

3) ***Are crops grown in the region climate sensitive?***

Most of the agriculture that occurs in the Inyo-Mono region is sheep and cattle grazing. This type of agriculture will be sensitive to changes in the naturally-occurring plant community resulting from climate change. There are a few areas within the region that grow crops, such as alfalfa. These tend to be the lower-lying areas in the regions and will be vulnerable to climatic warming, altered precipitation regimes, altered snowmelt and streamflow timing, and flooding. Other types of crops occurring in the region are mostly grown on small family farms.

4) ***Do groundwater supplies in the region lack resiliency after drought events?***

Little is known about most of the aquifers in the Inyo-Mono region, except for perhaps the Owens groundwater basin. This is a topic that needs more thorough examination throughout the region. What is known, however, is that long-term intensive pumping can lead to impacts both to the groundwater itself and to the above-ground resources.

5) ***Are water use curtailment measures effective in the region?***

Water conservation measures have been implemented primarily in the two largest communities in the region – Mammoth Lakes and Ridgecrest. Both of the water districts serving these communities have begun water education and conservation outreach programs. While these programs have been effective so far, both are fairly new, and their long-term efficacy is yet to be seen. Other parts of the region have not yet focused heavily on water conservation. There is a perception in much of the region that because the communities are relatively high in the watershed and/or close to the source water, there is plenty of water available and conservation is not a main priority. As an indicator of the lack of attention to water conservation in the region, Inyo and Mono County residents use 3-4 times the national average of water per day.

6) ***Are there export demands from the region?***

The City of Los Angeles has exported water from the Owens Valley and Mono Basin since

1913. These exports will continue into the future. Although the LADWP has put a substantial amount of effort into water conservation with the city of Los Angeles through retrofits, education, and restrictions, these measures will likely not decrease the demand for water exports from the Inyo-Mono region. The uncertainty and unreliability of State Water Project and Colorado River water add to the continued demand for Los Angeles Aqueduct water.

In addition to the Los Angeles Aqueduct, there is a Crystal Geyser bottling facility in Cartago. Water pumped for bottling ends up being moved out of the region, essentially creating an export of water. This facility plans to double its bottling capacity in the next few years.

Water Quality

1) *Are increased wildfires a threat in your region?*

Absolutely, yes. In recent years, several fires have burned close to or even within communities in the region. As is true for much of the West, forests in the region are overgrown due to a century of fire suppression, though thinning projects have reduced the density in treatment areas. It is expected that there will continue to be larger, more intense forest fires. By the end of the century, the incidence of fire in the higher elevations of the region could increase five-to-seven-fold. While sagebrush and other desert vegetation naturally have a lower fire return interval than the region's predominant mid-elevation Jeffery pine forests, the increasing presence of humans and potential drought conditions could create higher fire hazard. Furthermore, as cheatgrass becomes more established throughout the region, we can expect an altered fire regime in high desert plant communities, including a shortened fire-return interval.

2) *Does part of the region rely on surface water bodies with current or recurrent water quality issues? Are there water quality constituents potentially exacerbated by climate change?*

Some streams in the region experience water quality degradation due to use by wildlife, grazing livestock, and recreationalists. This same surface water is then used by local communities or provided as export to the City of Los Angeles. Climate change may intensify the use of waterways if drought becomes more common. This is an area that needs further study for the Inyo-Mono region.

3) *Are seasonal low flows decreasing for some waterbodies in the region? Are reduced low flows limiting the waterbodies' assimilative capacity?*

In particularly dry years, such as 2007, some streams in the region experience very low flows. If those dry years start to stack up into multi-year drought periods, low flows could become a concern for water quality and for in-stream and terrestrial wildlife. For example, the Amargosa River, stretches of which are designated as Wild and Scenic, is currently partly ephemeral due to its desert location. Prolonged drought could impact its Wild and Scenic designation and affect the wildlife that depends on the river. Analyses of past low-flow conditions for area streams and rivers have not been done.

4) ***Does part of the region rely on groundwater supplies with current or recurrent water quality issues?***

Yes. As described above, some of the groundwater pumped in the region exhibits naturally-occurring arsenic and/or uranium that exceed the maximum load regulations. Yet there are some wells that produce groundwater without these elements. More information is needed about the locations of arsenic and uranium contamination as well as the movement of groundwater within or among aquifers.

5) ***Does part of the region currently observe water quality shifts during rain events that impact treatment facility operation?***

In at least two of the more densely populated communities within the region, stormwater management is a growing concern. Not only does poor stormwater management result in flooding in these communities, but it also affects the initial quality of water being treated. Increases in storm intensity and/or rain-on-snow events will exacerbate these concerns.

Flooding

1) ***Does critical infrastructure in the region lie within a 200-year floodplain?***

Two hundred-year floodplain data are not available for the Inyo-Mono region. Instead, 100-year floodplain data were used. The vulnerable areas include the upper East and West Walker River Watersheds, parts of the Owens Valley, the Tri-Valley, and some of the inter-mountain valleys in southeast Inyo County, particularly those in Death Valley National Park. There is critical water conveyance and water storage infrastructure in the Walker, Owens, and Tri-Valley areas.

2) ***Does aging critical flood protection infrastructure exist in your region?***

Yes. Where there is flood protection infrastructure, much of it is aging and in need of repair or replacement. For example, the diversion ditches and gates in the Antelope Valley (West Walker Watershed) are old and were damaged by a recent flood, rendering them virtually non-operational.

3) ***Have flood control facilities been insufficient in the past?***

Yes. Refer to the example of the Antelope Valley above. The bigger issue, however, is lack of flood mitigation programs in much of the region.

4) ***Are wildfires a concern in parts of the region?***

Yes. This hazard is discussed above. The loss of vegetation caused by wildfires has led recently to intensified erosion and flooding, impacting habitat, fisheries, and communities.

Terrestrial and Aquatic Ecosystems

1) Does the region include aquatic habitats vulnerable to erosion and sedimentation issues?

Yes. Because of the complex topography of the region and the numerous large and small waterways, erosion is an ongoing occurrence. However, erosion exacerbated by wildfires or extreme precipitation events can lead to increased water quality concerns and degraded in-stream habitat.

2) Does the region include estuarine habitats which rely on seasonal freshwater flow patterns?

There are no estuaries in the Inyo-Mono region as there is no connection to the ocean. All of the region lies inland.

3) Do climate-sensitive flora or fauna live in the region?

All plant and animal species are sensitive to climate in some way. Some species have larger tolerances (or climate envelopes) than others. Some species, such as sagebrush, saltbush, some tree and bird species, deer, and mountain lions are able to tolerate the large diurnal and seasonal fluctuations in temperature and precipitation in the region. Other species, particularly those that live at the highest elevations in the region, are more specialized and thus may be impacted disproportionately by climatic changes. Terrestrial species including pika, mountain yellow-legged frog, willow flycatchers, desert tortoise, and desert bighorn sheep have been garnering increased attention due to climate change, while pupfish and hydrobiid snails are examples of aquatic species that show sensitivities to climate-driven habitat changes.

4) Do endangered or threatened species exist in the region?

Yes. There are endangered and threatened plant and animal species in the region, some of which occur only within this region. A full list specific to this effort has not yet been developed.

5) Are changes in species distribution already being observed in parts of the region?

Again, high-elevation species with limited habitat and smaller climatic tolerances seem to be moving to more favorable habitat (or are running out of favorable habitat). Most evidence of species movements in the region thus far has been anecdotal. More quantitative observations are needed.

6) Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

Absolutely, yes. Tourism drives the economies of virtually every community within the region except Ridgecrest. In the winter, tourism is largely snow-based and includes skiing and snowmobiling, both of which are fully dependent on winter snowfall. Summer recreation revolves mostly around watersports – fishing, boating, etc. Several fish spawning and rearing facilities operate in the region and rely on water from natural streamflow. It could be argued that most jobs in the region can be related to the central position of water in the region's economy.

7) ***Are there rivers with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?***

Yes. There are now quantitative environmental flow requirements for several waterways in the Inyo-Mono region, including Mono Lake tributaries, Mammoth Creek, and the lower Owens River. Some of these requirements are currently under discussion, and it is unknown whether climate change is being considered as a potentially complicating factor.

8) ***Do other sensitive habitats occur in the region?***

Yes. Meadows and other wetland-type habitat occur at both the higher and lower elevations of the region. These habitats are dependent on unimpeded seasonal water availability and support a large number of species.

9) ***Does the region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?***

Yes. The Inyo-Mono region includes two of these habitats: the Sierra Nevada and the Southwest deserts. In addition, one of the Endangered Species Coalition's other ecosystems of focus is the sagebrush steppe.

10) ***Are there areas of fragmented habitat in the region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?***

Fortunately for wildlife, much of the land in the Inyo-Mono region is undeveloped. Because much of the land area is owned and managed by federal or local resource agencies, threats to wildlife coming from development are relatively few, and species are able to move relatively freely throughout the region and into adjacent regions. There are some more localized examples of fragmented habitat, such as that occurring from groundwater pumping in the Owens Valley. Meadows and wetlands seem to be particularly vulnerable to fragmentation in the region because they occur in otherwise development-friendly areas. While large-scale infrastructure is not typically a problem in the Inyo-Mono region, the proposed large solar developments in southeast Inyo County have become a growing concern. Not only would these developments alter habitat quality, but they could also create barriers to species movement, such as for the desert tortoise.

Table 3-1: Climate change impacts and vulnerabilities in the Inyo-Mono region by category

Category	Impacts	Vulnerabilities
Water Supply	• Changes in amount of snowpack, SWE • Timing of snowmelt, runoff and streamflow • Increased rain-on-snow events • Extreme precipitation events • More rain, less snow • Groundwater recharge	• Snowpack • Snowmelt • Groundwater quantity • Storage capacity • Drought tolerance

Category	Impacts	Vulnerabilities
Water Demand	• Longer, drier summers • Increase in summer water demand • Increased demand from City of L.A.	• Agriculture • Landscape irrigation • City of Los Angeles
Water Quality	• Intensified summer recreation • Longer grazing seasons • Unknown impacts to groundwater quality	• Wildfires • Erosion • Stormwater/flooding • Recreation • Seasonal low flows • Groundwater contaminants
Flooding	• Increased rain-on-snow events • Extreme precipitation events • Increased wildfire incidence • Unknown impacts of altered snowpack, snowmelt, and streamflow	• Lack of, inadequate, or aging infrastructure • Wildfires • Communities
Terrestrial and Aquatic Ecosystems	• Changes to species distributions • Novel and unpredictable species relationships and interactions • Competitive advantage of invasive species • Hydrological impacts – changes to water temperature, pH, DO, turbidity, and flow regimes	• Aquatic habitats • Meadows, wetlands, estuaries • Climate sensitive species • Threatened and endangered species • Species distributions • Reliance on aquatic ecosystems for recreation and livelihoods • In-stream environmental flow requirements

3.1.4 Prioritizing Vulnerabilities

New to this update of the Phase II Plan is a list of prioritized climate change vulnerabilities specific to the Inyo-Mono region. An overarching theme that is common to all vulnerabilities is the lack of region-specific information and an underdeveloped understanding of potential impacts to the region. Accordingly, the prioritized vulnerabilities vary in terms of the feasibility to address them. Therefore, the highest priority for data gathering related to climate change (see next section) is simply collecting and/or developing more region-specific information. The prioritized vulnerabilities presented below follow from the vulnerability analysis in the previous section but do not always match the specific topic within the specific category (e.g., see discussion of groundwater, below). Furthermore, not all of the vulnerabilities discussed in the analysis are listed below. These are simply the most important vulnerabilities for the region at this time. The importance of vulnerabilities is expected to change over time.

Priority vulnerability #1: Snowpack and snowmelt. Because we depend so entirely on the winter snowpack and spring snowmelt for our surface water supplies and to recharge the lower-elevation groundwater basins, improving our understanding of potential changes to these processes is our first priority. We need more regional-scale climatic and hydrologic modeling results available for our region. This information would also help us understand how rivers with regulatory flow requirements might be impacted by altered hydrology.

Feasibility: Medium. Few climate change studies focus on the eastern Sierra and desert regions of California. Funding and expertise in climate change impacts are limited within the RWMG.

<u>Priority vulnerability #2: Groundwater quantity and quality.</u> The level of understanding of most of the 61 groundwater basins in the region is very low. For most basins, we lack knowledge of how groundwater levels fluctuate naturally over time; how human and agricultural water use impacts the amount and quality of groundwater; where and how much recharge occurs each year; and what impacts the quality of groundwater. The exception is the Owens Valley, where extensive groundwater monitoring takes place by multiple entities. While CASGEM measurements and SGMA processes will improve our knowledge about some of our groundwater basins, these measurements will likely be concentrated in the most highly-populated areas, thereby exacerbating the dearth of information in less-used basins. Considering climate change impacts simply highlights what we do not already know.

Feasibility: Medium-High. The importance of water in the region has resulted in many hydrologists living in, working in, and studying water in the eastern Sierra (primarily the Owens River Watershed). The potential to improve our understanding of groundwater resources, and climate change impacts, exists; however, funding largely does not.

<u>Priority vulnerability #3: Water quality.</u> There have been no reported studies that we know of that either model or measure the impacts of climate change on water quality, such as through changes in runoff, changes in seasonal low flows, changes in water use/demand, or increased number or frequency of extreme events. Similar to water supply, we need to understand changes to water quality on a regional level in order to advise land and water managers and to inform planning.

Feasibility: Medium-high. Because water quality is such an important aspect of domestic water resources, the will to understand how quality is impacted by climate change is high. However, such understanding is currently fairly community-specific and not treated at a regional level.

<u>Priority vulnerability #4: Water demand.</u> The seasonal variation in water demand throughout the region is concerning. Although there has been more talk of water conservation in recent years due to drought conditions, not enough conservation is taking place. The California governor requested a drop in water usage statewide by 20% as of early 2014, but actual water use has fluctuated between a 5% decrease and a 5% increase. Water conservation needs to become a way of life, however, and not just in drought periods. We need improved knowledge of and education about our water sources, our water use, and how we, as individuals, can impact overall water demand. It is time to sound the alarm, particularly at the local level. A complicating factor in water demand in the Inyo-Mono region is the ongoing export of water to Los Angeles. There is a viewpoint of some residents in the Inyo-Mono region that any water conserved in the region "just goes to L.A.", and therefore we should not conserve.

Feasibility: High. There is good anecdotal, if not quantitative, understanding of how demand fluctuates in the region and the need for water conservation. In general, educating on and implementing water conservation measures does not require very specific technical expertise and should therefore be easier to achieve.

<u>Priority vulnerability #5: Flooding.</u> As we expect to see increases in extreme weather events – in number and/or frequency, we would expect to experience more flooding in the region. Yet there is still a lack of understanding in how extreme events might change into the future, particularly at the regional level. Flooding is also a concern in the area because of the aging flood/stormwater control infrastructure, some of which is already insufficient to handle the largest floods. Flooding that occurred in several parts of the region over the last decade may provide a glimpse into the future. We could also use updated and improved floodplain maps for the region. Several tribes, in particular, have expressed concern that existing floodplain maps do not accurately represent the reality of flooding on the reservations.

Feasibility: Low-Medium. A lack of understanding and a lack of concern about flood-related climate change effects yield a low will to take action on this vulnerability. Only one community (Mammoth Lakes) has completed a stormwater resources plan, and although several other communities face flood issues at times, flooding does not seem to be high on the priority list of immediate water issues.

Priority vulnerability #6: Waterways as drivers of the economy. Water drives so many parts of the economy in the region: recreation-based tourism (skiing, snowmobiling, fishing, boating, sightseeing), education (about communities, water resources, and ecosystems), and agriculture (crops, livestock grazing, hatcheries). More work is needed to understand and quantify likely impacts of climate change on these sectors. Significant negative impacts to any one aspect of the regional economy would likely damage livelihoods and result in population shifts away from the region.

Feasibility: Medium-High. Because water is a primary driver of our recreation- and tourism-based economy, there is a high degree of interest in how water, snow, and seasons are going to change over time. The studies and modeling required in such an analysis would also lead to a better understanding of changes in water resources in other sectors.

Priority vulnerability #7: Water-dependent ecosystems. Similar to many of the other types of impacts expected in the Inyo-Mono region, impacts to water-dependent ecosystems are only broadly understood at this point. More information is needed on impacts to both individual species and to communities and ecosystems. Threatened and endangered species' responses to climate change are a particularly needed area of study.

Feasibility: Medium. Ecosystems are important parts of the communities and economies of eastern California, and as such, there is motivation to understand climate change impacts to ecosystems. Actually performing the science necessary, however, requires resources our communities may not have or may not be willing to devote to this purpose.

Priority vulnerability #8: Wildland and structural fire. Each year, fire becomes a more imminent concern for communities in the Inyo-Mono region. In the last decade, several fires have burned adjacent to or even within communities. Increasing drought conditions and longer, drier summers will heighten the fire risk in the region. More quantified, region-specific information regarding possible changes in fire frequency and intensity would be helpful. Indeed, fire may soon move up the list of priority vulnerabilities.

Feasibility: Medium-High. Because of the recent on-the-ground impacts of fire in all parts of the region, along with the threat of increased risk with changes in the climate, communities are desperate to better understand their risk and how to mitigate it. Many different stakeholders are working on fire issues in the region, and this should lead to better region-specific information.

3.1.5 Plan for Data Gathering and Analysis for Vulnerabilities

Although we know that climate change portends significant impacts for many parts of the water management system in the Inyo-Mono region, climate change “projects”, per se, are not high priority actions for Inyo-Mono stakeholders. Instead, projects examining particular aspects of climate change, such as drought impacts or water demand, will gain more traction among regional water managers. As we saw in the prioritized list of vulnerabilities above, we need improved and more quantified information about virtually every kind of impact expected, including the climatic changes themselves.

While individual water systems and stakeholders will continue to work on behalf of their communities and water resources, the IRWM Program can act as an organizer of larger climate change-related projects. There is little internal funding available within regional stakeholders for data gathering and analysis; most of these activities would be dependent upon external grant funding. As a region with a large number of economically-disadvantaged communities and small population, we also have limited resources for seeking out and applying for such funding. For example, there is currently no opportunity to pay for grantwriters to apply for grant funding. For most climate change information gathering-type projects, Program Office staff would need to work on grant applications as volunteers, or IRWM stakeholders would need to take on grantwriting tasks as additional duties in their already busy jobs.

Despite those limitations, however, we do have some immediate priorities for climate change analysis that would greatly benefit the region. The biggest immediate need is for some more quantitative hydrologic trend information. We have already begun to look for opportunities to partner with entities that do hydrologic modeling and would be willing to use such models for the Inyo-Mono region. Having this kind of quantitative model output would go a long way in helping us identify and measure potential impacts to the water management system. Another high priority is to implement more surface water and groundwater monitoring throughout the region so that we can spot changes as they occur and begin to develop long-term datasets. Some of these types of measurements are already underway by IRWM stakeholders; the IRWM Program can work to ensure that this information is collected on a truly region-wide basis, but again, funding is needed and is difficult to come by. The IRWM Program will work to take on climate change-related activities in partnership with regional stakeholders as time and funding allows and will do its best to seek out funding opportunities for specific data gathering and analysis priorities.

3.2 Measuring Impacts of Climate Change for the Inyo-Mono Region

After assessing which water-related resources in the Inyo-Mono region are vulnerable to the impacts of climate change, it is important to attempt to understand to what degree these resources will be impacted. A full quantitative impacts analysis for these resources (water supply, water demand, water quality, flooding, terrestrial and aquatic ecosystems) is beyond the scope of this iteration of the Inyo-Mono IRWM Plan; instead, a brief qualitative assessment of likely impacts is provided in the previous section. Future updates of the Inyo-Mono Plan will incorporate regional data to allow for more robust and quantitative impact analyses for each of these resources. In order to understand potential impacts of climate change, however, it is important to first consider what changes in the climate might be expected.

3.2.1 Changes in the Climate: Methodology

As discussed at the beginning of this chapter, the most currently-accepted means of understanding possible future climatic patterns is through computer models. Because different models have different strengths and weaknesses, many climate change practitioners have taken to using a suite or "ensemble" of models to develop an average and range of projected future conditions. A 2009 study commissioned by the California Climate Action Team (CAT), a group of state government officials working to implement greenhouse gas emissions reductions programs as well as the state's Climate Adaptation Strategy, used six GCMs to drive subsequent impact analyses (DWR 2010). These GCMs were selected based on their ability to model historical precipitation and temperature patterns and variability, as well as the El Niño Southern Oscillation, and are listed below.

Table 3-2: General circulation models used by Climate Action Team and Inyo-Mono RWMG

No.	Model name; modeling group, country	Model identification	Primary reference year
1	Parallel Climate Model; National Center for Atmospheric Research (NCAR), USA	PCM	2000
2	Geophysical Dynamics Laboratory model version 2.1; US Dept. of Commerce / National Oceanic and Atmospheric Administration (NOAA) / Geophysical Fluid Dynamics Laboratory (GFDL), USA	GFDL-CM2.1	2006
3	Community Climate System Model; National Center for Atmospheric Research (NCAR), USA	CCSM3	2006
4	Max Planck Institute (MPI) for Meteorology, Germany	ECHAM5/ MPI-OM	2006
5	Center for Climate System Research (University of Tokyo), National Institute for Environmental Studies, and Frontier Research Center for Global Change (JAMSTEC), Japan	MIROC3.2 (medres)	2004
6	Meteo-France / Centre National de Recherches Meteorologiques (CNRM), France	CNRM-CM3	2005

A collaboration of research institutions and federal agencies has made these models, along with others, readily available through the World Climate Research Programme's (WRCP's) Coupled Model Intercomparison Project Phase 3 (CMIP3) model output archive (http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html#Welcome). Through the archive's website, the user can request biased-corrected spatial downscaled (BCSD) model output for any geographic region and for any time period within the 21st century. Both temperature and precipitation projections are available. This set of projections has been widely reviewed and used by scientists and practitioners in California. Models can be run with any combination of three IPCC Special Report on Emissions Scenarios (SRES) – A1B, A2, or B1. These emissions scenarios represent a set of "best guesses" of what future emissions might be based on population, economic conditions, energy sources, technological development, environmental policy, etc. A1B is a medium-emissions scenario, reaching approximately 700 ppm CO_2 by 2100 (global CO_2 is currently appx. 390 ppm). B1 is a lower-emissions scenario, leveling out at just over 500 ppm by 2100, while A2 is a higher-emissions scenario and reaches 850 ppm by 2100.

The same six GCMs listed in Table 3-2 were used for an analysis of project climatic changes for the Inyo-Mono region for the 21st century, using the downscaling method described in the previous paragraph. Only the A2 and B1 emissions scenarios were used, in order to bound the high and low probabilities of changes in the atmosphere. Six geographic areas within the region were chosen, based on watersheds and/or areas where most of the population resides. Because the model output is only available on a grid scale, it was not possible to request projections for true watersheds. Table 3-3 lists the approximate watersheds for which projections were downloaded, and Figure 3-2 shows the geographic extent.

For each region, projections of temperature and precipitation were examined through the 21st century. For each year, average temperature was calculated for the output of the six models and each of the two emissions scenarios. In addition, the highest temperature value and lowest temperature value were identified in an attempt to elucidate the range of possible temperature scenarios. Similarly, cumulative precipitation was calculated for each year based on the model output and two emissions scenarios. An average was calculated over the six models and then a highest precipitation value and lowest precipitation value were identified in order to acknowledge the uncertainty in the projections and the range of possibilities.

On the pages to follow, graphs are presented for each watershed/area of interest. The top graph in each geographic region is for temperature and shows the mean value of average annual temperature as well as the highest value and lowest value for the two emissions scenarios. For both emissions scenarios, temperature is expected to increase over the next century, though less so under the B1 scenario. The bottom graph shows precipitation over the next century based on projected average cumulative precipitation for both emissions scenarios as well as the highest value and lowest value as explained above. For all areas analyzed, there is no discernible trend in precipitation amounts through 2100. This result matches with literature cited at the beginning of this chapter stating that model projections of future precipitation patterns are inconsistent.

Since this original analysis was completed, an updated suite of CMIP models has been made available (called CMIP5). Although the analysis has not yet been re-done for the Inyo-Mono region, it is known that, in general, downscaled CMIP5 model output shows a greater tendency towards wetter conditions in the future.

Figure 3-2: Geographic area for each downscaled climate model analysis

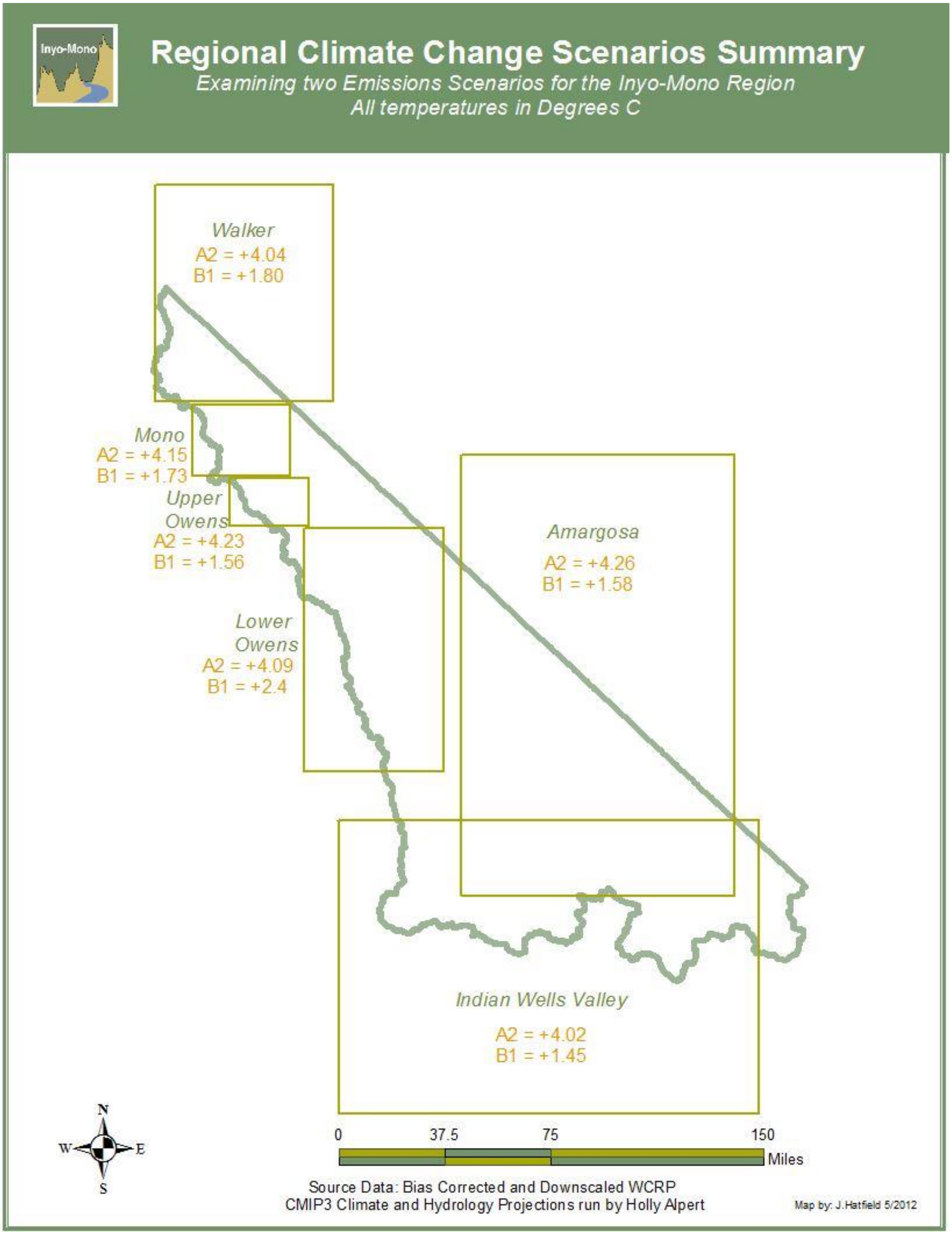


Figure 3-3: Temperature Projections for Amargosa Basin

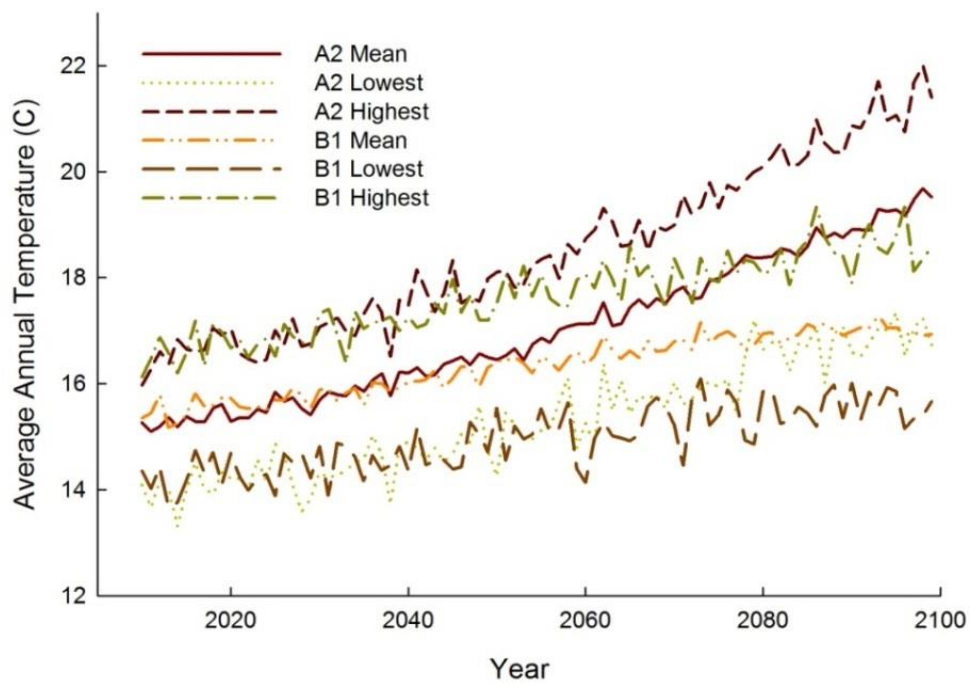


Figure 3-4: Precipitation Projections for Amargosa Basin

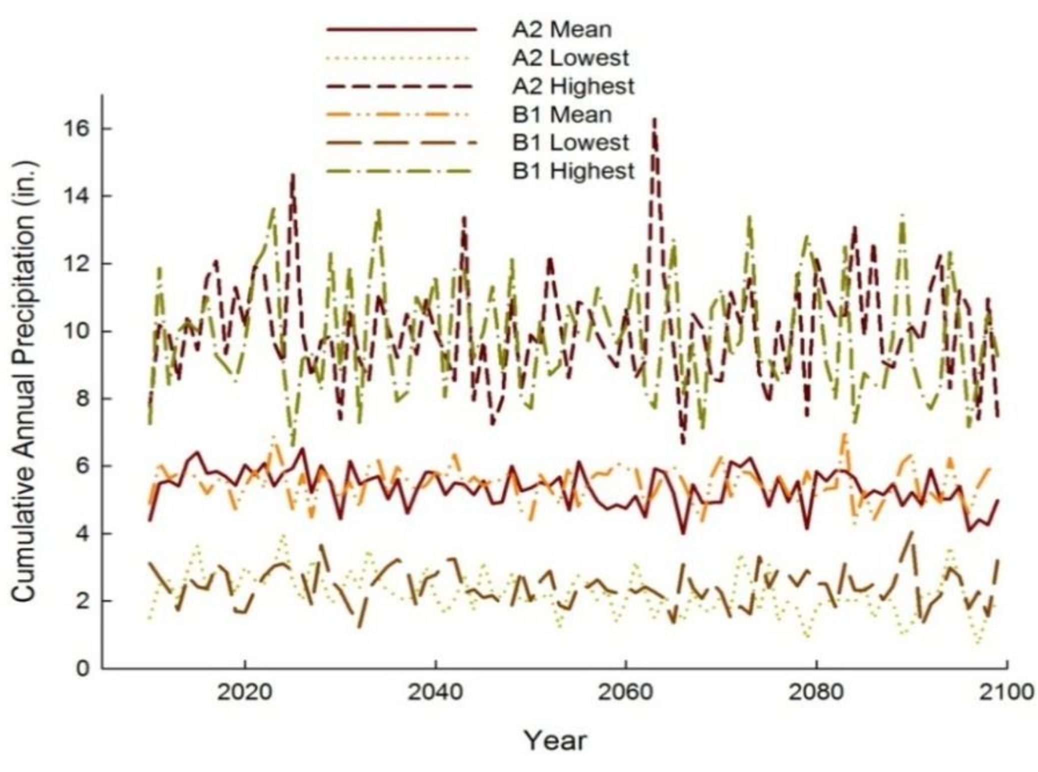


Figure 3-5: Temperature Projections for the Indian Wells Valley

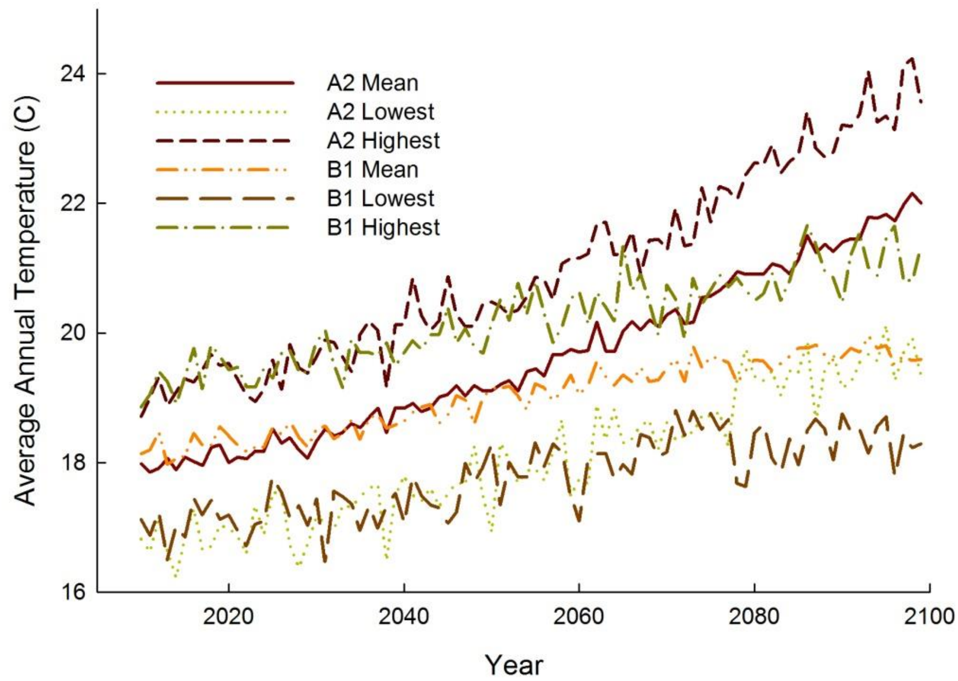


Figure 3-6: Precipitation Projections for Indian Wells Valley

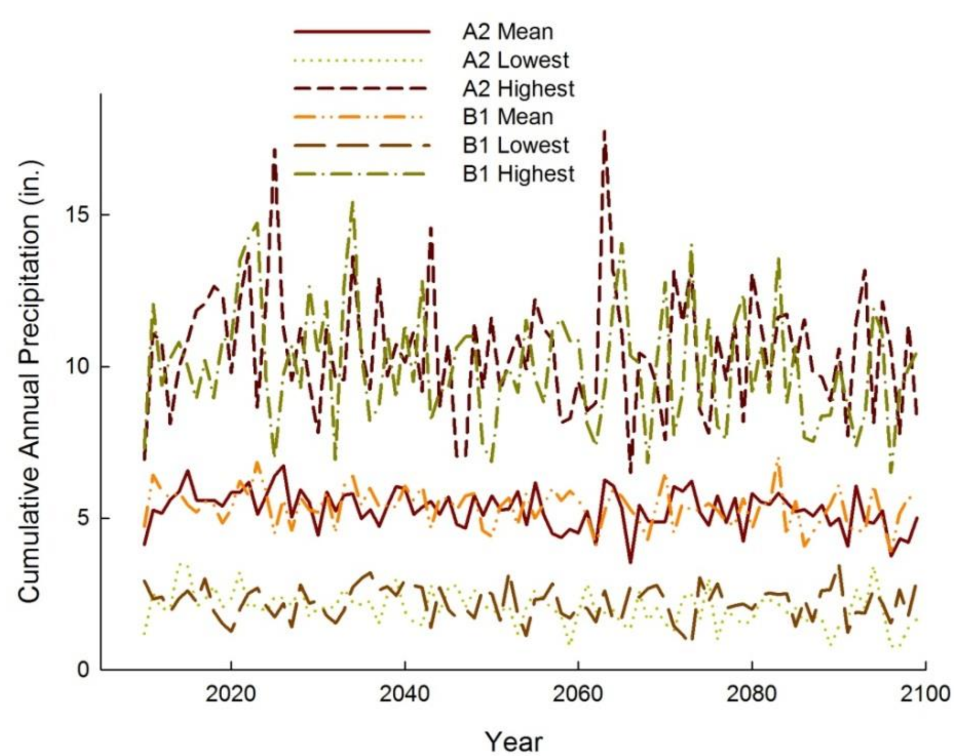


Figure 3-7: Temperature Projections for the Lower Owens River

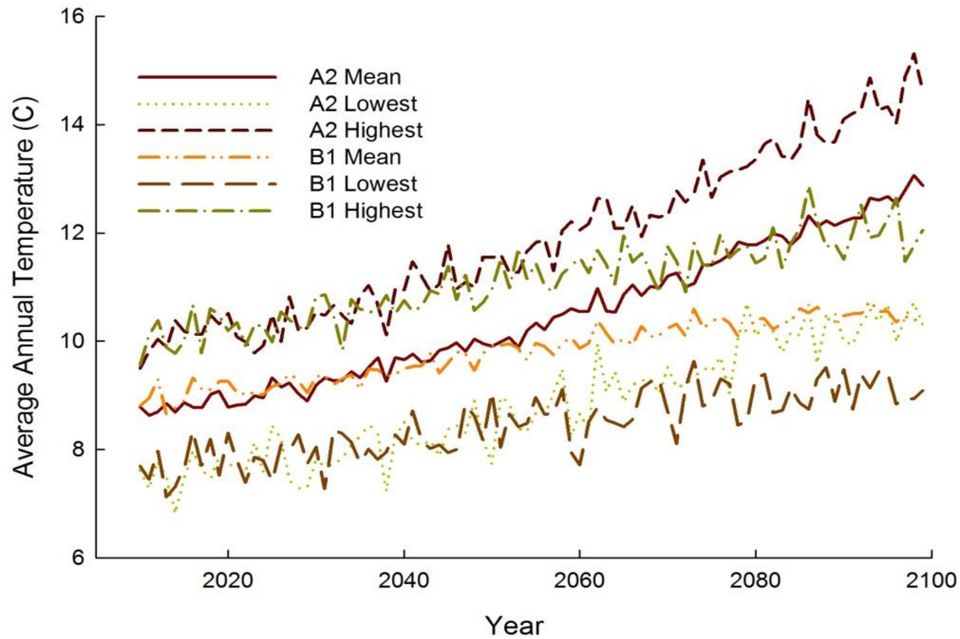


Figure 3-8: Precipitation Projections for Lower Owens River

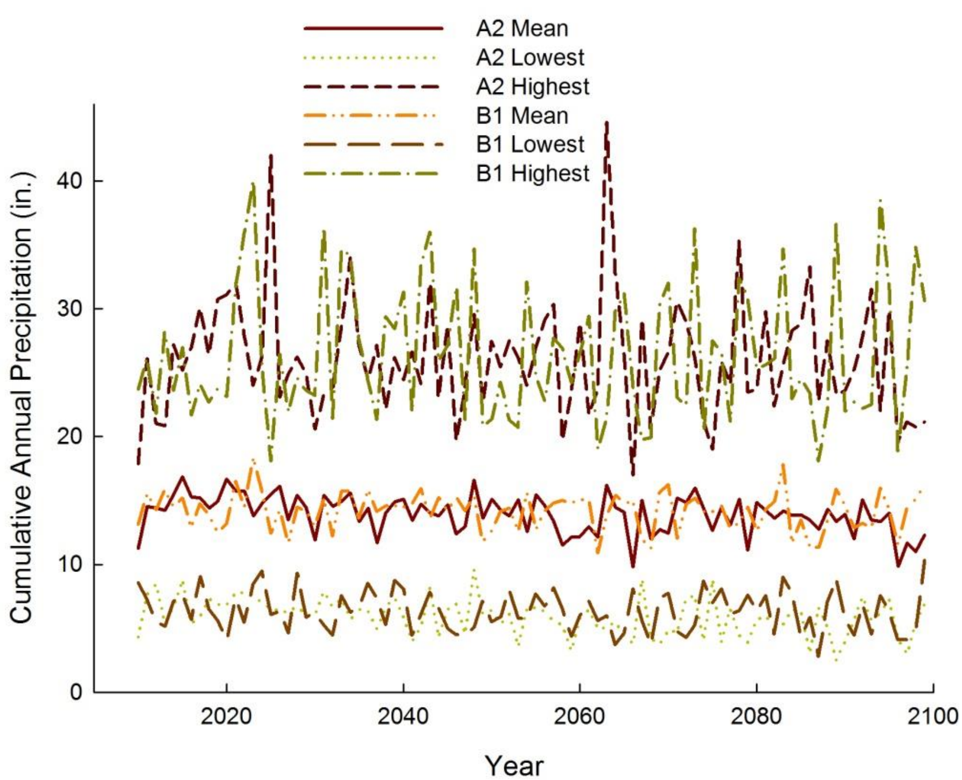


Figure 3-9: Temperature Projections for the Upper Owens River

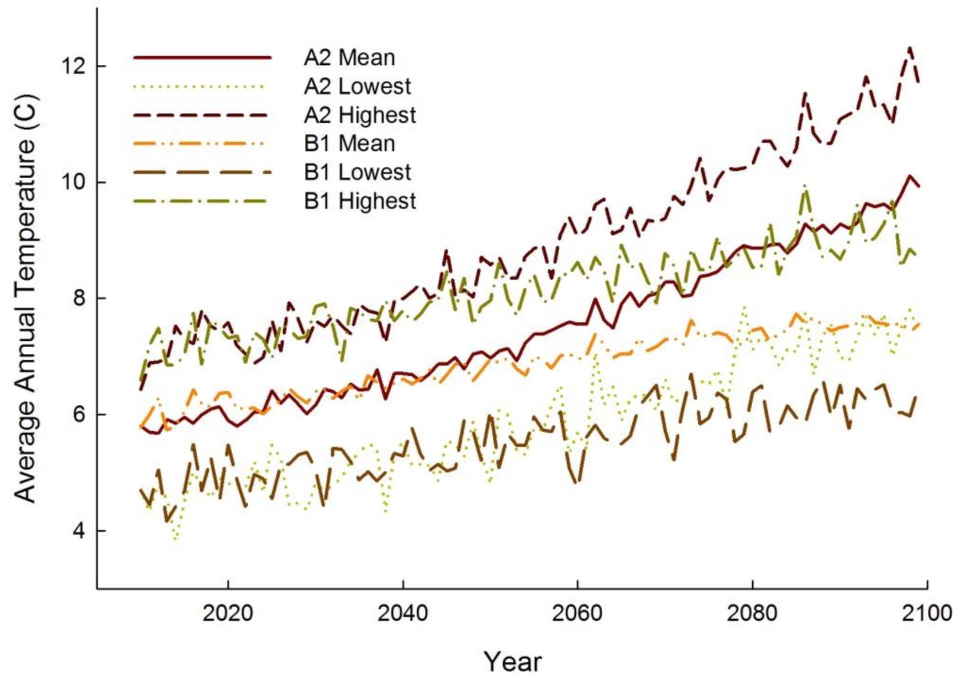


Figure 3-10: Precipitation Projections for Upper Owens River

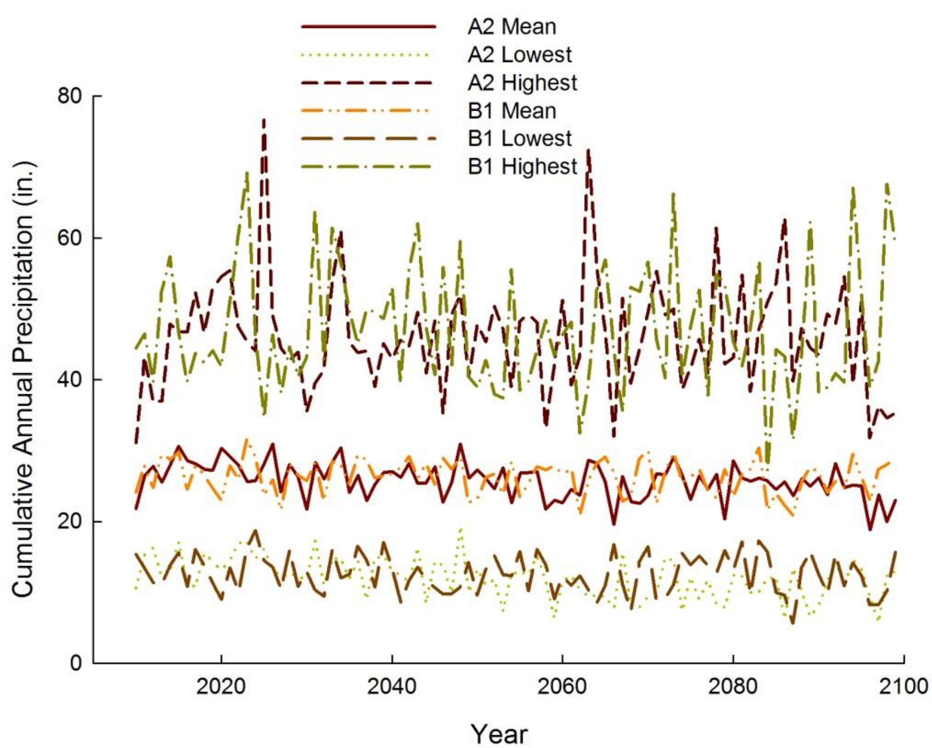


Figure 3-11: Temperature Projections for the Mono Basin

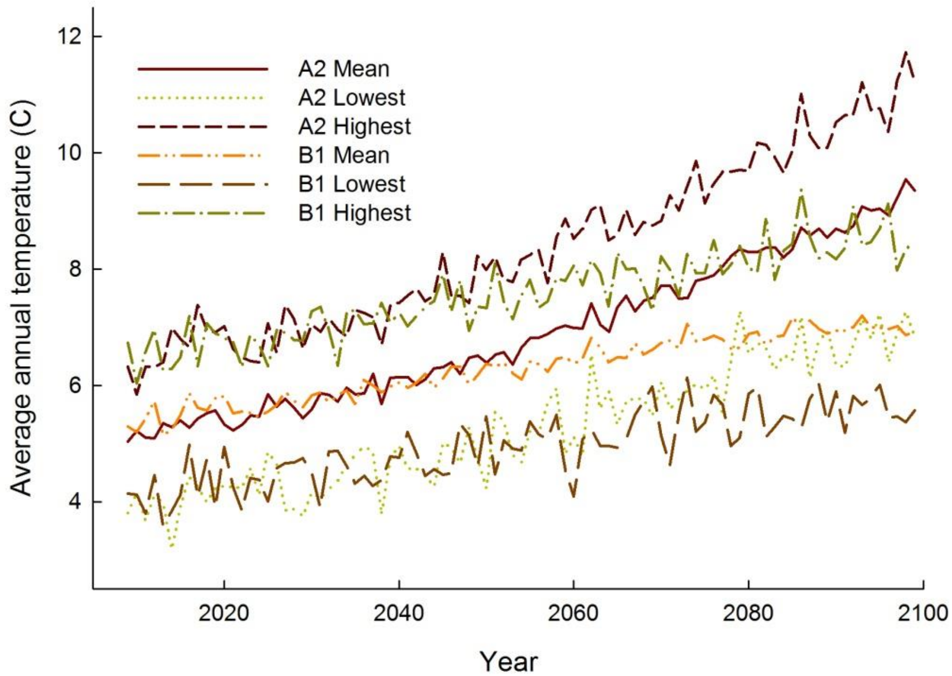


Figure 3-12: Precipitation Projections for the Mono Basin

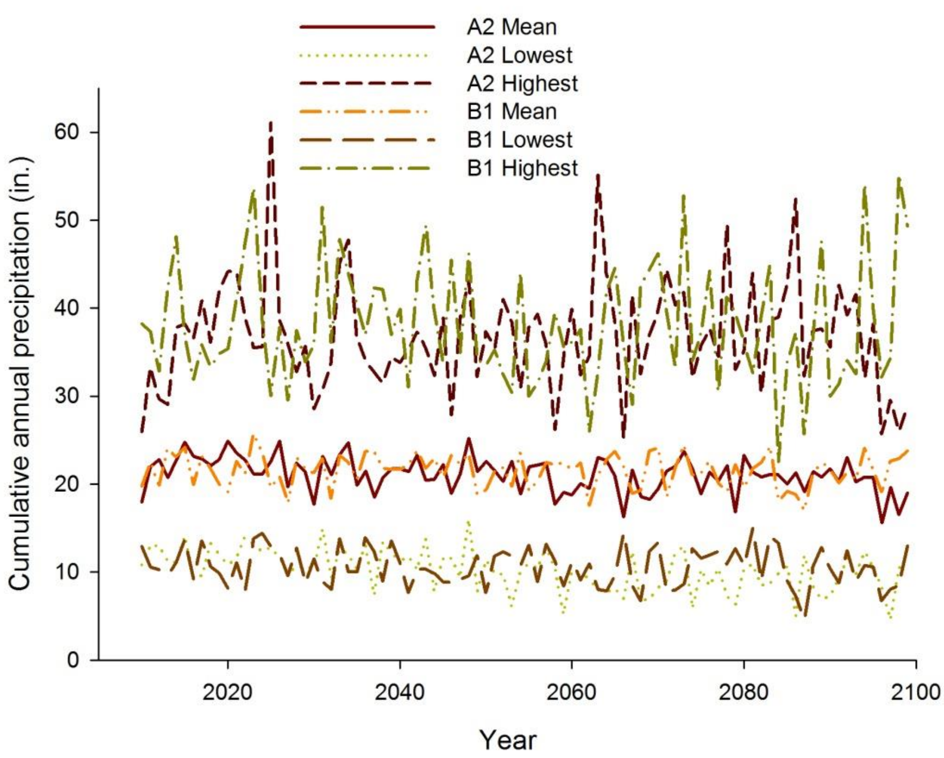


Figure 3-13: Temperature Projections for the East-West Walker

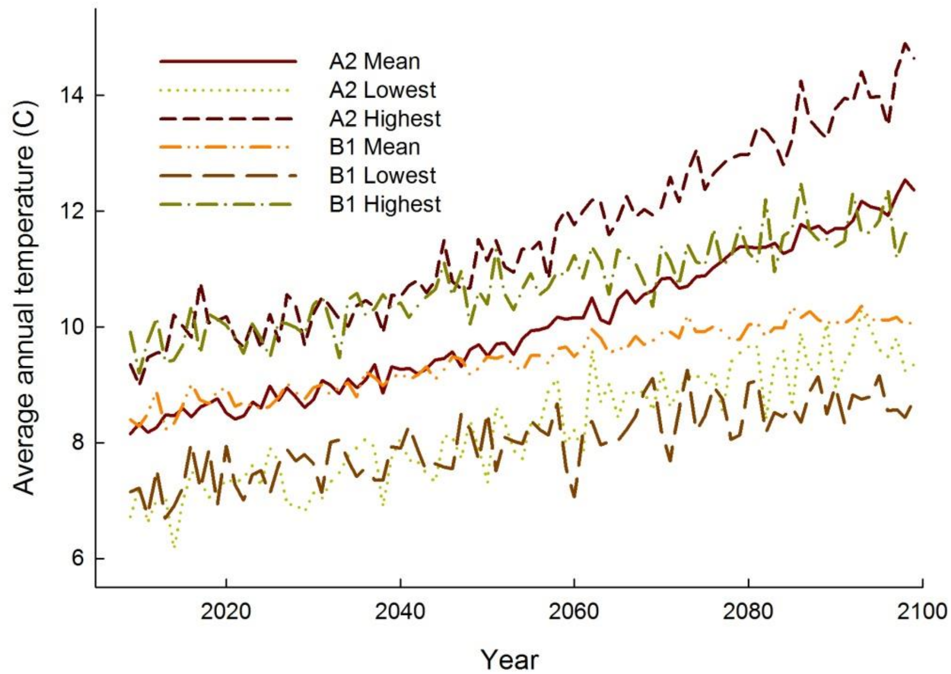
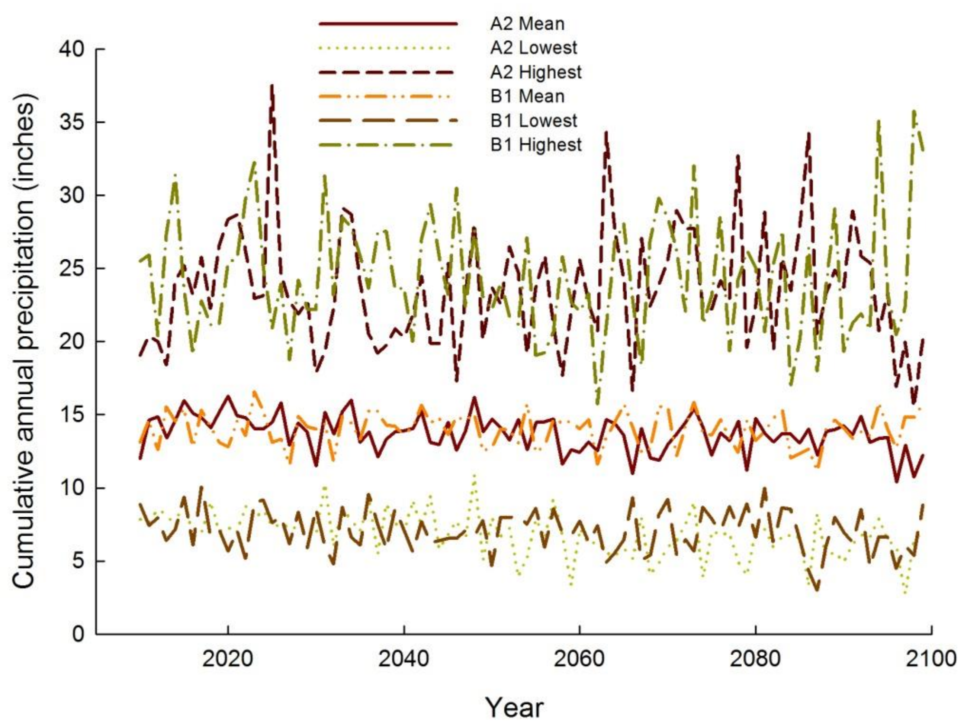


Figure 3-14: Precipitation Projections for the East-West Walker



3.2.2 Future Analysis for the Inyo-Mono Region

Although a substantial amount of work has been done to understand the impacts of climate change to the Sierra Nevada snowpack and streamflow, much of this work has been focused on western Sierra watersheds because of their importance to the Bay-Delta system and urban water supplies. Relatively little analysis has been performed on eastern Sierra hydrology, despite the importance of our waterways not only for local communities and in-stream uses, but for water exports to Los Angeles and urban uses. The analysis of climate change projections presented above is a first step to understanding possible changes to snowpack and streamflow in the Inyo-Mono region; the next step is to incorporate these climate projections into models of streamflow in order to try to understand more directly impacts to water supplies, water quality, and ecosystem health. While streamflow modeling is beyond the scope of this iteration of the Inyo-Mono IRWM Plan, it will be pursued by the RWMG as a part of upcoming work on climate change as a way to better understand climate change impacts to the region, and results will be incorporated into a future version of the Plan. In the meantime, we will use the best available science to provide information to water resource managers and practitioners as they prepare to deal with and respond to climate change.

3.3 Climate Change Adaptation Strategies for the Inyo-Mono Region

In the context of climate change, *adaptation* is defined as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects" (http://climatechange.worldbank.org/climatechange/content/adaptation-guidance-notes-key-words-and-definitions). Climate change adaptation strategies as they relate to water resources management have gained increasing attention and momentum over the last decade. Researchers and state and federal agency officials have put much thought into the subject and have produced a plethora of reports, papers, and guidance. While examples of adaptation practices are increasing, published case studies are still lacking. DWR published a report in 2008 titled "Managing and Uncertain Future: Climate Change Adaptation Strategies for California's Water". In this report, DWR proposes 10 adaptation strategies for water resources management (DWR 2008):

1. ***Provide sustainable funding for statewide and integrated regional water management***
2. ***Fully develop the potential of integrated regional water management***
3. ***Aggressively increase water use efficiency***
4. ***Practice and promote integrated flood management***
5. ***Enhance and sustain ecosystems***
6. ***Expand water storage and conjunctive management of surface and groundwater resources***
7. ***Fix Delta water supply, quality, and ecosystem conditions***
8. ***Preserve, upgrade, and increase monitoring, data analysis, and management***
9. ***Plan for and adapt to sea level rise***
10. ***Identify and fund focused climate change impacts and adaptation research and analysis***

While not all of these strategies are relevant for the Inyo-Mono region, many of them are, and using this list as a guide will allow water managers to begin thinking about how to manage their water supplies in response to climate change impacts.

In addition to "Managing an Uncertain Future", in 2014 (with a 2016 update), Governor Jerry Brown developed the California Water Action Plan in response to the ongoing 2012-2016 drought. This document set forth ten actions that water managers and all water users in the State should strive to achieve:

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

Below is a consideration of the most relevant of the DWR adaptation strategies for the Inyo-Mono region. As the action plan items are closely related, those items that are relevant to the region are also indicated within each of the adaptation strategies.

1) Provide sustainable funding for statewide and integrated regional water management

2) Fully develop the potential of integrated regional water management

These first two adaptation strategies are closely related. While the first strategy is extremely pertinent for, and is strongly supported by, the Inyo-Mono planning region, it is not within direct control of the region. The Inyo-Mono RWMG is committed to maintaining a long-term presence in the region and will continue to build its program, including finding funding opportunities for high-priority projects as well as bringing other needed resources to the region. In addition, the RWMG will continue its involvement in statewide water fora so as to have a voice in determining management and funding priorities. One climate change scientist stated that IRWM is the backbone of climate change water-related activities in the state.

Action Plan: Increase regional self-reliance and integrated water management across all levels of government

Action Plan: Provide safe water for all communities

Action Plan: Identify sustainable and integrated financing opportunities

3) Aggressively increase water use efficiency

Awareness of water conservation has increased throughout the region over the past several years, as have water conservation practices. These measures have included encouraging water-efficient and native landscaping, installing water meters, and educating water consumers about efficient landscape irrigation. Regardless of climate, all communities within the region can benefit from increasing water use efficiency. Furthermore, those water districts that have successfully implemented water conservation measures can serve as a resource for smaller districts that have yet to implement programs.

Action Plan: Make conservation a California way of life

Action Plan: Manage and prepare for dry periods

4) **Practice and promote integrated flood management**

It has become more apparent to the RWMG that flood management is a common issue shared by several areas in the region. Integrated flood management does not take on the same meaning in the Inyo-Mono region as it does in other parts of California, such as the Central Valley. However, because of the large amount of undeveloped and public land in the region, managing the land use-water use nexus requires a great deal of thought and collaborative planning. More careful planning around flood management needs to take place, and such planning will help land and water managers address climate change impacts such as rain-on-snow events, increased wildfire incidence, and earlier peak streamflow.

Action Plan: Increase flood protection

5) **Enhance and sustain ecosystems**

Many organizations and individuals are working in the Inyo-Mono region to enhance and sustain ecosystems. The Inyo-Mono RWMG has adopted an objective related to ecosystem stewardship and has committed to promoting projects that would help meet this objective.

Action Plan: Protect and restore important ecosystems

6) **Expand water storage and conjunctive management of surface and groundwater resources**

This adaptation strategy represents perhaps one of the most significant opportunities within the Inyo-Mono region. In certain parts of the region, groundwater resources have been thoroughly monitored over time (see Chapter 4: Data Management and Technology for more information). In other areas, the recent implementation of the CASGEM program will help to ensure more accurate information on groundwater basins. In general, however, opportunities for aquifer recharge and storage have not been thoroughly explored.

Action Plan: Manage and prepare for dry periods

Action Plan: Expand water storage capacity and improve groundwater management

8) **Preserve, upgrade, and increase monitoring, data analysis, and management**

This adaptation strategy represents another large opportunity for the Inyo-Mono region. Again, while some geographical and topical areas within the region have been well explored, others have received little attention. The RWMG has been working with individual entities in the region to identify their data collection and data management efforts, and a summary of the findings is provided in the Data Management chapter. The RWMG, through its data management program, can help identify the gaps in monitoring and data, and develop plans and identify resource for filling those gaps.

Action Plan: Increase operational and regulatory efficiency

10) **Identify and fund focused climate change impacts and adaptation research and analysis**

Over time, the RWMG will identify climate change-specific projects and seek out funding opportunities. An alternative may be that projects focus on a different issue but have a benefit related to climate change adaptation. In a region where basic water supply and water quality issues are of utmost concern to the residents, climate change simply is not at the forefront of water managers' thinking. However, it is possible that climate change impacts and adaptation strategies can be incorporated into our thinking about water management and planning simply as an extension of our current ways of thinking.

3.4 Climate Change Mitigation

In contrast to adaptation, which consists of actions that respond to the impacts of climate change, climate change mitigation refers to strategies to reduce the causes of climate change, such as limiting the amount of greenhouse gases being emitted. Recently, increasing attention has been paid to reducing the amount of energy used in water resources management. The nexus of energy and water is increasingly identified as having large potential for greenhouse gas (GHG) mitigation. In California, 19% of the state's electricity and 30% of the state's non-power plant natural gas is used for conveyance, treatment, distribution, and end use of water (Climate Action Team 2008). This statewide baseline assessment is very important because identifying the largest sources of water-related emissions helps to prioritize projects by taking into account the potential emissions reduction, which often corresponds closely to cost savings, thus creating a more accurate cost-benefit analysis. Conducting a similar analysis on the IRWM region scale will ideally improve project prioritization and cost savings for the Inyo-Mono region.

In the Inyo-Mono region, little to no accounting of water-related energy use and greenhouse gas emissions has taken place. While techniques to perform such accounting have improved, most water agencies and rural water districts in the region do not have the resources to perform these tasks. In partnership with the Sierra Nevada Alliance, we have begun performing initial assessments of energy use and emissions for the larger water districts within the region: Mammoth Community Water District, Indian Wells Valley Water District, and June Lake Public Utilities District. It is the intention that by performing emissions inventories for the larger districts first, the methodologies can be worked out, and this experience will make it easier to then communicate with the numerous small community services districts, mutual water companies, and the like, in order to perform individual emissions inventories. Two further inventories were completed through the disadvantaged communities grant. The results of those assessments will be included in a future update of the Plan.

The IRWM Plan standards require that a process be created to consider GHG emissions when choosing between project alternatives. At this time, the IRWM Program has neither the financial resources nor the authority to demand that emissions inventories be performed outside of the IRWM process by potential project proponents. However, as much as project proponents are required to perform CEQA analysis of various project alternatives, they will be required to consider GHG emissions for each alternative, and this information can then be used in the IRWM project review process. We will also encourage RWMG Members with more resources (such as the urban water suppliers) to assist in such analysis for Members with fewer resources. If funding allows, we would consider working with an outside entity, such as the Sierra Nevada Alliance, that has the expertise and established methodology for assessing GHG emissions.

3.4.1 Water-Energy Nexus

The relationships between water and energy have begun to be explored in recent years. Inability to meet all water demands and concern about impacts of fossil fuel use have led to greater awareness of interactions between development of water and energy resources. The amount of water "embedded" in (i.e., used to produce) food received consideration by policy makers in the 1980s and 1990s and perhaps got people thinking about the amount of water used to produce energy. An early discussion of the basic issues (Gleick, 1994) appeared in the 1994 Annual Review of Energy and the Environment. National laboratories of the U.S. Department of Energy formed an Energy-Water Nexus Committee early in this century (U.S. Department of Energy, 2006; Sehlke and Wichlacz, 2009). A 2005 report prepared for the California Energy Commission (CEC) remains one of the basic references and is cited in most subsequent reports on the topic. Currently, the subject is often discussed in a broader context of a water-food-energy-climate nexus (e.g., World Economic Forum, 2011).

The headline-generating conclusion from the 2005 CEC report was that transportation and treatment of water, treatment and disposal of wastewater, and the energy used to heat and consume water account for nearly 20 percent of the total electricity and 30 percent of non-power plant related natural gas consumed in California (California Energy Commission, 2005). The CEC's initial estimates of water-related energy consumption were further refined in a subsequent report, but the basic results have held up (Navigant Consulting, Inc., 2006). The concept that one-fifth of California's total electricity consumption (or about 50 terawatt-hours [Twh] out of a total of almost 250 Twh) was used to supply, treat, and move water caught the attention of policy-makers and water and energy professionals. Water infrastructure consumes more than one-third of the water-related electricity in California (or about 7.7 percent of the total electricity – compared to a nationwide average of about 4 percent). The other two-thirds of the water-related electricity use are categorized as agriculture end-use; agriculture water supply and treatment; residential, commercial, and industrial end-use; residential, commercial, and industrial water supply and treatment; and wastewater treatment (Navigant Consulting, Inc., 2006). Subsequent studies have produced different estimates of the relative mix of electricity use in various aspects of water conveyance and use (Water in the West, 2013), but these differences seem to result largely from varying definitions of categories of water demand and delivery and varying aggregation schemes in the accounting.

In the past, water and energy were generally considered separately from each other. Water projects were typically planned and built under an assumption that energy would have low costs and be abundantly available. Similarly, energy development usually proceeded under assumptions of low-cost and readily available water (e.g., Cooley, et al. 2011; Cohen, et al. 2004). In many cases, this conceptual separation of water and energy went so far as to avoid any consideration of the need for water in electricity generation or factoring costs for electricity in planning for water supplies (Larson, et al. 2007).

One area of water supply where electricity need is rarely overlooked is groundwater pumping. Most irrigators or small municipal water suppliers that depend on groundwater have been well aware of the cost of electricity or diesel fuel needed to run their pumps. Although these costs are borne by individuals, small companies, or public water-supply agencies, when aggregated across California, the amount of energy used to extract water from below ground is astounding. More than five percent of California's total energy use is for pumping groundwater (California Agricultural Water Stewardship Initiative, 2016). During the summer irrigation season, statewide groundwater pumping uses more electricity than the State Water Project, Central Valley Project, and Colorado River Aqueduct combined.

Because energy use is tied to greenhouse gas (GHG) production, the State of California quickly realized that the water-energy nexus must be considered in policies and practices intended to reduce GHG emissions. Because California produces about one percent of the world's anthropogenic greenhouse gases, any means of reducing that production is quantitatively important. In 2006, an interagency Water-Energy Team of the Climate Action Team was created from staff of the California Energy Commission, Department of Water Resources, California Public Utilities Commission, State Water Resources Control Board, Air Resources Board, Department of Public Health, and Department of Food and Agriculture to design policies and approaches to reducing GHG emissions from water delivery and use.

The 2013 update of the California Water Plan acknowledges the water-energy nexus but does not get into much detail. The Water-Energy Team sponsored or catalyzed many of the reports cited in this section.

A recent publication of the California Department of Water Resources (2015) about climate change contains the following illustrations about water-related energy use in the two Lahontan regions (most of the Inyo-Mono IRWMP region is in South Lahontan with the exception of the Walker River basin). Each figure below shows the amount of energy required to obtain and convey one acre-foot of water from source to a centralized delivery location for different categories of water supply. The figures allow comparison of the relative energy intensity (amount per volume of water) of different sources and does not include the total volume of water delivered, and consequently, energy required. Perhaps the main message here is that groundwater pumping has a much lower energy intensity than the State Water Project – and, of course, no SWP water reaches the Inyo-Mono region.

North Lahontan

Type of Water	Energy Intensity (= 1-250 kWh/AF = 251-500 kWh/AF)	Percent of Regional Water Supply
Colorado (Project)	*This type of water not available*	0%
Federal (Project)	*This type of water not available*	0%
State (Project)	*This type of water not available*	0%
Local (Project)	<250 kWh/AF	44%
Local Imports	*This type of water not available*	0%
Groundwater	<250 kWh/AF	22%

South Lahontan

Type of Water	Energy Intensity (= 1-250 kWh/AF = 251-500 kWh/AF)	Percent of Regional Water Supply
Colorado (Project)	*This type of water not available*	0%
Federal (Project)	*This type of water not available*	0%
State (Project)		14%
Local (Project)	<250 kWh/AF	7%
Local Imports	*This type of water not available*	0%
Groundwater		64%

Within DWR's IRWM Program, current guidelines require that regional plans "address the nexus of water, energy, and climate". Reducing "energy embedded in water use, and ultimately reducing GHG emissions" is mentioned in the IRWM grant guidelines as an important strategy for mitigating negative consequences of climate change on water resources. The DWR IRWM program is hoping to fund more projects that reduce energy use related to water by increasing the efficiency of water use and the energy efficiency of providing water as well as increasing reuse and recycling of water (Park and Kellen, 2013).

Because the IRWM Program currently lacks specific guidelines regarding water-energy nexus issues, one study has recommended developing a set of principles that could guide incorporation of energy efficiency and GHG reduction measures into IRWM projects (Ajami and Truelove, 2014). This report also recommended development of a framework to evaluate tradeoffs between water and energy when following guidelines and best management practices in the IRWM context.

DWR's Water-Energy Grant Program (http://www.water.ca.gov/waterenergygrant) is a new means of using funds generated by the Greenhouse Gas Reduction Fund to reduce water use and water-related energy use through improvements in residential, commercial, and institutional water-use efficiency. About $28 million was made available in the 2014 funding cycle.

In the Inyo-Mono region, water-energy relationships are relatively simple and rarely involve multiple jurisdictions or agencies. Groundwater pumping is likely the largest water-related energy use in the region. The largest water infrastructure project in the region, the LADWP aqueduct, is entirely gravity driven. None of the water-intensive means of electricity production described by Larson, et al., (2007), such as fossil-fuel generating plants cooled by water, are present in the Inyo-Mono region. Similarly, none of the energy-intensive means of supplying water described in that study are present in the Inyo-Mono region. Such large-scale operations include pumping from very deep aquifers, water recycling with purification via reverse osmosis, huge surface-water diversions that require pumping uphill (e.g., State Water Project), and seawater desalination (Larson, et al., 2007).

Several sections of the Inyo-Mono Regional Plan (e.g., 2.1.4, 2.3.2, 2.3.4, 2.4.4-7, 2.4.9 and Chapter 3) were reviewed for clues about areas and projects where there might be a significant relationship between water and energy. Because of the very low population, small proportion of private land, and minimal development of the region compared to most of California, the potential for substantial improvements in efficiency in water and energy use and reduction in GHG emissions is miniscule compared to the state as a whole. Nevertheless, there is room for improvement in almost every operation, even though they may be small in size. Aggressive pursuit of energy-efficiency throughout the water sector in the Inyo-Mono region could reduce GHG emissions significantly, although there is no way to quantify the amount beyond educated estimates.

As mentioned above, groundwater pumping is likely to be the overwhelming energy use in the region with respect to water (see next section). Although a few companies (e.g., Grundfos) advertise their pumps as energy efficient, energy use does not yet seem to be a critical factor in the marketing of well pumps nor the planning of projects. Perhaps Southern California Edison, Pacific Gas and Electric, and other utilities in California could start an energy conservation incentive program for pumps as they have for household appliances. As an alternative to utility electricity or diesel or natural gas-powered pumps, there are many vendors of solar electric systems specifically for well pumps.

Communities in the Inyo-Mono region seem to have responded quite effectively to appeals for water conservation during the 2012-2015 drought. If residential water users learn that continuing to conserve water also reduces GHG emissions, perhaps water use could remain below historic levels. The State of California needs to build upon the Environmental Protection Agency's recommended approaches for energy conservation by water suppliers (EPA, 2013). This small sourcebook appears to be an excellent basis for creating a substantive program for improving energy efficiency by water systems. Incentives (beyond the cost of electricity) to improve irrigation efficiency could be created to increase agricultural water conservation and, in turn, reduce GHG emissions. As snow-making technology continues to evolve, there could be some options for improving the energy efficiency of snow-making operations at Mammoth Mountain, but presumably the ski area is using reasonably efficient techniques simply because of the energy cost.

There is significant potential for continued development of large-scale geothermal and solar power in the Inyo-Mono region. As is readily apparent from the current (2015) controversy over expansion of the Mammoth Pacific geothermal power plant, impacts on water resources from such development must be carefully considered during environmental planning.

The attention given to the water-energy nexus in the past decade prompted the California Energy Commission to examine the potential for increased hydroelectric generation in (and near) existing water projects (Navigant Consulting, Inc., 2006b). Following legislation (SB 1078, Sher 2002), the CEC was most interested in projects that would not require a new or increased diversion of water. This potential for "new" hydropower would be primarily in existing structures and conduits where sufficient hydraulic head and water flow allow cost-effective installation of generators. Throughout California, the undeveloped potential of small-scale hydropower in existing hydraulic structures was estimated to be more than 250 megawatts (Navigant Consulting, Inc., 2006b). However, neither Inyo nor Mono counties had any sites that were considered by the methodology of this study. A more detailed local examination would probably find some potential for small-scale hydroelectric generation within the Inyo-Mono region at existing facilities operated by Southern California Edison, Los Angeles Department of Water and Power, Mammoth Community Water District, June Lake Public Utility District, and perhaps other entities.

3.4.1.2. Estimates of Greenhouse Gas Emissions from water sector in Inyo-Mono region

In section 3.4.1 of the Inyo-Mono IRWM Plan and Appendix J of the Inyo-Mono DAC study, inventories of annual GHG emissions from five water and wastewater systems within the region are presented. These estimates are used to crudely extrapolate water-related GHG production in the entire region.

Based on the inventories conducted by the Sierra Nevada Alliance for the IRWM Plan and DAC report, the following annual GHG amounts were estimated for each of the five systems:

System Name	Greenhouse Gas Emissions (Metric Tons CO_2e)
Big Pine CSD (wastewater only)	126
Bridgeport PUD	144
June Lake PUD	168
Mammoth Community Water District	1800
Indian Wells Valley Water District	1846

There appears to be an error in the estimate for the Indian Wells Valley Water District. The District pumps about 22,000 AF per year from a depth of about 900 feet (Leroy Corlett, personal communication, Oct. 28, 2015). Using conversion factors of 1.02 Kwh per AF per foot of lift (e.g., Todd Engineers, 2014) and 0.00064 MT CO_2e per Kwh, 22000 x 1.02 x 900 x0.00064 = 12,925 MT CO_2e for the IWVWD's annual pumping, which is the overwhelming amount of energy use by the District.

Using these values (including the larger value for the IWVWD) and population estimates (including estimated average visitors in Mammoth Lakes and June Lake), two crude factors were developed for per capita water-related annual GHG production: 0.2 MT CO_2e per person in Mono and Inyo counties and 0.4 MT CO_2e per person in Kern and San Bernardino Counties. These factors were multiplied by approximate populations in the counties (and small portions of Kern and San Bernardino counties within the region) to yield a total for the region: 15,000 x 0.2 + 19,000 x 0.2 + 32,000 x 0.4 = 20,000 MT CO_2e.

An independent estimate for the water systems of the region was generated categorizing the water suppliers in region described in section 2.4.7 of the Inyo-Mono IRWM Plan and applying an amount of GHG emissions based on the inventories mentioned above and then adding the totals for each category. The categories and assumed annual GHG emissions appear below:

Population served	# in Mono	# in Inyo	GHG output per system per year (MT CO_2e)
<50	39	45	10
50-200	39	47	40
200-1000	18	20	100
>1000	1	5	1800 (Mono) 600 (Inyo)

The totals from this method were 5550 for Mono, 7330 for Inyo, and 13,000 for Kern/SB, and a total for the region of 25,880 MT CO_2e or about 30% greater than the per capita approach. Additional estimates were made for groundwater pumping by LADWP:

72,000 AF x 1.02 kWh per ft of lift x [est 750 ft] x 0.00064 MT CO_2e per Kwh
= 35,250 MT CO_2e/yr

and pumping of the Lower Owens River Project, which involves pumping 50 cfs up 130 feet:

36,200 AF x 1.02 kWh per ft of lift x 130 ft x 0.00064 MT CO_2e per Kwh
= 3,070 MT CO_2e/yr

An additional estimate needs to be made of GHG emissions in support of LADWP aqueduct operations.

Besides the groundwater pumping by the IWVWD and LADWP, several public systems, irrigators in Indian Wells Valley and the Tri-Valley area of southern Mono County, and perhaps hundreds of individual residences pump groundwater. With the notable exception of the agricultural pumping in the Indian Wells Valley (where total energy use may soon approach that of the IWVWD [inference based on Todd Engineers, 2014]), other pumping in the Inyo-Mono region is believed to account for comparatively small amounts of energy because the volumes of water and depth of lift are very small in relation to that of the LAWDP and IWVWD. Based on anecdotal information, most residential wells are less than 100 feet deep.

Given the tiny sample size of inventories, wide variation in results, and simplifying assumptions made, our initial estimate of the annual GHG production by the water sector in the Inyo-Mono region is somewhere in the range of 50,000 to 70,000 MT CO_2e/year. That amount is about 0.002 percent of the total California water-sector GHG output of 3.2 x 10^7 MT CO_2e/year (50 Twh x 6.4 x 10^5 MT CO_2e per TWh). *The pumping of tens of thousands of acre-feet of groundwater from several hundred feet of depth by LADWP and IWVWD appears to be the overwhelming use of energy in the Inyo-Mono region.*

3.4.2 GHG Inventory Methodology

Boundaries and Sources

The initial GHG inventory for the Inyo-Mono region focuses on the larger water utilities within the region, partly because of the availability of information within these agencies, and partly because of their larger energy use compared to smaller water districts and individual wells and septic systems. Once the emissions inventory protocol is established, future inventories will be easier to conduct, particularly for smaller water purveyors that may not have data readily accessible.

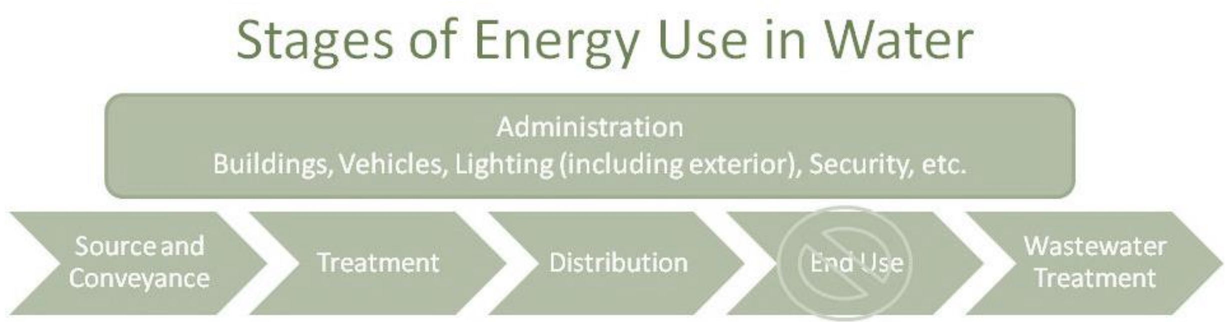
Table 3-4 shows the potential GHG emission sources relevant to water utilities. Direct emissions are those emitted by activities within the region itself (i.e. motor vehicles), while indirect emissions are emitted outside of the region but are due to activity within the region (i.e. electricity generation). Wastewater is included in both categories because the utility may have onsite treatment or may send its wastewater to another site for treatment. Direct and indirect emissions are commonly referred to as Scope 1 and Scope 2 emissions, respectively. There is a Scope 3 that includes activities such as workers' commutes and emissions from the manufacture of goods used by the region (lifecycle emissions), but these are not included in this inventory.

Table 3-3: Direct and indirect water-related emission sources

Emissions Type	Source Sector	Source Category
Direct (Scope 1)	Transportation	On-road mobile sources (motor vehicles: passenger cars, trucks, buses)
		Off-road vehicles (boats, snowmobiles, lawn and garden equipment, etc.)
	Fuel combustion	Natural gas combustion (residential and commercial)
		Other fuel combustion (propane, wood, etc.)
	Waste	Wastewater treatment
Indirect (Scope 2)	Energy	Electricity consumption
		Wastewater treatment

When discussing the energy-water nexus, it is important to identify which steps of the water use process produce the most emissions. Those steps with the most emissions are often the most costly, due to energy prices. Figure 3-2 shows the different stages of water-related energy use. This inventory does not look at the end user (i.e. water heating), although that may be possible to calculate in future inventories using resources such as the Residential Energy Consumption Survey.

Figure 3-15: Stages of Energy Use in Water



Base Year and Inventory Frequency

In California, a base year of 2005 is preferable because it aligns with legislative goals such as AB 32 and SB 375. Unfortunately, complete fuel and electricity use records for past years were not readily available from the utilities addressed here. With that caveat, it is important to establish a year that has consistent and accurate data across all of the emitters in question. Based on these criteria, the year 2011 was chosen as a baseline for the Inyo-Mono region. In order to identify emission trends, such as the effects of deliberate efficiency and conservation measures or indirect effects (e.g., economic trends), inventories should be conducted at least every five years, although annual inventories are preferable. Going forward, we recommend that the water utilities actively track the sources identified in this inventory.

Quantifying Emissions

Quantifying GHG emissions follows a straightforward path: multiplying “activity data” by “emissions factors” and the Global Warming Potential (GWP). Activity data are the amount of fuel consumed, vehicle miles traveled, population served, etc., and emissions factors are the amount of each GHG emitted by each activity (e.g., burning fuel or driving miles). Global warming potential weights each of the GHGs in terms of strength and the amount of time they spend in the atmosphere. Each relevant fuel source and type is discussed below.

Direct Emissions (Scope 1)

Stationary Combustion

Stationary combustion is the burning of fuels within the region (water district) to generate heat or electricity. For water districts, this generally means remote generators or boilers to create heat for buildings or processes such as wastewater treatment.

Emissions for natural gas, propane and diesel are each calculated by multiplying the amount of fuel by the emissions coefficient for carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Indian Wells Valley uses diesel for both stationary combustion and motor vehicles, but they do not break out these uses so all diesel emissions were calculated as mobile sources, as described next.

Mobile Emissions

Mobile emissions apply to the vehicles used by the utility districts to service and build infrastructure and to read water meters if applicable. Calculating CO_2 emissions is straightforward: gallons of gasoline and diesel were provided by each utility and those amounts were multiplied by the emissions coefficient for CO_2. Emissions of CH_4 and N_2O are more dependent on miles traveled and year and type of vehicle than gallons burned. June Lake provided mileage and vehicle year and type, so the emissions were calculated by multiplying miles driven by the appropriate emissions coefficients. Indian Wells Valley supplied gallons of gasoline and diesel, but not miles. Additionally, IWV uses diesel for stationary combustion and vehicles but does not differentiate them. For this inventory, all diesel emissions were calculated using the alternative mobile sources equations, based on gallons, with coefficients for CO_2, N_2O, and CH_4.

Wastewater

Direct emissions from wastewater treatment arise from the actual biologic process of decomposing the organic materials in wastewater when methane and nitrous oxide are released, and from on-site electricity or heat generation from burning fossil fuels. In the Inyo-Mono region, the three water utilities analyzed use aerobic digestion which releases negligible amounts of CH_4 and N_2O. In accordance with the Local Governments Protocol and the U.S. EPA, these negligible process emissions are not included in the inventories. Mammoth Community Water District burns some propane in their wastewater treatment plant for space heating, and these emissions are included in the MCWD inventory. On-site burning of natural gas and propane are calculated as above ("Stationary Combustion").

Indirect emissions from wastewater treatment include the purchased electricity and vehicle fuels used to in order to transport, treat, and dispose of wastewater and its byproducts. Indian Wells Valley sends their wastewater to the city of Ridgecrest for treatment. Those emissions are not included in this inventory. Mammoth and June Lake own their wastewater treatment plants, and the electricity purchased to run the plants are included in their respective inventories. The emissions from purchased electricity are calculated as described below ("Purchased Electricity"). Mammoth found that wastewater treatment was the district's top single use of electricity and responded by installing a one-megawatt solar array to offset that demand; see the Mammoth inventory for more details.

Indirect Emissions (Scope 2)

Purchased Electricity

Purchased electricity tends to be a large source of emissions but is indirect because the fuels are burned at the power plant in another location while the electricity demand and use is in the water district. Nationally, the U.S. EPA maintains a database of region-specific emissions factors based on the mix of fuels (i.e. natural gas, coal, renewable, etc.) used at each power plant. Most California utilities, either in the past or currently, calculate a specific and more accurate emissions factor. Southern California Edison, the electricity provider to all of the water districts inventoried here, last updated their emissions factor in 2007, so that was the number used.

3.4.3 GHG Inventory Case Study: Indian Wells Valley Water District

Background

Indian Wells Valley Water District (IWVWD) is a medium-sized public water retailer, providing water to about 12,000 residential and commercial connections, totaling approximately 30,000 residents, in the Ridgecrest area of Kern and San Bernardino Counties, California. The district service area is approximately 38 square miles of the Indian Wells Valley, which lies in the northern Mojave Desert, southeast of the Sierra Nevada and south of Owens Valley (Krieger & Stewart 2011). The water source for Indian Wells Valley is a single aquifer, which is a naturally-occurring underground reservoir, and area residents and businesses pump nearly 30,000 acre feet (AF) per year, while replenishment from rain and snow is closer to 10,000 AF (Mulvihill 2008). The water district was incorporated in 1955, and groundwater levels have been dropping since the 1960s (IWVWD 2011).

Although seldom seen by the public, IWVWD has over 200 miles of pipeline as well as storage tanks, wells, pumping plants, boosters, arsenic treatment plants, and office headquarters. The District currently operates 10 active wells with capacities ranging from 1,000-1,400 gallons per minute (Mulvihill 2010). There are eleven storage tanks with capacities ranging from 100,000 gallons to 5 million gallons at strategic locations throughout the District, with at least one tank located in each of five service zones. The district's largest recent capital investment (about $15 million) was to support two arsenic treatment plants.

Greenhouse Gas Inventory

Indian Wells Valley Water District has direct emissions from their vehicle fleet, gasoline and diesel, and burning of natural gas. Indirect emissions are a result of electricity purchased from Southern California Edison and wastewater treatment, which is carried out by the city of Ridgecrest. Greenhouse gas emissions for CO_2, N_2O, and CH_4 were calculated following the *Local Government Operation Protocol* developed and adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry (May 2010). See the methodology section for full details.

Fuel and electricity use records were available for 2011, so this will be the baseline year going forward. Year-to-date data are available for 2012, and the District is encouraged to update these numbers on a monthly basis. Wastewater treatment is by far the largest source of GHGs, largely due to the methane emissions from anaerobic digestion. Indirect emissions from purchased electricity are an order of magnitude larger than the direct emissions of diesel fuel use. Gasoline and natural gas, respectively, make up the rest of IWVWD's GHG emissions profile. Figure 3-16 shows the annual emissions for the baseline year of 2011, and Figure 3-17 shows the monthly emissions for 2011. In the first three months of 2012, emissions are down 16.5% from 2011 emissions, largely because of an almost 50% decrease in gasoline and diesel use. Figure 3-18 shows GHG emissions by activity (water production, administration, etc.)

Figure 3-16: IWVWD GHD Inventory 2011

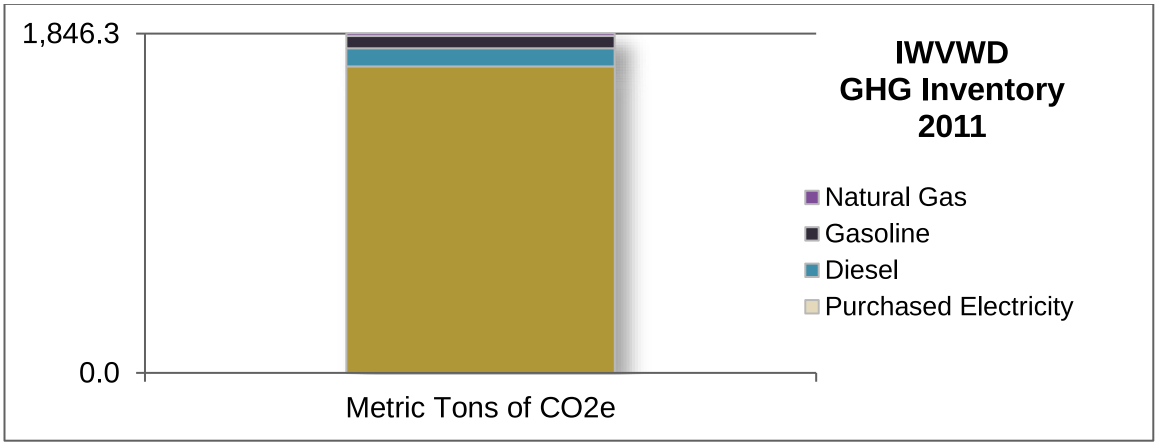


Figure 3-17: IWVWD Monthly GHG Inventory 2011

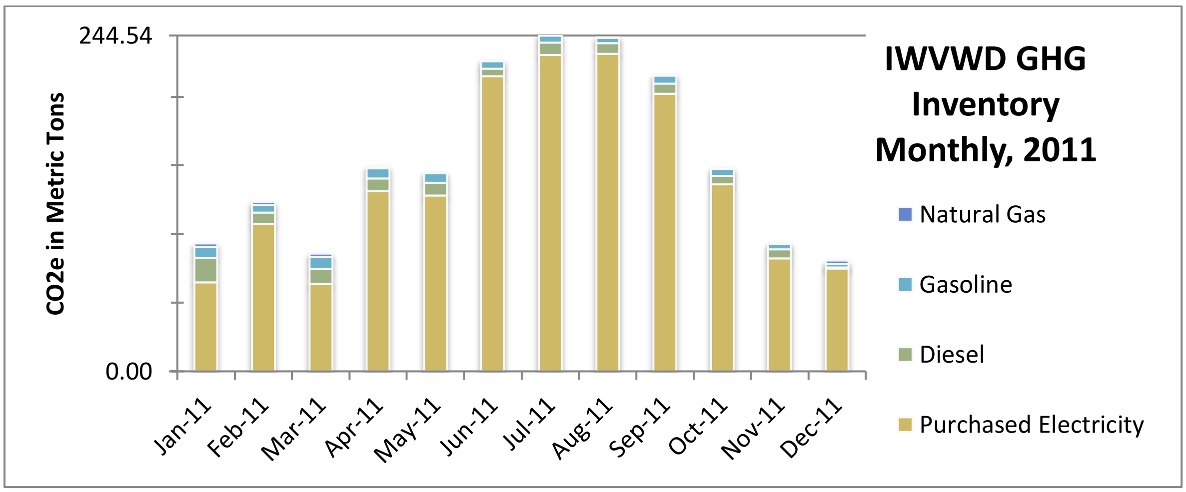
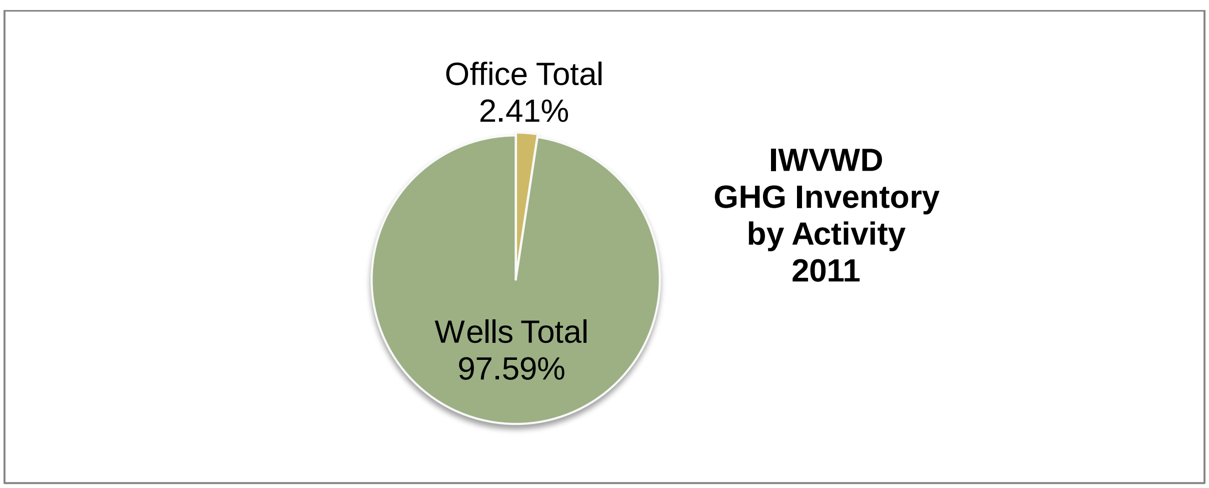


Figure 3-18: IWVWD GHD Inventory by Activity 2011



3.4.4 GHG Inventory Case Study: June Lake

Background

The June Lake Public Utility District (JLPUD) serves a full-time residential population as well as a substantial visitor population. The district provides water treatment and distribution, sewer collection and treatment, and mosquito abatement services (Mono County LAFCO 2009). According to the 2010 census, the year-round residential population of the town of June Lake is approximately 629 people, while the seasonal visitor population peaks at approximately 2,500 people-at-one-time for a plethora of winter and summer recreational activities (U.S. Census 2010). The JLPUD's water consumption is difficult to predict accurately. The fluctuating tourist population and the small permanent population, along with weather conditions and the economy, all contribute significantly to the oscillating water consumption (Mono County LAFCO 2009). According to the Rodeo Grounds Water Demand Project, which can serve as a proxy for the rest of JLPUD's service area, peak winter months are from December through March (averaging 2,000,000 gallons per month), while peak summer months are June through September (averaging 4,000,000 gallons per month) (Hansford 2006). Peak summer months double the amount of water used each month due to increased residential use and resort irrigation. The Mono County General Plan section specific to June Lake concludes that estimated water demands are expected to peak only for a few days per year, and the system has been designed to meet those peak demands. However, the water system may not be able to meet the projected maximum month-average day demand at build-out (Mono County LAFCO 2009).

The JLPUD provides water and sewer service to an area of 1,720 acres within the June Lake Loop (Highway 158 to the west of Highway 395). The June Lake Loop houses a majority of the developed community and is situated against the west rim of the Great Basin and Range Province, adjacent to the steep eastern escarpments of the Sierra Nevada. The Inyo National Forest allotted surface water diversion rights to the JLPUD for both the Village System and the Down Canyon system, totaling approximately 1,116,000 US gallons per day, which is serviced by almost nine miles of pipes (Mono County LAFCO 2009). Both the Village System and the Down Canyon System have sufficient storage capacity to meet existing and fire flow demands, although the Water Master Plan recommends that both systems build 500,000-gallon reservoirs to meet future demands at build out (Mono County LAFCO 2009). The utility district provides sewer service to three major service areas: the June Lake Village, Down Canyon areas of June Lake, and U.S. Forest Service campgrounds. The sewer system currently includes 14 miles of pipeline, 29 lift stations, 5 pump stations, and the wastewater treatment plant. The treatment plant provides secondary improvements to the system to meet current and projected future demand (Mono County LAFCO 2009).

Greenhouse Gas Inventory

June Lake Public Utility District has direct emissions from their vehicle fleet, which largely uses gasoline. They do not track the minimal diesel use. Indirect emissions are a result of electricity purchased from the utility Southern California Edison and wastewater treatment, which is carried out by the utility district itself. The district does not use any other fuels directly (i.e. propane, natural gas). Greenhouse gas emissions for CO_2, N_2O, and CH_4 were calculated following the *Local Government Operation Protocol* developed and adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for

Sustainability, and The Climate Registry (May 2010). See the methodology section above for more details.

Full fuel and electricity use records were available for 2011, so this will be the baseline year going forward. Year-to-date data are available for 2012, and the district is encouraged to update these numbers on a monthly basis. Electricity purchased from Southern California Edison is the largest source of GHGs, followed by wastewater treatment (largely methane emissions), and gasoline used in the small vehicle fleet. Figure 3-19 shows the annual emissions for the baseline year of 2011, Figure 3-20 shows the monthly emissions for 2011, and Figure 3-21 breaks down electricity emissions into water and sewer categories (a negligible amount is used for administration and maintenance buildings). In the first three months of 2012, emissions are up about 8% from 2011, largely due to an almost 38% increase in gasoline use.

Figure 3-19: June Lake GHG Inventory 2011

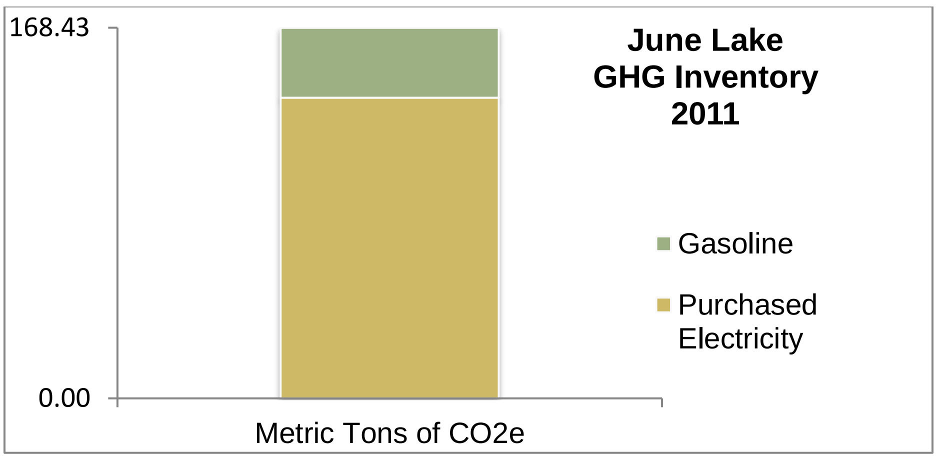


Figure 3-20: June Lake Monthly GHG Inventory 2011

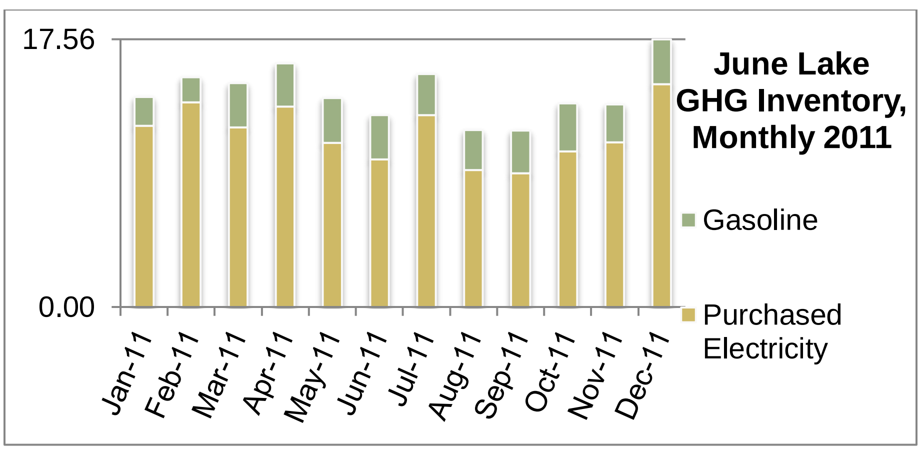
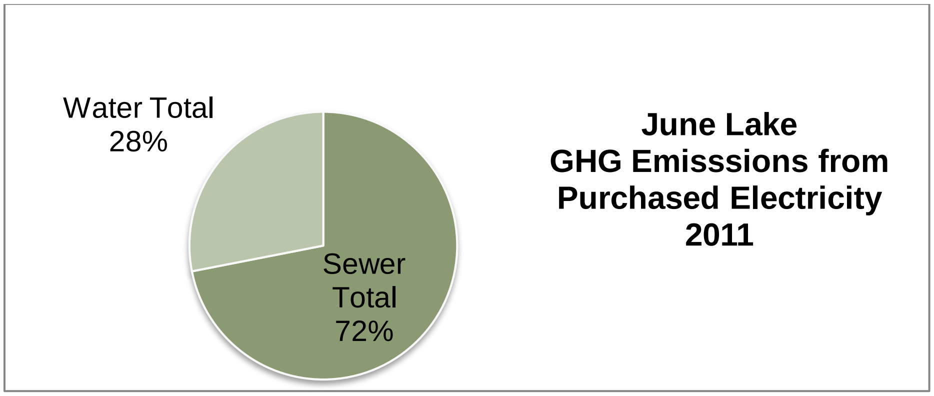


Figure 3-21: June Lake GHG Emissions from Purchased Electricity 2011



3.4.5 GHG Inventory Case Study: Mammoth Community Water District

Background

The Mammoth Community Water District (MCWD) provides water and sewer services to the Town of Mammoth Lakes in Mono County, California. This small resort community is located on the eastern slope of the Sierra at an elevation of approximately 8,000 feet above sea level. The economy of the area is primarily based on recreation and tourism, and visitation is bimodal between the winter ski season and the summer recreation season. Mammoth Lakes has a year-round population of about 8,500, but during peak tourism the population swells to about 35,000 people (US Census 2010, Town of Mammoth Lakes 2007). Most of the area's precipitation comes as winter snowfall, with the area receiving an average of about 17 feet of snow (equating to approximately 24 inches of water) annually (1993-2010; MCWD 2010). The population and precipitation seasonality creates an interesting set of water management considerations and is visible in the water district's emissions profile.

The MCWD provided fuel and electricity use data for the years 2008-2011, broken down into water supply, wastewater treatment, and administration. The district also provided data on water supply and wastewater treatment. Tracking emissions along with the amount of water delivered allows us to looks at "emissions intensity," metric tons of greenhouse gas emissions per millions of gallons of water. Not only does the emissions intensity provide a more detailed view of the district's efficiency, but it allows a direct comparison between water utilities.

Greenhouse Gas Inventory

The Mammoth Community Water District has direct emissions from their vehicle fleet and on-site burning of propane for space heating. Indirect emissions are a result of electricity purchased from Southern California Edison, as well as wastewater treatment carried out by the water district itself. The MCWD treats its wastewater aerobically; therefore, process emissions from wastewater treatment are considered negligible and not included in this inventory. Greenhouse gas emissions for CO_2, N_2O, and CH_4 were calculated following the *Local Government Operation Protocol* developed and adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry (May 2010). See the methodology section for full details.

The GHG inventory for MCWD reveals a number of interesting trends and highlights some of MCWD's efficiency measures. Figure 3-22 shows GHG emissions for all of MCWD's activities from 2008 through 2011 as bar graphs, and the amount of water procured and treated as a line graph. Purchased electricity is the largest single source of emissions and is also where the district has made the most efficiency gains. Between 2010 and 2011 in particular, the district successfully reduced its electricity demand while maintaining approximately the same level of water supply and treatment, largely due to the focus on maximizing the use of surface water. Surface water is gravity-fed, thereby decreasing demand for electricity for groundwater pumping, and saving MCWD a significant amount of money. In fact, many days the district is able to completely shut off pumps between noon and 6pm, when electricity is the most expensive. In 2008, 50% of the electricity used was for water supply and 45% was used for wastewater treatment, with the last 5% used in administration buildings. In 2011, only 19% of the electricity was used for water supply while 73% and 8% was used for wastewater and administration, respectively. This shows the large effect that water management decisions can have on energy use. Figure 3-24 shows emissions by activity for 2011. The district is now focusing on reducing GHG emissions from wastewater treatment by installing solar panels (see case study) and increasing efficiency in the administration category by following recommendations provided from a recent energy audit.

Looking at monthly emissions from 2011 (Figure 3-23), water supply and treatment spikes during the winter and summer due to increased recreation population. Emissions increase in the summer as surface water begins to dwindle and the district must pump more groundwater. Gasoline and diesel used in the district's vehicle fleet is included in administration and these emissions spike in the summer when the majority of construction and maintenance takes place. In the winter, propane is used for heating, which drives the higher emissions seen in the cold winter months. October is generally the least water- and emissions-intense month because there is virtually no tourist population in Mammoth Lakes, and there is little outdoor water use as the short growing season ends.

As 2012 data become available, MCWD will update the charts and graphs. The Inyo-Mono RWMG will follow up with MCWD to determine how the solar panels and energy audit have affected the amount of electricity purchased by MCWD and the resulting emission inventory. By reducing electricity demand through water management and technical upgrades, MCWD successfully decreased the amount of electricity it needs to deliver water, and by generating clean energy on-site, the district is able to reduce GHGs on the supply side.

Figure 3-22: MCWD GHG Inventory 2008-2011

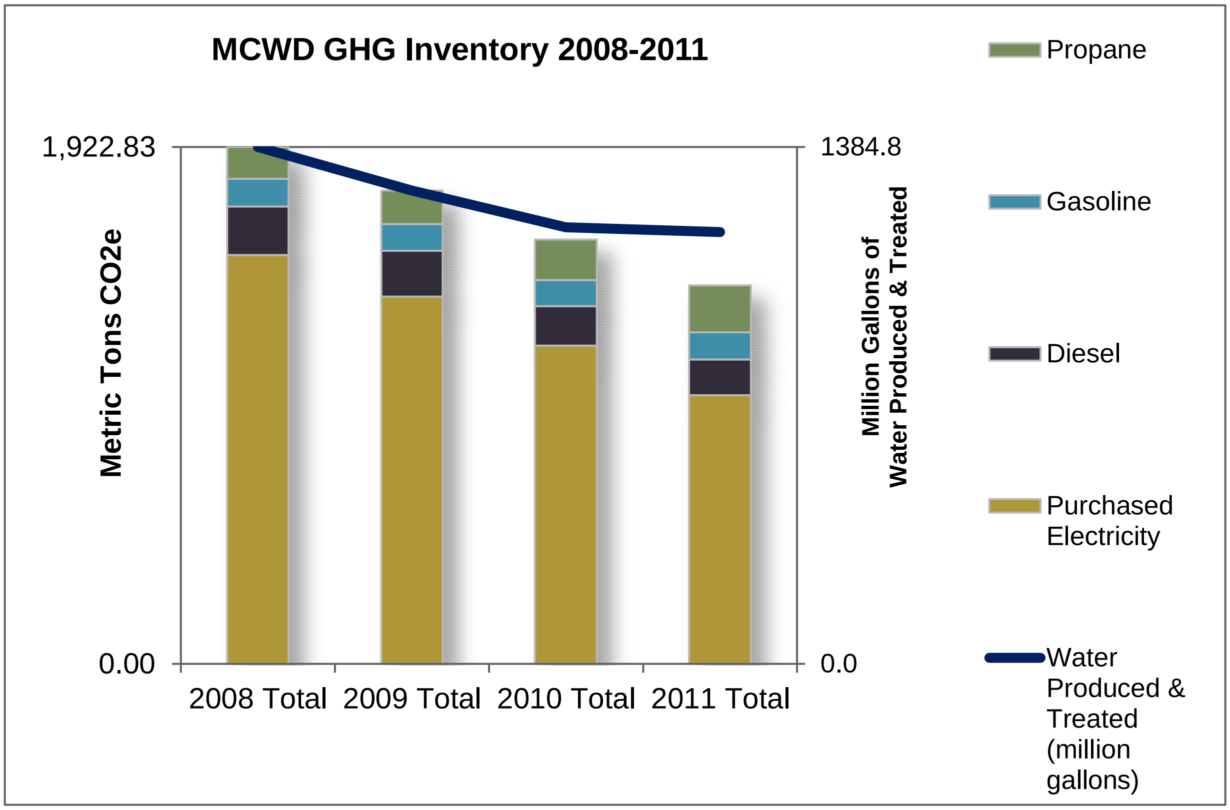


Figure 3-23: MCWD Monthly GHG Inventory 2011

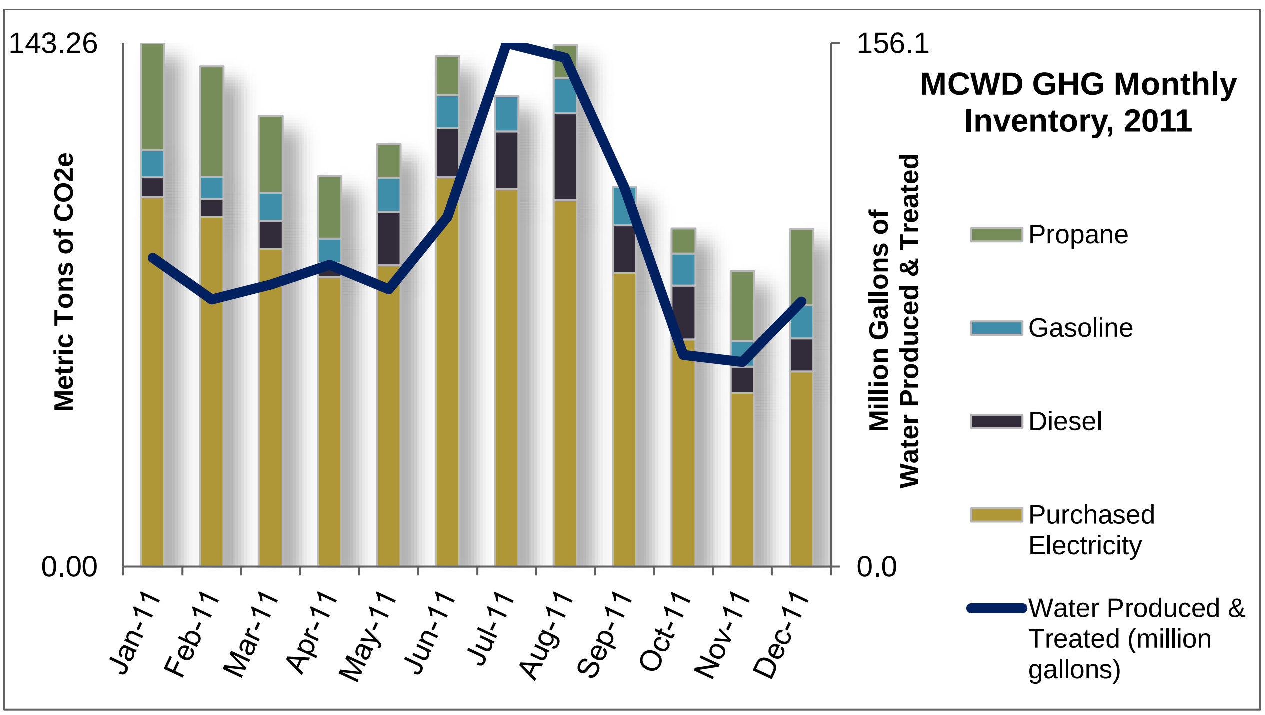
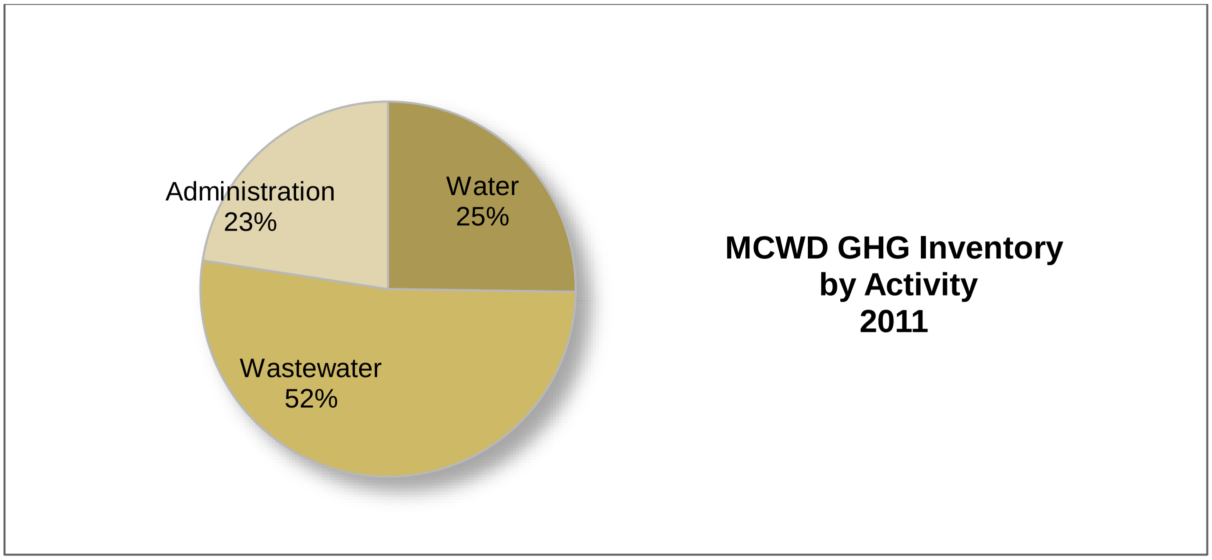


Figure 3-24: MCWD GHG Inventory by Activity 2011



3.4.6 Comparison of Three Water Districts

Figure 3-25 shows the GHG inventories for the three water utility districts in the baseline year of 2011. A direct comparison of gross 2011 GHG emissions is misleading given the significant disparity in size among the three water districts, but it is instructive to see emissions quantified and sources identified. A common metric must be used in order to fairly compare the three districts' GHG emissions. Emissions per population served would be convenient, but due to the large seasonal population swings, especially in June Lake and Mammoth Lakes, this is not a reliable method. Emissions per amount of water (metric tons of CO_2-equivalent emissions per million gallons of water procured and wastewater treated) may be a better common metric, but as the Mammoth Community Water District inventory details, the source of the water each district relies on (groundwater vs. surface water) largely determines how much electricity is needed to extract the water. In future IRWM Plan updates, we will explore the idea of finding a common metric, possibly by using the amount of water handled by each district or integrating monthly populations, if either of those data are available, or some other metric discovered through a more extensive literature review.

Case Study: Mammoth Community Water District's Solar Array

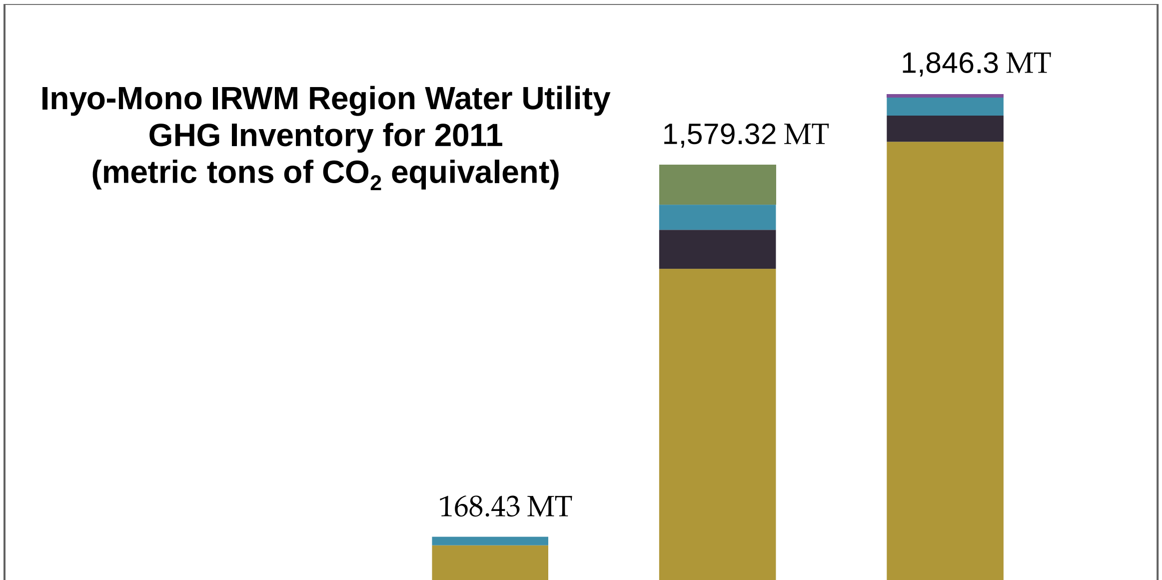
- ***Up front cost: $5.5 million***
- ***Estimated payback period: 9 years***
- ***Life of solar panels: 20 years***
- ***State and Federal Incentives: $3.5 million***

MCWD 1MW Solar Photovoltaic Power Plant

In 2009, the MCWD Board began discussing the possibility of installing arrays of solar panels on or around its property in Mammoth Lakes. The largest single demand for electricity is the wastewater treatment plant, costing about $17,000 per month to power. In order to save costs and reduce its environmental impact, the MCWD Board started discussing the possibility of installing solar panels in 2009. There is not enough roof space on MCWD buildings to support a large solar array, so MCWD staff decided to site the project on a retention pond. The three-acre site covers the emergency overflow pond as well as some adjacent land and, rated at 1 megawatt, covers about 80% of the electricity load for the wastewater treatment plant. The four large arrays of solar panels follow the sun and automatically lay flat in high winds to protect the panels from damage. Due to the cutting-edge design of the panels and the cool weather and clear skies, the system has been performing at about 115% of expected power generation since the system went live in October 2011. The water district considered a number of ways to pay for the system but in the end was in the fortunate position to be able to pay the upfront costs. Including state and federal incentives, the system should pay for itself within nine years. The panels have a life expectancy of about 20 years, but the framework is expected to last longer and will be able to support more advanced solar panels as they become available and affordable.

For more information: http://www.mcwd.dst.ca.us/Solar Page/MCWDSolar.htm

Figure 3-25: Comparison of emissions inventories for the three water systems



	June Lake Public Utility District	Mammoth Community Water District	Indian Wells Valley Water District
Propane	0.00	152.25	0.00
Natural Gas	0.00	0.00	12.16
Gasoline	31.79	95.54	68.39
Diesel	0.00	147.06	98.98
Purchased Electricity	136.64	1184.48	1666.76

3.4.7 Next Steps

As discussed above, 2011 will serve as the baseline year for GHG emissions. It is important to collect energy use data at least annually in order to track progress and minimize the time and cost required to conduct inventory emissions. Actively compiling the data in a form such as Excel, on a monthly basis, will further reduce the time needed at the end of the year while allowing real-time tracking of emission-reducing measures.

Based on emissions inventories, water districts can pinpoint the largest sources of emissions and the most energy-intensive activities. This information can help prioritize projects in order to reduce emissions for the region and save money for the water districts. A key outcome of emissions tracking and identifying successful emissions-reduction measures undertaken by water districts in the Inyo-Mono IRWM region will be information sharing and mutual assistance among area water purveyors.

Finally, by identifying the energy use data and district-specific information needed, and by working through the three case studies included in this inventory, a proof-of-concept was developed. With the knowledge gained, it will be faster and easier to help similarly-sized districts inventory their emissions.

Moving forward, the Inyo-Mono RWMG would like to explore and test methods to help and encourage smaller water districts, as well as households and communities on individual wells and septic systems, to inventory their water-related emissions. Additionally, referring back to Figure 3-15, inventorying water-related emissions at the end user point (e.g., water heating) would help to paint a more complete picture of the energy embedded in water. A more detailed description of the water-energy nexus in the Inyo-Mono region will more fully inform water management and allow the IRWM Program to continue to act as a model for the Sierra and similar rural, mountain regions.

3.5 Carbon Sequestration

Carbon sequestration is a climate change mitigation action that aims to remove carbon dioxide from the atmosphere and store it in vegetation or soils. In regions with climates that support carbon-rich soils, or that have a large potential for reforestation, carbon sequestration may be a viable option for mitigating GHG emissions. Due to the very dry climate and relatively sparse vegetation in the Inyo-Mono region, soils hold little organic matter and have high mineral content. Thus, soil sequestration is not a viable option. Carbon sequestration in vegetation also does not hold much promise in this region. There has been little deforestation due to logging and other anthropogenic disturbances, so there is little opportunity for reforestation. Furthermore, most of the forests in the region are overgrown due to fire suppression, so they will likely become a source of carbon emissions rather than a sink. It seems that the best option for mitigation of GHGs in the region is to reduce emissions from the sources.

Conclusion

"In presently dry regions, drought frequency will likely increase by the end of the 21st century…Climate change is projected to reduce raw water quality and pose risks to drinking water quality even with conventional treatment, due to interacting factors: increased temperature; increased sediment, nutrient, and pollutant loadings from heavy rainfall; increased concentration of pollutants during droughts; and disruption of treatment facilities during floods. Adaptive water management techniques, including scenario planning, learning-based approaches, and flexible and low-regret solutions, can help create resilience to uncertain hydrological changes and impacts due to climate change" (IPCC AR5 Summary for Policymakers).

The Inyo-Mono RWMG and Program Office staff will continue to work to understand the potential (and current) impacts of climate change in the region as well as options for responding to those impacts. A key need for water and land managers in the region is better access to up-to-date climate change information, as well as information (such as models) developed on scales appropriate for land and water management and planning. The RWMG will continue to serve as a liaison between agencies and institutions producing information, and agencies and organizations requesting that information.

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Chapter 4 : Data Management

Introduction

The Inyo-Mono IRWM Program strives to provide a central hub for water related data and information in the region. In a region of this size, water information is voluminous and can span over a century. Yet historically the sharing of this information has been difficult due to high political tension, geographic separation, rural technology challenges or just low prioritization.

The Inyo-Mono IRWM Program has created a platform for the sharing of these data and information through the development of the Regional Water Management Group, an Integrated Regional Water Management Plan, and a continually improving IRWM Program website. (http://inyo-monowater.org/)

Significant resources were invested in the Program and website development as a fundamental step in facilitating open communications among once silent stakeholders. From this grassroots effort, a Program has been built that has succeeded in bringing some much overdue funding for water projects to the region. With success comes an added responsibility to monitor the implementation of the IRWM Plan as well as meet more specific grant deliverables to ensure our regional planning efforts do not merely exist on paper.

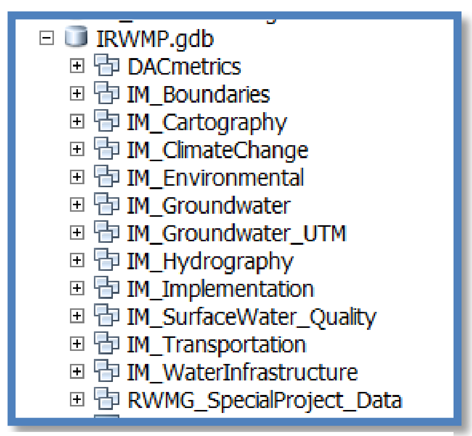
This chapter addresses the requirements specified in the revised 2012 Plan Standards and at the same time reflects our regional data management needs and priorities.

4.1 Building an Integrated Regional Water Management Program

Once the Integrated Regional Water Management planning effort began in the Inyo-Mono region, the Program focus for data collection fell to assessing and addressing fundamental issues and needs of the newly established IRWM region. Data acquisition mirrored current needs and remained fairly basic in its extent, consisting of baseline stakeholder data and the beginnings of regional project needs list. As expected, minimal data collection, coupled with a small IRWM Program Office staff, equated to the low prioritization of an official data management program.

With the attainment of the first Planning Grant, the RWMG was able to hire additional staff that brought a complementary set of skills and helped continue to build the Program. Tasks for the new staff under the Round 1 Planning Grant included the development of an improved Program website as well as the creation of a land and water planning documents digital library that was hosted on the redesigned site. Additionally, the concept of an online project upload form was born and implemented, which in turn populated a Regional Project Needs Database.

Figure 4-1: Organizational structure of Inyo-Mono file geodatabase



Additionally, a large amount of spatial data were given to the Program Staff by RWMG stakeholders upon the Inyo-Mono IRWM Program launch. Many of these data existed on hard disks with minimal record of the acquisition date, origin or other valuable metadata. Data were redundant, legacy and/or incomplete in many cases and were stored in differing projections and datums, which commonly lead to alignment issues of the data thus necessitating the need for skilled GIS personnel to make basic maps. To remedy this situation, the Program Office has worked steadily to consolidate a plethora of disparate spatial data into a file geodatabase. This effort purged redundant or legacy datasets and reorganized and reprojected all datasets using the same spatial reference information. This effort resulted in a new hierarchically organized IRWM Program file geodatabase and contained feature datasets for each major category deemed necessary by the Inyo-Mono Program (Figure 4.1).

4.2 Data Management System & Information Sharing

The Water and Land Use Planning Documents Digital Library, the Regional Project Needs Database, and the newly-developed IRWM Program Geodatabase provide the building blocks for the Inyo-Mono Data Management System (DMS). The 2012 Guidelines and the revised data management plan standard repeatedly refer to a DMS for regional data sharing and organization. Given that the DMS itself is not defined by DWR, it leaves the function, architecture and purpose of the DMS open to regional interpretation. With that, the Inyo-Mono IRWM Program has analyzed regional data availability, data needs, current finances, and the future of the IRWM Program to come up with a DMS that is economically feasible, meets our regional needs, and addresses the current plan standards.

Thus the Inyo-Mono DMS is being organized into three distinct segments, each of which the data sharing capabilities are outlined in *blue italicized text*.

- Spatial data will be housed in the aforementioned Inyo-Mono **IRWMP geodatabase**. The advantage of the geodatabase is that all spatial data are kept using a standard datum (NAD 83) and projection (UTM Zone 11 N) for the region. This allows for less experienced GIS users to easily and quickly generate one-off map products in a timely manner without needing advanced troubleshooting knowledge of common GIS alignment issues that arise with poor metadata.

  File geodatabases are easy to zip and email to stakeholders or other interested parties and leave little room for alignment issues due to metadata ambiguity as is common when sharing independent ESRI shapefiles.

- Land Use and Water Planning documents are voluminous in a geographic area this large. Thus, electronic versions of relevant planning documents are housed on the Inyo-Mono IRWM Program **digital library**. This allows for a centralized location for all stakeholders and interested parties to learn more about both land use and water planning efforts in the region. The development of this library has helped stakeholders become familiar with planning documents relevant to their community, organization, or project area. This format also allows for low-cost maintenance and is simple to update frequently changing documents.

  The majority of the planning documents are available for download from the library. However, some larger planning documents file sizes make housing the document on the

Inyo-Mono website prohibitive, in those instances; documents are linked to the parent site. (http://inyo-monowater.org/resources/library/)

- Aspatial data will be housed in a traditional **Microsoft Access Database**. Currently, these data are scattered in abundant Microsoft Excel or Google spreadsheets and other document formats. The need for a comprehensive database to consolidate all these data has been known for some time, and work has begun to design and build an Access Database for these aspatial components. By choosing Access, the finished database will provide an efficient way to define, create, query, update, and administer program level data. Access databases can also readily accept exported data from ArcGIS products, and conversely table objects from the database can also be imported and joined to assigned spatial components within ArcGIS.

  An Access database can be easily attached via an email to interested parties who can then apply more advanced queries for increased performance of the data if needed. Further, specific tables of data can be easily published to the web via .html or .pdf files or exported to Excel for integration into statewide databases or other program databases that use Excel. At an additional cost, the Access databases can also be shared via a Microsoft Sharepoint site if the need for server-based data applications arise in the future.

  The database will provide a user-friendly interface using custom forms, queries, and reports to input and analyze program data. Data validation rules and input masks will be applied at the design level to ensure data quality assurance and control measures are in place and that data input into the database meet baseline quality control and assurance parameters.

  Initial database design is underway. Full implementation of the Access Database will be completed as part of the Round 2 Planning Grant.

Beginning in 2019, an adjunct DMS for the Inyo-Mono region is being developed through the Prop. 1 Disadvantaged Communities Involvement grant. This additional DMS is not intended to take the place of the three distinct parts of the current DMS detailed above; rather, this GIS-based DMS will provide a more user-friendly platform for stakeholders to view and explore various aspects of the IRWM Program and region. In addition, it is being developed in conjunction with DMSs for several neighboring IRWM regions and will showcase a common approach among these regions.

With these fundamental tools in place, the Program will be poised to better meet the data and information needs of our stakeholders.

4.3 Data Needs within the IRWM Region

While the Inyo-Mono IRWM Program has been able to make considerable strides in the area of data acquisition and management, it is not surprising in a geographic region of this size that substantial data gaps remain.

4.3.1 Challenges of Census Data in Rural Areas

One primary challenge is the fact that U.S. Census data are not available for much of the region, or they are inconsistently available, even within individual Census-designated communities. Only 46 of the 73 locally recognized communities within the region are even recognized by the U.S. Census bureau. This makes understanding basic demographics more difficult, as we begin to explore patterns and trends of data throughout the region.

4.3.2 Large Water/Energy Utilities Unable to Prioritize Participation

A secondary challenge is that the Los Angeles Department of Water and Power, as well as Southern California Edison, remain intermittent in their IRWMP participation. These two entities hold a vast amount of water and environmental data that are only available to the public where mandated by law. An immense amount of their data remains proprietary and leaves a large gap in our understanding of both surface water and groundwater and well as the water-energy nexus in the Inyo-Mono region. Without these two major players, it is difficult to fully integrate all of the water management efforts in the region. The Inyo-Mono IRWM Program staff and stakeholders continue to explore ideas of how to engage these valuable stakeholders.

4.3.3 Military Lands

Two major military inholdings operate within the boundaries of the Inyo-Mono IRWM Region. The first is the Marine Corps Mountain Warfare Training Center, which is located 21 miles north of Bridgeport in Pickle Meadows, CA. This military installation has been in operation since 1951 and currently supports billeting facilities for some 1200 training personnel not including permanent staff. Another 111 offsite homes are offered at the Lincoln Military Housing Area in Coleville, CA.

The second installation is the China Lake Naval Air Weapons Station, northeast of Ridgecrest, CA. “China Lake is the United States Navy's largest single landholding, representing 85 percent of the Navy’s land for weapons and armaments research, development, acquisition, testing and evaluation” (Wikipedia, 2014). Though largely undeveloped, infrastructure on the base includes over 2,000 structures, hundreds of miles of roads, and a transient population of some 9,500 service men and women.

The geographic footprint and assigned personnel on these military installations and their associated strain on water resources within the region are recognized. Frequent changes in military staff make it challenging to maintain reliable contacts at the various bases. Efforts will continue to acquire data and establish communications with these military units to promote coordination and fill the gaps of water resources knowledge within the region.

4.3.4 Climate and Ecological Data

Because of the region’s vast size and relative isolation with respect to urban centers in California, the climate and ecology of the region are relatively poorly-understood compared to other parts of California. A recent increase in research interest in the region is helping to fill in data gaps. Similarly, few climate change forecasts have been developed specifically for the region or areas within the region (see Chapter 3 for a further discussion). This lack of forecasting information complicates water planning activities.

4.3.5 Local Monitoring Efforts

It is known that numerous entities within the RWMG as well as those who remain more distant from IRWM planning activities collect routine water quality and flow data. To date, efforts to consolidate this information have not been initiated for a number of reasons. Primarily, the RWMG has chosen to focus on meeting critical water infrastructure needs which are abundant. Given the laborious nature of participating in IRWM planning activities, and project prioritization, local water monitoring data consolidation has not been a priority. In the future, it would be ideal to be able to house data from those efforts in the Inyo-Mono GIS as well as the Access Database.

4.4 Available Data

This section outlines the data available and used by the Inyo-Mono IRWM Program to help answer questions and share information about our region.

4.41 Stakeholder Data Contributions

As with most regional water management groups, the stakeholders in the Inyo-Mono region are enormously diverse, ranging from small Community Service District representatives, local and federal government organizations, non-profit groups, and large urban water and power utilities. Given that diversity, the amount, quality and types of data generated and contributed from each of these stakeholders vary dramatically. This section provides a brief summary of the types of data available from our stakeholders.

Mono County

The Mono County GIS department is the most comprehensive geospatial data contributor in the region. Their website hosts a robust online data center that provides geospatial data files for the majority of public data they manage. Esri shapefiles (.shp) files are available for download from this site at no charge, with the exception of some of the Mono County imagery collection. Imagery, because of its large file size, is available by regular mail on DVD for a small fee. Data from this site are limited geographically to Mono County and the Town of Mammoth Lakes. (https://gis.mono.ca.gov/site/data)

Inyo County Water Department

The Inyo County Water Department (ICWD) monitors the vegetation, soil water, and hydrology of the Owens Valley to help manage groundwater exports by the City of Los Angeles. ICWD assists in the implementation of the County Policy on Extraction and Use of Water. Inyo County and the LADWP use this information to jointly manage the Owens Valley's water resources under the Inyo/Los Angeles Water Agreement. ICWD also advises the County on other water resource issues in Inyo County. (http://www.inyowater.org/)

The ICWD has recently completed a much-needed overhaul of its website, which now provides a rich source of data and information specific to the Owens Valley and its water resources. The site houses a variety of documents, legal agreements, reports, and data, all of which revolve around the joint management of water resources in the Owens Valley. In many instances, these documents are also linked in the digital documents library on the Inyo-Mono Program website. (http://inyo-monowater.org/resources/library/)

Kern County

The Kern County Water Agency (Agency) maintains a robust relational database that can store data relating to groundwater, surface water, hydrologic conditions and well production, and well construction for Kern County. The Agency also maintains GIS applications that are provided to Indian Wells Valley Cooperative Groundwater Management Group in the form of groundwater elevation maps, watershed conditions, geological information, cadastral, population, and assessors' data.

San Bernardino County

The portion of San Bernardino County that lies within the Inyo-Mono Region is by far the least populated and developed portion of that County as well as within the Inyo-Mono Region. Thus, data availability for this area is limited compared to its surroundings. Further efforts need be employed to seek out available data for this sector of the planning area. Initial communications with San Bernardino County officials indicate that our local knowledge of the section of the region contained within San Bernardino County may be greater than any data the County has on file.

Los Angeles Department of Water and Power

As mentioned above, the LADWP works with Inyo County to manage the water resources in the Owens Valley. LADWP also manages additional water resources near Mono Lake in central Mono County. Due to its significant water interests, LADWP has monitored hydrologic and weather conditions in the eastern Sierra for over 100 years. More recently, LADWP has been required to produce numerous reports and environmental documentation as part of the various legal agreements that have been put in place to ensure that local resources are protected while providing water to the City of Los Angeles.

Data that are required to be made publicly available are housed on the LADWP website and linked through several other sites. Hydrologic data include real-time flow data, daily Los Angeles Aqueduct reports, precipitation conditions, Lower Owens River Project (LORP) flow and monthly reports, and current weather conditions along the aqueduct. Additionally, LADWP performs their own snow surveys to better forecast summer water supplies. (https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-losangelesaqueduct/a-w-laa-laaqueductconditionsreports?_adf.ctrl-state=d3wzwpu62_64&_afrLoop=896665869580153)

Further extensive environmental documentation is provided on the revised LADWP website, including annual reports and planning documents for the Owens Valley that address various subjects such as endangered species preservation, drought recovery, and groundwater pumping effects on vegetation. (https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-losangelesaqueduct/a-w-laa-environmentaldocumentation?_afrWindowId=null&_afrLoop=894895328073699&_afrWindowMode=0&_adf.ctrl-state=tztl7wcmc_17#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D894895328073699%26_afrWindowMode%3D0%26_adf.ctrl-state%3Dd3wzwpu62_17)

In many instances, these data are also linked from the Inyo County Water Department website directly to LADWP's website so that the County does not have to maintain the voluminous data source. The same is true for the Inyo-Mono IRWM Program website where many of the water planning documents can be found.

Mono Lake Committee

The Mono Lake Committee has worked for decades toward the preservation of healthy lake levels for this unique landlocked saline lake in central Mono County. The committee has a membership of approximately 16,000 concerned citizens who work together toward the protection of this resource. In doing so, the committee maintains a website for public outreach as well as a data center known as the Mono Basin Clearinghouse. The clearinghouse contains a wealth of data and reports specific to the lake, including raw data, historical documents, legal transcripts, current research, relevant chronologies, and a link to state-level GIS data sources. (http://www.monobasinresearch.org)

Mammoth Community Water District

The Mammoth Community Water District has been a keystone stakeholder in the Inyo-Mono RWMG, actively participating in nearly every component of the planning process. Additionally, the District manages a strong in-house GIS and water quality data management program from which they have generously shared data. The District has provided both aspatial and spatial data and served in an advisory role with respect to data management and organization. They also work closely with the GIS departments of Mono County and the Town of Mammoth Lakes. As a result, water-related data for the town of Mammoth are comprehensive, well organized, and readily available.

United States Geological Survey

The United States Geological Survey (USGS) provides a comprehensive suite of water quantity, and in fewer instances, water quality data throughout the region. These data can be accessed using the National Water Information System (NWIS) online database. (http://waterdata.usgs.gov/nwis) An abundance of surface water, groundwater, and water quality data may be obtained from this website.

For the last 100 years, the USGS has explored groundwater resources throughout the region, leaving behind a network of monitoring wells that provided various levels of groundwater elevation data. Historically, this network contributed valuable groundwater data from 387 well locations in Inyo County and 133 in Mono County (Figure 4-2 USGS, NWIS, 2012). Currently, the majority of these wells sit idle and no longer provide groundwater data to the region. For specific USGS wells, monitoring may have been discontinued for a number of reasons. In some cases, monitoring responsibilities were transferred to other entities. Other monitoring efforts ceased due to decreases in funding or completion of specific projects of limited time and duration.

National Water Information System (NWIS) databases include all past monitoring locations. Upon initial discovery, the data are deceiving with regards to current data availability within the region. Of the total USGS-owned wells given in the database for Inyo and Mono Counties (520 wells), only a small percentage (30 wells or 5%) have continued to serve as monitoring wells within the region (USGS, 2012). The comparative maps that follow (Figures 4-2 and 4-3) were created to illustrate the loss of data collection capacity as well as infrastructure associated with USGS and other efforts.

During the past decade, even fewer USGS monitoring data have been collected. At present, only two USGS monitoring locations are providing consistent groundwater data within the region (Long Valley Caldera study area: USGS Well # LV19, 4S28E1F1M and

USGS Core Hole #CH10B, 3S29E30E2M; USGS, Personal Communication, 2012).

The extent of USGS surface water gauging stations is also reduced from past efforts. In the past, there existed 47 USGS stream gaging stations in Inyo County and 36 in Mono County, all which contributed surface water information for the region. Due to downscaled funding within the USGS, those surface water gauges currently collecting data have been drastically reduced, leaving only two in Inyo County (both on the Amargosa River) and less than a dozen in Mono County, all of which are concentrated in a few locations: Bridgeport Valley, East and West Walker Rivers, and the critical streams near Mammoth Lakes (Figure 4-4). Some historical USGS gauges in Owens Valley have been transferred to LADWP. Although the USGS stations yield predominantly flow data, on rare occasions some sites have water quality data available (USGS, Personal Communication, 2012).

Figure 4-2: Historic Groundwater Data Acquisition

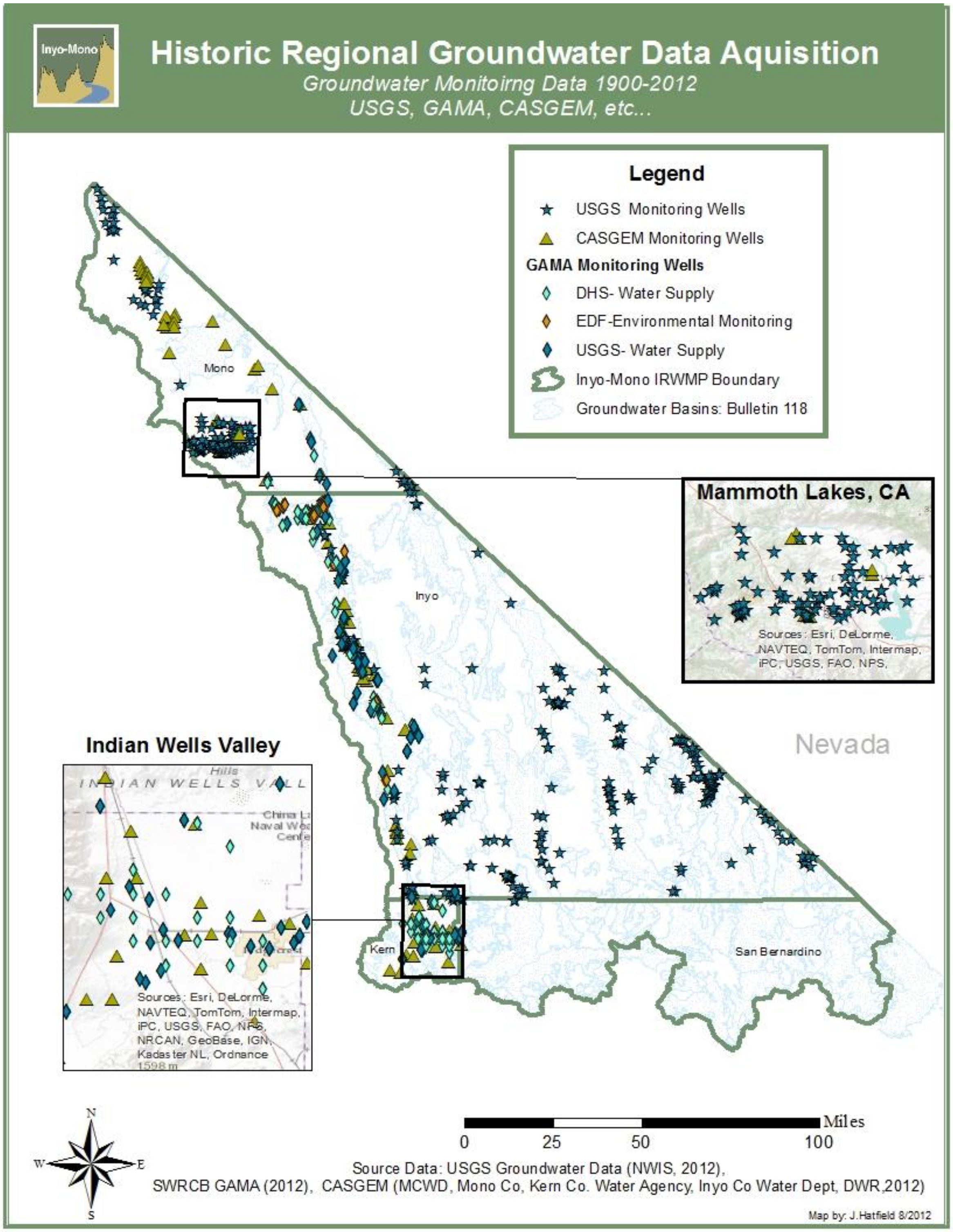
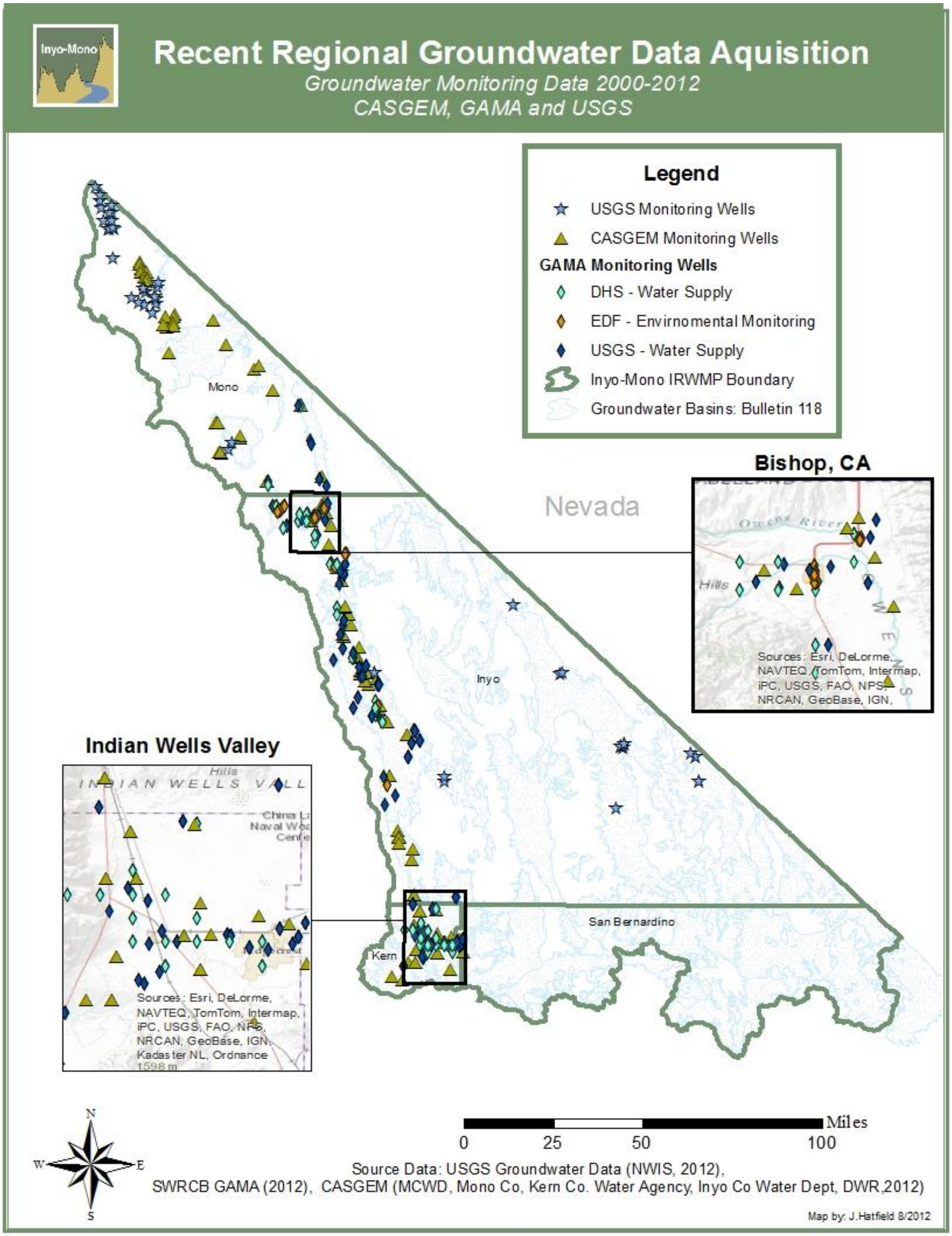


Figure 4-3: Recent Groundwater Data Acquisition



United States Forest Service

Federal data are also quite important given the percentage of federally managed lands within the region. The Inyo National Forest in particular contributed environmental and boundary data to the Inyo-Mono IRWM Program. In addition, some USFS national efforts have generated watershed specific data for the region.

Watershed Condition Framework

The Watershed Condition Framework leverages work done by the USFS to evaluate watersheds managed in full or part by the USFS. The USFS analysis utilized basins described by their 12-digit hydrologic code, which is a nationally standardized naming convention designed by the USGS to identify watersheds at various levels. "The Watershed Condition Framework (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands" (USDA, 2011a). The report recognizes the watershed as a fundamental component of broader ecosystem health and was designed for the USFS as a first step in a larger six-step watershed restoration process. As a first step, each watershed was evaluated against the Watershed Condition Framework using the Watershed Condition Class assessment, and one of three classes was assigned to each watershed: Class 1=Functioning Properly, Class 2=Functioning at Risk, or Class 3=Impaired Function:
(http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf
http://www.fs.fed.us/publications/watershed/watershed_classification_guide.pdf/)

An ArcGIS Online map has been provided by the USFS to promote integration of this effort with other planning efforts. The Inyo-Mono IRWM Program has utilized that map to create a version specific to the Inyo-Mono Region as a way to further promote integration of information. (http://inyo-monowater.org/wcf-map/ ,http://apps.fs.usda.gov/WCFmapviewer/)

Of local significance, the Oak Creek and Deadman Creek watersheds were selected as priority watersheds by the Inyo National Forest as a result of its collaborative work on the Watershed Condition Framework. Consequently, the USFS, in partnership with the Fort Independence Indian Reservation, received a Prop. 84 planning grant award in the amount of $75,000 to begin a Stream Rehabilitation and Stabilization Study for the Oak Creek Watershed.

Forests to Faucets

The USDA Forests-to-Faucets project "uses GIS to model and map the continental United States land areas most important to surface drinking water, the role forests play in protecting these areas, and the extent to which these forests are threatened by development, insects and disease, and wildland fire. The results of this assessment provide information that can identify areas of interest for protecting surface drinking water quality. The spatial dataset can be incorporated into broad-scale planning and can help identify areas for further local analysis. In addition it can be incorporated into existing decision support tools that currently lack spatial data on important areas for surface drinking water" (USDA, 2011c).
(http://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml)

Again, capitalizing on work already performed by the USFS, the IRWM Program has provided an ArcGIS Online version of the USDA Forests-to-Faucets map to bring regional relevance to the work done by the USFS in the region. Key scores to high-ranking watersheds are also provided in summary beneath the map on the provided web page. (http://inyo-monowater.org/forest-to-faucets/)

The Surface Drinking Water Index map layer gives particular weight to mountain/headwater regions in recognition of their role in providing high-quality drinking water to distant urban regions, giving considerable weight to a number of HUC-12 watersheds in the Inyo-Mono region. High scores indicate greater importance to surface drinking water.

Table 4-1: USDA Forest to Faucets: Surface Drinking Water Importance Index

USDA Forest to Faucets: Surface Drinking Water Importance Index for Inyo-Mono Region Watersheds	
Watershed (HUC-12)	**Score**
Goodale Creek-Owens Valley	97
Grant Lake	97
Mammoth Creek	96
Rush Creek	95
Convict Creek	93
South Fork of Bishop Creek	93
Hot Creek	92
Dry Creek	91
Lake Crowley-Owens River	91
Oak Creek	91

Department of Water Resources

CASGEM

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program was initiated by the State legislature's SBX7-6 in 2009 to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. Groundwater elevation monitoring was scheduled to begin in 2012 and is to be done by local entities that are approved as Designated Monitoring Entities by DWR. The CASGEM program has already begun to generate valuable groundwater data within the region. Currently, local entities are strategizing as to how to fund such programs within already restricted budgets, while fully realizing the value of the potential data generated within the CASGEM program. CASGEM groundwater data being collected both within the region and throughout the State are available through DWR's Water Data Library. (http://www.water.ca.gov/waterdatalibrary/)

CASGEM's approved Designated Monitoring Entities within the Region include Inyo County, Los Angeles Department of Water and Power, Indian Wells Valley Cooperative Groundwater Management Group, Tri-Valley Groundwater Management District, and Mono County (a conditionally approved Monitoring Entity as of January 2012). Continued efforts are being made to prioritize expanded CASGEM efforts within the region.
(*http://www.water.ca.gov/groundwater/casgem/designated_entities.cfm)*

Climate Change

Over the past decade, there has been an increasing amount of climate change information and data available to California water managers. Although DWR does not directly collect many climate change-specific, the data it does collect and house (such as CASGEM) will be helpful to IRWM practitioners moving forward. However, DWR has worked to become a resource with respect to climate change and regional water management. In 2011, DWR, in cooperation with the EPA and the Army Corps of Engineers, released the Climate Change Handbook for Regional Water Planning (EPA 2011), which provides guidance to regional water management groups performing climate change analyses for their regions. In addition, DWR has made four staff members available to IRWM regions to help provide climate change information and resources. More recently, DWR's Climate Change Technical Advisory Group has been charged with developing a set of recommended global climate models for use by DWR and other water planning entities and will release these recommendations by the end of 2014.

State Water Resources Control Board

Major data collection and monitoring programs spearheaded by the State Water Resources Control Board (SWRCB) include the Surface Water Ambient Monitoring Program (SWAMP) and Groundwater Ambient Monitoring and Assessment Program (GAMA).

GAMA

"The GAMA Program was created by the State Water Board in 2000. It was later expanded by Assembly Bill 599 – the Groundwater Quality Monitoring Act of 2001. The main goals of GAMA are 1) to improve statewide groundwater monitoring, and 2) to increase the availability of groundwater quality information to the public" (SWRCB, 2012a). (http://www.swrcb.ca.gov/water_issues/programs/gama/)

Data collection for the GAMA program in many instances began before the program's "official" start in 2000, with data available for the Inyo-Mono Region from as far back as 1984 (SWRCB, 2012b). Live, online data resulting from the GAMA Program can be retrieved for a handful of monitoring wells located within the region through the SWRCB geotracker link below, although downloadable data appear to be more complete. (http://geotracker.waterboards.ca.gov/gama/)

Also available through the GAMA website are groundwater basin water quality assessments from the CA Groundwater Bulletin 118 updates for all California counties. Of interest to the Inyo-Mono Region are data for Inyo, Mono, Kern, and San Bernadino Counties: (http://geotracker.waterboards.ca.gov/gama/gamamap/public/gama_reports.asp?county=INYO)

SWAMP

The SWRCB also leads an extensive Surface Water Ambient Monitoring Program (SWAMP) data collection effort that can be accessed through the California Environmental Data Exchange Network (SWRCB 2012c; CEDEN, http://ceden.org/). Within the Inyo-Mono Region, there are approximately 68 stations that collect or have collected SWAMP data, the majority of which were parts of studies conducted by the University of California Sierra Nevada Aquatic Research Laboratory from 1999-2007. Station locations are concentrated mainly on the Walker River and Mammoth Creek/Hot Creek with additional outlying stations dispersed throughout the region.

Figure 4-4 below details surface water quality data (SWAMP), and Figure 4-2 details groundwater data (GAMA) currently available from within the regional boundaries from the SWRCB.

4.4.2 IRWM Program Data

Additional IRWM Program-generated data that will contribute to the Inyo-Mono Data Management System's Access database as well as the IRWMP geodatabase are summarized below.

Stakeholder Involvement Data

At its inception, the Inyo-Mono Program began collecting basic stakeholder information, which formed the basis of Program-level data. These data included stakeholder contact information and MOU signatory status, stakeholder attendance at RWMG and committee level meetings, and attendance at capacity-building workshops and trainings. These data also include participation in Plan and Project review processes. Thus these data are indicators of the level of involvement of a particular stakeholder.

Census Data

As the program grew, baseline Census level data were obtained to begin to study the region's demographics in order to better focus aid and outreach, and to identify disadvantaged communities. Immediately, we understood that Census data were limited in what they could teach us given that 36% of the population centers of the region are not represented in Census surveys. Also included within this category are American Community Survey data, which are generally collected on a more frequent schedule than decennial Census data.

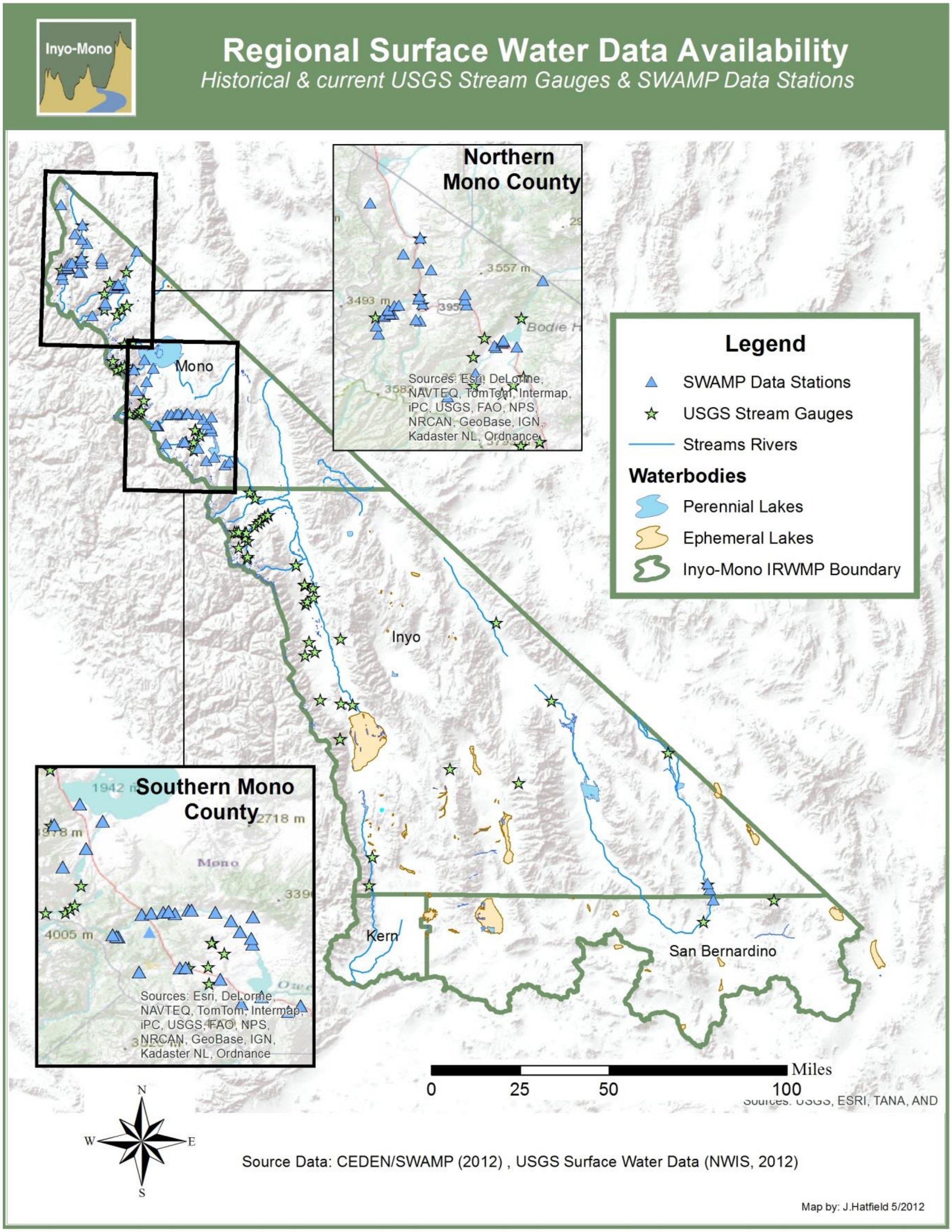
Outreach Effectiveness Data

As the Program grew and grant funding was secured, the Inyo-Mono Program was able to significantly ramp up outreach efforts, particularly to the more remote, smaller, and/or more disadvantaged communities. Hours of travel and a variety of communication methods were employed to seek out much needed information that could begin to fill gaps in our understanding about the water needs of various geographies in the region. Included in these efforts were multiple open-house events, one-on-one meetings with water systems and other stakeholders, individual water system needs assessments and surveys, and consistent follow-up communications aimed at collecting information about Plan objectives and resource management strategies, water-related regional issues, project needs, training deficiencies, and water system-specific information. These efforts were documented in various ways, including calendars, agendas, and meeting notes.

Regional Project Data

The Phase I Planning effort yielded a list of 101 project needs in the Inyo-Mono Region. Fifteen of these projects were submitted in the Prop. 84 Round 1 Implementation Proposal, of which seven received funding. Three additional projects were granted funding through the Prop. 84 Round 2 Planning Grant as planning studies. Information on the 101 projects was collected through the use of a spreadsheet submitted to the Program from individual project proponents.

Figure 4-4: Regional Surface Water Data Availability



For second Implementation Round, an online project upload form was designed to ease the administrative burden of Program Staff, as well as to feed directly into the Program's Regional Needs Database. Stakeholders were asked to submit projects still viable from the initial list of 101 projects, as well as any new projects they wished to be eligible for the second implementation round. This process ultimately led to a reduction of projects, which is likely attributable to the increased amount and specificity of information required by the online upload form, together with stakeholder skepticism and fatigue following the Round 1 Implementation application process. These projects make up the Regional Needs Project Database and include basic project information such as cost, scope, and timeframe as well as relation to Inyo-Mono IRWM Plan objectives and RMS. Six projects were funded through the Prop. 84 2015 Implementation round. More information on specific projects can be found in Chapter 13.

Small Water Systems Data

The Inyo-Mono Region contains over 200 small water purveyors. These water systems vary in size, governance, need, and capacity. At the outset of the IRWM planning process, small water system information was recognized as a significant data gap. Through our partnership with California Rural Water Association and US EPA's Safe Drinking Water Information System (SDWIS), we were able to acquire fairly comprehensive data about the systems in our region. Once assembled, these data were shared with respective County Environmental Health departments whose data were also lacking prior to IRWM Program development.

Using the list of about 200 water purveyors, we circulated (online and through U.S. mail) a Small Water System Needs Survey to water managers and operators. This survey was designed to ascertain respondents' level of concern on a number of issues, learn about planning challenges systems may be facing, as well as determine how systems analyze and interpret routine regulatory water samples. Data from this survey helped the IRWM Program select the most "needy" water systems to receive needs assessments from the CRWA. The data were also used to bring a select number of strategically-targeted trainings to the region at no cost to participants while also allowing them to earn continuing education units for their attendance.

Project/Plan Performance and Monitoring Data

With the acquisition of implementation funding comes the need to evaluate projects against their own project-specific monitoring plans as well as against IRWM Plan Objectives and RMSs. To this end, and to monitor IRWM Plan implementation, a Project Performance Checklist was created in 2014. An excerpt of this checklist can be found in Chapter 13: *Plan Performance and Monitoring*. The checklist evaluates project accomplishments using both outcome and output indicators based on the performance measures agreed to in the Implementation Grant Agreement. Additionally, the checklist gives project proponents flexibility to add any monitoring they already perform under other regulatory or voluntary conditions. Lastly, the checklist evaluates projects against Inyo-Mono IRWM Plan objectives and requests the identification of Resource Management Strategies employed to realize said objective. Data from this checklist will be input into the Program database and used to chart Inyo-Mono Plan Implementation.

Implementation Project Data

The process of applying for implementation funding requires collection of data about each project:

feasibility studies, engineering and design plans and specifications, environmental documentation, cost estimates, previous studies, etc. The Program has created a project monitoring page on its website that aggregates valuable information learned through the implementation process. On the page are quarterly invoice reports, final reports, completed feasibility studies, lessons learned, and vendor information for all different phases of the project (http://inyo-monowater.org/implementation-round-1/project-reporting-monitoring/). Eventually, the Program hopes to turn this part of the website into a go-to resource for first-time IRWM project proponents.

Figure 4-5: Small Water System Online Survey

General Water System Information

What is the name of your water system? *

Is your water system currently operating under permit? If so who is the permit issued by

- ○ Not currently permitted
- ○ California Department of Public Health
- ○ County Environmental Health Department
- ○ Other: ______

Does your system have a Water Operator? If so, please indicate below his/her certification level.

- ☐ No Water Operator
- ☐ Level 1
- ☐ Level 2
- ☐ Level 3
- ☐ Water Operator but no "official" certification
- ☐ Other: ______

Who analyzes your water quality samples?

Check all that apply

- ☐ Water Operator
- ☐ Other Staff/Board member
- ☐ Outside consultant
- ☐ Local or State government official
- ☐ No samples taken/water not tested
- ☐ Other: ______

Who interprets your water quality results?

Check all that apply

- ☐ Nobody
- ☐ Water Operator
- ☐ Other staff/board member
- ☐ Outside consultant
- ☐ Local/State government official
- ☐ Other: ______

Is your water source intake achieved through ground water (wells), surface water or both

- ○ Groundwater
- ○ Surface Water
- ○ Both
- ○ Other: ______

Please indicate the level of concern for your system on the following topics:

	No Concern	Limited Concern	General Concern	Moderate Concern	Extreme Concern
Water Quality	○	○	○	○	○
Inadequate water supply for drinking	○	○	○	○	○
Inadequate water supply for fire protection	○	○	○	○	○
Inadequate water pressure	○	○	○	○	○
Aging infrastructure	○	○	○	○	○
Inadequate wastewater infrastructure	○	○	○	○	○
Inadequate staffing	○	○	○	○	○
Storm water and flood protection	○	○	○	○	○
Sustainable Capital Improvement Funds	○	○	○	○	○

Are your current rates sufficient for building capital improvement funds and covering operating and maintenance costs?

- ○ Yes
- ○ No

Downscaled Climate Modeling Data

The Inyo-Mono IRWM Program has worked to generate its own information on climatic changes, impacts, and adaptation options specific to the Inyo-Mono region. Perhaps the most robust information generated thus far are the climate model output summaries for six sub-regions within the IRWM region. These summaries show projections of temperature and precipitation over the coming century using several climate models and greenhouse gas emissions scenarios (see Chapter 3). That we know of, these are the only climate change projection analyses that have been performed at this scale within the region. Similarly, we have developed a vulnerability analysis and an impact assessment based on the unique features of water management in the Inyo-Mono region. The Program will continue to seek out information from climate modelers, agency climate change staff, and local water managers regarding climate change and its impacts in the Inyo-Mono region.

4.4.3 Data Acquisition Methods

From a purely organizational perspective, building on regional IRWMP data is much easier now that the Inyo-Mono geodatabase is in place. Yet data scarcity remains a formidable barrier for the Inyo-Mono Program. This section outlines the primary methods of data acquisition in the Inyo-Mono region in the recent past.

Fundamental Program Data

Day-to-day program efforts contribute to program-level data. Meeting attendance and summaries, stakeholder correspondence, outreach efforts, new contacts, and revolving funding opportunities, along with other types of data, accrue at a fairly consistent rate. These data are currently stored in Excel or Word files managed by Program Office staff. In the future, these data will be input into the IRWM Program Access Database via user-friendly forms to ensure data integrity and database accuracy.

Survey-Level Data

A major source of new data has arisen through the use of surveys of various kinds. Staff have performed field surveys, mailed out paper surveys, and circulated electronic surveys to gain much needed information about small water systems, projects, disadvantaged communities, and training needs within the region.

Emerging Tools & Data

At random intervals, tools with relevant data for the region will be discovered through the professional community, online research, or academia. Examples of these tools include climate models and mapping tools that provide a wide range of outputs relevant to water resources in the region. We have implemented a number of these tools to help us bridge data gaps for the region as well as to assist in our own downscaled climate models and research. Many of these tools provide downloadable data that can be leveraged with our Inyo-Mono IRWMP geodatabase to help broaden the scope and ensure completeness of this resource.

An example of such a tool is the Cal EPA Environmental Health Tracking Program's Water Boundary Tool. The open source online web mapping application sought to collect water service area boundaries for all public water systems in the State of California. The Inyo-Mono region as a whole has poor location information on service area boundaries. Working with CDPH and local environmental health departments, we engaged with stakeholders to learn basic computer skills needed to work with the tool and upload data. http://www.ehib.org/page.jsp?page_key=61 Inyo County has the large majority of its systems input into the tool, but accuracy remains an issue. Data for these systems are easily downloaded via the web and have been input into the IRWMP geodatabase.

4.5 Data Management Responsibility

During the Prop. 84 grants, the Inyo-Mono IRWM Program employed a GIS/Data Management Coordinator who is solely responsible for the management and distribution of Program-level data for the region. Management of other water-related data generated by other organizations remains the responsibility of the parent organization. In a region of our size and limited resources, the current practice is the only feasible way to manage water related data.

Long term viability of a data management program remains a central concern to the Inyo-Mono IRWM Program. Present data generation, collection, and maintenance efforts were possible through Proposition 84 planning grant awards. The lack of programmatic support in Prop. 1 has meant that the data management systems described here are not being kept up-to-date. The lack of such baseline funding jeopardizes the investment in data management the Inyo-Mono Program has made. At this time, Inyo-Mono stakeholders have been reluctant to increase their commitment to IRWMP-related work, citing the already intensive time commitment many Member representatives have in their organizations' duties. Thus the reality of a stakeholder organization adopting the data management portion of the Program upon loss of programmatic funding is unlikely and risks a loss in the investment in integrated regional water management planning in the region. Regardless, the digital library, file geodatabase, and Access database will work in unison to preserve institutional knowledge of progress made thus far in the event a gap in funding is encountered.

4.6 Data Quality Assurance and Control Measures

With heightened momentum in a data management program, the need for quality assurance and controls became immediately obvious. In response, a Data Management Plan (DMP) was created for the Inyo-Mono IRWM Program. This plan outlines best practices for spatial data creation, acquisition, and management to ensure that the sharing of data is met with a baseline level of confidence. The DMP also articulates how the Access Database will improve data quality through the use of validation rules and input masks as well as a well-designed user interface for non-technical database users.

Further, the plan creates a standardized file naming convention for Inyo-Mono Program aspatial data files so that file names are easily recognizable, sortable, and dated for all internal Program documents. The complete Data Management Plan is available in *Appendix A.*

4.7 Data Compatibility

The request from the Department of Water Resources for IRWMP regional data compatibility with State databases like CEDEN, CASGEM, CEIC, CERES and the WDL is a tall order. These databases each require unique data standards, specific vocabulary, and often complex formatting for data submission.

For surface water and groundwater quality projects, data will be submitted to such databases as required by the grantor. Where required, project data that are prepared for submission into statewide databases will be seamlessly consumable by the Inyo-Mono Program's Access Database. This will preserve the data in required format for the appropriate statewide database, while enabling the Inyo-Mono Program to integrate the data into queries and reports for regional analyses.

Fortunately, data from these statewide databases can easily integrate into the Inyo-Mono Access Database due to the ease of importing Excel data into Access or alternatively using the data as an external data source. Similarly, State programs such as CASGEM that export data as ESRI shape files can be downloaded and re-projected in the Inyo-Mono File Geodatabase as a new feature dataset. Subsequently, the tabular components of those data can easily be imported into the Access Database to be used in creating queries, forms and reports and for other local analyses.

Currently the Inyo-Mono Access Database is designed to use the State Drinking Water Information Systems (SDWIS) data as an external table to create queries that match public water systems with funding opportunities within the database. The advantages of linking statewide data externally to the database include improved performance and the preservation of data management responsibilities at the State level.

4.8 Technical Analysis

Numerous data sources were used in the generation of this plan. For clarity purposes, a comprehensive table of data used to generate all tables and figures as well as a synopsis of technical analyses performed can be found in Appendix F.

Conclusion

The data segment of the Inyo-Mono IRWM Program has recently been gaining traction due to consistent programmatic funding for planning in the region. Given the lack of a large well-funded entity providing financial support to planning and programmatic efforts, the Department of Water Resources financial support has been vital to this effort. Data collection, organization and sharing have evolved from a few basic Excel spreadsheets to a full three-part Data Management System.

The Inyo-Mono DMS has been designed to preserve institutional knowledge in the event of a funding gap, meanwhile organizing three main types of related data and information relevant to the local IRWM effort. This organization allows for straightforward sharing of information with stakeholders, other regions and the State by providing the data in common software packages that are standard in the industry. By utilizing these three components (File Geodatabase, Access Database, and Digital Library), data updates and maintenance are relatively quick and inexpensive. Data in this type of system do not require those outside the region to learn an entirely new system to access data due to our choice of software packages, thus facilitating the sharing of our regional information with others.

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Chapter 5 : Governance

Introduction

The Inyo-Mono Regional Water Management Group (RWMG) has operated successfully for 11 years as a collaborative, consensus-based organization. The initial governance structure, described below, was put into place with the first Memorandum of Understanding (MOU) in 2008 and still exists today. The Inyo-Mono RWMG continues to be committed to transparent, open, and collaborative regional water planning for eastern California and wants to see continued financial and technical resources brought to the region.

5.1 Governance Structure

A MOU sets out the governance structure of the Inyo-Mono IRWM Program. The RWMG acts as the primary forum for MOU signatories (also known as RWMG "Members") and other participants to meet and discuss issues relevant to IRWM Plan development and implementation. All decisions about the Inyo-Mono IRWM Program are made by the RWMG. The RWMG is the final approval body for the IRWM Plan components, including, but not limited to, goals and objectives, project prioritization, funding proposals to finance and implement the Plan, hiring and overseeing management of consultants and staff, and approving any revisions to the MOU or the Plan itself. RWMG Members that have signed the MOU are affirming their commitment to the success of the Inyo-Mono IRWM Program, including: ensuring long-term ecosystem health of the area watersheds; protecting water supply and water quality; involvement of local communities, especially disadvantaged communities; building institutional and human capacity; protection, preservation, and restoration of natural resources of the Inyo-Mono region; and open communication and collaboration. There is no financial requirement to participate in the RWMG either as a Member or an interested party.

Initially, the Inyo-Mono RWMG met about once per month, and now meets approximately once per quarter, usually in Bishop or Mammoth Lakes, which are the two most geographically central communities in the region. *RWMG meetings are always open to the public and are posted in local media outlets, on the Inyo-Mono website, and through County Board agendas, in compliance with the Ralph M. Brown Act.* RWMG meetings also always have a call-in option in recognition of the large geography of the region. Throughout much of the pre-planning phase, RWMG meetings were facilitated by a qualified contracted facilitator from the Center for Collaborative Policy. Due to the State budget freeze in December 2008, the Inyo-Mono RWMG was no longer able to employ the services of the facilitator, and Program Office staff began facilitating RWMG and Administrative Committee meetings.

Under the November 15, 2010, MOU (described in next section), an Administrative Committee replaced what was the Coordinating Committee during the pre-planning governance structure. The Administrative

Committee is made up of six RWMG Members. The primary roles of the Administrative Committee are to provide advice and guidance to the Program Office and to help guide the decisions and process of the RWMG. The Administrative Committee helps to review materials to be presented at RWMG meetings, including agendas and other documents. A new role of the Administrative Committee is to help resolve conflict within the RWMG – for example, when consensus cannot be reached on a particular decision item. The Administrative Committee may also play a role in developing substantive proposals, policies, and recommendations at the request and subject to approval of the RWMG, but the Administrative Committee has no decision-making authority. All RWMG Members have the opportunity to serve on the Administrative Committee on a rotating basis. Three Administrative Committee seats will rotate each year to new members, and three will remain for another year to provide consistency between years. At the time of the writing of this Plan, the members of the Administrative Committee were: Mammoth Community Water District, Indian Wells Valley Water District, Sierra Club, and Eastern Sierra Audubon Society, City of Bishop, and Fort Independence Indian Reservation.

The Administrative Committee also appoints a new Chair and Vice-Chair every six months. These positions are used as primary contacts for the Program Office to review agendas and provide general guidance and advice on a more day-to-day basis. The Chair and/or Vice-Chair also call to order and adjourn Administrative Committee and RWMG meetings. *Administrative Committee meetings are also open to any stakeholder of the Inyo-Mono RWMG or the public and are publicly noticed according to the Brown Act.*

Ad-hoc working committees are formed and directed as needed by the RWMG to undertake work on specific topics or issues and provide input and recommendations to the Administrative Committee and/or RWMG. All results from working committees are reviewed by the RWMG. Ad-hoc working committees have no decision-making authority and are intended to undertake focused work on particular topics and to develop databases, recommendations, and/or queries for the Group to consider. Topics or issues for ad-hoc work groups include, but are not limited to, budget development and review, fundraising, community outreach, developing Plan objectives and resource management strategies, project development and proposal assistance, project ranking process, Plan implementation, and issue-specific research and analysis. *Any interested RWMG stakeholder or member of the public may be a part of a working committee*.

The Inyo-Mono IRWM Program Office handles day-to-day IRWM Program operations and also represents the RWMG in meetings with other local, state and regional organizations and agencies, other RWMGs, and the general public. Program Office staff oversees consulting contracts approved by the RWMG to assure appropriate and timely results and is responsible for project documentation and timely and accurate reporting to the RWMG, DWR, and other agencies as appropriate. Program Office staff also works closely with the fiscal agent of each grant to ensure accurate and timely payment and documentation of IRWM budget expenditures.

5.1.1 MOU and Decision-making

The Inyo-Mono IRWM process has been divided into phases, and these phases have corresponded to different MOUs. The initial, or pre-planning, phase of the Inyo-Mono IRWM Program utilized an initial MOU. This MOU laid out the general organizational structure and decision-making powers that have been used throughout the duration of the Inyo-Mono IRWM Program. It was agreed through this MOU that only MOU signatories could participate in the decision-making process, though all interested entities were welcome to attend and participate in RWMG meetings. Entities were invited to sign this MOU at any time; there was no deadline. Indeed, groups signed the pre-planning MOU up until the time that the next iteration of the MOU was being developed. The pre-planning MOU also provided background on the Inyo-Mono IRWM Program and described the consensus decision-making process. Eventually, 29 entities had signed the pre-planning MOU.

As the RWMG moved forward into the planning phase, several participants thought it important to revisit and make changes to the MOU. What resulted was an entirely new MOU (Appendix B) that sets forth the purpose of the RWMG, the structure of the RWMG and its decision-making processes, and other items related to staffing, fiscal agent, budget, meetings, and reporting. One major change was the implementation of a quorum requirement for meetings. At least 50% of the Members must be present at an RWMG meeting to convene the meeting and conduct business. The planning/implementation MOU became effective November 15, 2010, and will govern the planning and implementation phases of the Inyo-Mono IRWM Program. This MOU has subsequently been revised once, with the effective date of those revisions as September 1, 2011. Additional revisions or amendments will be made as they become necessary. Currently, there are 41 signatories to the planning/implementation MOU (Table 5-1).

Inyo-Mono RWMG decisions on policies and actions are made *by consensus* (meaning all must agree with the proposed decision item) at publicly-noticed meetings held in compliance with the Brown Act. RWMG Members must be present at a publicly-noticed meeting (either in person or via conference call) to participate in the decision-making process for an agendized decision item. Meeting agendas are developed well in advance to allow time for RWMG Member representatives to consult with their governing boards regarding agenda topics, action items, and decision items. In reaching a consensus decision, some Members may strongly endorse a particular proposal while others may accept it as "workable". Others may only be 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. Any of these actions constitutes consensus. If any RWMG Member opposes an action, the proposed action fails. It is expected that Members in opposition to a particular action will verbally state their concerns during the meeting at which the decision is being made. If no consensus is reached, the matter is turned over to the Administrative Committee so that it can work with the opposing entity(ies) in addressing their concerns and ideally, work to craft an acceptable decision item for the RWMG's consideration.

Since neither the Administrative Committee nor the RWMG has any regulatory authority, any decisions they make cannot regulate or force another entity against its will to take an action not in its interest or against its own regulations or policies. All decisions will be made and developed under the consensus rule. If consensus cannot be reached during the second consideration by the RWMG, "avoided decisions" will be archived and may be reviewed at a later time in order to continue seeking solutions for difficult and important issues. This consensus process is designed to achieve the development of a single, collaborative water management portfolio that is prioritized based on the adopted objectives and resource management strategies of the Inyo-Mono RWMG. To date, the consensus process has been employed successfully by the RWMG. Decisions are considered carefully by the RWMG and worded such that they are agreeable to all Members. Some topics may require several meetings of discussion before they can be formed into a decision item. It is this careful consideration of decision items by the

RWMG that has allowed the consensus process to succeed thus far.

5.2 Group Responsible for Development and Implementation of Phase II Plan

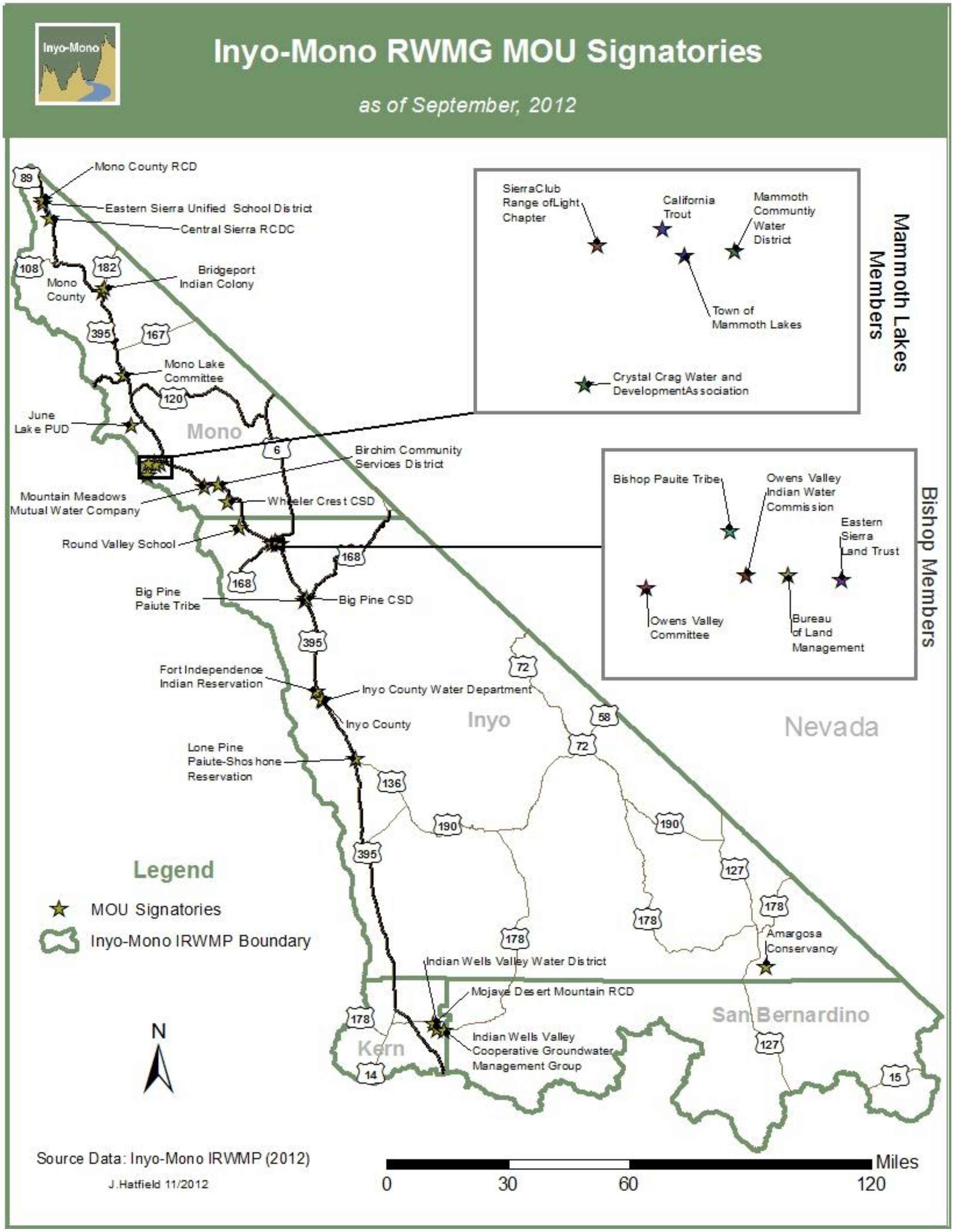
The Inyo-Mono RWMG is the entity responsible for the development, adoption, and implementation of the Phase II Inyo-Mono IRWM Plan, including this 2019 update. Membership in the RWMG is defined by signing the planning/implementation Memorandum of Understanding, Revised Version #1. *Any entity, regardless of type of organization (or as an individual), is eligible to sign the MOU provided it understands the responsibilities of being an RMWG Member. All Members have equal decision-making power and responsibility through the consensus process, described above. At this time, Members are not required to make a financial contribution in order to participate in the IRWM Program. Therefore, any interested entity is welcome to become a Member of the RWMG regardless of its financial circumstances.* Below, Table 5-1 lists the membership of the Inyo-Mono RWMG, current as of July 1, 2019, including those entities with statutory authority over water.

Table 5-1: MOU Signatories as of May 1, 2019

RWMG Member Organization	Statutory Authority over Water	Represents Disadvantaged Community
Amargosa Conservancy		X
Amargosa Opera House and Hotel		X
Big Pine Community Services District	X	X
Big Pine Paiute Tribe of the Owens Valley	X	X
Birchim Community Services District	X	
Bishop Paiute Tribe	X	X
Bureau of Land Management – Bishop Office	X	
Bridgeport Indian Colony	X	X
Bridgeport Public Utilities District	X	X
California Trout		
Central Sierra Resources Conservation & Development		X
City of Bishop	X	X
Crowley Lake Mutual Water Company	X	
Crystal Crag Water & Development Association	X	
Desert Mountain Resources Conservation & Development		X
Eastern Kern County RCD		X
Eastern Sierra Audubon		
Eastern Sierra Community Service District		X
Eastern Sierra Land Trust		
Eastern Sierra Unified School District		X
Fort Independence Tribe	X	X
Indian Wells Valley Cooperative Groundwater Management Group		X
Indian Wells Valley Water District	X	

RWMG Member Organization	Statutory Authority over Water	Represents Disadvantaged Community
Inyo County	X	X
June Lake Public Utilities District	X	
Keeler CSD		X
Lone Pine Paiute-Shoshone Reservation	X	X
Lundy Mutual Water Company		X
Mammoth Community Water District	X	
Mono County	X	X
Mono County Resource Conservation District		X
Mono Lake Committee		
Owens Valley Committee		
Owens Valley Groundwater Authority		X
Owens Valley Indian Water Commission		X
Round Valley Joint Elementary School District	X	
Sierra Club Range of Light Group		
Town of Mammoth Lakes	X	
U.S. Forest Service/Inyo National Forest	X	
Wheeler Crest Community Services District	X	
WRAMP Foundation		

Figure 5-1: MOU Signatories as of September 2012



The IRWM Program Office staff, along with a few RWMG Members, was responsible for the majority of the writing and revising of the Phase II Plan. Other RWMG participants provided specific information for inclusion in the Plan and also helped to review drafts.

5.2.1 Public Noticing of Phase II Plan Development

Any stakeholder or member of the public is welcome to review and provide input to the IRWM Plan. Inyo-Mono Program Office staff developed the following public notice statement for publication in area newspapers to provide notification of the development and adoption of the Phase II Plan, in accordance with §6066 of the Government Code.

> NOTICE OF UPDATE OF INYO-MONO INTEGRATED REGIONAL WATER MANAGEMENT PLAN, PHASE II
>
> August 16, 2019
>
> The Inyo-Mono Regional Water Management Group intends to update its Phase II Integrated Regional Water Management Plan. Any member of the public who wishes to provide input to the document may do so by contacting Allison Dodds at allison@inyo-monowater.org by September 11, 2019. All input must be received by September 20, 2019. The Regional Water Management Group intends to adopt the Plan at its September 25, 2019, regular meeting. This meeting is open to the public. The location for this meeting will be posted at the Inyo-Mono IRWMP website, listed below. A draft of the complete Plan will be made available electronically at the website www.inyo-monowater.org and in hardcopy upon request. Contact Allison Dodds with questions.

This public notice was published for two consecutive weeks in late August and early September 2019, in the *Mammoth Times* and *The Sheet* (serving Mammoth Lakes and Mono County), and the *Inyo Register* (serving Bishop and Inyo County). These three newspapers are papers of public record for Mono County and Inyo County. This public notice provided an opportunity for the public to provide input into the Phase II Plan as well as to be present during the adoption of the Plan (during which a public comment period was available).

5.2.2 Plan Adoption Process

RWMG Members and participants were provided opportunity to review and comment on individual Plan chapters as they were being written in the spring and summer of 2019. Once a complete draft of the Plan was available in September 2019, RWMG Members were asked to take the Plan to their governing boards for approval. The initial Phase II Plan was adopted by the RWMG in November 2012. The 2014 update was adopted October 22, 2014. This subsequent version of the Phase II Plan was scheduled for adoption at a September 25, 2019, RWMG meeting. Because of the consensus decision-making process of the Group, a decision to adopt the Plan means that all RWMG Members have signed on.

Since, at this time, entities presenting projects for funding through Prop. 84 Implementation grants must be MOU signatories, by default all project proponents have adopted the Inyo-Mono IRWM Plan.

5.3 Public Involvement in Inyo-Mono RWMG

The governance structure and processes of the Inyo-Mono RWMG ensure opportunity for public participation and involvement in the development of the IRWM Plan and in other RWMG activities. *All meetings are open to the public, and members of the public may find information about the IRWM Program at any time by visiting the Inyo-Mono website, or by request. The inclusive nature of the RWMG, along with consensus-based decision-making and extensive outreach efforts on behalf of the RWMG, help to ensure that the Inyo-Mono IRWM Program will remain an open and transparent process into the future.*

Through more than eleven years of meetings and discussions, the RWMG has developed a process to ensure that RWMG Members' governing boards are provided with consistent and timely information about Inyo-Mono IRWM Program efforts and activities. RWMG meetings are scheduled so that governing boards with strict agenda requirements have opportunity to meet and discuss the upcoming meeting topics and provide guidance to representatives. Draft agendas are sent out via email for comment and additions by the RWMG, and final agendas, along with meeting location and call-in information, are provided to the RWMG at least one week ahead of the meeting. For most items that will require a decision on the part of the RWMG Members, the action item is put on the agenda for discussion at one RWMG meeting with the goal of recommending a decision item for the next meeting. This process provides RWMG Members opportunity to discuss the decision with their respective governing boards and receive guidance for decision-making at the next meeting.

The Program Office staff requests Members to RSVP for a meeting when the final agenda is sent out. This helps to ensure that the quorum requirement (50% of Members + 1) will be reached on the day of the meeting, particularly since many Members travel long distances to attend meetings (though there is always a call-in option), and it is difficult to reschedule meetings.

Although operation of the RWMG under the IRWM Program is not technically subject to the Ralph M. Brown Act for ensuring opportunity for public participation in meetings, the Inyo-Mono RWMG decided by consensus in October 2010 to adopt a policy requiring the RWMG to abide by Brown Act rules. This includes publicly noticing meetings, holding meetings at locations compliant with the Americans with Disabilities Act (ADA), and posting locations of those Members calling into the meetings via the conference call option, who must post the agenda at their call-in locations and whose locations must also be ADA-accessible.

It was recognized early on that it would be imperative to have tribal involvement in the RWMG as there are several federally-recognized (and a few non-federally-recognized) tribes in the area that contribute significantly to the economy and culture of the region and have been involved in regional water issues for centuries. Targeted outreach efforts yielded good results, and all tribes in the region but two are signatories to the Inyo-Mono MOU. The Inyo-Mono RWMG recognizes area tribes as sovereign entities and as such encourages RWMG Member organizations that are government agencies to coordinate with tribes on a government-to-government basis.

5.3.1 Access and Opportunity for Participation in Inyo-Mono IRWM Program

Inyo-Mono RWMG Members are involved in a variety of ways. At the most basic level, RWMG Members attend and participate in RWMG meetings. A subset of the RWMG sits on the Administrative Committee, which provides guidance to Program Office and helps to resolve disagreement within the RWMG. Staff relies on the members of the Administrative Committee, as well as other RWMG participants, to provide feedback and advice on day-to-day decisions and operations. RWMG participants also have opportunities to participate in working committees that perform specific tasks or functions, such as developing budgets for grant proposals, creating project review criteria, or assisting with writing assignments. Because of the large and remote nature of the Inyo-Mono region, many stakeholders mostly participate in RWMG meetings by phone, or if they cannot participate at all, they stay informed about Inyo-Mono IRWM Program activities through the website, emails, or through contact with staff. Stakeholder involvement is actively sought and welcome at all levels.

For stakeholders that are not yet a part of the IRWM process, any member of the public is welcome to attend RWMG, Administrative Committee, and work group meetings. As discussed above, in 2010 the Inyo-Mono RWMG decided by consensus that it would abide by the Brown Act in convening and noticing its standing committee meetings. Stakeholders and other members of the public can find meeting information on the Inyo-Mono IRWM Program website as well as at several posted locations throughout the region. Furthermore, each RWMG meeting agenda is presented to the Board of Supervisors of both Inyo and Mono Counties and is part of the public record. Call-in locations are available and open to the public.

5.3.2 Internal and External Communication

Communication between the Program Office and the RWMG, and among RWMG representatives, primarily occurs via email. Program Office staff uses email to send out meeting notices and agendas, documents, announcements, and other relevant material. The program website (www.inyo-monowater.org) is used as another primary tool for outreach and communication throughout the Inyo-Mono IRWM planning region. The website was overhauled in late 2011 and now provides more access to information than before. On this website, visitors can find topics such as introductory information about the Inyo-Mono IRWM Program, Member organizations, meeting summaries, a library of planning documents, and links to other IRWM Program websites. Documents being circulated to the RWMG are posted to the website. Internet access has improved over the eleven years of the Program's existence. Initially, it was evident that not everybody could easily access email and websites, so some communications, particularly notices of special events, were sent out in hardcopy to stakeholders. Notices of RWMG meetings and Administrative Committee meetings are still posted in several physical locations throughout the region as part of the Program's compliance with the Brown Act.

External communication of IRWM Program matters takes place primarily through the website and through local media sources. The three most widely-read local newspapers have each run several articles about various aspects of the Inyo-Mono IRWM Program, including interviews with Program Office staff and RWMG participants. There are several documented cases of these articles contributing to the involvement of new RWMG participants. One local newspaper in particular posts notices of upcoming meetings and other IRWM Program events in its calendar. All public notices regarding IRWM Program activities – the public notice for development of this Plan, for example – are published in the three regional newspapers. However, given the size and sparsely-distributed population of the region, Program representatives are always looking for ways to improve communication to potentially interested stakeholders and the public.

5.4 Long-term Implementation of the IRWM Plan

It is the intention of the Inyo-Mono RWMG to create an IRWM Plan with a time horizon that goes beyond the Proposition 84 and Proposition 1 IRWM Program. Indeed, language in the MOU was selected for the purpose of creating a body to address the region's water resources in a long-term, collaborative manner, whether funding is acquired from DWR or from some other source. The collaborative, diverse, consensus-based governance structure is designed not only to develop a Plan, but to create a robust and adaptable RWMG that will create a single management portfolio to address regional water issues consistent with the objectives of the Inyo-Mono IRWM Plan. The Inyo-Mono RWMG has also provided for the creation of a non-profit organization (Eastern California Water Association, or ECWA) to be formed that will allow the Group to diversify its funding sources beyond Props. 84 and 1 and help to ensure the long-term sustainability of the Inyo-Mono IRWM Program.

5.5 Coordination with Other IRWM Regions, State Agencies, and Federal Agencies

Through the 2009 Region Acceptance Process, the Inyo-Mono RWMG made contact with and met regularly with all neighboring and adjacent IRWM planning regions. These meetings were held to ensure consistency in IRWM planning region boundary designations and to set the stage for potential future interregional planning and implementation efforts (see Chapter 13). In addition, the Inyo-Mono RWMG sought guidance from several established IRWM groups in the development of its Round 1 Planning Grant application and Phase I Plan. Since that time, the Inyo-Mono Program Office has continued to collaborate with other IRWM regions on specific topics such as responding to preliminary grant recommendations and disadvantaged communities. More recently, conversations took place among the six IRWM regional groups of the Lahontan Funding Area regarding allocation of the remaining Proposition 84 funds.
(http://www.water.ca.gov/irwm/grants/docs/FundingAreaContacts/FA%20factsheetrev1.pdf) An informal agreement was developed to split the remaining funds using a formula that accounts for equal allocation, population distribution, and IRWM region land area. This agreement was presented to DWR ahead of the final Prop. 84 Implementation funding round and was used to guide applications and determine grant awards. Likewise, for Proposition 1 funds, the Lahontan Funding Area IRWM groups have agreed on an allocation and will use this split to guide funding applications. The six regions communicate regularly, and Inyo-Mono Program Office staff is serving as a point of contact and coordination for the whole funding area. The firm commitment on

the part of the RWMG to supporting multi-benefit projects and processes will ensure that these relationships with other IRWM groups continue.

Another way in which the Inyo-Mono RWMG has collaborated with other IRWM regions is through the Sierra Water Workgroup (SWWG). This informal alliance of IRWM regions in the Sierra Nevada began in 2009 and developed a formal charter in 2011. The group meets periodically to discuss issues of regional importance or concern and to help raise the profile of issues specific to the Sierra Nevada in Sacramento. Since 2012, the SWWG has been holding annual summits, which provide opportunities for Sierra IRWM representatives to interact, share information, and discuss important and timely issues. Inyo-Mono IRWM Program Office staff and stakeholders have participated in the SWWG since its inception and usually participate in the meetings via conference call. Similar to the SWWG, the Roundtable of Regions is a consortium of all IRWM regions in the State. This group meets via conference call regularly to discuss issues of interest or concern to all IRWM regions and to provide input to DWR regarding the State's IRWM Program.

For several years, the Inyo-Mono Program Office participated in meetings of the Central Nevada Regional Water Authority, a collaborative group comprised of stakeholders from central and northern Nevada, as well as Utah and three counties within California (including Inyo and Mono Counties), that meets regularly to discuss water issues of concern in Nevada and bordering states. Because the Inyo-Mono region shares a border with Nevada and includes common watersheds and groundwater basins, it is important to conduct outreach to Nevada stakeholders and understand their water concerns.

Both State and federal agencies are involved in the RWMG and regularly attend meetings. This includes California Department of Fish and Wildlife, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. National Park Service, and U.S. Bureau of Reclamation. Each federal or State entity provides a unique perspective on managing land and water resources. Given that more than 90% of the Inyo-Mono region is comprised of public land, these government agencies are important partners in land and water planning.

The relationship between the Inyo-Mono RWMG and DWR has been vitally important in the development of the Inyo-Mono governance structure and planning process. DWR is able to provide useful information from other IRWM groups, along with its own perspective, to help guide the activities of the Inyo-Mono RWMG. Inyo-Mono RWMG Members and Program Office staff have made significant efforts over the life of the program to build a relationship with DWR and participate in most IRWM- and non-IRWM-related activities, such as process improvement workshops, IRWM guidelines and proposal solicitation package public comment periods, the IRWM Strategic Plan process, the California Water Plan Update process, and the DWR Climate Change Technical Advisory Group. It is because of this ongoing effort to maintain close ties with DWR that the RWMG is able to take advantage of many state-directed opportunities.

5.6 Integration of Stakeholders and Institutions

One of the most tangible, yet unquantifiable, benefits of the Inyo-Mono IRWM process to date has been the practice of gathering water-related stakeholders at meetings on an almost-monthly basis to discuss the structure and governance of the Group, the activities of its Members, and water issues of local or regional importance. Many of the organizations sitting at the table have historically been at odds over water issues. While it is not expected, nor intended, that the RWMG will solve all water-related conflicts in the region, many RWMG participants have acknowledged the advantages of increased communication and cooperation among adversaries and allies alike. The process has helped to educate stakeholders about each other's activities, priorities, and concerns. Smaller water districts have sought advice from larger water districts on technical issues. Less experienced communities benefit by learning from groups with more experience in water management, and in turn, RWMG stakeholders have begun to understand the difficulties of maintaining high-quality water resources and ensuring ecosystem protection in small, rural, and/or economically disadvantaged communities. During the RWMG's visioning exercise in early 2010, several RWMG participants expressed the desire that the IRWM planning process should help individual stakeholders overcome conflict and should allow the group to speak with one voice and from common objectives.

5.7 Process Used to Establish Plan Objectives

See Chapter 7 for a discussion of the process used to establish Phase II Plan objectives.

5.8 Process for Updating or Amending the Inyo-Mono IRWM Plan

As with the Memorandum of Understanding, the Inyo-Mono RWMG will periodically review the Inyo-Mono IRWM Plan and provide opportunity to change and/or amend the Plan. For minor changes, including corrections and small wording changes, the Plan will be reviewed once every six months. During this semi-annual review period, there will also be opportunity to add, modify, or remove projects to/within/from the Plan. Proposed changes to Plan text or projects will be requested by a certain date. These changes will be discussed at a subsequent RWMG meeting. The Group Members will then make a recommendation to incorporate approved changes into the Plan, which will go before governing boards and come back to the RWMG for a consensus decision at a subsequent meeting. A similar process will be used for making amendments to the Plan, which will be considered on an as-needed basis.

The Inyo-Mono IRWM Plan will be reviewed for substantive changes and updates every two years. Expected substantive changes include updates regarding regional description details, water-related policies and plans in the region, climate change impacts and responses, changes to the project list and prioritization, and measuring progress of the Plan implementation, among others. All changes to the Plan, whether they are major or minor, will follow the same process of discussion and decision by the RWMG Members.

Chapter 6 : Outreach and Engagement

6.1 Overview of Community and Stakeholder Involvement

Since its inception in early 2008, the Inyo-Mono RWMG has undertaken extensive outreach to inform, listen to, understand, educate, and engage constituents, stakeholders, and interested parties. The RWMG recognized early in the process that because of the large geographic size of the planning region and the breadth of water-related issues within the area, community involvement was critical in order to facilitate meaningful input, foster collaboration, ensure an inclusive and well-managed process, engender trust, and establish credibility. The RWMG sees broad stakeholder involvement as absolutely integral to the success of the IRWM Program, and the involved parties are proud of what has been achieved through outreach so far.

The RWMG has maintained its commitment to frequent public meetings, timely outreach to interested stakeholders, and focused efforts to build interest and involvement of Native American tribes and disadvantaged communities. From the beginning, effort was made on the part of Program Office and early RWMG participants to involve stakeholders from many different types of organizations that have some kind of involvement with water resources: government agencies, non-profit organizations, businesses, water suppliers, academic institutions, and Native American tribes. Currently, all of these sectors are represented in the RWMG by at least one organization, and in many cases, several organizations. The specific composition of the RWMG is presented in Chapter 5.

6.2 Process Used to Encourage Broad Participation in IRWM Planning Process

The original stakeholders of the Inyo-Mono RWMG consisted of the Sierra Nevada Alliance, California Trout, and California Department of Water Resources, with facilitation provided by the Center for Collaborative Policy. One of the primary tasks of this initial group was to identify water-related stakeholders in the planning region and to encourage attendance and participation at RWMG meetings. Within the first few months of the initiation of the IRWM planning process, meeting attendance grew to 35-40 people. Throughout the first two years, effort was continually made to identify new stakeholders and invite their participation in the process. This was mostly done through word-of-mouth from existing RWMG participants and through outreach to various media sources.

Program Office staff and Members of the Inyo-Mono RWMG have conducted outreach on a continual basis to encourage further participation from all groups and individuals within the planning boundaries having interests in water resources management. Such outreach efforts continue to this day, which include, but are not limited to, attending meetings of various entities throughout the planning region. Either Program Office staff or RWMG participants attend such meetings to provide an overview of the IRWM Program, to answer questions, to hear what water issues are of concern in the community, and to provide information on how to be involved in the IRWM planning process. These meetings may be ongoing public meetings, such as Mono County Regional Planning Advisory Committee (RPAC) meetings, County Board of Supervisors meetings, individual meetings with stakeholders, or special IRWM Program outreach meetings. Often, follow-up phone calls or visits are conducted with meeting participants to continue answering questions or to begin folding them into the RWMG (adding them to contact lists, providing additional information, encouraging signing of the MOU, etc.). Outreach has also occurred through the many topic-specific trainings that have been sponsored by the IRWM Program (see below; also discussed in Chapter 10). Often, water system operators and managers, who do not otherwise have time to participate in the IRWM process, will attend these trainings, thereby providing another venue for meeting stakeholders and learning about regional water issues.

Outreach has been conducted and is ongoing with other Sierra IRWM planning groups such as CABY, Upper Feather, Tahoe-Sierra, Southern Sierra, Mojave, Antelope Valley, Fremont Basin, Lahontan Basins, Mariposa, Kern County, and Madera County. This outreach builds rapport with other regional efforts and contributes to collaboration among other mountain-region and headwater RWMGs. In addition, the knowledge gained from discussions with other IRWM groups has provided valuable information for the Inyo-Mono RWMG.

In 2011, the Inyo-Mono IRWM Program undertook a special project, funded through a Proposition 84 DWR grant, to focus on disadvantaged community and tribal outreach and engagement in IRWM planning. This work is being continued through a 2017 Proposition 1 disadvantaged communities involvement grant. A more complete description of the work performed through these efforts is included in the section of this chapter titled “Involving Disadvantaged Communities and Native American Tribes.”

Since the Program’s early meetings in 2008, more than 100 specific outreach meetings have been conducted throughout the region. These meetings are in addition to regular RWMG and Administrative Committee meetings and have resulted in dozens of new individuals and entities being added to the IRWMP contact list, several of whom now regularly attend meetings and participate fully in the IRWM process.

It is through these dozens of meetings that the RWMG and Program Office staff learned of several potential barriers to involvement in the IRWM process. While no financial commitment is required to become an Inyo-Mono RWMG Member, attending RWMG meetings in our large region does require an expenditure of resources, whether it is staff time, gas for traveling to meetings, or lost wages and work time for attending meetings as a volunteer of an organization. To help overcome these barriers, Program Office staff ensures that a conference call option is available for all RWMG and Administrative Committee meetings. Also, at times during the history of the Program, disadvantaged communities have been able to receive travel assistance to attend meetings. After working with many small water systems for several years, it is understood that the limited staffs of these water systems may not have time to participate in meetings, and board members are often volunteers who have other day jobs and cannot take time off to attend meetings. To date, RWMG meetings have always been conducted during weekdays, although many outreach meetings, and some of the trainings, are conducted in the evening, and staff can be available to work with stakeholders during evenings and/or weekends.

Table 6-1: IRWMP outreach meetings conducted 2008-2018

Name of Community	Number of Times Visited 2008-2018	Participation in RWMG as a result of outreach?*
Antelope Valley (Walker, Coleville, Topaz)	4	Yes
Bridgeport	8	Yes
Bridgeport Indian Colony	4	Yes
Lee Vining	4	Yes
June Lake	4	No
Mammoth Lakes	8	Yes
Mono City	4	Yes
Crowley Lake	1	No
Tri-Valley (Benton, Chalfant, Hammil)	7	No
Round Valley	3	Yes
Bishop	9	Yes
Bishop Paiute Tribe	4	Yes
Big Pine	4	Yes
Big Pine Paiute Tribe	6	Yes
Fort Independence Indian Reservation	5	Yes
Lone Pine	1	Yes
Lone Pine Paiute Tribe	1	No
Tecopa/Shoshone/Death Valley	5	Yes
Timbisha Shoshone Tribe	1	No
Ridgecrest/Inyokern	10	Yes

*Some of the “no” responses in the above table are communities that were already engaged with the IRWMP before formal outreach began.

In addition to the stakeholders who regularly attend meetings or otherwise participate in the IRWM planning process, the Program Office maintains a list of stakeholders who receive communications about the Inyo-Mono IRWM Program but who do not actively or consistently participate. This list is used to send communications about RWMG meetings, trainings, IRWM Plan updates, funding opportunities, and other items of interest to water stakeholders. This list once grew to over 200 contacts and now stands at about 180.

Given the very large area of the Inyo-Mono planning region, it is not possible to reach out to and include every stakeholder that has water-related interests, though we have found that some groups are simply not interested in the IRWM process. Considerable effort has been put into ensuring that all communities and areas of the region are represented by at least one stakeholder group. A further challenge is maintaining levels of stakeholder involvement through staffing changes, budget cuts, rounds of grant funding, and shifting priorities. If Program Office staff observes that a previously engaged stakeholder has not been participating at the same level, a staff member contacts the organization and works to facilitate that entity's continued involvement. Having broad and consistent representation in the RWMG is key as the representatives bring many different opinions and points of view to discussions. The Inyo-Mono RWMG is truly a grassroots, member-driven organization.

Staff relies heavily on the knowledge and contacts of current RWMG Members and other stakeholders in determining which potential new stakeholders to contact. There are myriad written materials, including maps and graphics, and the website itself, to aid in providing information to new stakeholders. New stakeholders have expressed that they find it difficult to learn about the history, process, and current activities of the Inyo-Mono IRWM Program, and written materials help to distill this information. These documents are available on the website or from Program Office staff and are updated as needed.

The IRWM Program intends to continue outreach both proactively and on an as-needed basis. As people move in and out of the region, and composition of stakeholder groups shift, it is necessary to continually meet with new contacts and to continue building relationships. ***This type of work requires ongoing programmatic funding and an emphasis on long-term relationships among stakeholders.***

6.3 Involving Disadvantaged Communities and Native American Tribes

Throughout implementation of Proposition 84, DWR placed emphasis on reaching out to and supporting disadvantaged communities (DACs) in the IRWM Program. The initial RWMG recognized that the Inyo-Mono IRWM planning region contains many DACs, as originally identified by 2000 U.S. Census Median Household Income data. Several unincorporated communities in the region are too small to be counted in Census data, and thus their DAC status is not clear. Inyo-Mono Program Office staff has updated the region's list of DACs using 5-year median household income data from the American Community Survey (ACS; household income data were not collected as part of the 2010 Census). An online mapping tool for DACs provided by DWR has been available for several years and uses updated 5-year ACS data (http://www.water.ca.gov/irwm/integregio_resourceslinks.cfm). The current 5-year period being used is 2013-2017. ACS data for the communities missing from the DWR map (such as tribes) are accessed directly from the American Factfinder website (https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml). Additional information regarding the process of determining which communities in the region are DACs, as well as a list and a map of the identified DACs, is discussed in Chapter 1.

Utilizing funding from the Prop. 84 DAC grant, the Inyo-Mono RWMG investigated alternative means of identifying and engaging DACs (including tribes) in IRWM planning processes. This project included performing DAC-specific outreach both within and outside of the region, assessing needs of DAC water systems, providing capacity-building trainings, producing a documentary film about water and DACs in the Inyo-Mono region, and researching alternative ways of defining and identifying disadvantaged communities. Because the availability of income data is limited, particularly for small and/or rural communities, the RWMG has been working to find other metrics that could be used to define DACs in California – either data-based metrics, such as high school dropout rate or unemployment rate, or observation-based metrics, such as house size, type of car, nature of landscaping, etc. The goal of this effort is to more effectively identify DACs so that resources can be provided to those communities that need them most. The findings of this study can be seen in the final report/white paper for the grant "Disadvantaged Communities and the Inyo-Mono IRWM Program" (https://inyo-monowater.org/wp-content/uploads/2014/10/IM_DAC_whitePaper_20140930_FINALcopy4Submittal.pdf).

Outreach conducted through the DAC grant included the stakeholders and communities both within and outside of the Inyo-Mono region. Specific stakeholder meetings included: Benton Paiute Tribe, Bridgeport Utilities District, Bridgeport Indian Colony, Tecopa & Shoshone, Big Pine CSD, Paiute-Shoshone Coalition for Protection of Aboriginal Lands Inter-Tribal Meeting, Mono Basin RPAC, Bridgeport RPAC, Tri-Valley Groundwater Management District, South Sierra IRWMP, Upper Pit IRWMP & associated stakeholders, Yosemite-Mariposa IRWMP (including Madera IRWMP and Merced IRWMP representatives), and Tuolumne-Stanislaus IRWMP including Tuolumne-Me-Wuk Tribe.

A subset of the DAC outreach efforts has focused on Native American tribes within the region. The Program Office has conducted targeted outreach to all of the tribes based in the region (vs. tribes with headquarters outside the region and only limited representation in the region). The results from this outreach have been excellent; all of the major tribes except two are involved in the IRWM planning process and are signatories to the MOU (see Chapter 5).

While not every outreach effort has yielded an ongoing working relationship between the RWMG and a DAC or tribal entity, the overall impact of these efforts is that there is solid (though not complete) representation of DACs and tribes among RWMG Members and other involved stakeholders, which has also led to a much more thorough understanding of the water issues faced by these communities.

A key goal of the outreach to DACs, tribes, and small water districts has been to assess their water-related and institutional needs and assist in bringing resources to those entities to address their needs. The RWMG has worked with the California Rural Water Association to undertake needs assessments for individual water systems and provide the technical, financial, and/or managerial expertise needed by small water purveyors.

More information about the work of the disadvantaged communities grant can be found at: http://inyo-monowater.org/inyo-mono-irwm-plan-2/dac/.

6.4 Governance, Decision-making Process, and Communication

Since the inception of the Inyo-Mono IRWM Program in 2008, the group has been governed by a Memorandum of Understanding. The first MOU, which governed the pre-planning phase of the Inyo-Mono IRWM Program, was adopted in November 2008 and was subsequently signed by 28 organizations (see Chapter 5). It was later agreed among RWMG Members that the MOU should be updated and revised to reflect the Group's progression into the planning and implementation phases. A working committee made up of a subset of RWMG participants developed a new MOU that took effect November 15, 2010, with 22 signatories. A slightly revised version (Appendix B) was adopted by the RWMG with an effective date of September 1, 2011. Additional organizations may sign the MOU at any time, and a continually updated list of signatories is available on the website (see Chapter 5 for more information and a current list of MOU signatories).

Decision-making in the RWMG has always occurred through consensus. The Inyo-Mono RWMG's operational definition of consensus is that all entities either approve or can live with the item being decided upon. If one or more entities disapprove, then no decision is made and it goes to a "parking lot" to be revisited at later time or further discussion ensues and an alternative decision is put forth for consideration. Only MOU signatories can participate in this decision-making process, although any individual or stakeholder can be part of discussions leading up to decisions. Every Member group has one "vote" and thus equal power, regardless of the size or influence of any given entity. At times, decision items must be discussed and vetted over the course of one or more RWMG meetings before a consensus decision can be made. More information about the governance and decision-making processes of the Inyo-Mono RWMG can be found in Chapter 5.

Any member of the public is welcome to attend and contribute to RWMG, Administrative Committee, and working committee meetings. In the summer of 2010, the Inyo-Mono RWMG decided by consensus that it would conduct all its activities under the provisions of the Ralph M. Brown Act. Stakeholders and other members of the public can find meeting information on the Inyo-Mono IRWM Program website (www.inyo-monowater.org), in local newspapers, and at several posted locations throughout the region. Furthermore, each RWMG meeting agenda is presented to both the Inyo County and Mono County Boards of Supervisors and thus becomes part of the public record. Call-in locations are available and open to the public (see Chapter 5 for more details).

Communication between the Program Office and the RWMG, and among RWMG representatives, primarily occurs via email. Program Office staff uses email to send out meeting notices and agendas, documents, announcements, and other relevant material. The program website (www.inyo-monowater.org) is used as another primary tool for outreach and communication throughout the Inyo-Mono IRWM planning region. The website was overhauled in late 2011 and now provides more access to information than before. On this website, visitors can find topics such as introductory information about the Inyo-Mono IRWM Program, Member organizations, meeting summaries, a library of planning documents, and links to other IRWM Program websites. Documents being circulated to the RWMG are posted to the website. Internet access has improved over the eleven years of the Program's existence. Initially, it was evident that not everybody could easily access email and websites, so some communications, particularly notices of special events, were sent out in hardcopy to stakeholders. Notices of RWMG meetings and Administrative Committee meetings are still posted in several physical locations throughout the region as part of the Program's compliance with the Brown Act.

External communication of IRWM Program matters takes place primarily through the website and through local media sources. The three most widely-read local newspapers have each run several articles about various aspects of the Inyo-Mono IRWM Program, including interviews with Program Office staff and RWMG participants. There are several documented cases of these articles contributing to the involvement of new RWMG participants. One local newspaper in particular posts notices of upcoming meetings and other IRWM Program events in its calendar. All public notices regarding IRWM Program activities – the public notice for development of this Plan, for example – are published in the three regional newspapers. However, given the size and sparsely-distributed population of the region, Program representatives are always looking for ways to improve communication to potentially interested stakeholders and the public.

6.5 Integration of Stakeholders and Institutions

One of the most tangible, yet unquantifiable, benefits of the Inyo-Mono IRWM process to date has been the practice of gathering water-related stakeholders at meetings on a regular basis to discuss the IRWM planning process, water issues, and opportunities for collaboration. Many of the organizations sitting at the table have historically been at odds over water issues. While it is not expected, (nor intended) that the RWMG will solve water-related conflicts in the region, many participants have acknowledged the advantages of increased communication and cooperation among adversaries and allies alike. In addition, during the RWMG's visioning exercise in early 2010, several RWMG participants expressed the desire that the IRWM planning process should help individual stakeholders overcome conflict and should allow the group to speak with one voice and from common objectives. The reality is that there are many common interests and opportunities for RWMG stakeholders to agree on and work on together without taking on the major water-related conflicts of the region.

The Inyo-Mono IRWM process has helped to educate stakeholders about each other's activities and priorities. Smaller water districts have sought advice from larger water districts on technical issues, such as sampling protocols and laboratory services. Disadvantaged communities benefit by learning from groups with more experience in water management, and in turn, RWMG stakeholders have begun to understand the difficulties of maintaining high-quality water resources and ecosystem protection in small, rural communities. Representatives from the various participating government institutions are sitting at the table with various individuals from within the region, and through discussions a stronger sense of the region's needs are being explored and understood. It is also through this repeated contact that the RWMG has been able to develop mutually-supported goals, objectives, and resource management strategies (Chapter 7) and to start choosing projects that move the Program towards achieving the goals and objectives.

6.6 Stakeholder Involvement in Plan Implementation

Inyo-Mono RWMG Members are involved in a variety of ways. At the most basic level, RWMG Members attend and participate in RWMG meetings. A subset of six RWMG members sits on the Administrative Committee, which provides guidance to the Program Office and helps to resolve conflict within the RWMG. Staff relies on the Administrative Committee, as well as other RWMG participants, to provide feedback and advice on day-to-day activities and operations. RWMG participants also have opportunities to participate in work groups that perform specific tasks or functions, such as developing budgets for grant proposals, researching issues as they arise, creating project review criteria, or assisting with writing assignments. Because of the large and remote nature of the Inyo-Mono region, many stakeholders only participate in RWMG meetings by phone, or if they cannot participate at all, they can stay informed about Inyo-Mono RWMG activities through the website or through contact with staff. Stakeholder involvement is welcome at any level.

Stakeholders that wish to put forward projects for funding consideration under the IRWM program are strongly encouraged to attend RWMG meetings and are required to sign the MOU. However, regardless of any party's ability to contribute financially to the IRWM Plan's development or implementation, the RWMG encourages participation from all interested individuals and organizations.

The Inyo-Mono RWMG continues to believe that outreach to and engagement of additional stakeholders and an open, transparent process are foundational to the IRWM planning process and are necessary for the program's ultimate success. *This bottom-up model helps to ensure that all voices are heard, regardless of community size, economic status, or type of interest group, and that water-related concerns are addressed in an equitable manner. It is only by continuing to progress using this collaborative process that the RWMG will succeed.*

Chapter 7 : Objectives and Resource Management Strategies

7.1 Development of Objectives and Resource Management Strategies

In the IRWM planning process, development of goals and objectives is a key step as they provide a basis for decision-making, guide work efforts, and can be used to evaluate project benefits. A set of resource management strategies (RMS) can provide further guidance on steps to take to achieve the objectives. Understanding this, the Inyo-Mono RWMG started this discussion by reviewing relevant existing plans and undertaking extensive outreach within the region. With a better understanding of the water-related issues facing the diverse communities of the region, in 2010 the RWMG developed and adopted both mission and vision statements to guide the overall effort. Utilizing a consensus-based approach, the RWMG adopted the following mission statement to guide the overall planning effort:

MISSION

> ***To identify, study, prioritize, and act on regional water issues so as to protect and enhance our environment and economy. Working together, we create and implement a regional water management plan that complements applicable local, state, tribal, and federal policies and regulations and promotes innovative solutions for our region's needs.***

To help the diverse communities and stakeholders within the planning region understand their role in implementing and undertaking this mission, the RWMG adopted the following vision statement:

VISION

> ***Our vision is a landscape that is ecologically, socially, and economically resilient. As diverse stakeholders, we identify and work toward our common goals. We achieve a broad-based perspective that benefits our regional ecosystems and human communities by combining our interests, knowledge, expertise and approaches. We strive to have every voice heard within our region and our collective voice heard in the state and nation.***

True to this vision, the RWMG has diligently solicited input from the varied residents and organizations within this extremely large planning region. To begin the process of soliciting stakeholder participation and input into the development of goals and objectives, Program Office staff collected and reviewed all relevant water supply plans, general plans, resource management plans, and existing watershed planning efforts, and an initial list of goals and objectives was drafted in August 2008. A working committee was formed to further refine this list, and a revised draft was presented to the RWMG in 2009.

The written product of this effort presented water resource objectives and management strategies organized under three strategic goal areas: Watershed Ecosystem Health, Water Resources, and Water and Community. Each goal had a number of specific objectives and management strategies identified. With this initial work in hand, the RWMG undertook an extensive outreach campaign in 2009 and 2010 across the planning region to meet with interested parties and identify and discuss their water-related issues and concerns. Based on meetings with interested landowners and representatives from various tribes, non-profits, and rural communities, including disadvantaged communities, the initial strategic goal areas were confirmed to be appropriate, and the objectives and RMS were clarified and refined. During this time, the RWMG also decided to simplify the presentation of the goals, objectives, and RMS in order to better align with the identified regional concerns and with the California Water Plan, Proposition 84 requirements, and the Lahontan Basin Plan. These strategic goal areas, objectives, and RMS became the backbone of the Inyo-Mono IRWM planning process, including being laid out in the Phase I IRWM Plan and used as the basis for the project review process.

With Phase I planning complete and an initial set of projects under implementation, the Inyo-Mono RWMG undertook another extensive outreach campaign to further understand the water-related issues facing the region and what resources the RWMG might be able to provide to address those issues. Public meetings were held in Ridgecrest, Benton, and Coleville in 2011 to gather feedback on the current set of objectives and RMS. Based on the results of these meetings, the initial set of six objectives and associated resource management strategies (RMS) was expanded in 2012 to eight objectives as the RWMG decided the original six objectives were not addressing some of the key water concerns in the Inyo-Mono region – specifically, groundwater and flooding/stormwater management. This set of objectives and RMS was incorporated into the Phase II IRWM Plan.

In 2013, the Inyo-Mono RWMG re-visited the objectives and RMS to ask if the objectives are accurately reflecting the identified water-related needs of the region and whether the RWMG has appropriately identified projects to help meet each objective. These discussions resulted in altered language for some of the objectives and RMS as well as revised evaluation metrics. At the same time, the RWMG also chose to develop statements to reflect the broader goals of the region, as it felt there were no goals against which to measure the success of project and Plan implementation. The goal statements, revised objectives and RMS, and slightly re-worded mission and vision statements were approved by the Inyo-Mono RWMG in July 2014. They were reviewed in early 2019 in response to the 2016 Prop. 1 Plan Standards.

Goals
The desired outcomes of efforts made by the Inyo-Mono Regional Water Management Group are:
1) ***Functioning watersheds that support regional flora and fauna***
2) Sustainable livelihoods supported by reliable access to potable water

7.2 Current Objectives and Resource Management Strategies

The planning objectives are targeted outcomes that benefit the region. When implementing regional projects, project partners will strive to meet as many objectives as possible utilizing the resource management strategies developed for each objective while also recognizing that some objectives may not be fully achieved. In addition, projects and activities aiming to achieve the eight objectives below will, where possible, consider and incorporate the strategies of California's AB 32 Scoping Plan. Although many of the water-related strategies of the Scoping Plan are aimed at urban areas and large water and wastewater utilities, communities in eastern California can certainly strive toward helping the State meet its goals for GHG reduction, including making water conservation a way of life, assuring the reliability and quality of local water resources, increasing energy efficiency in the development and use of water resources, and increasing the use of renewable energy to pump, transport, and treat water. The following section describe the Inyo-Mono RWMG's eight objectives, their rationale, corresponding resource management strategies to achieve the objectives, and evaluation metrics that can be used to gauge the utility of each RMS towards meeting its objective. Resource management strategies that address climate change adaptation and mitigation are indicated with a green circle (**o**).

Objective 1: Protect, Conserve, Optimize, and Augment Water Supply While Maintaining Ecosystem Health

Water is a highly valued resource in the Inyo-Mono IRWM region. Rivers, streams, lakes, and aquifers supply water for domestic, agricultural, and recreational uses, support abundant wildlife and fisheries, and are an important aesthetic component of the local landscape. Water resources in the region have been heavily impacted over the years by the export of large volumes of water for use outside the planning region, a practice that has been detrimental to local water users and the natural environment within the region. Water exports are a continuing concern.

The future of water supplies in the region is a concern. While some communities have community water systems, other areas are served by a variety of public water agencies, mutual water companies, small private systems, and individual-owned wells. Additional surface water is becoming more difficult to obtain due to concerns about in-stream uses and water-dependent resources, as well as large interannual fluctuations in runoff. Inadequate and insufficient data about many groundwater resources hinder projections on meeting future demand from those sources. Potential off-site impacts on natural resources as a result of groundwater extraction are also a concern. In addition, wells for existing development have intermittently run dry in some areas; pumping new and deeper wells is expensive. At this time, many communities do not know how much groundwater is available, nor can they assume a constant supply of groundwater in the future. A further complication to managing water resources is the impact of climate change to the region's hydrology. The uncertainty around climate change projections and lack of region-specific information make it difficult to adequately prepare for, and respond to, impacts.

The demand for water is constantly changing. Communities in the region that see heavy tourism must plan for large short-term fluctuations in water use. For some communities, such as Mammoth Lakes and June Lake, these fluctuations occur year-round. We have also seen populations of permanent residents increase in several Inyo-Mono communities. In addition, development of new agricultural land, such as that being developed in the Indian Wells Valley, can put pressure on already-strapped groundwater supplies.

Table 7-1: Objective 1 RMSs and Evaluation Metrics

Objective 1: Protect, conserve, optimize, and augment water supply while maintaining ecosystem health	
Resource Management Strategy	**Evaluation Metric**
1.1 Improve water supply reliability **o**	Reduction of number of water distribution systems that are unable to attain or distribute a reliable potable water supply
1.2 Improve system flexibility and efficiency **o**	Reduction of amount of water lost and/or increase in number of uses resulting from specific water sources
1.3 Update and improve compliance with current and future state and federal water supply standards **o**	Reduction of number of water supply standards compliance violations
1.4 Increase local water supply through various techniques, including, but not limited to: groundwater recharge projects, conjunctive use of water supplies, water recycling, water conservation, water transfers, and precipitation enhancement **o**	Amount of increase in local water supply through techniques listed
1.5 Optimize existing storage capacity **o**	Increase in volume of water stored
1.6 Conserve and adapt water uses to future conditions **o**	Reduction in amount of water used
1.7 Capture and manage stormwater runoff where feasible **o**	Reduction in amount of unmanaged runoff entering natural waterways
1.8 Promote and implement low-impact development design features, techniques, and construction practices **o**	Reduction in amount of water used
1.9 Promote education about water supply issues and needs **o**	Number of people indicating additional understanding of issue and needs
1.10 Promote planning efforts to provide emergency drinking water to communities in the region in the event of a disaster **o**	Number of emergency preparedness/ response plans developed or revised
1.11 Promote water efficiency in fish hatcheries **o**	Reduction in amount of water used in hatcheries
1.12 Protect water supplies that support public recreational opportunities **o**	Number of plans, agreements, or projects aimed at improving quality and quantity of water supporting recreational activities

Objective 2: Protect, Preserve, Restore, and Enhance Domestic and Ecosystem Water Quality

A primary purpose of the IRWM Program is to support the provision of high-quality drinking water that meets current and future federal and state drinking water standards throughout the region and that supports our water-dependent ecosystems. Clean, high-quality water is essential to public health, economic well-being, and healthy ecosystems. The region's IRWM water quality objective and corresponding RMS are consistent with the intent of *Safe Drinking Water Act* goals to protect drinking water "from source to tap" and broader *Clean Water Act* goals for clean, fishable, and swimmable waters.

The region's water quality-related issues vary, and certain areas are affected by outdated and aging water and wastewater infrastructure, land management practices, sewage disposal, construction practices, solid waste disposal, road maintenance techniques, naturally occurring minerals and ores, alternative energy development, etc. There is a concern in some areas about the potential impacts of increased stormwater runoff resulting from increased development, and inadequate or failing stormwater infrastructure. Potential unmitigated stormwater impacts in some areas include increased streamflows, siltation, erosion, loss of aquatic habitat, flooding, and impacts to roads and agricultural areas. In other areas, particularly in the Indian Wells Valley, salt accumulation creates issues for both human water consumption and agricultural concerns. Climate change will add another challenging element to preserving and improving water quality in the region as air and water temperatures rise and timing of snowmelt and streamflow shifts.

At present, the water quality of the snowmelt runoff in the region is generally excellent but is degraded in some reaches and threatened throughout the entire region due to non-point source loading from increased recreational use, grazing, development, and on-site septic systems. The Owens hydrologic unit (Mammoth Creek, Crowley Lake, and Pleasant Valley Reservoir) is an impaired waterbody identified in Table 3 of the 2010 CWA 319(h) NPS Grant Program Guidelines. Although Total Mean Daily Loads (TMDLs) have not been established for the Owens hydrologic unit, constituents of concern include: mercury, manganese, dissolved oxygen, ammonia, and organic enrichment (see Chapter 2 for more information on water quality).

In other areas, aquifers of poor-quality water underlie the high-quality aquifer currently being pumped. As groundwater levels decline, underlying poorer-quality water may begin to mix with higher-quality water, resulting in deterioration of the quality of the overall water supply. In many locations, portions of the aquifer have levels of arsenic and uranium higher than the current primary drinking water maximum contaminant limit (MCL) due to the granitic bedrock, requiring treatment prior to domestic use. In other areas, nitrogen and phosphate levels are elevated.

Table 7-2: Objective 2 RMSs and Evaluation Metrics

Objective 2: Protect, preserve, restore, and enhance domestic and ecosystem water quality	
Resource Management Strategy	**Evaluation Metric**
2.1 Protect and preserve water sources of current high quality o	Number of high-quality water sources protected
2.2 Support achieving compliance with local, state, and federal water quality standards o	Reduction in number of violations of water quality standards; number of efforts aimed at meeting progressively more stringent standards
2.3 Improve the quality of urban, agricultural, and wildland runoff and/or mitigate impacts of runoff to surface waters and groundwater o	Improvements in water quality sampled at areas of concern
2.4 Support monitoring to better understand sources and causes of erosion, and, where feasible, reduce its impacts	Number of monitoring studies and programs undertaken
2.5 Promote alignment of water quality and water use o	Identification and maintenance of appropriate water quality for specific use
2.6 Support appropriate recreational programs that minimize impacts to water quality	Number of water quality samples showing no impairment
2.7 Support efforts to understand, protect, and improve groundwater quality o	Measured improvement in groundwater quality parameters

Objective 3: Provide Stewardship of Water Dependent Natural Resources

Across the region, interested parties stressed the value and importance of the natural environment for a variety of reasons, including, but not limited to, protecting the health of native flora and fauna, providing a wide variety of recreation and tourism interests, and supporting a number of agricultural and grazing operations. The region is home to a variety of unique species of fish, wildlife, and aquatic invertebrates, including a number of threatened and endangered plants and animals – for example, endangered Owens tui chub. Hot Creek and the Upper Owens River are two of the most productive and popular trout fisheries in California and, as a result, provide for world-class fishing which supports the local economy.

The protection and enhancement of natural habitats is a critical element in preserving and restoring regional flora and fauna and their habitats. Riparian woodlands, wetlands, migration corridors, and wintering and summering grounds are recognized as critical, highly-localized wildlife habitat. Increased recreational use in the region and localized development, particularly in areas outside of existing community areas, create potential impacts to the long-term sustainability of fish and wildlife populations and plant communities through degradation of habitat and resources and increased conflicts between wildlife and humans. Although not extremely prevalent in the Inyo-Mono region, invasive species can alter natural ecosystems by replacing native plant and animal communities and upsetting ecological processes. As an example, introduced trout have displaced native Lahontan cutthroat trout and amphibians in many parts of the northern watersheds of the region.

Many cross-cutting issues related to this objective also overlap with and link to the objectives for water quality and water supply. These cross-cutting issues serve as a reminder that the availability of high-quality water is essential to both human and natural communities.

Table 7-3: Objective 3 RMSs and Evaluation Metrics

Objective 3: Provide stewardship of water dependent natural resources	
Resource Management Strategy	**Evaluation Metric**
3.1 Protect, restore, and enhance natural processes, habitats, and threatened and endangered species, while providing opportunities for public access, education, and recreation where appropriate **o**	Number of acres of project site and/or habitat being protected, restored, or enhanced, or number of species being protected
3.2 Support research and monitoring to better understand the impacts of water-related projects on environmental resources **o**	Number of research and monitoring studies undertaken
3.3 Identify, develop, and enhance efforts to control invasive species **o**	Number of acres or sites where invasive species are removed or prevented from establishing
3.4 Support dedication of riparian water rights for in-stream use **o**	Amount of water set aside for in-stream use

Objective 4: Maintain and Enhance Water, Wastewater, Emergency Response, and Power Generation Infrastructure Efficiency and Reliability

Throughout the region, and in disadvantaged communities in particular, outdated water delivery equipment, lack of back-up generators, and/or antiquated piping present significant challenges to providing safe and reliable water supplies for both human consumption and fire protection, as well as wastewater treatment. Compounding this situation is the fact that much of the antiquated water infrastructure is in areas that experience extremely cold winters with significant snowfall; thus, the period of time during the year within which any construction and/or maintenance can occur is extremely limited. Moreover, many of these same areas are rural and do not have the technical, managerial, financial, and political capacity to effectively manage, maintain, and fund their water-related infrastructure and regulatory compliance matters.

Another concern is the energy and water use efficiency of both water treatment and delivery infrastructure and of power generating facilities. Since many of the areas within the region rely on old and/or inefficient equipment and motors to drive their groundwater pumping and water conveyance, a significant amount of energy is currently being wasted. Additionally, recent proposals for desert solar energy developments have generated concern about the water needed to help maintain their infrastructure. A better understanding of the energy and water intensity of various types of infrastructure in the region would help to improve efficiency and reduce greenhouse gas emissions.

Table 7-4: Objective 4 RMSs and Evaluation Metrics

Objective 4: Maintain and enhance water, wastewater, emergency response and power generation infrastructure efficiency and reliability	
Resource Management Strategy	**Evaluation Metric**
4.1 Promote rehabilitation and replacement of antiquated water and wastewater delivery and treatment facilities **o**	Number of improvements made and/or amount of improved infrastructure, in appropriate units (e.g., linear feet of pipe replaced and/or repaired)
4.2 Promote and improve energy efficiency of water and wastewater systems and uses **o**	Reduction in energy demand from water and wastewater systems
4.3 Support water use efficiency in power generating facilities **o**	Reduction of water volume required by power generating facilities
4.4 Ensure adequate water supplies for fire protection and emergency response **o**	Number of fire suppression systems meeting fire flow requirements
4.5 Provide resources for development and improvement of emergency response plans **o**	Number of emergency response plans developed, updated, and implemented

Objective 5: Address Climate Variability and Reduce Greenhouse Gas Emissions

Since the inception of the Inyo-Mono IRWM Program, the information on climate change specific to the region has increased in both amount and quality. Model projections have also improved and show continued increased temperatures, longer summers, declines in snowpack, and changes in runoff and streamflow timing. Increased weather variability, as well as extreme events, are already being observed (e.g., the large winter of 2010-2011, the drought of 2012-2016). Scenarios indicate a higher reliance on groundwater as surface water availability becomes more unpredictable in order to maintain current levels of agricultural development and to accommodate population growth. Yet impacts of climate change to groundwater recharge in the area are little-known. Drier-than-average conditions may also result in an increase in the frequency of fires. Primary and secondary impacts caused by fires include damage to watersheds, changes in surface runoff and percolation, damage to water systems, and economic impacts to the area (see Chapter 3 for a more in-depth discussion). Additionally, proposals for renewable energy production facilities, to be located in the desert, may have their own water demands and associated impacts to quantity and quality of groundwater resources.

It is important to consider both adaptation and mitigation measures related to climate variability and water resources in the Inyo-Mono IRWM region. Adaptation may include activities and projects that respond to and protected against changes in amount, intensity, quality, and timing of surface water runoff as well as changes in groundwater recharge. Mitigation measures would reduce energy consumption in relation to water resources (or promote renewable energy resources) and thus decrease the region's greenhouse gas contribution. Finally, though carbon sequestration is not a primary topic of interest in the Inyo-Mono IRWM region, there may be opportunities to support this practice through wetland restoration.

The Resource Management Strategies for this objective were developed as a result of the vulnerability assessment and impacts analysis detailed in Chapter 3.

Table 7-5: Objective 5 RMSs and Evaluation Metrics

Objective 5: Address climate variability and reduce greenhouse gas emissions	
Resource Management Strategy	**Evaluation Metric**
5.1 Increase understanding of the greenhouse gas emissions resulting from water operations and management, and support efforts to reduce water-related greenhouse gas emissions in the region **o**	Number of greenhouse gas emissions inventories completed; reduction in water-related greenhouse gas emissions in Inyo-Mono region
5.2 Increase understanding of impacts of climate change on water supplies and water quality **o**	Completion of vulnerability assessment and impacts analysis
5.3 Manage and modify water system operations to respond to increasing climate variability **o**	Number of projects completed
5.4 Support efforts to diversify energy sources, that do not negatively impact water supply or quality, to move and treat water within the region in order to reduce greenhouse gas emissions **o**	Number of research and development projects developed and/or implemented
5.5 Support assessment and mitigation of water-related impacts of renewable and non-renewable energy projects **o**	Number of assessment studies and mitigation plans completed
5.6 Promote public education about climate change impacts and adaptation measures, particularly as they relate to water resources management in the region **o**	Number of survey responses indicating gained understanding about potential climate change impacts
5.7 Develop and implement integrated drought preparedness measures **o**	Number of drought preparedness activities developed and implemented
5.8 Support efforts to manage fuel loads in regional forests to reduce fire hazard **o**	Number of acres treated; number of communities protected

Objective 6: Encourage Participation of Small and Disadvantaged Communities, Including Tribes, in IRWM Process to Identify and Work towards Meeting Their Needs

The RWMG's mission statement emphasizes the need for a consensus approach in water resources management within the region, and the vision statement emphasizes the need for a stakeholder-driven process. Maximizing stakeholder and community involvement and stewardship is essential to the success of the IRWM Plan. A vital part of stakeholder involvement is the inclusion of disadvantaged communities and Native American Indian tribes. Both types of stakeholders are prevalent in the Inyo-Mono region, and there has always been an emphasis on outreach to these communities throughout the existence of the IRWM Program.

Stakeholder involvement is a vital part of the IRWM planning process as a means to identify and address public interests and perceptions, address questions and issues, ensure that the Program and any proposed solutions are in keeping with public interests, and provide for public ownership and support of proposed solutions. The Inyo-Mono RWMG has maintained its commitment to a bottom-up, stakeholder-driven process as its model to ensure successful and widely-supported projects and programs. Stakeholder involvement assists the Program in identifying areas where increased education, outreach, and capacity building are required.

More recently, an increased awareness of cultural uses of water has arisen as a result of engagement with Native American Indian tribes. Such uses include subsistence fishing, ceremonial activities, and spiritual fulfilment.

Table 7-6: Objective 6 RMSs and Evaluation Metrics

Objective 6: Encourage participation of small and disadvantaged communities, including tribes, in IRWM process to identify and work towards meeting their needs	
Resource Management Strategy	**Evaluation Metric**
6.1 Provide technical, managerial, and financial assistance for tribal, DAC, and small water systems **o**	Number of requests received; number of water systems assisted
6.2 Promote education and training programs for small water systems, schools, DACs, and tribes about water resource protection, pollution prevention, conservation, water quality, watershed health, and climate change **o**	Number of lectures and/or materials developed and distributed; number of survey responses indicating gained understanding about water resources
6.3 Promote social resilience in DACs, small water systems, and tribes to more effectively respond to social, economic, or environmental disturbances impacting water-related resources **o**	Number of lectures and/or materials developed and distributed; change in number and impact of social, economic, and environmental disturbances
6.4 Facilitate outreach to establish new relationships and build on existing relationships with stakeholders	Number of new contacts; additions to master IRWMP contact list

Objective 7: Promote Sustainable Stormwater and Floodplain Management that Enhances Flood Protection

The outreach conducted since completion of the Phase I Plan highlighted the flood-related management challenges faced by a few communities in the region, including Ridgecrest, Mammoth Lakes, Coleville, and Fort Independence Indian Reservation. As is common in many mountainous areas, development in upper elevations and steep hillside areas exacerbates problems of stream instability, erosion, and flooding. A challenge somewhat unique to the Inyo-Mono area is the erosion and subsequent flooding experienced after wildfires, which in turn can impact the amount and quality of water supplies available for human communities. Additionally, many areas are ill-equipped to handle and direct high flows that result occasionally after extreme rainstorms. In a few isolated situations, extensive damage to commercial businesses has resulted from extensive rainstorms. In other areas, sediment management is needed to increase channel carrying capacity while also increasing habitat values. Addressing these challenging issues is made increasingly difficult by the fact that ownership of the various streams is mixed among private and public entities

The Inyo-Mono IRWM Program completed three planning studies that help to address concerns about stormwater runoff and flooding in the region. These studies target three different watersheds in the region – West Walker, Mammoth Basin, and Oak Creek – all of which have experienced fairly recent impacts of flooding resulting from large precipitation events. The Town of Mammoth Lakes used its stormwater master plan developed through a Prop. 84 Planning Grant to provide the foundation for a Stormwater Resources Plan. With the completion of this plan in 2018, the Inyo-Mono RWMG hopes that the other two incorporated cities in the region, Bishop and Ridgecrest, will undertake development of their own stormwater resource plans.

Table 7-7: Objective 7 RMSs and Evaluation Metrics

Objective 7: Promote sustainable stormwater and floodplain management that enhances flood protection	
Resource Management Strategy	**Evaluation Metric**
7.1 Characterize current stormwater and flood management situations and challenges o	Number of studies undertaken and reviewed
7.2 Promote region-wide integrated stormwater and flood management planning o	Number of planning efforts undertaken and/or implemented
7.3 Improve existing stormwater and flood management infrastructure and operational procedures o	Number of relevant stormwater and flood techniques/strategies implemented or facilities improved
7.4 Encourage integrated land use and water policies that promote sustainable development o	Number of sustainable development policies adopted by various local and regional governments
7.5 Promote projects and practices to protect infrastructure and property from flood damage o	Number of acres, buildings, or system elements protected as a result of projects
7.6 Integrate ecosystem enhancement, drainage control, and natural recharge into policy and planning documents, project review, and project implementation o	Number of relevant projects constructed
7.7 Develop and implement education and outreach activities focused on stormwater and flood management matters o	Number of lectures and/or materials developed and distributed; number of survey responses indicating gained understanding about flood management
7.8 Capture and manage stormwater runoff where feasible o	Amount of stormwater runoff diverted from drainage system

Objective 8: Support Groundwater Monitoring, Management, and Mitigation in Cooperation with all Affected Parties

Water purveyors and individual homeowners throughout the Inyo-Mono region rely heavily on groundwater as a primary source of domestic and agricultural water. Many water users in the region have expressed serious concerns with both the quantity and quality of the groundwater on which they rely. Many parties expressed a growing desire to protect groundwater resources from pollution, degradation, and overdrafting as an important step towards improving water quality, water supply reliability, and habitat quality within the region. Furthermore, there is a need to better understand the current status and recent trends in groundwater quality and quantity, which will help regional entities respond to recent groundwater regulations. Two basins in the region (Owens Valley and Indian Wells Valley) have been listed as high-priority through the Sustainable Groundwater Management Act process. Actions taken within the IRWM and/or SGMA processes will impact the reliability and quality of groundwater in these two basins.

Table 7-8: Objective 8 RMSs and Evaluation Metrics

Objective 8: Support sound groundwater monitoring, management, and mitigation in cooperation with all affected parties	
Resource Management Strategy	**Evaluation Metric**
8.1 Support and implement state-mandated groundwater and surface water monitoring requirements, and other groundwater monitoring efforts o	Number and scale of monitoring and compliance efforts undertaken
8.2 Promote efforts to monitor, manage, and mitigate impacts of groundwater-dependent projects o	Number of and scale monitoring efforts undertaken; reduction in adverse effects
8.3 Develop and support projects that mitigate for the effects of groundwater extraction o	Number of mitigation efforts undertaken; reduction in adverse effects from extraction
8.4 Protect and improve the quality and quantity of stored groundwater supplies and recharge areas o	Number of projects undertaken; improved water quality parameters; improvement in groundwater elevations over space and time
8.5 Promote conjunctive use projects o	Increased reliability and increased elevation of groundwater
8.6 Identify existing gaps in groundwater and surface water quantity and quality information and undertake appropriate characterization studies o	Number of studies initiated and/or completed; number of data gaps identified; number of data collected/assessed
8.7 Collect data and monitor groundwater and surface water supply variability o	Number of research and monitoring studies undertaken; number of data contributed to State and federal databases
8.8 Promote efforts to manage and design groundwater projects so that future impacts requiring mitigation are avoided o	Number of projects designed and/or changes in mitigation requirements

7.3 Prioritization of the IRWM Plan Objectives and Resource Management Strategies

The Inyo-Mono RWMG has determined that all objectives and corresponding resource management strategies are to be "co-equal" in terms of prioritization. However, the RWMG has also stated that there is explicit support for planning and implementing projects that benefit disadvantaged communities and tribes. The RWMG recognizes that by pursuing a wide range of projects that support the eight independent objectives, synergies among the various objectives will be enhanced and the end result will be in pursuit of the overarching mission. Since this Plan represents the region's evolving IRWM efforts, the RWMG supports projects that advance any of the stated objectives. When implementing regional projects, project proponents will strive to meet and integrate as many objectives as possible while also recognizing that some objectives may not be fully achieved. Furthermore, additional objectives may be considered in future revisions of the IRWM Plan.

7.4 Relationship to Proposition 84 Guidelines and California Water Plan Updates 2009 and 2013

The Inyo-Mono IRWM planning process has been developed and implemented with a consideration both of regional priorities and the Proposition 84 IRWM Plan Guidelines. The Inyo-Mono IRWM Plan is consistent with the intent of the Proposition 84 IRWM Grant Program: to encourage integrated regional strategies for management of water resources and to provide funding for projects that protect communities from drought, protect and improve water quality, and improve local water security by reducing dependency on imported water.

Furthermore, the Inyo-Mono IRWM Plan objectives and resource management strategies are consistent with the Proposition 84 Grant Program Preferences for proposals that:

- Include integrated projects with multiple benefits
- Effectively integrate water management programs and projects within a hydrologic region identified in the California Water Plan; the Regional Water Quality Control Board region or subdivision; or other region or sub-region specifically identified by DWR
- Effectively resolve significant water-related conflicts within or between regions
- Address critical water supply or water quality needs of DACs within the region
- Effectively integrate water management with land use planning
- For eligible SWFM funding, projects which a) are not receiving State funding for flood control or flood prevention projects pursuant to PRC Section 5096.824 or Section 75034 or b) provide multiple benefits, including, but not limited to, water quality improvements, ecosystem benefits, reduction of instream erosion and sedimentation, and groundwater recharge
- Address Statewide priorities:
    - Drought preparedness
    - Use and reuse water more efficiently
    - Climate change response actions
    - Expand environmental stewardship
    - Practice integrated flood management

- Protect surface water and groundwater quality
- Improve tribal water and natural resources
- Ensure equitable distribution of benefits

The Inyo-Mono IRWM Plan objectives and resource management strategies described above are also in line with statewide priorities set forth by the *California Water Plan* (2009 and 2013 Updates) and the Proposition 84 Guidelines.

The California Water Plan lays out a roadmap for water management through the year 2030. Where appropriate, these California Water Plan objectives have been applied in the Inyo-Mono IRWM planning process. The RWMG recognizes that various strategies are often connected to one another, as well as to other activities. As such, the IRWM Plan looks to find projects that help diversify the water management portfolio for the region as well as create positive synergistic effects that aid in improving the overall water and environmental condition of the region and State. An analysis of the relationship between California Water Plan Update 2009 Resource Management Strategies and Inyo-Mono IRWM Plan RMS is shown in Table 7-2.

Table 7-9: Relationship between CA Water Plan Update 2009 and Inyo-Mono IRWM Resource Management Strategies

Resource Management Strategies		
CA Water Plan Update 2009		Inyo-Mono IRWM Plan
Pillars	Resource Management Strategies	Resource Management Strategies addressed *Yes, No, Not Applicable* *(Identified from Tables 7-1 through 7-8)*
Reduce water demand	1. Agriculture Water Use Efficiency	1. Yes
	2. Urban Water Use Efficiency	2. Yes
Improve Operational Efficiency and Transfers	1. Conveyance-Delta	1. Not Applicable
	2. Conveyance-Regional/local	2. Yes
	3. System Reoperation	3. Yes
	4. Water Transfers	4. Yes
Increase Water Supply	1. Conjunctive Management and Groundwater Storage	1. Yes
	2. Desalination	2. Yes
	3. Precipitation Enhancement	3. Yes
	4. Recycled Municipal Water	4. Yes

Resource Management Strategies		
CA Water Plan Update 2009		**Inyo-Mono IRWM Plan**
Pillars	Resource Management Strategies	Resource Management Strategies addressed *Yes, No, Not Applicable* *(Identified from Tables 7-1 through 7-8)*
	5. Surface Storage-CALFED	5. Not Applicable
	6. Surface Storage-Regional/Local	6. Yes
Improved Water Quality	1. Drinking Water-Treatment and Distribution	1. Yes
	2. Groundwater Remediation/Aquifer Remediation	2. Yes
	3. Matching Quality to Use	3. Yes
	4. Pollution Prevention	4. Yes
	5. Salt and Salinity Management	5. Yes
	6. Urban Runoff Management	6. Yes
Improved Flood Management	1. Flood Risk Management	1. Yes
Practice Resources Stewardship	1. Agricultural Lands Stewardship	1. Yes
	2. Economic Incentives (Loans, Grants, Water Pricing)	2. Yes
	3. Ecosystem Restoration	3. Yes
	4. Forest Management	4. Yes
	5. Recharge Area Protection	5. Yes
	6. Water-Dependent Recreation	6. Yes
	7. Watershed Management	7. Yes

Resource Management Strategies		
CA Water Plan Update 2009		**Inyo-Mono IRWM Plan**
Pillars	Resource Management Strategies	Resource Management Strategies addressed *Yes, No, Not Applicable* *(Identified from Tables 7-1 through 7-8)*
Other Strategies	1. Crop Idling for Water Transfers	1. Yes
	2. Dewvaporation or Atmospheric Pressure Desalination	2. No/Not Applicable
	3. Fog Collection	3. No
	4. Irrigated Land Retirement	4. Yes
	5. Rainfed Agriculture	5. Yes
	6. Waterbag Transport/ Storage Technology	6. No

7.4.1 Relationship to California Water Plan Update 2013 RMS

The 2013 California Water Plan Update contains three resource management strategies in addition to the RMS listed in the previous section:

- Sediment Management
- Outreach and Engagement
- Water and Culture

All three RMS are considered in the Inyo-Mono IRWM Plan's objectives and RMS.

Chapter 8 : Coordination

8.1 Intent of Coordination

The intent of coordination in the context of the Inyo-Mono IRWM planning effort is to ensure the following:

- ***The RWMG coordinates and integrates its activities with local agencies and stakeholders to avoid conflict within the region and to best utilize resources;***
- ***The RWMG is aware of adjacent planning efforts and is coordinating with adjacent RWMGs;***
- ***The RWMG is aware of State, federal, and local agency regulations, resources, and roles pertaining to the implementation of the IRWM Plan and individual projects; and***
- ***The RWMG participates in local, regional, and statewide efforts to influence water policy and management.***

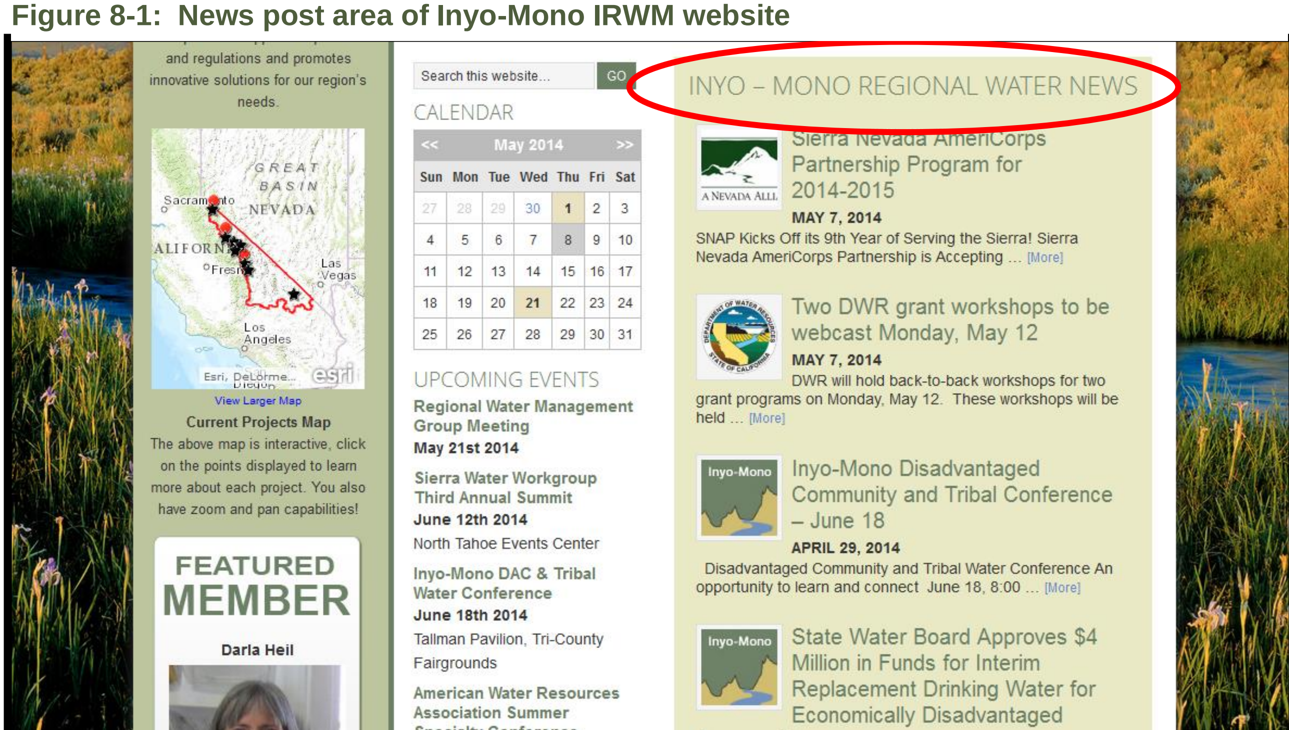
The Inyo-Mono RWMG has made a concerted effort to identify, engage with, and involve all relevant local agencies and stakeholders since the inception of the IRWM Program. Indeed, outreach to regional stakeholders, be they public agencies, private business, NGOs, water systems, disadvantaged communities, or tribes, has a high priority of the IRWM Program. The RWMG believes strongly that through coordination among local agencies, interested stakeholders, and adjacent IRWM regions, efficient use of resources can be achieved, redundant actions can be reduced, and opportunities for cooperative and integrated projects can be identified.

8.2 Coordination of Water Management Activities within Region

The strength of any IRWM planning effort lies in the degree to which involved parties engage and coordinate with one another. Understanding this fundamental concept, the Inyo-Mono RWMG has worked hard to create a forum for local project proponents and stakeholders to coordinate with one another on relevant water-related activities and efforts. The result is a broad and encompassing stakeholder group that meets regularly and works together to avoid conflicts and maximize efficiencies. Those entities involved represent interests ranging from federal, state, and local government; resource and water agencies; non-profit and conservation organizations; American Indian tribal organizations; educational organizations; business interests; agriculture and ranching groups; and individuals having vested interests in how water is managed in eastern California (see more on the composition of the RWMG in Chapter 5). In addition to those entities that are RWMG Members and/or regularly participate in the planning process, there is a large number of organizations and individuals who are on the Inyo-Mono RWMG contact list and regularly receive updates and notices of meetings. Some of these entities have been regular participants in the past but do not currently participate at a high level. The contact list, however, provides opportunity for coordination and collaboration through the regular communications that are distributed from the Program Office. In total, almost 200 people are included in the Inyo-Mono contact list, representing about 100 organizations (see Chapter 1).

To keep all interested parties informed of the IRWM effort and recent developments, a variety of communication tools are used. Notices and agendas for upcoming RWMG meetings are sent to all people on the email contact list, as are meeting summaries and any other relevant information about the Inyo-Mono IRWM process or issues related to water planning and management in the region. In addition, Program Office staff is available by phone and by email for questions and information requests. When warranted, staff will travel within the region, or to Sacramento, to meet with stakeholders, members of the public, and DWR officials. The program website (www.inyo-monowater.org) has become an increasingly visible and important tool for sharing information with current Members and reaching out to new stakeholders. On this website, visitors can find topics such as introductory information about the Inyo-Mono IRWM Program, member organizations, meeting summaries and other important documents, and links to other IRWM Program websites. A particularly important component of the website are the news posts. These bits of information help to communicate news and events to the RWMG and the public, are often related to entities outside of the Inyo-Mono IRWM region, and help to communicate opportunities for creating alliances and collaboration. Despite problematic Internet availability in some areas of the region, the Program Office regularly hears that email and the website are the best way to communicate information to stakeholders in the region.

Figure 8-1: News post area of Inyo-Mono IRWM website



One of the most tangible, yet unquantifiable, benefits of the Inyo-Mono IRWM process to date has resulted from the practice of gathering water-related stakeholders at meetings on an almost-monthly basis to discuss the group, its activities, and water issues. Many of the organizations sitting at the table have historically been at odds over water issues. While it is not expected, nor intended, that the RWMG will solve all water-related conflicts in the region, many RWMG participants have acknowledged the advantages of increased communication and cooperation among adversaries and allies alike. The process has helped to educate stakeholders about each other‘s activities, priorities, and challenges. For instance, smaller water districts have sought advice from larger water districts on technical issues. Less experienced communities benefit by learning from groups with more experience in water management, and in turn, RWMG stakeholders have begun to understand the difficulties of maintaining high-quality water resources and ensuring ecosystem protection in small, rural communities and DACs. During the RWMG‘s visioning exercise in early 2010, several RWMG participants expressed the desire that the IRWM planning process should help individual stakeholders overcome conflict and should allow the group to speak with one voice and from common objectives.

There are two tangible examples of how coordination of water management activities has increased in the region thanks to the IRWM Program. The first example involves a small mobile home park in northern Mono County whose groundwater source is out of compliance for arsenic (the water source is also hot). The homeowners' association has consulted with two other small water systems in the region, one of which also has arsenic compliance issues, to learn how these water systems have approached issues with regulations, staffing, water testing, etc. The IRWMP facilitated first contact among these systems and stays in touch with the water managers on a regular basis.

The second example of coordination involves the Oak Creek watershed in central Inyo County. A 2007 fire in the watershed burned much of the vegetation, leaving the hillsides susceptible to erosion. A year later, a summer monsoon event caused a large flash flood and accompanying mudslide in the canyon, destroying homes and other structures. The Inyo National Forest, which manages much of the land in the Oak Creek watershed, is working with the Fort Independence Indian Reservation, which is on the downstream end of the canyon and experienced flooding on the reservation. Through an IRWM planning grant, the parties are working together to develop a restoration and management strategy for the watershed.

8.3 Identification and Coordination with Neighboring IRWM Regions

Inyo-Mono IRWM stakeholders have recognized the importance of understanding water management issues in neighboring IRWM regions and their relation to Inyo-Mono water issues. Understanding and appreciating the importance of coordination between the Inyo-Mono RWMG and neighboring RWMGs, the Inyo-Mono RWMG began reaching out to other efforts early on. Specifically, through the 2009 Region Acceptance Process, the Inyo-Mono RWMG identified all eastern California IRWM planning regions (see Figure 1-1 in Chapter 1) and held a series of meetings to ensure consistency in IRWM planning region boundary designations and to set the stage for potential coordination at the interregional scale. For example, the Inyo-Mono region overlaps with the Mojave IRWM planning region due to differences between the watershed boundary and a water agency jurisdictional boundary. As a result of this overlap, the two efforts have communicated during development and refinement of the respective IRWM Plans. In addition, the Inyo-Mono RWMG sought guidance from established IRWM groups in the development of its first planning grant application and the Phase I Plan.

As the Inyo-Mono IRWM Program developed, solid working relationships were established with several adjoining IRWM groups, including CABY, Tuolumne-Stanislaus, Tahoe-Sierra, Yosemite-Mariposa, Mojave, and Antelope Valley. The Inyo-Mono Program has also worked with several of the Sierra Nevada IRWM groups on issues of specific importance to the mountain range, such as water exports, economic development, and disadvantaged communities. There has also been a significant amount of coordination among the IRWM groups in the Lahontan Funding Area, whose boundaries are contiguous with the Lahontan Regional Water Quality Control Board Region 6. It is recognized among all of the groups that coordination on grant funding is desired, as this helps to ensure that all six regions in the funding area receive a portion of funding. Such coordination was undertaken for the final round of Prop. 84 Implementation funding and has taken place throughout the duration of Prop. 1 funding rounds thus far.

Although not a neighbor to the Greater Los Angeles County (GLAC) IRWM Program by geographic standards, the Inyo-Mono planning region provides critical source water for the City of Los Angeles. Water exports from the Inyo-Mono region are a continued source of struggle between local water stakeholders and the City of Los Angeles. It is hoped that the IRWM effort can help “downstream” users establish a connection with their source water. Maintaining stewardship of water resources within the Inyo-Mono region has direct implications for the water quality and supply to millions of people in Los Angeles; stewardship of water resources should be of interest to both regions. Recognizing these mutual interests, Inyo-Mono Program Office staff has met with members of the Leadership Committee of the GLAC IRWM Program in the hopes of developing inter-regional collaborations benefitting residents and resources of both regions. Though no tangible outcomes have resulted from these conversations thus far, Inyo-Mono staff and stakeholders will continue attempts to create a relationship with southern California water managers and users to foster understanding of source water regions and concerns.

8.4 Coordination and Involvement with Other Planning Efforts

Recognizing the importance of engaging with other water planning efforts within and adjacent to California, the Inyo-Mono IRWM Program has been part of several efforts both within and outside of specific IRWM activities.

8.4.1 Sierra Water Work Group

The Sierra Water Workgroup (SWWG) is a coalition of 11 Sierra Nevada RWMGs that seeks to raise awareness of the importance of Sierra Nevada snowpack, watersheds, and communities to California's water supply. The mission of the group is to assist regional efforts to protect and enhance water quality, water supply, and watershed health; to develop cooperative regional responses; and to facilitate reinvestment in our watersheds and water resources by all beneficiaries. The Inyo-Mono IRWM Program was a founding member of the SWWG and has remained engaged as a member since its inception. Program Office staff and RWMG stakeholders participate in a leadership role in SWWG meetings and its annual summit. (http://www.sierrawaterworkgroup.org/)

8.4.2 Roundtable of Regions

The IRWM Roundtable of Regions (RoR) is an ad-hoc group comprised of representatives from IRWM Programs throughout California. As with the SWWG, the RoR provides an opportunity for dialogue amongst IRWM Programs and with the State. However, unlike the SWWG, the geographic scope of the RoR is significantly broader, providing a greater opportunity to give input to, and gain knowledge from, other IRWM planning efforts. This group is a good source of information and input for both participating RWMGs and DWR, particularly when specific statewide initiatives, programs, or funding opportunities are launched. More recently, the Roundtable process has become more formal through the hiring of contracted staff members. The Inyo-Mono Program Office is an active participant in the RoR and has been since its inception.

8.4.3 California Water Plan Update

The California Water Plan serves as an umbrella water planning document for the State. The Plan is revised every five years to reflect current trends, needs, and priorities related to water planning and provide the framework for policy development and funding priorities. Included in this planning is an emphasis on DWR's IRWM Program. Program Office staff was extensively involved in the Water Plan Update 2013 process, serving on the Public Advisory Committee and several topical caucuses (Finance, DAC, and Climate Change), as well as playing a leadership role in the development of the North and South Lahontan regional description chapters. Program Office staff was not as heavily involved in the Update 2018 process but did participate in one of the plenary sessions. Through its involvement, Program Office staff has provided a voice in Sacramento for high-priority water needs of the Inyo-Mono region, and, in turn, has acted as a liaison between state and regional planning entities by bringing information to the RWMG regarding state water planning activities.

8.4.4 Central Nevada Regional Water Authority

Early on in the Program, Inyo-Mono Program Office staff participated in annual Great Basin Water Forum meetings convened by the Central Nevada Regional Water Authority, a collaborative group comprised of stakeholders from central and northern Nevada, as well as Utah and three counties within California (including Inyo and Mono Counties). This group meets regularly to discuss water issues of concern in Nevada and bordering states. Because the Inyo-Mono region shares a border with Nevada and includes common watersheds, the RWMG recognizes the importance of understanding western Nevada water issues and establishing relationships with Nevada water stakeholders.

8.5 Coordination with Agencies and Agency Support

Recognizing the important role that both federal and State government agencies play in water resources management in the Inyo-Mono region, the RWMG has worked diligently to involve relevant agencies in the overall effort. A number of agencies, including California Department of Fish and Wildlife, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. National Park Service, and U.S. Bureau of Reclamation, regularly attend RWMG meetings. Given that more than 90% of the Inyo-Mono region's land area is comprised of public land, these government agencies are important partners in coordinating land and water planning for the region. Similarly, the Inyo-Mono RWMG has spent considerable time and effort cultivating its relationship with DWR. Staff at DWR provided helpful guidance and information during the development of the Inyo-Mono governance structure and planning process. DWR continues to be an essential partner in the Inyo-Mono IRWM process.

A key role for DWR is in facilitating connections among IRWM regions. DWR maintains contact information for each region and has access to the most up-to-date activities for each region. In addition, encouragement for coordination among regions from DWR carries weight with the regions. One example of such inter-regional communication being encouraged by DWR are the meetings that have taken place among the seven IRWM regions that received DAC outreach & engagement grants. While all of the regions agree that the communication and coordination that has taken place was beneficial, encouragement from DWR helped to ensure that these conference calls took place and were attended by all seven regions.

Over the years it has become apparent that another important role of the IRWM Program is to provide a voice for regional stakeholders and water issues at the state level. Because of the strong network built over time by the Program Office and the RWMG, the IRWM Program is in a unique position to relay regional issues and concerns to state agencies and officials. Indeed, several Inyo-Mono RWMG Members have indicated that this is a valued role and service provided by the Program.

Given the rural nature of the Inyo-Mono region and the numerous disadvantaged communities, there is a preponderance of small yet critical water needs. These needs span the water supply, water quality and ecosystem stewardship scope, and many of these needs occur in small water systems supplying between 10 and 100 households. In addition to direct water-related needs, there is a paucity of technical, managerial and financial resources necessary to manage the small water systems that occur throughout the region. Funding is often difficult to come by as a result of challenging proposal requirements, high administrative costs, and prohibitive match funding requirements. The Inyo-Mono RWMG has attempted to address these needs at the State level by providing feedback to DWR about its grant requirements. The RWMG encourages more flexibility within the State's IRWM Program to be more responsive to the needs of small, rural communities. Furthermore, DWR is in a position to serve as an advocate for these small and disadvantaged communities with legislators, regulators, and policymakers.

Although awareness of the needs of disadvantaged communities has improved substantially over the last decade, local, state, and federal agencies can and should do more to help the needs of small, rural, and disadvantaged communities and water systems. Such assistance would require a more coordinated approach among granting agencies and regulatory agencies to achieve better alignment between grant requirements and the actual needs and abilities of communities. Improved coordination of this type would provide greater opportunity to leverage multiple funding opportunities to meet match requirements and increase the scope of funding available to support local and regional needs. Similarly, state and federal grant programs could increase their outreach to stakeholders to improve awareness regarding what funding opportunities exist. For example, the California Financing Coordinating Committee conducts annual funding fairs that are open to the public, yet stakeholders living in small, rural areas often are not aware of these fairs or of the opportunities they provide. Moreover, the fairs are almost always convened in more densely populated areas, requiring many hours of travel and often an overnight stay in order to attend. The Inyo-Mono RWMG encourages innovative solutions, such as a "finance extension" program where representatives from funding agencies travel throughout the state, engaging with communities to increase awareness of funding opportunities and building capacity to respond to such programs.

Similar to alignment among agencies with respect to grant funding, there could be better alignment among agencies regarding regulations and other requirements for planning and implementation efforts. Project sponsors must often follow rules of one or more local, state, and/or federal agencies when implementing projects. At times, these rules overlap or conflict. Improved coordination among agencies and with project sponsors could eliminate redundant efforts and inefficiencies. An added challenge is that sovereign tribal entities are obligated to comply with State regulations and requirements in order to be awarded State grant funding. At times, these requirements are not consistent with or more burdensome than the tribes' rules.

The Inyo-Mono RWMG has always strived to maximize the opportunity to work and coordinate with stakeholders throughout the region, throughout the state, and even into neighboring Nevada. Although primarily focused on the Inyo-Mono region, the RWMG seeks to learn from and support other planning efforts in order to leverage one another's experiences and positively impact a greater number of communities throughout the state of California. Fundamental to the success of the Inyo-Mono Program is a continued recognition of the importance to reach out to local, regional, and state-wide stakeholders representing public, private, tribal, and non-profit sectors. The Inyo-Mono IRWM Program will continue to reach out and coordinate with neighboring as well as other water-related planning efforts moving forward.

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Chapter 9 : Finance

Introduction

The Inyo-Mono IRWM Program has, from its inception, been challenged with funding constraints emanating from the very limited number of large, well-funded water-related entities in the region, the preponderance of disadvantaged communities, and the rural nature of the region itself.

Prior to receiving Prop. 84 Planning Grant funding, financial support for the Inyo-Mono IRWM effort primarily comprised of financial support from California Trout and a pre-planning grant awarded by the Sierra Nevada Conservancy. In addition, several monetary contributions have been provided by RWMG participants. However, since that time, significant progress has been made to secure financial resources for the region, falling broadly under three categories: planning, building capacity for economically disadvantaged communities, and project implementation. The implementation of the Inyo-Mono IRWM Plan involves addressing all three of these categories.

Although securing significant short- to medium-term funding for the Inyo-Mono region has been achieved, the financing needed to support broader regional goals and objectives is both critical and significant. *Long-term, consistent programmatic and operational funding is needed in order to sustain the IRWM Program and to continue its beneficial role in the region well into the future.* What follows in this chapter are descriptions of:

1. ***Funding sources that have supported, or currently support, the Inyo-Mono IRWM Program***
2. ***Known and possible funding sources, programs, and grant opportunities***
3. ***Various funding mechanisms, including water enterprise funds, rate structures, and private financing options, for projects that implement the IRWM Plan***
4. ***Certainty and longevity of known or potential funding***
5. ***How operation and maintenance costs for projects that implement the Inyo-Mono IRWM Plan will be covered guaranteed long-term***

9.1 Proposition 84 Funding

Proposition 84 was passed by California voters in 2006 and provided $1 billion in funding to IRWM in California. Prop. 84 funding was made available to individual IRWM regions through a series of grant rounds for planning, DAC engagement, and project implementation. The Inyo-Mono IRWM Program received two planning grants, a DAC engagement pilot project grant, and two project implementation grants. Each grant is briefly described below.

9.1.1 Prop. 84 Planning Round 1

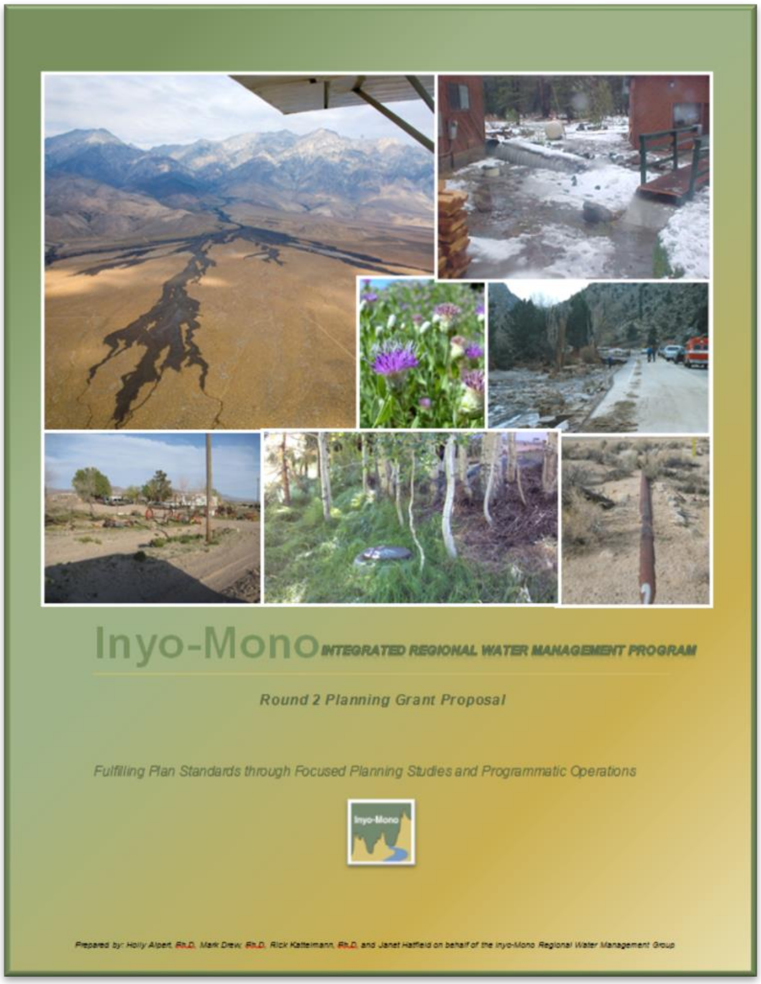
In 2010, the Inyo-Mono IRWM Program received its first CA Department of Water Resources Planning Grant in the amount of $237,615, with California Trout serving as grantee. This funding was matched by local contributions (primarily in-kind), bringing the total of the Round 1 Planning Grant to $331,653. The primary tasks and associated expenses per task are presented in Table 9-1. The Round 1 Planning Grant concluded in the fall of 2012.

Table 9-1: Round 1 Planning Grant tasks

Task #	Task Description
1	Enhance and Maintain Inyo-Mono IRWMP Collaborative Process & Stakeholder Involvement
2	Update all relevant planning documents and processes in the Inyo-Mono Region
3	Re-evaluate governance and organizational structure for Inyo-Mono IRWMP
4	Incorporate Climate Change into the Inyo-Mono IRWM Plan and Develop Climate Change Adaptation Strategies
5	Conduct Region-Wide Outreach to Refine Phase I Issues, Goals, Objectives, and Strategies
6	Solicit & Evaluate Phase II Projects from Inyo-Mono Planning Region
7	Develop Draft Inyo-Mono IRWMP Phase II, including prioritized projects
8	Review and evaluate draft Inyo-Mono IRWMP Phase II with RWMG
9	Develop and Submit Final Inyo-Mono IRWMP, Phase II
10	Maintain and Enhance Inyo-Mono IRWMP Website, GIS, and Communication Tools

9.1.2 Prop. 84 Planning Round 2

In March 2012, the Inyo-Mono IRWM Program submitted a Round 2 Planning Grant proposal requesting a total of $683,651, with an additional $361,349 being provided as match contributions. As with the Round 1 Planning Grant proposal, California Trout was the grantee. In July 2012, DWR presented preliminary recommendations for Round 2 Planning Grant funding. The Inyo-Mono region was recommended to receive $480,270, representing 70% of the total funding requested. The amount awarded provided necessary funding for the RWMG to revise the Phase II Plan and update it to the 2012



Plan Standards, expand and implement planning projects, and realize general programmatic needs through 2014. More specific details regarding tasks and budgets for the Round 2 Planning Grant are presented in Table 9-2, below. For the Inyo-Mono Region, these funds supported more sophisticated climate change analyses, a significant expansion of GIS and data management, and the completion of a long-term sustainable financing plan. Additionally, three planning studies were completed, supporting river restoration needs in the Walker Basin, streambank stabilization in the Independence area, and a stormwater management plan for the Town of Mammoth Lakes. The Round 2 Planning Grant concluded in 2012.

Table 9-2: Round 2 Planning Grant tasks

Task #	Task Description
1	Sustain and build upon Inyo-Mono IRWM Program Operations
2	Planning Studies
2a	Oak Creek Stream Stabilization Technical Study
2b	West Walker River Restoration Planning Study
2c	Town of Mammoth Lakes Stormwater Management Master Plan
3	Enhance integration of climate change information into the Inyo-Mono IRWM planning process

Task #	Task Description
4	Information/data management, Geographic Information Systems (GIS), and the Inyo-Mono IRWMP website
5	Sustainable funding plan for the Inyo-Mono IRWM Program
6	Integration and updating the Inyo-Mono IRWM Plan to meet Plan Standards

9.1.3 Prop. 84 DAC Pilot Project Grant

In 2011, DWR made a decision to route some of the Prop. 84 funds reserved for inter-regional activities to a handful of pilot projects aimed at engaging and involving disadvantaged communities in regional water planning efforts and building water resources-related capacity for DACs. The Inyo-Mono IRWM region received one of the grants in order to specifically focus on DAC involvement in the rural headwater communities of the eastern Sierra. In August 2011, the Inyo-Mono IRWM Program was awarded $371,000 for this work. Tasks and associated budgets are provided in Table 9-3. This grant was completed in early 2016. As with the two Planning Grants, California Trout served as the grantee.

Table 9-3: DAC Grant Tasks and Budgets

Task #	Task Description
1	Identify under-represented stakeholders in the planning region and develop and implement an outreach strategy to engage them in at least 10 critical planning meetings.
2	Conduct stakeholder meetings to gather feedback on (1) priority local water issues (2) goals and objectives (3) strategies for addressing water issues.
3	Needs Assessments
4	Capacity Building
5	Final synthesis and report drafting
6	Project findings dissemination
7	Develop alternative methods to define rural/mountain/headwaters DACs using quantitative and/or qualitative information
8	Production of documentary film showcasing importance of DAC involvement in water planning in rural communities of California

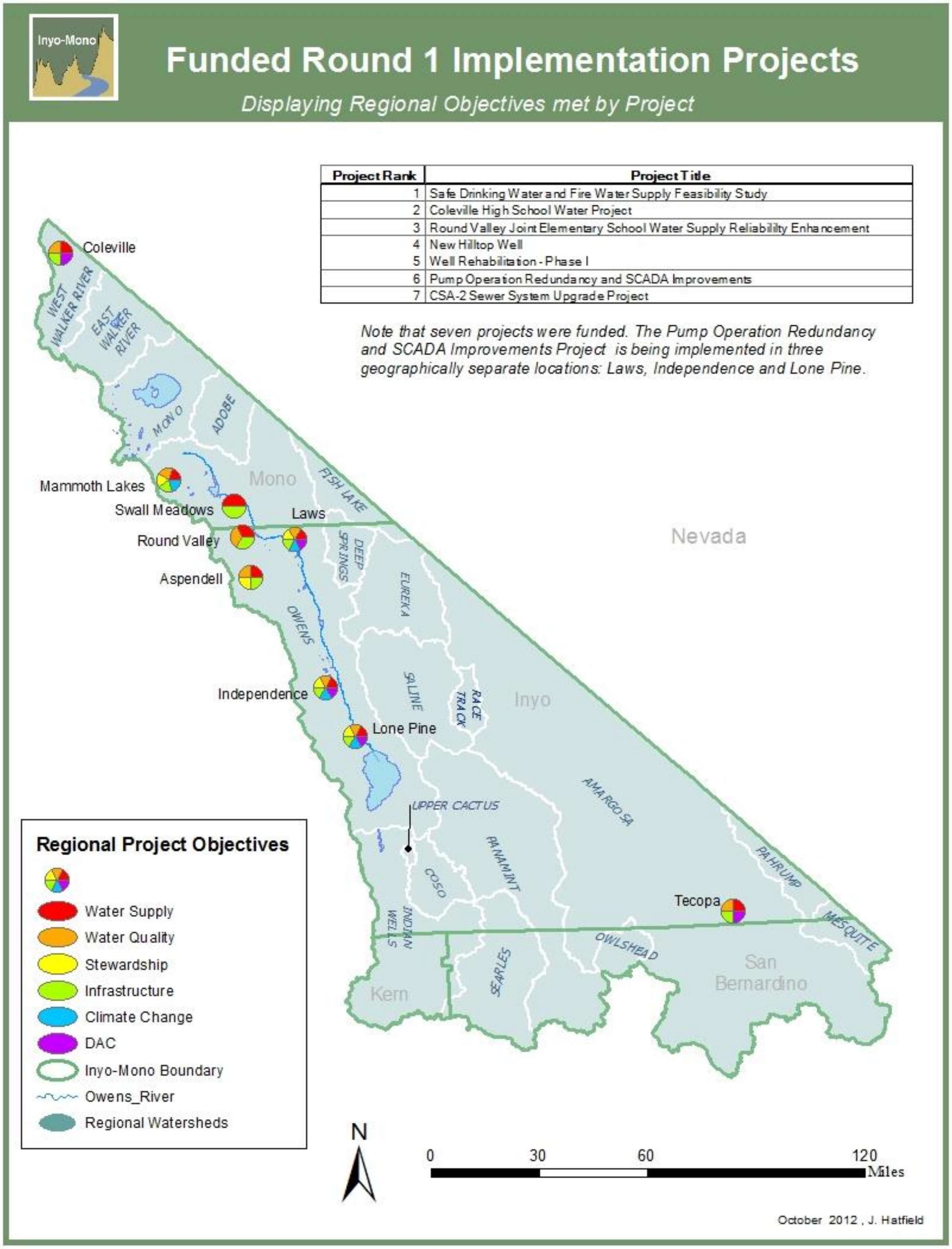
9.1.4 Prop. 84 Round 1 Implementation

In January,2011, the Inyo-Mono IRWM Program submitted a proposal for Round 1 Prop. 84 Implementation funding in the amount of $4,299,858, with a match commitment of $1,400,409. Central Sierra Resources Conservation and Development was the grantee. Although the application was initially not recommended for funding, the RWMG challenged the preliminary recommendation and won a partial funding award. In August 2011, DWR presented the Inyo-Mono IRWM Program an award of $1,075,000, supporting seven distinct projects (see Table 9-5 and Figure 9-1 below).

Table 9-4: Funded Round 1 Implementation Projects

Project sponsor	Project title	Non-State Share (Funding Match)	Requested Grant Funding	Total
Armargosa Conservancy	Safe Drinking Water and Fire Water Supply Feasibility Study for Tecopa, CA	$1,000	$65,172	$66,172
Inyo County	Pump Operation Redundancy and SCADA Improvement Project	$20,391	$62,708	$83,099
Round Valley Joint Elementary School District	Round Valley Joint Elementary School District Water Project	$30,300	$80,400	$110,700
Wheeler Crest Community Services District	New Hilltop Well	$62,100	$55,300	$117,400
Eastern Sierra Unified School District	Coleville High School Water Project	$88,667	$266,000	$354,667
Inyo County	CSA-2 Sewer System Improvements Project	$110,626	$310,895	$421,521
Mammoth Community Water District	Well Rehabilitation (Phase 1)	$37,000	$98,000	$135,000
Central Sierra RC&D	Central Sierra Grant Administration	$ -	$136,525	$136,525
Grant Total		**$350,084**	**$1,075,000**	**$1,425,084**

Figure 9-1: Round 1 Implementation Projects



9.1.5 Prop. 84 (2015) Round 3 Implementation

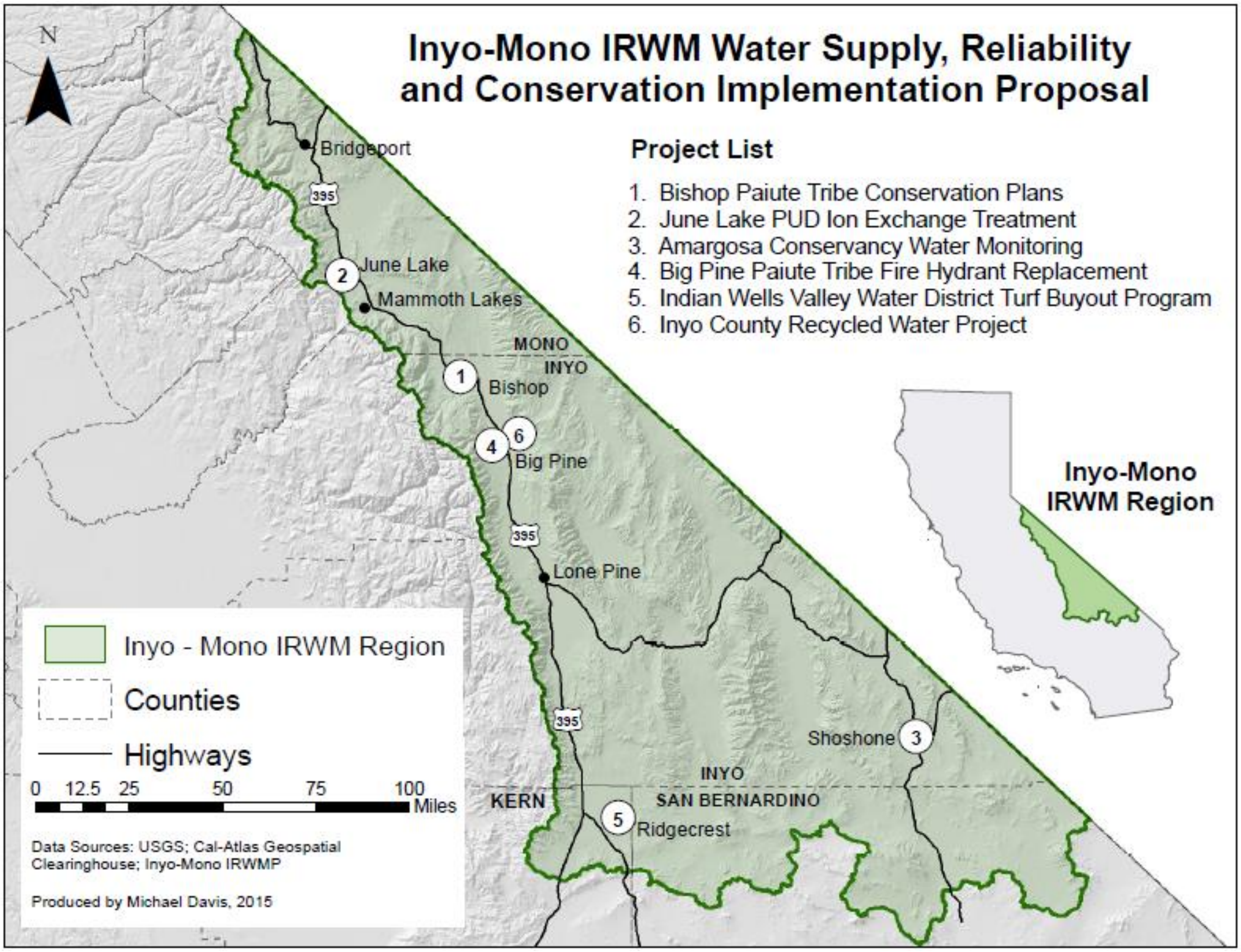
Although the Inyo-Mono IRWM Program applied for the Round 2 Implementation grant, the application was not recommended for funding. The final round of implementation funding was made available in 2015. Because of the agreement in place among the Lahontan Funding Area IRWM regions, the Inyo-Mono region received its full request of $1,816,942 to support six projects. Desert Mountain Resource Conservation & Development was the grantee. Some of the projects are still in process as of the updating of this Plan.

Table 9-5: Funded Prop. 84 Round 3 (2015) Implementation Projects

Project sponsor	Project title	Non-State Share (Funding Match)	Requested Grant Funding	Total
Bishop Paiute Tribe	Bishop Paiute Tribe Irrigation, Domestic Water, and Wastewater Conservation Plans*	$0	$186,712	$186,712
June Lake PUD	June Lake Public Utility District Uranium Removal Plant	$48,850	$145,800	$194,650
Amargosa Conservancy	Amargosa Basin Water, Ecosystem Sustainability, and Disadvantaged Community Project*	$195,000	$492,053	$687,053
Big Pine Paiute Tribe	Big Pine Tribe Fire Hydrant Replacement Project*	$0	$225,300	$225,300
Indian Wells Valley Water District	Ridgecrest Cash-for-Grass Landscape Rebate Incentive Program	$167,800	$322,000	$489,800
Inyo County	Recycled Water for Restoration and Community Projects in Big Pine*	$0	$280,234	$280,234
Desert Mountain RC&D	Overall Grant Administration	$0	$164,843	$164,843
Grant Total		**$411,650**	**$1,816,943**	**$2,228,593**

* Project full or partially benefits a DAC and was granted a partial or full funding match waiver

Figure 9-2: Prop. 84 Round 3 Implementation Projects



9.2 Proposition 1 Funding

Proposition 1 was passed by California voters in 2014. It earmarks $510 million for IRWM throughout California. Proposition 1 mandated that 10% of the IRWM funding be allocated to grants supporting DAC involvement and engagement and another 10% to support DAC implementation projects.

9.2.1 Prop. 1 Disadvantaged Community Involvement (DACI)

The first grant made available was for DAC involvement and engagement. Again, through an agreement with the other Lahontan Funding Area IRWM regions, the Inyo-Mono IRWM Program received $466,822. For the Inyo-Mono region, the tasks of this grant are largely an extension and continuation of work begun under the Prop. 84 planning and DAC grants. The Inyo-Mono DACI grant work began in early 2018 and is slated to be complete in 2021.

Table 9-6: DAC Involvement Grant tasks

Task #	Task Description
1	Grant Administration
2	Needs Assessments
3	Education
4	Community Outreach
5	Engagement in IRWM Efforts
6	Facilitation
7	Technical Assistance
8	Project Development

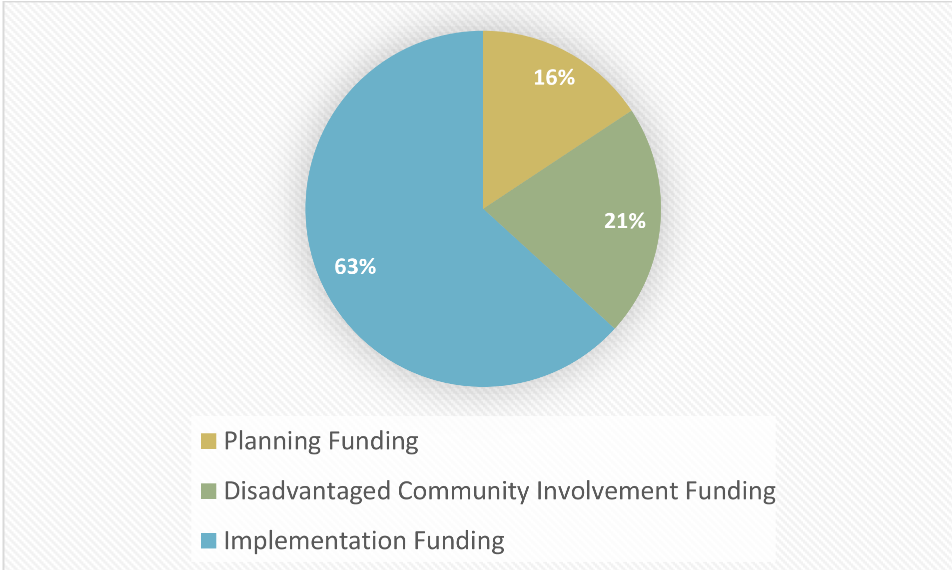
More detailed information on all Inyo-Mono IRWM grants can be found on the Inyo-Mono website.

It is expected that at least two rounds of Prop. 1 implementation funding will be available.

9.3 Summary of Funding to Date

Figure 9-3 summarizes funding secured for the Inyo-Mono Program 2010-2019. Although modest for some regions, funding secured thus far represents a significant step forward in beginning to address regional needs. Sixty-three percent of funding has supported implementation projects. Of note is the significant amount of funding dedicated to DAC involvement in the region. This amount does not include DAC-specific implementation projects and other DAC efforts conducted during the planning grant process. In total, the Inyo-Mono IRWM Program has received more than $4.6 million in grant funding, the large majority of which has directly benefitted, and has remained in, the region. This money has created jobs, has supported the participation of DACs and tribes in the regional water management planning process, and has gone directly to regional entities to implement projects that improve water supply and water quality.

Figure 9-3: IRWM funding secured for the Inyo-Mono region (2010-2019)



At times during the Inyo-Mono IRWM planning process, the RWMG has embarked on campaigns to raise money internally – i.e., from RWMG Member organizations and other stakeholders. Contributions are not required to maintain membership in the RWMG. Participation in donating funds is voluntary. Several smaller agencies donated $250-1,000, while some of the larger water districts, municipalities, and counties have contributed $4,000-10,000 at a time. These donations have been requested to help fill funding gaps between grant rounds. More recently, internal fundraising is being conducted on an annual basis to help cover activities that are not otherwise funded by grants. The RWMG aims to raise about $20,000 annually.

9.4 Regional Funding Needs

During the spring of 2012, the Inyo-Mono Program Office conducted a project needs assessment for the planning region. The objective of the assessment was to gain a broader understanding of the types of projects needing funding as well as the amount of funding that would be necessary to complete them (see Chapter 14 for additional information regarding the assessment and findings). Many entities with known significant water-related issues did not provide information regarding project needs for one reason or another during this assessment, and therefore the findings are thought to be conservative. Regardless, the findings suggest that the total amount of funding needs for the region far exceeds $120 million, only slightly more than $1 million of which has been secured thus far. Please refer to Chapter 14 for a list of identified project needs. Moving forward, a concerted effort will need to be made to secure additional financial resources for the region.

9.5 Known and Possible Funding Sources, Programs, and Grant Opportunities

As part of the development of a sustainable finance plan, specific funding opportunities have been collated into a “living” database, providing Program Office staff and RWMG stakeholders an ability to refer to, and investigate, potential funding opportunities in response to project needs. This funding database is included within a larger, comprehensive database created for the Inyo-Mono region (Chapter 4) as one means of establishing a regional, integrated source of data and information. Non-IRWM funding sources are listed on the Inyo-Mono IRWM website (https://inyo-monowater.org/resources/links/alternative-funding-resources/), including a spreadsheet of funding opportunities compiled by Program Office staff. In addition to the funding database, a number of other funding sources have been identified and are included below.

9.5.1 The California Financing Coordinating Committee

The California Financing Coordinating Committee (CFCC) was formed in 1998 and is made up of seven funding agencies: six state, and one federal. CFCC members facilitate and expedite the completion of various types of infrastructure projects by helping customers combine the resources of different agencies. CFCC provides a simple one-page application form that is shared among CFCC members so that appropriate funding opportunities can be identified. CFCC members conduct free Funding Fairs in several California communities each year to educate the public and potential customers about the different member agencies and the financial and technical resources available. Appendix C contains specific funding mechanisms and opportunities sponsored by members of the CFCC. Information about funding opportunities made available or publicized through the CFCC can be found at the following websites:

- California Financing Programs: http://cfcc.ca.gov/ca_financing.htm
- California Grant Programs: http://cfcc.ca.gov/ca_grant.htm
- Federal Financing Programs: http://cfcc.ca.gov/fed_financing.htm
- Federal Grant Programs: http://cfcc.ca.gov/fed_grant.htm

9.5.2 Other Online Funding Sources and Grant Opportunities

Federal grant opportunities and application information can be found at www.grants.gov.

The Foundation Center provides a resource for finding philanthropic funding for project needs: www.foundationcenter.org.

The Sierra Nevada Conservancy maintains a list of funding opportunities on its website: http://www.sierranevada.ca.gov/other-assistance/current-funding-opportunities.

Many other IRWM Programs have developed websites containing grant opportunity-related information. One such example is the North Coast IRWM Program funding opportunities webpage: www.northcoastirwmp.net/Content/103423/preview.html. A list of additional websites for selected IRWM regions can be found at: http://Inyo-Monowater.org/other-irwmp-regions/.

There are myriad funding resources available to support Native American tribal lands and resources:

Resources and References for Native Land and Trusts & Conservancies

- Indian Country Conservancy: http://www.indiancountryconservancy.org/
- Maidu Summit Consortium: http://www.maidusummit.org/
- Native American Land Conservancy: www.nalc4all.org/

Potential Funding Sources for Eco-Cultural Land Conservation

- Administration for Native Americans: www.acf.hhs.gov/programs/ana/programs/program_information.html
- California State Parks OHMVR Program: www.ohv.parks.ca.gov
- Council on Foundations: www.cof.org
- Environmental Grantmakers Association: www.ega.org
- First Nations Development Institute: www.firstnations.org
- Funding Exchange: www.fex.org
- Indian Land Tenure Fund: www.iltf.org
- International Funders for Indigenous Peoples: www.internationalfunders.org
- Lannan Foundation - Indigenous Communities Program: www.lannan.org/programs/indigenous-communities/
- National Park Service - Historic Preservation Grants: www.nps.ogv.hps/hpg/index.htm
- Seventh Generation Fund for Indian Development: www.7genfund.org
- The Christensen Fund: www.christensenfund.org
- U.S Fish and Wildlife Service -Tribal Grants: www.fsw.gov/grants/tribal.html

9.6 Alternative Funding Mechanisms for Projects that Implement the IRWM Plan

Below is a brief presentation of certain types of funding mechanisms other than grants that may be relevant to project needs in the region and to the implementation of the Phase II Inyo-Mono IRWM Plan.

9.6.1 Water Enterprise Fund

Water enterprise funds are generally used to account for operations that are financed and operated in a manner similar to private enterprises, with the intent being that the costs of providing goods or services to the general public on a continuing basis are financed or recovered primarily through user charges. The fund commonly includes:

1) Water Enterprise Utility Fund - accounts for activities relating to the operation of a community's water system, including water distribution and treatment.
2) Water Capital Projects - used to account for costs associated with large capital projects.
3) Water Impact Fees - accounts for connection charges paid by new users of a water system. Fees collected are to be used for future Water System Capital Improvements.

9.6.2 Financial Capacity: Rate Structure

Financial resources of a water system include, but are not limited to, revenue sufficiency, credit worthiness, and fiscal controls. It is necessary for a water system to have a budget and enough revenue coming in to cover costs, repairs, and replacements. Financial capacity recommendations related to rate structures include the following:

1) Revenues from drinking water sales should cover all public/private water system costs, including operating costs, maintenance costs, debt service costs, operating reserves, debt reserves, emergency equipment replacement reserves, and revenue collection costs.

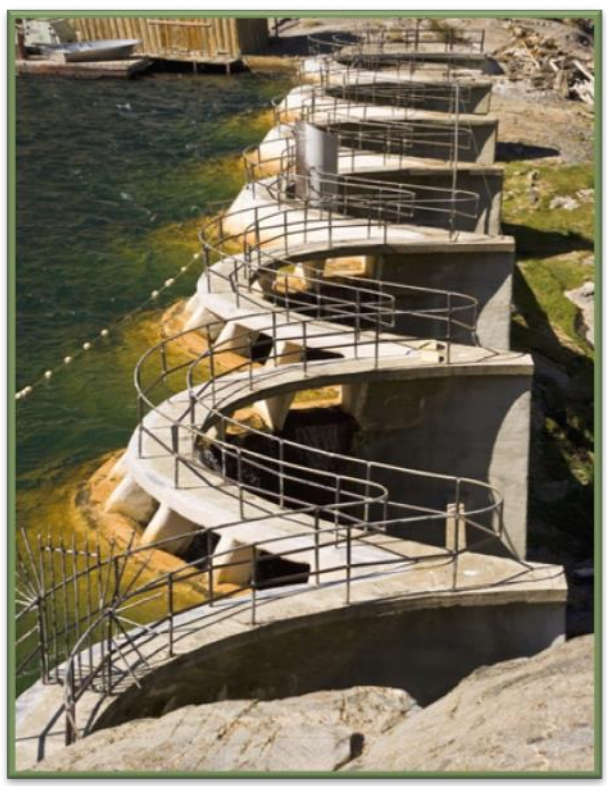
2) Capital improvement funding for facilities needed for upgrading the existing system should come from revenue from water sales or other sources of capital. Rates should be set accordingly.
3) New connection fees, development fees, and other funding sources should cover all public water supply capital improvement costs for facilities needed for expanding the system for new customers. Fees should be set accordingly.
4) All drinking water-generated revenues should be used for drinking water purposes. For public water systems owned by entities that provide other services in addition to drinking water, drinking water purposes should include equitable share of administrative costs for the entire entity.

9.6.3 Bridge Loans: Revolving Loan Fund

The National Rural Water Association Revolving Loan Fund (RLF) was established under a grant from United States Department of Agriculture and Rural Utilities Services to provide financing to eligible utilities for pre-project costs associated with proposed water and wastewater projects. RLF funds can also be used with existing water/wastewater systems and the short-term costs incurred for replacement equipment, small-scale extension of services, or other small capital projects that are not a part of regular operations and maintenance. Systems applying must be public entities. This includes municipalities, counties, special purpose districts, Native American tribes and corporations not operated for profit, including cooperatives, with populations up to 10,000. For more information, interested parties can go to: http//www.nrwa.org/revolvingloan.htm.

9.6.4 Private Financing Options

Private financing can come from several sources, including private foundations, corporations, or individual donors. Although, to date, the Inyo-Mono region has not secured specific funding from private sources, they are recognized as a potential source of future funding. It is noted that in the case of certain projects that have been funded via DWR Planning and Implementation grants, private sources have contributed to project needs in the form of in-kind match as well as financial contributions. Examples of such contributions include time and financial resources contributing to the Hilltop Well project, valued at $55,000, and to a lesser degree, the West Walker Restoration Plan, where in-kind contributions on the part of local stakeholders were a significant contribution to the completion of the project.



9.7 Certainty and Longevity of Known or Potential Funding

As described above, significant funding has been secured in support of the Inyo-Mono IRWM Program, but it is not sufficient to address all of our regional needs, nor the ongoing operations of the IRWM Program. Beyond the issue of technical capacity to pursue existing funding sources, the state of California's economy and that of the nation as a whole creates uncertainty with respect to future funding opportunities. The termination of each bond proposition poses a significant challenge to IRWM regions.

9.8 Operation and Maintenance Costs and Certainty of Funding

As part of the project review process for specific grant solicitations, project proponents are required to provide information specific to how long-term management of a given project will be ensured (Chapter 13). Included in this request are the expected means to address operation and maintenance expenses. Given the diversity of project proponents and the scope of their respective projects, there is not one single source, strategy, or plan to address operation and maintenance costs for all projects that implement the Inyo-Mono IRWM Plan. Instead, coordination of the various projects will involve financial monitoring and evaluation of progress being made (see Chapter 12). Monitoring and evaluation of projects will include identifying the status of necessary operation and maintenance expenses throughout the duration of the projects themselves and, when necessary, developing the means to ensure adequate resources are made available.

The Inyo-Mono RWMG recognizes, however, that securing adequate funding for operation and maintenance costs is challenging. Granting agencies often would rather fund capital improvement projects than operation and maintenance. Therefore, as a part of the long-term sustainable finance plan being developed for the region, operation and maintenance will be a topic of particular focus.

The Inyo-Mono planning region has made significant strides towards addressing financial resource needs to develop and implement the Inyo-Mono IRWM planning program as well as to support on-the-ground implementation projects. At the same time, it is recognized that there is an enormous disparity between the financial resources that have already been secured relative to the needs of the region, and also between the financial needs of the region and the resources potentially available to the Inyo-Mono IRWM Program through proposition funding, which is limited and inconsistently and sporadically.

Chapter 10 : Needs Assessment and Capacity Building

Introduction

Although a primary objective of the Integrated Regional Water Management Program is to bring funding to high-priority water resources projects within the region, the Inyo-Mono RWMG envisions a larger purpose. Through eleven years of interacting with stakeholders in the Inyo-Mono region, the RWMG has learned that the resource needs of the region are not always financial. Many small water districts and DACs require resources in the form of time, technical expertise, or additional staff. The operating philosophy of the Inyo-Mono RWMG is that it is better to provide training on specific topics (grantwriting, CEQA, etc.) than to contract expensive consultants to do the work for it. Thus, another main objective of the Inyo-Mono IRWM Program is to assess the needs of stakeholders in the region and to bring resources to address those needs and to build capacity within stakeholder groups.

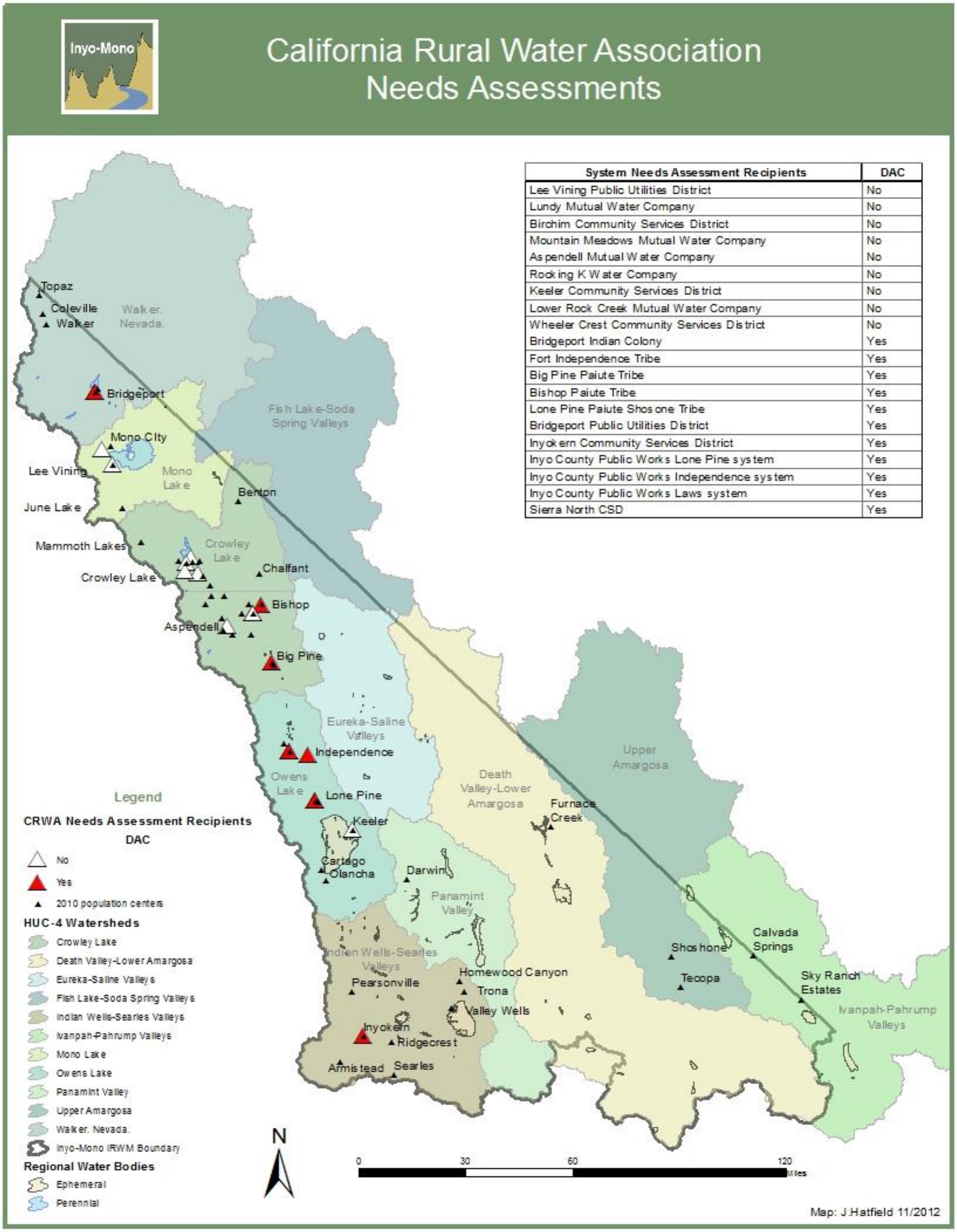
10.1 Needs Assessments

During preparation of the Phase I IRWM Plan, the RWMG recognized that many of the small water systems and DACs of the region could benefit from independent evaluation and assistance toward improving operations. Early on, a relationship with the California Rural Water Association was forged. This organization is "dedicated to meeting the needs of water and wastewater systems by providing quality information, training and technical assistance in maintaining a high level of service to their communities" (California Rural Water Association, 2011). One of CRWA's services is to assess the needs of rural water systems with respect to each system's Technical, Managerial, and Financial (TMF) capacity for meeting applicable laws and regulations regarding drinking water and sustainability over the long term (California Rural Water Association, 2011).

During the autumn of 2011, the CRWA conducted needs assessments of 22 water systems in the region (Figure 10-1). These assessments were funded through a DWR Planning Grant and were conducted at six tribes, ten public entities, and six private mutual water systems. Operators or board members of each system provided information to the CRWA representative, and they discussed the organizational capacity to provide safe drinking water and to comply with laws and regulations over the foreseeable future. These independent and standardized evaluations provided an opportunity to remind and/or educate each system operator about any outstanding needs for improving the TMF capacity of the system in a non-regulatory context.

A report that summarized problems identified in the needs assessments identified some common issues faced by small water systems in the Inyo-Mono Region (Reger, 2012). Five of the 22 systems had water quality issues because of either arsenic or uranium contamination in their water supply. As another fundamental problem, three of the 22 systems had managerial difficulties with day-to-day operations and inadequate information about system infrastructure (Reger, 2012).

Figure 10-1: Needs Assessments conducted within the Inyo-Mono region in 2011



Aging infrastructure and an inability to replace and/or expand it in a timely manner were common problems in most of the systems. Very few systems had replaced any or all of their water mains and pipes in the last ten to twenty years, primarily because of anticipated high costs. Other needs identified by the study were installation of additional storage capacity for fire flow or other emergency situations and automated control of the system (Reger, 2012).

The compilation of technical, managerial, and financial (TMF) information gathered from each system showed a number of commonalities. Most water suppliers had operating plans, general and financial policies, ownership records, water rights, records of their current water capacity and usage, and emergency notification plans. Items that were commonly lacking were written operator instructions and job responsibilities, water conservation plans, five-year budgets, meters, and capital improvement plans (Reger, 2012).

Through the Prop. 84 DAC grant, an additional 17 needs assessments were conducted, for a total of 39. These systems included two tribes, six public entities, and nine private mutual water systems. The general findings from those needs assessments are reported fully in Chapter 4 of the white paper report of the DAC grant (https://inyo-monowater.org/wp-content/uploads/2014/10/IM_DAC_whitePaper_20140930_FINALcopy4Submittal.pdf).

10.2 Building Capacity

The results of the 39 needs assessments directly informed several subsequent RWMG efforts aimed at building capacity of stakeholder organizations in the region. These efforts mostly took the form of targeted workshops on particular topics but also include the overall Inyo-Mono IRWM process.

10.2.1 Topical Workshops

A variety of training needs within the region became evident as the RWMG developed its organizational structure, assembled the initial IRWM Plan, and worked on the proposal for the first round of implementation funding.

Water Supplier Training by CRWA

The California Rural Water Association conducted three water-related workshops within the Inyo-Mono region during the autumn of 2011. Topics included Regulatory Review, Capital Improvements, and Water Shortage. In each of two workshops held in Mammoth Lakes and Bishop, 15 water system operators participated. A third workshop held in Independence benefitted another eight water systems. Water operators attending these workshops received six California Department of Public Health Water Contact Hours. Another seven training sessions were provided in 2013 and 2014 by CRWA through the Prop. 84 DAC grant, covering nine topics (Utility Management/TMF Tune-up, Water Conservation, Budget Planning, Regulatory Update, Basic Hydrogeology, Water System Rates & Rate Structures, Emergency Response, Sampling Procedures, Drought Preparedness).

As of the updating of this Plan, a new set of trainings is being planned through the Prop. 1 DACI grant. RWMG Members and region water systems were surveyed to determine the topics of greatest need in the region. Trainings are being scheduled accordingly.

California Environmental Quality Act Compliance

During the process of preparing the proposal for the first round of implementation grants, many RWMG Members expressed a lack of knowledge about details of the state and federal environmental review laws (California Environmental Quality Act [CEQA] and National Environmental Policy Act [NEPA]). The RWMG attempted to build capacity among its Members and participants by organizing a series of workshops about CEQA. Although several participants in the Inyo-Mono RWMG are federal agencies (two National Forests, Bureau of Land Management, National Park Service, and federally-recognized tribes) or occasionally have projects in which they partner with a federal agency, a NEPA-specific workshop has yet to be developed for our region.

Four CEQA workshops were held during December 2011 in Ridgecrest, Bishop, Mammoth Lakes, and Bridgeport. Three workshops provided an introduction to preparing CEQA documentation as a project proponent. These were titled "Water Resources and the California Environmental Quality Act" and were generously provided in-kind by the Law Firm of Chatten-Brown and Carstens of southern California. The fourth workshop was more general in scope and was organized from the perspective of reviewing and commenting on an environmental review. This workshop was conducted by the Planning and Conservation League of Sacramento and roughly followed their standard outline for such sessions. Details may be found at http://www.pclfoundation.org/events/aboutceqaworkshops.html.

Grant Writing Skills

An obvious disparity between a rural region such as the Inyo-Mono Region and many of the large urban or irrigation-district based RWMGs elsewhere in California is the lack of technical and managerial capacity to prepare thoroughly competent and competitive proposals for funding. RWMGs that include large urban water utilities and/or large well-funded irrigation districts have significant advantages with technical staff, consultants, and internal funding over rural RWMGs with respect to proposal development. There is a strong need to greatly improve the capacity of small rural water entities to prepare adequate proposals. Similarly, economically-disadvantaged communities and their water suppliers need significant help in improving their grant-writing capabilities to be better prepared to respond to the funding opportunities of the IRWM Program and others.

The Inyo-Mono RWMG took an initial step to build capacity for grant writing with a series of workshops offered in June 2012. Three workshops were held – one each in Independence, Bishop, and Lee Vining. Each workshop covered the fundamentals of responding to requests for proposals. The sessions were interactive, and the participants informed their peers about many useful experiences. Although overall attendance was rather limited, the participants gave favorable reviews of the workshops and encouraged the RWMG to offer additional workshops. Three additional grant writing/proposal development workshops were held through the Prop. 84 DAC grant in 2013 and 2014, targeted to regional DACs and tribes. Because there is always the need to improve grant writing skills, more workshops will be offered through the Prop. 1 DACI grant.

10.2.2 Process-based Capacity Building

The IRWM planning process in the Inyo-Mono region has contributed to increased knowledge, abilities, contacts, referral resources, and funding opportunities -- often collectively called "building capacity" -- among the groups, agencies, and individuals participating in the RWMG. Capacity of Inyo-Mono RWMG Members and affiliates has been enhanced simply by participating in the routine meetings of the RWMG. The regular meetings as well as work on the Plan and various proposals have increased knowledge and understanding of technical and policy matters relating to water in the region and the state. Through collaboration within the RWMG, the collective group has improved its understanding of local issues, problems, and solutions that neighbors have employed. Through involvement with the IRWM planning process, the RWMG has improved its understanding of statewide priorities and program preferences and solutions adopted by other regions. The creation, development, review, and revision of suitable projects for potential IRWM Program funding have certainly improved the ability of many RWMG participants to consider and craft quality proposals and projects.

The RWMG meetings have provided avenues for networking among attendees and secondary associates such as contractors, advisors, and colleagues who have been recommended by a RWMG attendee as a means of advising on or solving a particular problem. These contacts have greatly increased the flow of information among people involved in the full range of water resources activities within the Inyo-Mono Region. Such networking activity has also provided an opportunity for technical assistance between peers.

As an example of building capacity among IRWM regions, the Inyo-Mono RWMG continues to participate in interregional groups and events. A Sierra IRWMP Summit in October 2009, and a Sierra Water Workgroup Summit in July 2012, both sponsored by the Sierra Nevada Conservancy and Sierra Nevada Alliance, provided excellent opportunities to learn from other IRWM groups in the Sierra Nevada. Both formal presentations and informal conversations allowed participants to exchange information, resources, and ideas with peer IRWM groups elsewhere in the Sierra Nevada. (See also Chapter 8, Coordination, for more information on interregional collaborations.)

Lastly, the Inyo-Mono RWMG website has been instrumental in local capacity building. Besides providing timely news about RWMG activities, meetings of other organizations, funding opportunities, and training possibilities, the website is an excellent resource and library for research papers, technical studies, maps, planning reports, and other useful documents concerning water in the region.

Indeed, the Inyo-Mono IRWM Program has become a primary source of information regarding water resources and water-related stakeholders in the region. Over eleven years, the IRWM Program has interacted with a majority of water systems in the region in various ways: helping to get started on a grant application, putting a board in touch with a consulting engineer, providing focused technical assistance, acting as a liaison among several entities to see a project through, advocating for high-priority projects to granting agencies.

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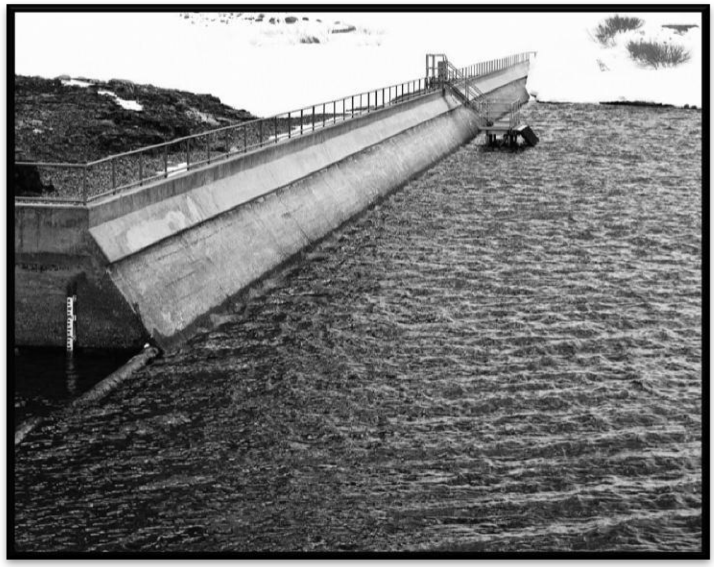
Chapter 11 : Land Use and Water Planning Integration

Introduction



The overarching goal of IRWM is to realize truly integrated and seamless water planning among various state, regional, and local entities. Thus, IRWM Plans should complement and consolidate local and regional plans without supplanting them. The Inyo-Mono IRWM Program continues to work to bring together disparate local planning efforts, reducing costs and eliminating both redundancy and inconsistency in regional water and land use planning. Within the Inyo-Mono IRWM Program, integration and alignment of IRWM Plan goals and objectives with those of local, state, and federal land and water use agencies remains a primary goal. This chapter outlines our past, present, and future work on the integration of land use and water planning documents with the Inyo-Mono IRWM Plan.

11.1 Assembly of Relevant Land Use & Water Planning Documents

The identification of local water and land use planning documents was a fundamental first step in the creating of the Inyo-Mono IRWM Program. While initial efforts identified the most obvious source documents, subsequent gap analyses have been performed to continue to cultivate a comprehensive list. Additionally, over time new documents have been completed having relevance to the Inyo-Mono planning effort. The acquisition of these documents is of limited value if accessibility to our stakeholders is problematic. Thus, the RWMG chose to offer this collection of documents through a digital library made publicly available through the program website. http://inyo-monowater.org/resources/library/

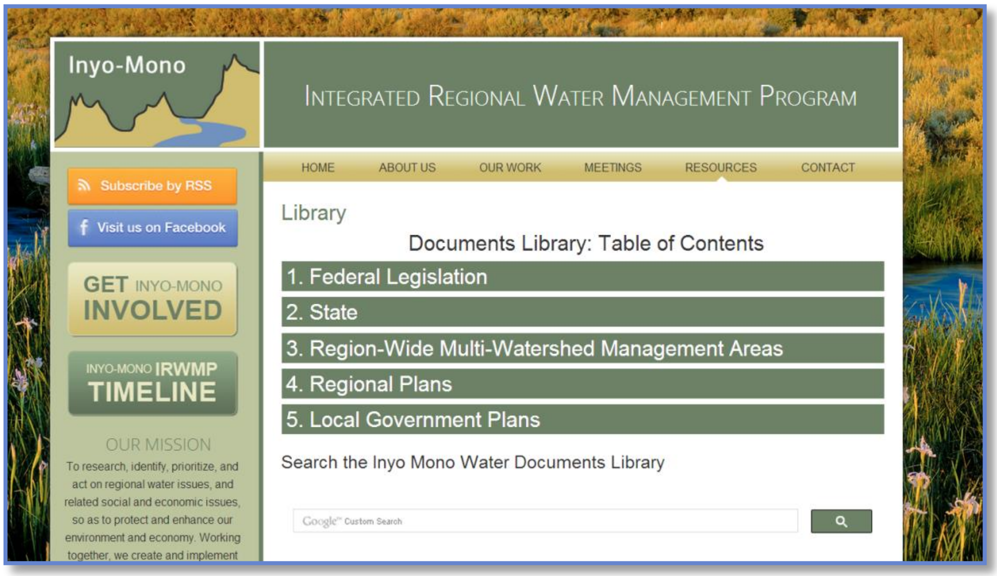
The planning gap analysis which yielded documents for the online digital documents library was completed as a six-step process summarized below:

1. **An initial planning effort which identified 50 core documents fundamental to understanding water planning in the region.**
2. **Subsequent internet research which yielded multiple updated or new planning documents.**
3. **Consultation with local water and land managers for assistance with planning gap analyses.**
4. **Consultation with neighboring IRWM Regions for useful planning documents.**
5. **A spatial gap analyses which identified large geographic regions where plans were missing.**

6. **A final revisitation of the Inyo-Mono IRWM objectives and RMSs for ideas on other helpful planning documents.**

11.2 Results of Planning Documents Gap Analyses

The aforementioned analysis added over 100 documents to the first 50 core documents of the mandatory documents table identified in the Phase I planning efforts. Due to the volume of this documents list, it is not included within the text of this chapter. Instead, a comprehensive documents table can be viewed in a Relevant Documents table, which is listed at the top of the Documents Library on the Inyo-Mono website (http://inyo-monowater.org/resources/library/). Within this table, detailed information is offered for each document, including but not limited to, source location information and a brief summary of the purpose and scope of each entry. In addition, entire documents can be viewed in their interactive library environment on this page. Here the documents have been organized categorically to help users find the documents they are searching for as well as a local Google search bar. Generally speaking, the newly improved water and land use documents library contains a wealth of information on a wide variety of documents that range dramatically in scope.



The documents list was reviewed through the update of this Plan in 2019, and several new planning documents were added. Perhaps more importantly, website links for each of these documents were checked and updated if necessary. It was determined that the online location of many of the documents had been moved, and it is the desire of the Program Office that this library continues to be an up-to-date and relevant resource.

11.2.1 Library Organization

A region the size of the Inyo-Mono contains extensive planning documents from myriad public and private entities. These documents have been organized into concise categories by the Inyo-Mono IRWM Program in an effort to provide an efficient and searchable data source. The categories are described below.

1.) Federal Legislation, Regulations, and Other Guidance

Legislation at the national level that drives water quality protection and management and is pertinent to the Inyo-Mono region is the basis of this section. This segment also includes federal level environmental plans and programs of relevance to water planning.

2.) State Legislation, Regulations, and Other Guidance

This category includes a variety of state level legislative acts, propositions, bulletins, and codes as they pertain to various state water management agencies. Also included are State level environmental plans, programs, or publications that are germane to water resources management in the State.

3.) Region-Wide Multi-Watershed Management Area Documents

This category of the documents library steps down in the organizational hierarchy to planning documents that cover large segments of the region or the entire region and beyond. The organizations that publish these documents manage large blocks of land and the resources within those lands and include entities such as the State Water Resources Control Board, United States Forest Service, Bureau of Land Management, National Park Service as well as the Inyo-Mono Agricultural Commissioner's Office.

4.) Regional Water and Land Use Planning Documents

This category is the most voluminous section of the library due to our expansive geography as well as some of the complexities that exist historically with respect to water management in the region. Within this category are relevant reports that cover topics such as advocacy, conservation, research, compliance, and outreach as well as watershed and groundwater management plans and reports for some of the basins in the region. Each subsection of the Regional Plans segment of the library is briefly summarized under the associated heading below.

Watershed/Groundwater Management and Sustainability Plans/ Reports

This subcategory contains watershed and groundwater management plans that create linkages between water quality and water quantity problems, conditions, processes, and activities occurring within the respective watersheds in the region. Defined in these Plans are goals, objectives, and best management practices (where applicable) as well as historical, current, and desired future conditions of the watershed. When the Groundwater Sustainability Plans for the Owens Valley and Indian Wells Valley are complete, these plans will be included here.

Los Angeles, Inyo and Mono County Documents

Separated by design is a Los-Angeles/Inyo-Mono County Plans and Reports subcategory, which was designated to house documents relating to the complex interrelationship between the City and the two Counties on a number of water-related issues. While some of these documents could easily be organized under more general subheadings, these documents have been assigned to this specialized section for clarity and ease of location purposes.

Relevant Reports (Research/Advocacy/Conservation/Compliance)

While not technically considered planning documents, the following reports are recognized by the Inyo-Mono IRWM Program to be valuable supporting documents to the region's planning efforts. A newer component of these reports is climate change.

As required by Section 4(f) of the *Endangered Species Act* (1973), recovery plans are required to ensure the adequate protection and monitoring of said species. The resulting documents support the monitoring and management of those unique resources. Also included under this heading are management and conservation plans for several of the resource conservation organizations that operate within the regional boundaries.

Section 305(b) of the *Clean Water Act* mandates biennial assessments of the nation's water resources. From these assessments a statewide impaired water bodies list is formulated, of which there are sixteen water bodies listed for the Inyo-Mono Region. These reports are also included here.

5.) Local Area Plans

County Plans

Per California State regulations, "Each planning agency shall prepare and the legislative body of each county and city shall adopt a comprehensive, long-term general plan for the physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning" (Cal. Gov. Code §65300).

Urban Water Management Plans

As required by the California State- Urban Water Management Planning Act of 1983 (CWC §10610,§10656), "all water suppliers which provide water to 3,000 or more connections, or provide over 3,000 acre-feet of water annually, take action to ensure reliability in its water service sufficient to meet customer needs during normal, dry, and multiple dry years" (Urban Water Management Planning Act, 1983). In the Inyo-Mono Region, Urban Water Management Planning requirements only pertain to the Indian Wells Valley Water District and the Mammoth Community Water District.

Stormwater Resource Plans

California Water Code §10562(b)(7) requires the development of a stormwater resource plan and compliance with the section's provisions for an entity to be eligible for California grants to fund stormwater and dry-weather-runoff capture projects. The Town of Mammoth Lakes was the first entity in the region to develop a stormwater resource plan and did so with IRWMP funding from the region's Prop. 84 Round 2 planning grant. That document has been integrated into the IRWM Plan.

City/Town Plans

Per California State regulations, "Each planning agency shall prepare and the legislative body of each county and city shall adopt a comprehensive, long-term general plan for the physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning" (Cal. Gov. Code §65300).

Tribal Plans

"Where Tribes qualify to be treated as States for the purposes of water quality standards, EPA has the responsibility to assist the Tribe in establishing standards that are appropriate for the reservation and consistent with the Clean Water Act. EPA recognizes that Tribes have limited resources for development of water quality standards" (40 CFR 131.3-1.8.6). The plans contained in this subcategory are products of area tribes eligible to be included in the Water Quality Standards Program as outlined in the EPA Water Quality Handbook: http://water.epa.gov/scitech/swguidance/standards/handbook/chapter01.cfm#section8

Small Water System Plans

There are nearly 200 small water purveyors that operate within the Inyo-Mono Region. Planning requirements by these entities are a product of the Federal Safe Water Drinking Act as well as SWRCB Division of Drinking Water requirements and are most often enforced by county environmental health departments. Unfortunately, most systems lack necessary resources to comply with planning requirements, as is made clear by the lack of planning documents under this subcategory. Through Prop. 84 and Prop. 1 grants, 39 water system needs assessments have been conducted in an effort to identify deficiencies and provide assistance to these entities in an attempt to improve compliance rates of required planning documents.

11.3 Current Relation & Dynamics of Land Use & Water Planning Documents

Initial IRWM planning efforts relied on well-known or core planning documents of the region by large organizations, counties, federal land managers, and large water districts. Additionally, regional groundwater and watershed plans were utilized when drafting the Inyo-Mono IRWM Plan which helped create linkages between planning goals and objectives as well as documents including water quality and quantity problems throughout the region.

As the planning process has matured, more focused documents have been utilized to develop goals and augment and revise objectives and resource management strategies on an iterative basis. For example, goals and policies from Inyo and Mono County general plans were analyzed for alignment with IRWM Plan objectives and resource management strategies. These local general plans were found to contain similar content with slightly different language, focus, and organizational structure. A review of such documents provided ideas for revision and/or addition of the IRWM Plan objectives.

11.4 Land Use & Water Planning Integration

The Inyo-Mono IRWM Planning effort has relied on both programmatic outreach and stakeholder involvement to gather information on the goals and objectives of the numerous water and land use planning entities within the region. The identification and organization of available planning documents has assisted stakeholders in recognizing established planning efforts, helped identify persistent planning gaps, and created a useful resource that will help integrate other organizations planning efforts with those of the Inyo-Mono IRWM Plan.

The Program has taken many initial steps towards truly integrating local water and land use planning efforts with IRWM planning efforts.

The first step, the creation of the digital documents library, has yielded significant benefits to the Inyo-Mono IRWM Region. From this documents library, planning voids have revealed themselves through familiarization with governing legislation, as well as through comparisons of planning efforts between agencies and across geographies. By acknowledging these deficiencies, the Inyo-Mono IRWM Program has gained a more thorough understanding of the planning needs within the Region.

Work with local county and community planners is underway and is recognized as the next step in a potentially longer, more in-depth process of aligning long-term planning goals, community needs, and project priorities. Ideally these strategies, if aligned, reduce redundant planning efforts, provide a centralized clearinghouse for water-related planning documents, and promote integration by aligning local priorities and objectives.

Functionally linking respective goals, objectives, and strategies, in both theory and practice, to the individual planning efforts in the region will allow the IRWM Program to have a more profound impact. Once Planning documents are successfully aligned, we can begin to realize the type of landscape-scale collaboration and resource management planning that leads to beneficial economies of scale as well as responsible land and water management. While significant strides have been made towards fulfillment of these goals, stakeholders continue to face challenges unique to the geographic qualities and political history of the region.

11.4.1 Current Coordination of Planning Activities

Many coordinated planning efforts currently underway in the Inyo-Mono region and are topically summarized below.

Groundwater and Watershed Management

Many of the entities involved in the development of Groundwater Sustainability Plans for the Owens Valley and Indian Wells Valley in the Inyo-Mono Region are signatories to the Inyo-Mono IRWMP MOU and/or are active participants in IRWM group meetings and other project planning activities. Their participation intrinsically fosters coordination and integration within the IRWM Program. In addition, Inyo-Mono Program Office staff participates in the SGMA processes in both basins, thereby helping to connect the processes and ensure one informs the other and vice versa. Likewise, most watershed-level planning efforts in the region are linked to the IRWM Program through their stakeholders.

Stormwater Resources Planning

Senate Bill 985 (SB 985), the Storm Water Management Planning Act of 2014, implemented through the Water Code section 10560 et seq. (as amended by Senate Bill 985, Stats. 2014, ch. 555, § 5) requires a Storm Water Resource Plan (SWRP) as a condition of receiving grant funds for storm water and dry weather runoff capture projects from any bond approved by voters after January 2014. The intent of SB 985 is to encourage the use of storm water and dry weather runoff as a resource maximize water supply, water quality, flood management, environmental, and other community benefits within the watershed (https://www.waterboards.ca.gov/water_issues/programs/grants_loans/swrp/).

While stormwater management is not a primary concern at the regional level, it is of local concern in several areas, including Mammoth Lakes, the Tri-Valley, and Ridgecrest/Indian Wells Valley. Already underway when SB 985 was enacted, the Town of Mammoth Lakes developed a stormwater master plan through the Prop. 84 IRWM Round 2 Planning Grant. After SB 985 took effect, Town of Mammoth Lakes staff, along with its consultant, converted the stormwater master plan into a Stormwater Resources Plan to be in compliance with the act's requirements for stormwater funding. With the adoption of this Plan update in 2019, the TOML Stormwater Resources Plan has been incorporated into the Inyo-Mono IRWM Plan.

Urban Water Management

There are two Urban Water Agencies in the Inyo-Mono Region: the Mammoth Community Water District (MCWD) and the Indian Wells Valley Water District (IWVWD). The Inyo-Mono IRWM Program has a longstanding and ongoing collaborative relationship with both of these agencies. Both MCWD and IWVWD were early signatories to the Inyo-Mono IRWMP MOU, and representatives from both groups have served on the IRWMP Administrative Committee. Their Urban Water Management Plans were used in the Inyo-Mono IRWM Plan, and the IRWM Plan has been used extensively as part of both the MCWD and IWVWD's planning processes. Additionally, in 2018, the IWVWD developed a Salt and Nutrient Management Plan for the southern portion of the Inyo-Mono region and is reporting back to the IRWMP on progress made in this area, which is discussed below in the Salt and Salinity Management section.

Although not wholly contained within the Inyo-Mono planning region, the Los Angeles Department of Water and Power has also developed an urban management plan that includes information relevant to water resources within the Inyo-Mono region.

Agricultural Water Management

The Inyo-Mono Agricultural Commissioner's Office works to promote and protect the agricultural industry of the Counties, protect the environment, and to ensure the health and safety of all of its citizens. http://www.inyomonoagriculture.com/ As such, the organization has participated in RWMG meetings for several years and brought several invasive plant abatement projects to the Group for implementation funding consideration. Twice the organization's projects have come up unsuccessful and unfortunately this has resulted in a loss of their participation in the RWMG.

Outreach efforts to a number of agricultural-based communities have been initiated, but overall ranchers are understandably nervous about working with what they see as a government-backed effort. Working with these communities remains both a challenge and an opportunity for the Inyo-Mono region.

General Plan Integration

As described above, each of the four counties with land contained in the Inyo-Mono IRWM planning region has prepared and updated a General Plan in accordance with California regulations. Several towns and small cities in the region also have updated General Plans. The Inyo-Mono IRWMP integrates with these local planning efforts in several ways. Representatives of Inyo and Mono Counties and the municipalities of Mammoth Lakes and Ridgecrest regularly attend IRWM group meetings and participate in various IRWMP activities. These local planners and managers participate in IRWM regional planning discussions and activities, as well as in project ranking, selection and development.

Additionally, the Inyo-Mono IRWMP has embarked on a specific effort to align the goals, objectives, and resource management strategies of the IRWM Plan with the goals, objectives and policies of county and city General Plans, as well as with the goals and policies of Mono County Local Area Plans. Beginning at the County level, Inyo-Mono IRWM Program Office staff reviewed the General Plans of Inyo and Mono Counties and created a matrix of salient water-related goals and policies found in these plans. These goals and policies were categorized by subject matter and compared with the IRWM Plan's objectives and RMS's. A series of meetings were held with planners from both counties during which opportunities for integration and aligning of goals, both in terms of subject matter and language, were discussed. As a result of those conversations, County planners have been working to incorporate specific IRWM Plan RMS's into their general plan updates.

As a specific example, neither the Inyo nor Mono County General Plan contained language about working to address and mitigate the effects of climate change as it applies to water supply and water quality. It was discussed that the IRWM Plan Objective related to climate change could be adopted in full by both counties and incorporated into the General Plans, with the result that the same goal and policy objectives will exist in all three documents, giving considerable strength to the region's commitment to addressing climate change. As of 2015, Mono County updated its General Plan to include a section on air quality, climate change, and greenhouse gases. The Inyo County General Plan is currently in the process of being updated, but the 2013 draft does not contain the language to address and mitigate the effects of climate change as it applies to water supply and water quality.

After looking at and aligning IRWM Plan goals with County planning goals, it is the Inyo-Mono IRWMP's intention to initiate a process by which regional project needs contained in the IRWM Plan are included in County General Plans, and possibly within Mono County Local Area plans. We also plan to initiate the same goal alignment exercise undertaken with Inyo and Mono County planning departments with the Cities of Bishop and Mammoth Lakes. Over time, the Inyo-Mono Program will also aim to implement a similar process with the Lahontan Basin planning process. This will allow the IRWM Program, counties, cities, and local land use areas to present a united front in terms of goals, policies, and area needs and project priorities that will ultimately streamline project funding and implementation, bringing more resources more easily to a largely rural and economically disadvantaged region.

Salt and Salinity Management

The Inyo-Mono IRWM Program has taken a regional approach to facilitating coordination between local agencies with respect to salt and salinity management. In light of the 2009 requirements put forth by the State Water Resource Control Board that priority watersheds prepare Salt and Nutrient Management plans and present them to the SRWCB staff, the Inyo-Mono Program Office staff has facilitated coordination among several regional watersheds to spur salt and nutrient plan drafting efforts. Several coordination meetings were held where local planners outlined a joint, multiple-step process for completion of salt and nutrient plans for the Owens Valley and Indian Wells Valley basins. The Indian Wells Valley groundwater basin completed its salt and nutrient management plan in 2018. Inyo-Mono Program Office Staff also help facilitate conversations with LRWCB staff regarding presentation of a region-wide, phased approach to salt and nutrient planning that will allow various local agencies to coordinate efforts and avoid any one watershed from being out of compliance. These conversations continue to date and the Program Office hopes to reach out to and gain support from the other major entity involved in watershed planning in the Owens Valley, the Los Angeles Department of Water and Power.

Mapping and GIS capacity coordination and integration

Additional efforts to integrate land and water use planning documents were inspired by California Department of Public Health's Environmental Tracking Program's Water Boundary Tool: (https://trackingcalifornia.org/water-systems/water-systems-landing). The tool aims to provide a GIS-based public use dataset for all public water systems in the State. Recognizing regional deficiencies of water system boundary and infrastructure data in both Inyo and Mono Counties, the water boundary tool provided a logical and economical next step for acquisition of public water system data. The tool also provided a platform for facilitation of regional collaboration as part of a greater statewide data gathering effort. Communications were initiated with U.C. Davis Information Center for the Environment (ICE) as well as CDPH to learn how we could contribute.

Once more familiar with the tool, the IRWM Program initiated conversations about the possibility of an integrated mapping effort at the County level. It was agreed that inclusion of Environmental Health Departments as well as Planning and GIS departments would yield the most robust action plan for integration of this tool into County datasets. The tool provided a clear benefit to all parties and was well received by all stakeholders.

An outcome of the County meetings was the development of a "Maps 101" curriculum by the IRWM Program as part of our capacity building effort. The class was offered first as a pilot to refine the content and work out any technology glitches. Subsequently, two classes were taught at the local community college computer laboratories for water system operators/managers of any interested local public water systems. The class covered use of various open source mapping tools as well as the Water Boundary Tool and emphasized integration of all online tools to maximize benefits to water system managers and operators.

One tangible benefit of this effort was the offer by the Mono County GIS department to extend their services further through the development of a secure web application to house more sensitive water infrastructure data for Mono County water systems. The IRWM Program continues to work with the County to realize this benefit.

Future efforts will focus on encouraging water system operators and managers to leverage new skills to input water boundary information into CDPH's water boundary tool and leverage online tools to meet new and ever-changing public water system requirements. Currently the IRWM capacity building effort will assist public water system managers to meet mapping component requirements relating to: 1) Bacteriological Sampling Site Plans, 2) Senate Bill 244, which requires cities, towns and Local Agency Formation Committees (LAFCO's) in California to identify, map and describe certain public system features of disadvantaged unincorporated communities within their boundaries, and 3) Assembly Bill 54, which requires any mutual water company operating as a public water system submit to their applicable LAFCO a map depicting their water system boundaries and area served (s*ee* Cal. Govt. Code § 56430, Cal. Govt. Code § 65302(5)(b)(1), Cal. Corporations Code § 14301.1(a)). The Inyo-Mono IRWM Program is currently serving as a central hub of these various efforts and can and will help integrate information among and within agencies, water systems, funding applications, and project needs.

In 2019, Inyo-Mono IRWMP signed a contract with Sierra Water Workgroup (SWWG) to develop a basic data management system (DMS) platform with a Geographic Information Systems (GIS) mapping interface, including spatial and tabular data for the Inyo-Mono region. When complete, this mapping tool will include a mapping system to identify DAC needs, identify current and conceptual projects, integrate with ongoing efforts, and engage communities in IRWM planning. Since the passage of Proposition 1, the Water Quality, Supply, and Infrastructure Improvement Act, in 2014, the SWWG DMS is being considered for all IRWM regions in the Mountain Counties Funding Area as well as the Inyo Mono IRWM region and Lahontan Basins IRWM region through the IRWM Disadvantaged Communities Involvement (DACI) Program. The acquisition of this mapping tool meets Proposition 1 DACI Program needs in addition to DWR's planning requirements.

The objectives of this mapping tool are to:

- Provide a DMS that will serve as a platform for promoting collaboration and data sharing in the watershed, and with other stakeholders of IRWMPs, and the public, as appropriate.
- Provide a platform for DAC water/wastewater needs, community capacity data, technical assistance material, and project information to be displayed and assessed.
- Improve and expand upon the DMS modular data input and assessment platform for projects and documents, expandable to the entire Sierra-Cascade region.

Land Use Planning Integration

There are numerous local, state and federal agencies and Native American Tribes that have land management responsibilities within the Inyo-Mono region. These include Native American Tribes, U.S. Forest Service, Bureau of Land Management, the National Park Service, LADWP, the U.S. Fish and Wildlife Service, and the California Department of Fish and Wildlife. Throughout the development of the Inyo-Mono Program, the vast majority of these agencies have been involved to some degree, either as a signatory to the MOU or as a participant in various meetings.

To date, some agency participation and commitment to the IRWM process are stronger than others, and not all land management agencies are signatories to the MOU. Sometimes, initial progress and contacts are made with large land management agencies, but due to resource limitations and conflicting priorities, an agency may not be able to maintain its involvement in the IRWM Program. The IRWM Program lacks the funding necessary to reach out in a continued and aggressive manner to these agencies once they no longer attend regular RWMG meetings. The most consistent participation of land managers in the region is by tribes and counties. These small land management bodies are MOU signatories and come to RWMG meetings regularly, where they participate in the planning and project selection process. In the case of many small entities, the land use and water planning individuals for an entity are the same people.

It is recognized that there is a need to better integrate land management agencies and activities in the Inyo-Mono region with the IRWM process, similar to how the IRWM Program has worked with the counties and municipalities. The IRWM Plan should reflect the major water- and watershed-related goals and priorities of the various land management agencies, and vice versa. One example of this opportunity was working with the U.S. Forest Service as they revised Sierra Nevada Forest Management Plans. Representatives from the Forest Service presented information to the RWMG about the planning process and how to get involved and they solicited input from Group participants. Additionally, several stakeholders involved in the Inyo-Mono effort were actively involved in the planning process, representing their viewpoints into forest management planning priorities. It is hoped that continued participation of federal, state, local land managers in the Inyo-Mono IRWM process will help to realize this integration, though more concerted and specific effort is also needed.

11.5 Challenges to Water and Land Use Planning Integration

It is predictable that a region of Inyo-Mono's size and rural nature retains a multitude of deficiencies in its planning efforts. As a start, the Inyo-Mono region is geographically very large, comprising 11% of the State of California's land. This large land area contains the state's highest mountains, rugged, forested backcountry, irrigated ranchlands, wetlands, and low-lying desert. In a region of such wide area and geographic diversity, water problems and needs vary widely within the region, making integration that much more difficult. Because communities are located at such great distances from one another, coordinating joint solutions to water problems is often prohibitive. Where human inhabitance and visitation populations are low, planning by default remains a low priority. Local planners and water and land managers are often responsible for huge areas of land and need to travel great distances to meet with and observe issues at small systems ostensibly under their control. They also need to travel to attend RWMG or special planning meetings, and often lack the resources to do so on a regular basis.

Rural Geography

The region's vast area and varying geography necessarily support a diverse population of stakeholders, the agendas of whom often serve as additional hurdles to effective land and water use planning integration. Individual and group interests in the region's water span the spectrum from those whose primary goal is water export, to agricultural users, municipalities concerned with providing water for residential and business use, and conservation and governmental organizations interested in preservation of water supply and water quality for recreation and/or wildlife habitat. These widely varied goals present challenges when trying to craft regional solutions to water problems, and occasionally cause gridlock in an organization such as the IRWMP, which operates on a consensus-based decision-making model.

Socio-economic

Further hampering integration efforts are the economic realities of the region. The majority of the Inyo-Mono region is comprised of disadvantaged communities as defined by California state statute and regulation. A pointed lack of resources to assist with needed planning efforts reveals itself rapidly when comparing local planning efforts to those of more advantaged regions. Glaring deficiencies are most prominent when considering tribes and small water districts regardless of DAC status. Even communities not technically designated as disadvantaged often do not have large numbers of planning staff, or they are unincorporated areas that are covered by overcommitted county planning staff. Also, the staff that is available often serves many roles within local organizations, making it difficult to tap these individuals for additional input on IRWM-related integration efforts.

Lack of Participation from Major Players

Finally, planning efforts within the Inyo-Mono IRWM Region are hampered by the existence of entities that exert significant control over local water resources but have not prioritized their involvement in the IRWM Program and its efforts at integrating water planning in our region. As explained at the beginning of this chapter, the Los Angeles Department of Water and Power owns 3-4% of the region's land and controls significant regional water rights. Southern California Edison also exerts significant influence over water planning in the Inyo-Mono Region where they control a series of dams and hydroelectric generation facilities under various FERC licenses. Despite the major role that both LADWP and Edison have on the present and future water situation in the Inyo-Mono region, each organization has thus far been only minimally interested in participating in the Inyo-Mono IRWM Program.

Starting at the initial planning stages for the IRWMP and continuing through the present, efforts have been made to include representatives from both Edison and LADWP in all aspects of the planning and implementation processes. Representatives from LADWP were actively involved in the initial IRWM group meetings and commented on the initial plan. However, since that point they have been largely absent from meetings, project selection, visioning exercises and other activities of the IRWMP. It is recognized that more complete integration and coordination of water planning in the Inyo Mono IRWM region would be realized with the cooperative participation of by both LADWP and SCE. The absence of these agencies in the planning process remains a challenge. It is also recognized that the CA IRWM Program does not have the authority, nor does the Inyo-Mono IRWM Program, to require any entity to participate in integrated regional water planning.

11.6 Ideas and Plans for Future Water and Land Use Planning Solutions

To better achieve true water planning throughout the region, the Inyo-Mono IRWMP plans to implement several strategies designed to aid in fostering collaboration between water-related stakeholders in its vast area. First, a more aggressive fundraising and finance strategy is planned to acquire funds necessary to conduct outreach, education and project planning in a large, diverse, and economically disadvantaged area. Such a strategy will not be limited to addressing project implementation needs but include necessary funding for programmatic needs. More funding will allow the IRWMP to continue outreach and relationship-building efforts throughout the region, especially in areas where stakeholders lack the funds and time to travel to planning and coordination meetings. Additional funding will also allow the IRWMP to bring educational programs, and possibly provide services such as grant drafting and technical consulting services, to poor, rural communities and programs operating at a marked disadvantage in these areas. The Inyo-Mono IRWM Program will also continue to engage in local, county, state and federal planning processes with the goal being to enhance and continue to align planning efforts amongst stakeholders in the region. In particular, the Inyo-Mono Program will continue to be engaged in the two SGMA processes in the region, in the Indian Wells Valley and Owens Valley. Finally, the Inyo-Mono IRWMP hopes to become the primary, single-source of information regarding water-related research, legislation and funding opportunities throughout the region. By keeping abreast of pending and recently enacted legislation, and by continuing to develop an extensive online documents library, the IRWMP will serve as an invaluable resource to local water-related stakeholders, which will in turn foster connection building and greater IRWMP involvement by local groups.

Despite the political complications described above and the funding challenges facing such a massive, rural, economically disadvantaged area, the Inyo-Mono IRWMP has successfully begun the process of truly integrating water and land planning throughout the region. Given more time, additional funding, and participation from major water players, the Inyo-Mono region could continue to improve on its integration strategies and the implementation thereof.

Looking to the future, interaction between the land-use planning agencies and water interests through the Inyo-Mono RWMG offers great potential to address critical issues of state-wide importance such as management of multiple water demands, adaptation of water management activities to climate change, and finding means to offset some impacts of climate change to water supply.

Important to the planning needs of the Inyo-Mono region is functionally linking identified goals, objectives, and resource management strategies not only theoretically but practically to the individual planning efforts in the region. In doing so, the IRWM Program can build upon sound regionally accepted goals and objectives. With a concrete foundation, the Inyo-Mono IRWM Program can improve on its desire to bridge the gap between disparate planning efforts and in doing so realize landscape-scale collaboration and resource management planning that leads to responsible land and water management stewardship as well as beneficial economies of scale.

At such time that other entities within the region have climate change adaptation and mitigation strategies in their plans, the Inyo-Mono RWMG will consider incorporating such strategies into the IRWM Plan.

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Chapter 12 : Plan Implementation, Impacts & Benefits, and Performance Monitoring

Introduction

Creating and implementing an effective IRWM Plan requires an understanding of the regional geography, water resources, demographics, economy, communities, stakeholders, and current issues regarding water use and management. The planning process also must consider concurrent planning efforts, data, and planning gaps, and must combine all the information into a coherent and comprehensive planning tool. With such an understanding, an effective IRWM Plan then develops objectives and strategies for management of and planning for water resources (as described in Chapter 7). These strategies, in turn, lead to the selection (Chapter 13) of an array of projects (Chapter 14) that contribute toward meeting the Plan's objectives. Equally important, to effectively implement an IRWM Plan, each region must create a willingness and desire on the part of community stakeholders and regional decision-makers to work together in a collaborative manner (Chapter 8).

Fundamental to successfully implementing the Inyo-Mono IRWM Plan is the means to monitor and evaluate progress at both the project and program levels. Doing so allows the Inyo-Mono RWMG an opportunity to determine whether the short and long-term objectives of the Plan are being achieved. Additionally, the needs within the Inyo-Mono region are expected to change as implemented projects address needs and as new and possibly unexpected situations arise. The implementation approach therefore needs to be flexible and iterative and provide for the opportunity to introduce changes as needed to accomplish the various resource management strategies identified for each planning objective. Thus, developing and implementing a monitoring and evaluation protocol system is critical in order to provide an opportunity to modify elements of the Plan based on an adaptive management approach. This chapter addresses the Plan Performance & Monitoring and Impacts & Benefits Plan Standards.

12.1 Actions and Projects to Implement the Plan

The initial (or Phase I) version of the Inyo-Mono IRWM Plan was created during the summer and autumn of 2010. It was formally adopted by the Inyo-Mono RWMG on December 15, 2010. Since that time, virtually all activities of the Inyo-Mono RWMG have been contributing towards implementation and/or updates of the Plan. The routine meetings of the RWMG, advanced outreach and needs assessment meetings (Chapter 6 and 10), the Round 1 Implementation and Round 2 Planning projects (see below), the focus on disadvantaged communities (Chapter 1), capacity-building activities (Chapter 10), the continued consideration of alterative governance structures (Chapter 5), collaboration with Inyo and Mono Counties on overlapping planning efforts (Chapter 8), and Plan updates and revisions all work together to implement the Plan.

12.1.1 Prop. 84 Round 1 Implementation Grant

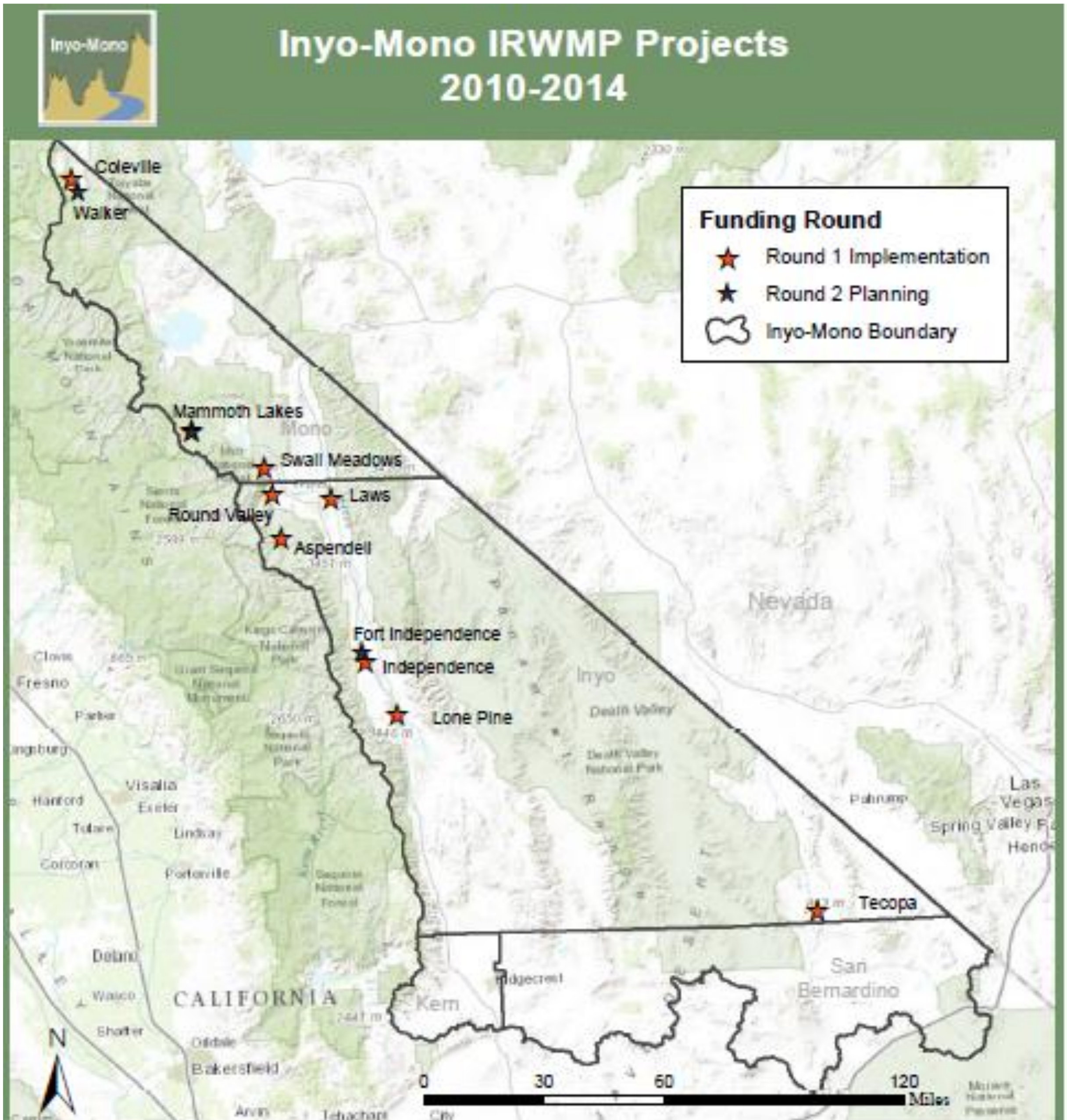
In August 2011, Central Sierra Resource Conservation and Development, acting on behalf of the Inyo-Mono RWMG, was awarded $1,075,000 through the first round of Prop. 84 Implementation funding. Although the initial proposal to DWR contained 15 projects and requested just over $4 million, the final award funded seven of the initial 15 projects (those projects ranked 1 through 7 by the RWMG). As a whole, these projects help to implement key features of the Inyo-Mono IRWM Plan, especially the Inyo-Mono objectives relating to water supply, water quality, water infrastructure, and involvement of disadvantaged communities (Table 12-1). Objectives 7 and 8 had not yet been developed when the Round 1 Implementation projects were awarded. These seven projects are a direct result of the extensive outreach done throughout the region and the effective governance and decision-making structure employed by the RWMG. A brief synopsis of each project is provided below. Figure 12-1 shows the location of each of the seven projects. The Inyo-Mono website has a page devoted to the description and current status of the seven projects, as well as an interactive map where project progress is tracked:

Table 12-1: Prop. 84 Projects as they relate to Plan Objectives

Prop. 84 Projects	Objective 1: Protect, conserve, optimize, and augment water supply while maintaining ecosystem health	Objective 2: Protect, restore, and enhance water quality	Objective 3: Provide stewardship of water-dependent natural resources	Objective 4: Maintain and enhance water, wastewater, emergency response, and power generation infrastructure efficiency and reliability	Objective 5: Address climate variability and reduce greenhouse gas emissions	Objective 6: Encourage participation of small and disadvantaged communities, including tribes, in IRWM process	Objective 7: Promote sustainable stormwater and floodplain management that enhances flood protection	Objective 8: Promote groundwater monitoring, management, and mitigation in cooperation with all affected parties
Safe Drinking Water and Fire Water Feasibility Study for Tecopa	•	•		•		•		
Coleville High School Water Project	•	•		•		•		
Round Valley Joint Elementary School Water Supply Reliability Enhancement	•			•				
New Hilltop Well	•			•				
MCWD Well Rehabilitation – Phase 1	•	•		•				
Inyo County Pump Operation Redundancy and SCADA Improvements	•		•	•	•	•		
CSA-2 Sewer System Upgrade		•	•	•				
Oak Creek Stream Stabilization Technical Study		•	•		•	•	•	
West Walker River Restoration Planning Study			•		•	•	•	
Town of Mammoth Lakes Stormwater Management Master Plan		•			•		•	
Bishop Paiute Tribe Water Conservation Plans	•	•	•	•	•	•		•
June Lake PUD Uranium Removal	•	•			•			
Amargosa Basin Water, Ecosystem Sustainability, and DAC Project	•		•		•	•		•

Big Pine Tribal Fire Hydrant Replacement	•			•	•	•	
Ridgecrest Cash-for-Grass Landscape Rebate Incentive Program	•				•		•
Recycled Water for Restoration and Community Projects in Big Pine	•	•	•		•	•	•

Figure 12-1: Inyo-Mono Funded Projects 2010-2014



Project Title	Proponent	Affiliated Town
West Walker River Restoration Planning Study	California Trout	Walker
Oak Creek Stream Stabilization Techical Study	USFS and Fort Independence Tribe	For Independence
Town of Mammoth Lakes Stormwater Planning Study	Town of Mammoth Lakes	Mammoth Lakes
Safe Drinking Water and Fire Water Supply Feasibility Study	Amargosa Conservancy	Tecopa
Coleville High School Water Project	Eastern Sierra Unified School District	Coleville
Round Valley Joint Elementary School Water Supply Reliability	Round Valley Unified School	Round Valley
New Hilltop Well	Wheeler Crest Community Services District	Swall Meadows
Well Rehabilitation - Phase I	Mammoth Community Water District	Mammoth Lakes
Pump Operation Redundancy and SCADA Improvements	Inyo County Department of Public Works	Laws
Pump Operation Redundancy and SCADA Improvements	Inyo County Department of Public Works	Independence
Pump Operation Redundancy and SCADA Improvements	Inyo County Department of Public Works	Lone Pine
CSA-2 Sewer System Upgrade Project	Inyo County Department of Public Works	Aspendell

Project #1: Safe Drinking Water and Fire Water Supply Feasibility Study for Tecopa

This project conducted a feasibility study to determine whether safe drinking water and fire flow storage facilities can be provided in the two areas that make up Tecopa (Tecopa Heights and Tecopa Hot Springs). Instead of focusing on the delivery of potable water to every household, the study analyzed the feasibility of constructing a public drinking water station and developed two alternatives for siting such a station in each area of Tecopa. The analysis of each site took into account recent water quality tests and developed appropriate treatment suggestions. The water station would provide treated, potable water where residents could fill drinking water containers. The study also identified locations in each part of town where an above-ground water storage tank for fire flow could be located and identified the type of storage tank that could be used. Although the feasibility study is complete, it is now the responsibility of the community members, Inyo County, and the RWMG to secure funding for the construction of the water-filling station and fire water storage tanks. The final feasibility study can be found on the Inyo-Mono website: http://inyo-monowater.org/wp-content/uploads/2013/12/Tecopa-Feasibility-Study-Report_pgs1-44.pdf.

Project #2: Coleville High School Water Project

The purpose of this proposal was to eliminate the public health hazard at the Coleville School campus resulting from high levels of uranium found in the groundwater used for the school's water supply. The natural levels of uranium exceeded the California maximum contaminant level of 20pCi/L. In order to meet this standard, the Eastern Sierra Unified School District employed an ion exchange treatment system. The project also provided for storage tanks to store both potable water and fire-fighting water. This new treatment and storage system benefits both the students, staff, and faculty at the school as well as other community users plumbed into the school's water system. The system came online in spring of 2013, and community members now have access to potable water.

Project #3: Round Valley Joint Elementary School District Water Project

Round Valley Elementary School was served by one shallow well with deteriorating steel casing. Over the last few years, the water system had failed three times, forcing the school to bring in portable bathrooms and bottled water, and to consider potentially closing the school. Current state water standards require new systems have redundant sources. A new well was drilled, providing a second water source. In addition, the existing well was lined with a new casing, and a new automated control system was installed.

Project #4: New Hilltop Well

The project drilled a new well and installed a small pressure system to service the Hilltop subdivision of Swall Meadows. The new system augments and may eventually replace an aging artesian well source that is located 2500 feet from the community, has become erratic in its reliability, and is prone to increasing supply line maintenance needs.

Project #5: Well Rehabilitation – Phase I

The Mammoth Community Water District (MCWD) operates two wells that have been shown to have issues with contaminants. This project provides profiling studies of both wells. By profiling the wells, MCWD will be able to determine if water quality can be improved by sealing off sections that contribute the highest contaminant loading. The testing will also verify the most efficient pumping rates while minimizing contaminant loading and maximizing yield.

Project #6: Pump Operation Redundancy and SCADA Improvements

Inyo County owns and operates three community water systems serving the unincorporated towns of Laws, Independence and Lone Pine. The combined population served by the water systems is approximately 2,000. The Lone Pine and Independence water systems are supplied by water from a well and gravity head storage tanks. A well and hydro pneumatic storage tank supplies the Laws community water system. Transducers located at the tanks send high/low signals to the Supervisory Control and Data Acquisition System (SCADA) system to operate the pumps. Currently, there is no redundancy to activate the pumps should the transducers or SCADA system fail. The goals of this project are to increase the overall reliability of the water systems' ability to start the pumps when necessary, provide redundancy to operator notification in the event of an emergency, increase the variables monitored by the SCADA system, install a communications line to increase the variables monitored, and achieve a degree of energy savings and efficiency by shifting the pump-on times to the low peak or base peak periods from the high peak period. This project will install secondary pressure sensor switches on each water system as a backup to energize and operate the well pumps and maintain system pressure in case of transducer or SCADA system failures. The project also will upgrade the SCADA systems to include capability to program off-peak pumping capability to save energy.

Project #7: CSA-2 Sewer Improvements Project

The sewer system in Aspendell, a small community to the west of Bishop, was installed in the late 1960s and consisted of a gravity sewer collector that discharged to a communal septic tank, force main, and leach field. By the early 1970s, the system began to exhibit various problems. In the mid-1970s an engineering study found that the leach field was poorly designed and the collector system had problems related to poor construction, hydraulics, and inflow and infiltration (I&I). By replacing approximately 3000 feet of main, Inyo County will eliminate the source of blockages and I&I that has resulted in overflow and spillage.

12.1.2 Prop. 84 Round 2 Planning Grant Planning Studies

In November 2012, California Trout, on behalf of the Inyo-Mono RWMG, was awarded a Round 2

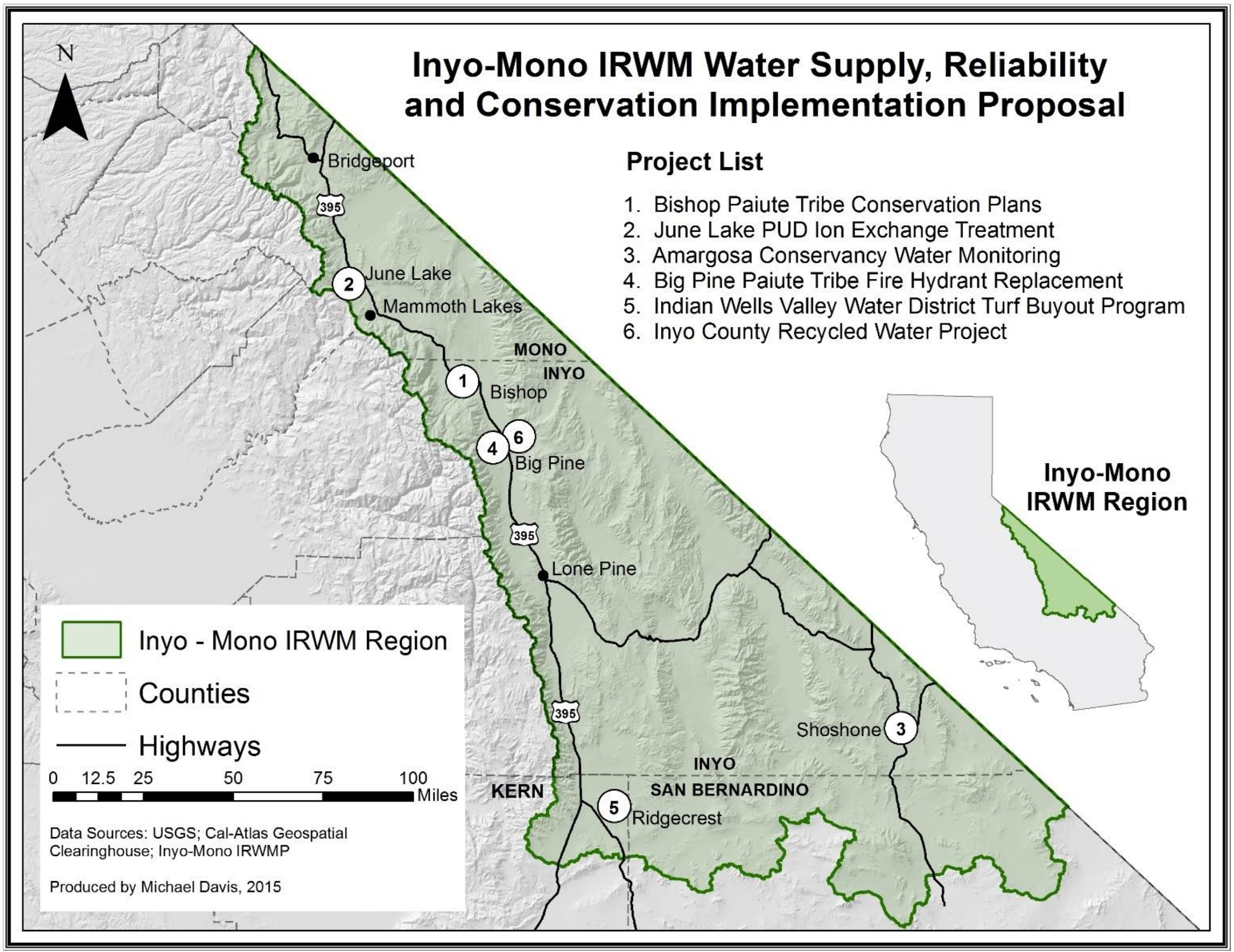
Planning Grant. The work of this grant includes three planning studies that will (1) provide relevant data to the IRWM Program, (2) add information to the Plan about project needs, and (3) address planning gaps in the region. All three planning studies (Oak Creek Stream Stabilization Technical Study; West Walker River Restoration Planning Study; Town of Mammoth Lakes Stormwater Management Plan) start to address the Phase II Plan objective concerning stormwater and flood management (Objective 7). The locations of these planning studies are shown in Figure 12-1.

In addition to ongoing Inyo-Mono IRWM programmatic work funded by the Round 2 Planning Grant, the grant funded three planning studies focusing on important issues for the region. The first project developed a restoration plan for the West Walker River. Flooding from large snowmelt or rain-on-snow events impacts adjacent agricultural land and restricts access along a major highway in the Eastern Sierra. Having a restoration plan in place will help to protect the natural flow of the river as well as the economic activity of the region. The second project produced a technical feasibility study for the Oak Creek watershed, which experienced severe fire and flood events in the last decade. This plan will lead to the restoration of parts of the stream channel and surrounding watershed as well as the protection of the downstream Fort Independence Indian Reservation. Finally, the Town of Mammoth Lakes developed a much-needed stormwater management master plan. A poor understanding of stormwater flow and drainage in the town has led to flooding of certain neighborhoods. This plan will lead the way towards improved stormwater management and will provide a template for other water managers in the Inyo-Mono region to use.

12.1.3 Prop. 84 Round 3 (2015) Implementation Grant

In 2016, the Desert Mountain Resource Conservation & Development was awarded $1,816,942 on behalf of the Inyo-Mono IRWM to administer six projects under the Prop. 84 Round 3 (also called the 2015 round) Implementation Grant. As of this Plan update, most of the six projects were complete. It is expected this grant will be fully complete in 2020. Table 12-1 shows how these six projects address the eight IRWM Plan objectives. Figure 12-2 depicts project locations.

Figure 12-2: Round 3 Implementation Project Locations



Project #1 is Desert Mountain RC&D's grant administration tasks.

Project #2: Bishop Paiute Tribe Domestic Water, Irrigation, and Wastewater Conservation Plans

The Bishop Paiute Tribe, a disadvantaged community (DAC) and federally-recognized Native American Indian Tribe, seeks to improve management of its water resources, one of the goals of which is conservation of the Reservation's surface water flow from the Bishop Creek watershed and groundwater from area wells. Through the proposed project, a sub-contracted civil engineer who understands the Bishop Paiute Tribe's water sources and water delivery protocols will be hired to complete a comprehensive water conservation plan that will guide and prioritize long-term water resource management needs for the Tribe. This conservation plan will consist of three focal areas within the Tribe's water management system: irrigation, domestic water, and wastewater. In addition, the plan will include a rate study that will facilitate a tiered rate structure to be implemented for the Tribe's long-term management of its water resources. The conclusion of the conservation plan will propose a series of improvements needed to better manage the Tribe's water resources.

Project #3: June Lake Public Utility District Uranium Removal Plant

The June Lake Public Utility District is confronted with a water quality, and in turn a significant water supply reliability, issue as it relates to the uranium content in June Lake, which is an approved surface water source for the District. During the 2012-2016 drought, the District saw uranium test results in exceedance of what the State allows, which is 20 pCi/L. District officials believe the more concentrated uranium is a result of reduced lake levels due to the ongoing drought conditions and decomposing natural materials within the lake. If the drought continues, uranium levels in June Lake would presumably continue to increase. The District has attempted to blend water from a secondary water treatment plant with the June Lake water treatment plant to reduce the uranium content. Blending has worked for the short term; however, if the secondary plant is offline for any reason, the District would be forced to use only the June Lake plant with the uranium content in exceedance of the State standard. The June Lake Public Utility District is proposing to install an ion exchange unit that would connect to the incoming raw water supply from June Lake, process the raw water through the ion exchange filtration system and then through the normal microfiltration process, and subsequently pump the water to the storage tank for domestic use.

Project #4: Amargosa Basin Water, Ecosystem Sustainability, and Disadvantaged Community Project

The Amargosa River Basin of Eastern California supports a unique and diverse ecosystem, a free-flowing river, and human needs – especially in the severely economically disadvantaged Tecopa area. Groundwater and surface water in the basin sustain one of the largest arrays of endemic and rare desert plant and animal species in the United States. In the disadvantaged community of Tecopa, groundwater and springs supply municipal, domestic, agricultural, wildlife, stock-watering, mining, and other industrial uses. The BLM-designated (2009) Wild & Scenic flowing portion of the Amargosa River near Tecopa is a groundwater-fed surface water body, and relatively small variations in the groundwater surface elevation can have considerable effects on spring flow and surface flow in the river. Severe economic, social, and environmental impacts could occur as result of a relatively minor lowering of the groundwater surface in the area, as the local economy depends on the tourism generated by the Amargosa River, the area's warm and hot springs, and the water-fed ecosystems, and the local community increasingly depends on local groundwater resources for domestic and irrigation water. Given the importance of the issues, the following tasks will provide the greatest benefit in protecting Tecopa's water supply by monitoring changes to the groundwater/surface water system due to regional water resource pressures, such as groundwater pumping "upstream" in the basin, proposed industrial-scale solar developments, and increasing climate variability. This project will accomplish two goals: (1) developing an improved understanding of the region's hydrologic system in order to effectively and economically monitor and protect water resources for the benefit of the disadvantaged community, and the environment in general, by enhancing the limited monitoring currently in existence, and (2) establishing a long-term groundwater monitoring network. The work includes:

- Siting, permitting, installing and sampling up to six monitoring wells;

- Robust evaluation of evapotranspiration (ET) along the Amargosa River (essential to an understanding of the basin's groundwater budget and water availability); and
- Continued groundwater level, spring flow, and river flow monitoring for 12 months.

Project #5: Big Pine Tribal Fire Hydrant Replacement Project

The Big Pine Paiute Tribe of the Owens Valley (Tribe) is a federally recognized tribe located on the Big Pine Indian Reservation in Inyo County. The Tribe is considered a disadvantaged community. The Big Pine Indian Reservation has a population of 500 people of which 400 are tribal members. The Reservation exists along a wildland-urban interface on the eastern slope of the Sierra Nevada Mountains. Isolated residential fires have caused extensive destruction of homes over the past decade on the Reservation, and the potential for wildland fire is a great risk to the community. In 2012, the Big Pine FireSafe Council was formed to protect the homes, communities, and environments from wildfire in the Big Pine area. The Tribe is a partner in the Council and through this proposal is working to protect the Big Pine area by replacing fire hydrants on the Reservation. This project will replace 38 hydrants on the Tribe's public water system that have reached the end of their useful lives, or for which hydrant parts are no longer available for purchase. The Big Pine Tribal Fire Hydrant Replacement Project shall replace obsolete fire hydrants throughout the distribution system to increase the safety of the residents, prevent property and infrastructure damage and loss, prevent fire from spreading to neighboring wildland areas, and reduce the likelihood of sedimentation and water quality impacts to Big Pine Creek, which runs through the Reservation.

Project #6: Ridgecrest Cash-for-Grass Landscape Rebate Incentive Program

The Indian Wells Valley Water District is implementing a cash-for-grass landscape rebate incentive program. It is believed that such a program will achieve measurable results within a reasonable time period. According to a five-year, multi-million-dollar study conducted by the Southern Nevada Water Authority, grass in a similar desert environment to Ridgecrest requires 73 gallons of water per square foot per year to thrive while xeriscape only needs 17 gallons per square foot – a significant savings. By converting a mere 1,000 square feet of grass to xeriscape, a single homeowner could save the Valley one acre-foot of water in less than six years, and if all customers followed suit, the District could save nearly 650 million gallons of water in just one year. A program of this nature requires adequate financial incentive to produce enough living turf conversion to substantially reduce water usage in the Indian Wells Valley. An attractive buy-back price per square foot of turf is $1.00. This project is a rebate incentive program to promote living turf removal at residential, multi-family, commercial, industrial, and institutional properties located within the boundaries of the Indian Wells Valley Water District service area to conserve water in the Indian Wells Valley groundwater basin.

Project #7: Recycled Water for Restoration and Community Projects in Big Pine

The County of Inyo proposes completing Phase I of a project to establish a wastewater recycling facility in the town of Big Pine. Phase I will consist of a planning study (comprised of a feasibility study and an improvement plan) to produce and distribute non-potable recycled water. Upon completion, it is anticipated Phase II will be implemented, thereby constructing a facility for recycled water to be produced in conformance with California's Water Recycling Criteria. Phase II would provide water for landscaping, agriculture, and environmental restoration in the Big Pine area that would otherwise be supplied with an already-limited potable water supply that serves two disadvantaged communities. The study proposed in this project will also assess the feasibility of using solar energy to supply power to operate the treatment plant and water pumps.

12.2 Benefits and Impacts of Plan Implementation

The Inyo-Mono RWMG is committed to ensuring that the IRWM Plan is consistent and compatible with existing planning documents, and in particular, established agreements and legal obligations. Rather than confounding the present legal and regulatory environment, the IRWM Plan is intended to streamline and improve stakeholders' ability to operate and succeed within the current (and possible future) policy and regulatory environment. Moreover, participants in the Inyo-Mono RWMG recognize the value of the Inyo-Mono IRWM planning effort in that it affords an opportunity for regional coordination and collaboration throughout the planning region itself. Indeed, the wide array of RWMG Members (Chapter 5) has committed to participating in the Inyo-Mono IRWM process as a means to leverage collaborative opportunities and realize multi-agency efficiencies and topical benefits. Table 12-2 provides a summary of the expected impacts and benefits derived from the development and implementation of the Inyo-Mono IRWM Plan.

12.2.1 Benefits of Plan Implementation

Activating a water management plan for the entire Inyo-Mono region has many advantages compared to local efforts done in isolation. Regional planning allows consideration of the broad range of interactions among various activities regarding water resources and their use. Regional planning has the potential to provide a better balance between conservation of natural resources and economic development. Given the small size of communities throughout this portion of eastern California, implementation of a regional approach permits some economies of scale to be realized that cannot be achieved by an individual community. In particular, rural disadvantaged communities and Native American tribal communities have more opportunity to address and solve their water-related issues when they work together and with entities with more resources. A good example of collaboration leading to more efficient use of resources is in relation to the Oak Creek watershed near Independence. The Inyo National Forest and the Fort Independence Indian Reservation are working together, using IRWM planning grant funds, to determine the best way to restore the watershed after recent fire and flood events.

The regional planning process has also created the opportunity for people throughout this large but sparsely populated area to agree on principles for water resources management as well as have a greater voice on statewide water issues and policies. As a coalition of small water suppliers and local jurisdictions and agencies, the Inyo-Mono RWMG has greater political and funding stature than any of the members in isolation. The Inyo-Mono IRWM Program Office has acted as an advocate in Sacramento for the small and dispersed water-related entities, agencies, and disadvantaged communities of the region on matters of policy, regulation, and legislation.

Initial development and subsequent revision of the Inyo-Mono IRWM Plan has forged cooperation and collaboration among local water providers, local government, federal and state agencies, conservation groups, and interested citizens around the common goal of improved management of the region's water resources. Many people are now talking and helping each other in ways that did not exist prior to the formation of the Inyo-Mono RWMG, such as small water districts sharing information and resources to help solve water system management issues. Partnerships now exist among agencies at various levels of government and private water entities. Such collaboration promotes sharing of data, information, and expertise and reduces duplication of effort and services.

The regional perspective of the Inyo-Mono RWMG provides a comprehensive approach to solving issues related to water supply, water quality, stormwater control and flood management, aquatic and riparian habitat stewardship, and DAC- and tribe-specific water concerns. Creating a regional planning process based on watershed boundaries is much more appropriate for addressing such matters than only through small political jurisdictions or water districts. Furthermore, regional water planning has encouraged and will continue to encourage coordination and cooperation among communities and local entities that had little interaction in the past. Such collaboration improves the chances that impacts and benefits of projects are shared and equitably distributed rather than the historical situation of one area benefitting at the expense of another. Because of the egalitarian nature of the Inyo-Mono governance structure, DACs and tribes have an equal voice to all other stakeholders and can ensure their interests are not ignored. A watershed approach also helps ensure that projects primarily designed for a particular purpose, such as stormwater management, adequately consider other objectives and potential consequences, such as water quality or riparian habitat conservation. When projects become truly integrated, then multiple benefits to a variety of beneficiaries can be achieved with minimal adverse impacts.

By combining water management strategies through a collaborative and integrated approach, there is potential for some synergistic benefits, where the combined benefits are greater than merely the sum of results from independent efforts. Such benefits are likely to be achieved at lower cost than through independent projects. In cases where agencies are able to cooperate and avoid "turf battles", a truly collaborative and integrated project, in theory, can be implemented more efficiently and more quickly than can be done by a single agency with a narrow focus.

Beneficiaries of Plan implementation include residents of the planning area; the hundreds of thousands of people who visit the eastern Sierra Nevada and northern Mojave Desert each year; water users throughout the region; local water providers; agencies of town, city, county, state, and federal governments; disadvantaged communities and Native American tribes; people within the service area of the Los Angeles Department of Water and Power who rely on the watersheds of the Mono Basin and Owens River for a substantial fraction of their water supply; irrigators in Nevada who rely on the watershed of the Walker River for their irrigation supply; residents in Nevada who depend on the Amargosa groundwater basin for domestic and irrigation water supply; and flora and fauna that depend on healthy ecosystems.

12.2.2 Adverse Impacts of Plan Implementation

Impacts of *not* implementing the plan are considered to be far greater than any adverse impacts that might occur as a result of plan implementation. To undo the progress from dozens of RWMG and outreach meetings and tens of thousands of hours of work would be to take a step backwards in water management for the region. All of the actions taken to implement the Plan have multiple benefits and provide advantages for one or more communities. Compared to some of the large water projects constructed elsewhere in California, the projects proposed within the Inyo-Mono planning region are quite small in scale and scope and are simply not of sufficient magnitude to cause significant adverse impacts to neighboring communities, whether classified as disadvantaged or not. None of the projects proposed to date could be considered as "zero-sum", where one community or water supplier benefits at the expense of another. Perhaps the primary impact of Plan implementation to tribes and DACs is the competitive nature of project funding where projects benefiting tribes and DACs are not adequately funded.

An economic impact of improved water management and infrastructure that needs to be mentioned is increased cost to most water users and to State taxpayers. Throughout the Inyo-Mono IRWM planning process, the RWMG has been learning that much of the water supply infrastructure in the region needs to be replaced or upgraded and that financial reserves are not adequate to cover the eventual costs. Water systems with aging infrastructure and low reserves will need to raise their rates to cover future maintenance and capital expenses and may need to impose large fees to pay for major repairs in the event of sudden failures. Furthermore, because these small systems cannot take advantage of economies of scale, such infrastructure upgrade or replacement projects may be more expensive per capita or per connection than urban water projects.

One may consider potential impacts associated with eventual project implementation. Adverse impacts can occur both during the construction period as well as over the long-term operation of a project. Some impacts are potentially cumulative, where two or more activities combine to produce adverse effects that exceed some threshold or level of significance. Specific impacts of individual projects (and their potential for cumulative effects) will be evaluated with respect to CEQA and/or NEPA prior to project implementation. Appropriate mitigation would be determined as part of the environmental review. Some possible impacts related to the usual CEQA categories are briefly described below:

Aesthetics: Any construction activities and resulting structures have the potential to affect aesthetics.

Air Quality: Construction activities may impact air quality, primarily by generating dust.

Biological Resources: Construction, particularly earth-moving activities, often impacts biological resources. Habitat fragmentation is often a risk associated with construction projects. Projects intended to control invasive species or improve habitat often have short-term impacts, although such projects have net benefits for biological resources over the long term.

Cultural Resources: Buried or otherwise unknown cultural resources could be damaged by construction.

Geology and Soils: Almost all construction will result in some soil disturbance.

Hydrology and Water Quality: Some minor amount of erosion and sediment delivery might be expected from projects involving construction. Otherwise, most projects that have been proposed are intended to produce benefits for water supply and water quality. Projects that develop new water supplies for human use are likely to decrease in-stream flow or stored groundwater.

Land Use and Planning: None of the projects proposed so far would be incompatible with current county general plans or USFS Forest Plans.

Noise: Some noise is commonly generated during construction projects.

Population and Housing: None of the projects proposed so far would impact population or housing, and none could be regarded as encouraging growth.

Public Services and Utilities: The projects proposed so far are intended to improve public services such as water supply, drinking water quality, storm water management, and flood control.

Recreation: Some construction activities could adversely affect recreation in the short term.

Transportation and Circulation: Construction activities can have minor short-term impacts on traffic flow and routing.

Table 12-2: Impacts and Benefits of Plan Implementation

Inyo-Mono IRWM Plan Objectives	Inyo-Mono Region	
Objective	**Potential Impacts**	**Potential Benefits**
1. Protect, conserve, optimize, and/or augment water supply	• Habitat degradation • Construction related delays or impacts to water supply or quality • Financial liability for long-term project management	• New water supply systems • Increased reliability of water supply systems • Additional water supply via water conservation measures
2. Protect, restore, and/or enhance water quality	• Habitat degradation • Construction related delays or impacts to water supply or quality • Financial liability for long-term project management	• Improved water quality • Improved aquatic and wetland habitats • Improved recreational opportunities • Improved human health within region • Improved health of regional flora and fauna
3. Provide stewardship of our natural resources	• Human and financial resource burden(s) • Limits on water diversions and groundwater pumping	• Restoration of ecosystem processes • Increased ecological resilience • Improved long-term services provided by regional resources • Improved health and viability of regional habitats • Improved health of regional flora and fauna • Improved recreational opportunities • Improved regional socio-economic conditions
4. Maintain and/or enhance water, wastewater, and power generation infrastructure efficiency and reliability	• Financial liability for long-term project management • Environmental impacts of infrastructure projects	• Increased reliability of water supply systems • Improved energy efficiency • Reduced potential for wastewater contamination • Reduced operational costs
5. Address climate variability and/or reduce greenhouse gas emissions	• Financial liability for long-term project management • Construction related delays or impacts to regional resources due to new, more efficient infrastructure and energy sources • Increased demand for water to support "green" technology/renewable energy sources	• Improved climate change adaptability • Reduction of greenhouse gas emissions

Inyo-Mono IRWM Plan Objectives	Inyo-Mono Region	
Objective	**Potential Impacts**	**Potential Benefits**
6. Increase participation of small and disadvantaged communities in IRWM process	• Time burden	• More comprehensive understanding of the needs of DAC and tribal entities • Improved ability to address water needs of DACs and tribal entities • Improved human and resource capacity
7. Promote sustainable stormwater and floodplain management that enhances flood protection	• Environmental impacts of stormwater and flood management infrastructure • Effects to surface water diversions • Unforeseen impacts as flood regimes revert to natural flood patterns	• Reduced adverse impacts of flooding in communities • Reduced erosion • Improved water quality • Improved habitat quality
8. Promote sound groundwater monitoring, management, and mitigation in cooperation with all affected parties	• Difficulty of obtaining information due to unwillingness to share data or infrastructure • Increased conflict among agencies/organizations	• Responding to and complying with mandates to monitor groundwater • Improved understanding of groundwater trends, quality, and quantity • Increased cooperation among entities • Improved water availability to parties using or desiring to use groundwater

The impacts and benefits will be reviewed throughout the Plan's duration. Based on the progress of the implementation of the Inyo-Mono IRWM Plan, the impacts and benefits may be revised to reflect lessons learned, achieved milestones, and to document any unforeseen impacts or benefits to date.

12.2.3 Inter-regional Benefits and Impacts

Most of Inyo-Mono's neighboring IRWM regions are on the west side of the main watershed divide in California, the Sierra Nevada that separates the Pacific Slope river basins from the Great Basin. Therefore, the Inyo-Mono region has no hydrologic or even hydraulic-engineering connections to the IRWM regions of the west side of the Sierra Nevada. Similarly, the boundary between Inyo-Mono and the Tahoe-Sierra region to the north is the watershed divide between the Walker River and Carson River basins, where there are no inter-basin water transfers. In the Northern Mojave Desert portion of the region, the southern boundary attempts to follow the approximate divides between groundwater basins. However, the Inyo-Mono region and the Mojave planning region share a portion of the Indian Wells - Searles groundwater basin within northern San Bernardino County. Otherwise, there are no significant hydrologic connections with immediate neighbors to the south. Because of the Inyo-Mono region's location in the Great Basin, there are simply no regions downstream within California.

The principal connection that the Inyo-Mono region has with other regions is to the Greater Los Angeles and Gateway planning regions via the Los Angeles aqueduct and delivery of water from the Mono Basin and Owens River Basin to the Los Angeles Department of Water and Power service area. Any projects that improve conditions in the Owens and Mono Lake watersheds potentially improve the quality of that exported water. None of the currently proposed projects would have any detrimental effect on the water quantity or quality exported from the Inyo-Mono Region.

12.3 Plan Performance & Monitoring

The Inyo-Mono IRWM Plan implementation will be evaluated based on the use of performance measures, quality assurance procedures, and periodic assessments. Performance monitoring will be employed with the intent of monitoring progress of project implementation as well as overall programmatic implementation. In particular, performance measures have been established to enable an objective evaluation of the Inyo-Mono IRWM Plan implementation relative to the objectives and resource management strategies agreed upon by Members of the RWMG. While specific projects are being implemented, evaluation will happen on an ongoing basis. Otherwise, general Plan implementation will be evaluated annually.

12.3.1 Development of Plan Performance Measures

In the initial process of implementing the Inyo-Mono IRWM Phase II Plan, performance indicators and measures were created to track the progress of the seven Round 1 Implementation projects. These indicators were based on project-specific expected outcomes and outputs as well as on how each project addressed the Plan's objectives and resource management strategies. The indicators will be reviewed and updated with subsequent rounds of project funding and completion. Performance indicators, at a minimum, include three types: 1) administrative; 2) output; and 3) outcome. A description of the three types of performance indicators is provided below.

1) Administrative indicators are used to evaluate progress being made by the Inyo- Mono IRWM Program Office, grantees, project proponents, and others that may be responsible for supporting the implementation of the Phase II Plan. Indicators may include, but will not be limited to, such metrics as the number of RWMG and Administrative Committee meetings convened, the number of targeted outreach meetings convened, and timeliness and adequate completion of project reporting and other administrative obligations.

2) Output indicators are used to measure the overall progress associated with implementing the Phase

II Inyo-Mono IRWM Plan. Output indicators will closely correspond to how projects are achieving their intended goals. Specific indicators may include the number of replaced wells, the number of infrastructure improvements targeted to improving water quality, the number of water conservation initiatives implemented, the number of acres reclaimed from invasive species, and the progress of projects in relation to their schedules.

3) Outcome indicators include indicators that evaluate either in a quantitative or qualitative manner the effects of projects that implement the Phase II Inyo-Mono IRWM Plan. For example, outcome indicators may include such metrics as the quantity of reclaimed water, the volume of water conserved via a water conservation initiative, the degree to which water quality was improved, and the area of native vegetation restored.

Each of the proposed performance indicators will be used to more broadly evaluate progress being made by the Inyo-Mono IRWM Program, provide information necessary to facilitate an adaptive management strategy, and provide relevant information to keep the general public and policy makers informed as to the successes, challenges, and shortfalls of the Inyo-Mono IRWM Program.

12.3.2 Development of Project-Specific Monitoring Plans

Project proponents are required to provide information in their project proposals specific to monitoring, assessment, and indicators enabling evaluations of projects to be conducted. Each project should be monitored with respect to compliance with all applicable rules, laws, and permit requirements. These project-specific monitoring plans may be modified based on input from granting agencies and other interested parties. Working with the grant-specific grantee and members of the RWMG, project proponents will finalize monitoring plans prior to any on-the-ground project work commencing. Once approved, project proponents will be responsible for monitoring their own projects and reporting results to the grantee. The monitoring plans need to include a description of how the grantee (fiscal agent) can monitor compliance with all applicable rules, laws, and permit requirements in coordination with the primary self-monitoring responsibility of the project proponent.

12.3.3 Monitoring Plan Performance through IRWM Projects

To meet the requirements of DWR’s Proposal Solicitation Packages (PSPs), each project proponent must include in its proposal submission information specific to monitoring, assessment, and measuring performance. For each of the projects that is awarded funding, the monitoring, assessment, and performance indicators provide the basis for a monitoring plan necessary to evaluate progress being made towards the Plan‘s implementation and towards successful completion of the project. Using the project-specific monitoring, assessment, and performance measures from the Prop. 84 Round 1 Implementation grant proposal (Attachment 6 of the application) for each of the seven projects, along with the Round 1 Implementation grant agreement, the Prop. 84 IRWM Guidelines, and the IRWM Plan’s regional objectives and RMS, the Program Office developed a customized monitoring checklist for each Implementation project (Figure 12-2). At the completion of the project, each project proponent is asked to complete this checklist and provide an optional narrative explaining their responses. Planning and implementation projects from subsequent rounds of funding will be monitored in a similar way.

Figure 12-3: Project Performance & Monitoring checklist

Only Inyo-Mono Objectives 1 and 2 are visible; however, project leaders are asked to respond to all eight regional objectives as well as indicate if they achieved project-specific output and outcome indicators.

Project Performance & Monitoring

Project #: 2 Coleville High School Water Project

Project Proponent: Eastern Sierra Unified School District

Project Specific Output Indicators			
	Yes	No	Comments
Has radioactive analysis been performed on the new treated water source?	☐	☐	
Was the target of 0pCi/L of Uranium achieved in the first water quality test?	☐	☐	
	☐	☐	
Project Specific Outcome Indicators			
	Yes	No	Comments
Has an annual laboratory analysis for water quality been set up for the project?	☐	☐	
Have new water quality parameters been compared with original water quality tests from the technical report	☐	☐	
Is the new uranium level below target MCL?	☐	☐	
Is the target of 0pCi/L of Uranium still achievable through periodic replacements of the ion exchange resin?	☐	☐	
Did you meet the goal or your project? If yes, please provide a brief description stating how you achieved this goal. If no, please comment as to why the goal was not achieved.	☐	☐	
Other Standard Reporting Requirements: *Please indicate here other monitoring/reporting requirements you may already be required to do independent from DWR contractual obligations. For example: CDPH Title 22 Ch. 15 "Domestic Water Quality AND Monitoring Regulations", GAMA, CASGEM, or other Internal reporting requirements that may yield valuable data.*			
	Yes	No	Comments
	☐	☐	
	☐	☐	

	☐	☐	
What Resource Management Strategies did you address to meet Inyo-Mono IRWM Objectives?			
Objective 1: Protect, Conserve, Optimize, and Augment Water Supply While Maintaining Ecosystem Health			
Resource Management Strategies	Yes	No	Comments
Improve water supply reliability	☐	☐	
Improve system flexibility and efficiency.	☐	☐	
Support compliance with current and future state and federal water supply standards	☐	☐	
Address local water supply issues through various techniques, including, but not limited to: groundwater recharge projects, conjunctive use of water supplies, water recycling, water conservation, water transfers, and precipitation enhancement	☐	☐	
Optimize existing storage capacity	☐	☐	
Conserve and adapt water uses to future conditions.	☐	☐	
Capture and manage runoff where feasible	☐	☐	
Incorporate and implement low-impact development design features, techniques, and practices	☐	☐	
Promote public education about water supply issues and needs.	☐	☐	
Promote planning efforts to provide emergency drinking water to communities in the region in the event of a disaster.	☐	☐	
Promote water efficiency in fish hatcheries	☐	☐	
Protect water supplies that support public recreational opportunities	☐	☐	
Objective #2) Protect, restore, and enhance water			
Resource Management Strategies	Yes	No	Comments

12.3.4 Entities Responsible for Evaluating Plan Implementation

Four entities are responsible for developing specific indicators for Plan implementation as well as evaluating the overall effectiveness of the Phase II Inyo-Mono IRWM Plan:

1) The Inyo-Mono Program Office is responsible for developing administrative indicators for the overall Program and will support the development of output and outcome indicators for Planning and Implementation Grants. Program Office staff will also be directly involved in performance evaluations.

2) Individual grantees (or fiscal sponsors) for each IRWM grant are responsible for developing appropriate administrative indicators for Planning and Implementation activities. Additionally, each grantee shall contribute to the evaluation of appropriate project performance indicators throughout the duration of the respective grant.

3) Planning and Implementation grant project proponents, in accordance with DWR requirements, propose elements for monitoring the progress of their projects in the grant application. Project

proponents, through agreements with the grantee and Program Office, are responsible for developing administrative, output, and outcome indicators for their respective projects, as well as a schedule to monitor progress, and for reporting progress to the grantee and Program Office.

4) Administrative Committee members have oversight of financial aspects related to the Inyo-Mono Program. Members of the Administrative Committee contribute to finalizing performance indicators and evaluating overall performance of both the Program and project implementation.

Together, the four entities described above serve as an informal Plan Evaluation Working Committee to ensure that the IRWM Plan is being implemented appropriately and successfully.

12.3.5 Data Management System for Tracking Plan Implementation & Performance

Based on the various performance indicators agreed upon by the RWMG, grantees, and/or project proponents in approved monitoring plans, a database will be created to house all Plan and project implementation monitoring and evaluation information. This database will allow for tracking Plan implementation performance against regional objectives and resource management strategies to effectively gauge success or deficiencies. Evaluation of effective Plan implementation will be undertaken after each funding cycle has been completed. More frequent evaluations may be conducted as needed; however, it is recognized that incomplete data collection prior to the completion of projects may skew early results. Currently the Program Office houses, manages, and disseminates all data generated from IRWM implementation and planning projects. More details about data management are available in Chapter 4.

12.4 Lessons Learned for Future Project Planning

The Inyo-Mono RWMG firmly believes in an active adaptive management approach to developing and implementing future IRWM Plan(s). As such, it is the intent of the RWMG to utilize the information derived from monitoring and evaluation of the Phase II Inyo-Mono IRWM Plan and projects to modify monitoring systems to help ensure projects achieve their intended objectives. Furthermore, the intention is to use the lessons learned from the first set of Implementation and Planning projects to develop a region-specific project development tool that other project proponents can use. Included in the tool would be various kinds of information related to project development, such as the cost for writing a grant application, review of engineering and consulting firms, recommended sources for certain materials, etc. This information will also be housed on a project resources page on the Inyo-Mono website (http://inyo-monowater.org/implementation-round-1/project-reporting-monitoring/) and in the database discussed in the previous section. The first version of this resources page includes quarterly invoice reports and feasibility studies from projects and will be further developed to include vendor information, costs, labor compliance, and CEQA information along with any other requested relevant and helpful information for future project proponents.

As part of the adaptive management approach, the RWMG will make note of observations and indications of climate change and adjust portions of this Plan accordingly. Future versions of this Plan will take advantage of new tools, data, research results, and all relevant information as such become available.

In addition to monitoring and evaluation of specific projects, the Program Office will coordinate with the RWMG on an annual basis to assess progress relative to the Plan's implementation, including progress made towards revisions to the Inyo-Mono Phase II IRWM Plan. Doing so on an iterative basis and at regular intervals will provide the Program Office an opportunity to modify strategies and approaches as needed.

12.5 Next Steps in Plan Implementation

The Inyo-Mono RWMG intends that the updated Plan will serve as the basis for the next 3-5 years of water-resources planning and management for the Inyo-Mono IRWM Region. Furthermore, the RWMG expects that, through regular updates that reflect new information and changing conditions, the Inyo-Mono IRWM Plan will continue to be useful in the long term.

The Inyo-Mono RWMG will continue to pursue implementation funding through the statewide IRWM Program. However, given that bond funding is temporary and unpredictable, the Group recognizes that alternative funding sources need to be sought out and pursued.

Chapter 13 : Project Review Process

Introduction

Projects are one of the ways in which the Inyo-Mono IRWM Plan is implemented within the planning region (see Chapter 12 for a full discussion). The Prop. 84 Round 1 Implementation Grant funded seven projects that focus on improving water quality, increasing water supply reliability, and/or upgrading antiquated infrastructure. The Prop. 84 Round 2 Planning Grant funded three projects that help to meet planning gaps in the region. More recently, the final round of Prop. 84 Implementation funding supported seven projects that helped to respond to increasing climate variability, protected and improved water supplies and water quality, and began to address groundwater issues in the region. The Inyo-Mono RWMG will continue to seek out projects that meet the most pressing needs in the region, as reflected in this Plan's Objectives and Resource Management Strategies (RMS; Chapter 7), and that also help to meet the Objectives, RMS, and Program Preferences of DWR and the California Water Plan (Chapter 1).

Each project that aims to be considered for funding will go through a two-step process. First, the project must be submitted to the general pool of projects using a newly-developed online upload form. Second, projects from the general pool that are ready to move forward for funding are put through a carefully-designed process of evaluation and ranking by the RWMG. Each of these steps is described below.

13.1 Projects Included in the IRWM Plan

The Inyo-Mono RWMG has an "open door" policy with respect to submitting and including projects in its IRWM Plan. This means that, other than requiring certain information be provided with each project submitted, projects are not filtered before including them in the Plan. The RWMG strongly feels that this policy allows a better assessment of the overall needs of the region with respect to water issues and funding and also provides more opportunity to combine and integrate similar projects. Filtering occurs when projects are being selected and ranked for funding.

13.2 Procedures for Submitting a Project to the IRWM Plan

Based on feedback received regarding the process used to submit projects for inclusion in the Inyo-Mono IRWM Phase I Plan, the process was substantially changed to better meet the needs of project proponents as well as the larger planning objectives of the region. In the Phase I Plan, project proponents simply emailed project descriptions and other basic information to Program Office staff. In working with other IRWM regions, staff learned that online project submittal forms are used with success in several regions, and staff endeavored to create a similarly useful process for the Inyo-Mono region.

The new online upload form was created in early 2012 to meet the needs of the Phase II Plan and upcoming rounds of Implementation funding (https://inyo-monowater.org/resources/project-upload/). The form is housed on the Inyo-Mono IRWM Program website and is password-protected to help ensure that fraudulent information is not submitted. Users who wish to submit a project using this form simply contact the Program Office for the password. Although any stakeholder with an interest in water management may submit a project using this form, only projects submitted or sponsored by RWMG Members will move forward for funding.

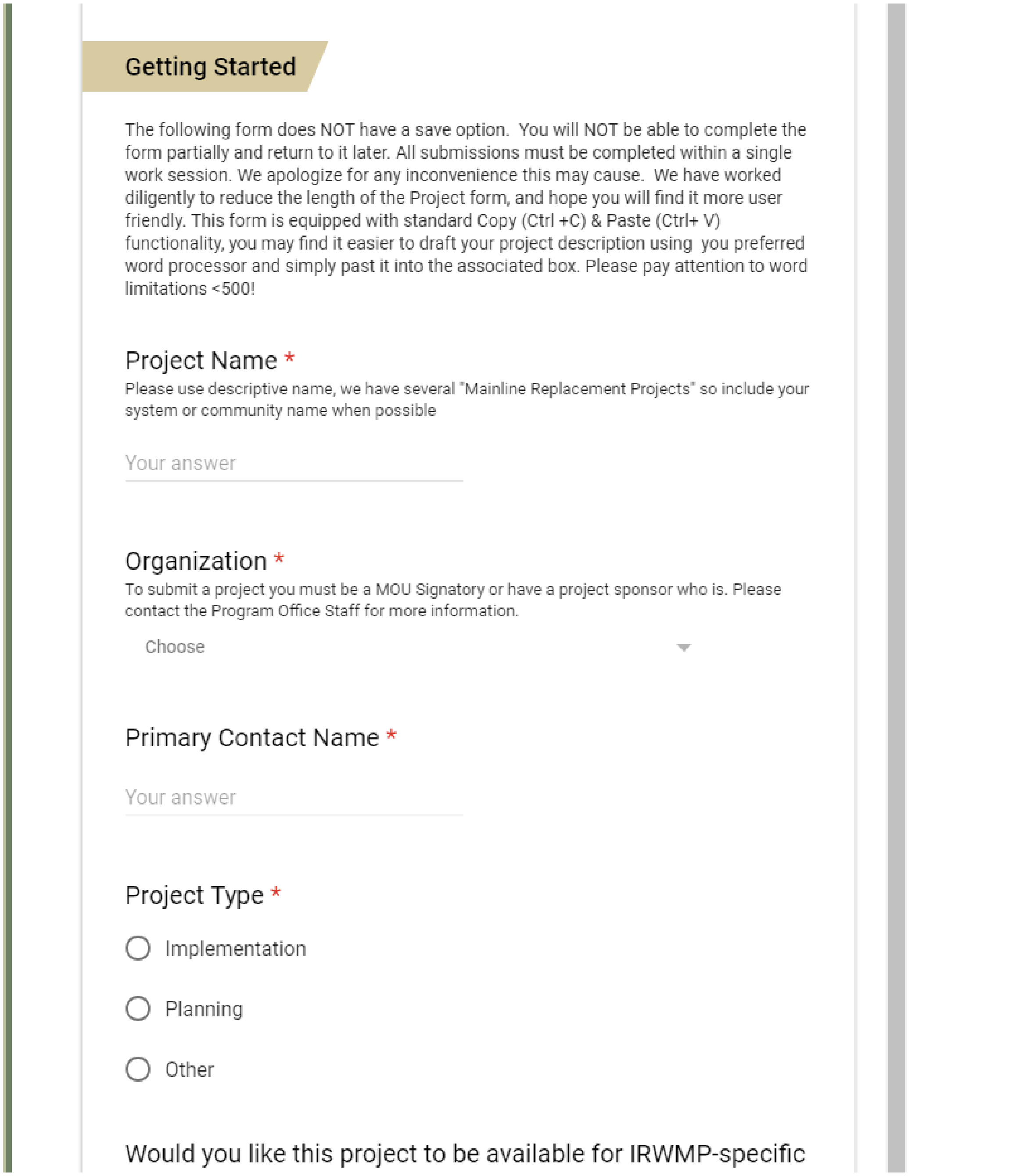
Although the first version of the online upload form requested information regarding project applicability to DWR Program Preferences and California Water Plan Strategic Objectives, RMS, and Integrated Water Management Benefits, the form was later shortened. In its current form, it provides relevant information concerning the project itself, including organizational contact information, project title and description, length of project, cost of project (including amount of funding needed and amount of funding already available), type of project (conceptual, planning, implementation), project location, communities and watersheds benefitted (including DACs), and relation to Inyo-Mono Objectives and RMSs.

Not all fields in the project upload form are mandatory. Those that are required are marked with a red asterisk. The extensive information requested in the upload form requires that the project proponent has carefully considered the need for and design of the project and can relate the project to larger regional and Statewide planning objectives. Thus, the amount of time required to fill out the online form provides a first filter on the number of projects submitted. Extensive instructions are included at the top of the online form (http://inyo-monowater.org/members/project-upload/), and Program Office staff is available to answer questions and provide assistance. Furthermore, additional tips for successful project upload are provided on the website, along with a study guide (http://inyo-monowater.org/members/). A downloadable Word document that contains all of the questions in the upload form is also available on the website at the previous link. Alternatively, for stakeholders in the region that may not have access to the Internet, the Word document version of the submission form can be made available (and then be submitted) in hardcopy. An example of the appearance of the online upload form is shown in Figure 13-1.

13.3 Procedures for Review of Projects for Inclusion in the IRWM Plan

All projects that meet the basic requirements of the project upload/submittal process described above are automatically included in the Inyo-Mono IRWM Plan. No filter is placed on this part of the process because the RWMG desires to assess and consider the full range of water-related needs in the planning region. Thus, potential project proponents are invited to submit projects that are (1) concept-only, (2) in the planning phase, or (3) shovel-ready (relevant for both planning and implementation projects). The RWMG has determined that it is important to maintain this “open-door” policy with respect to project submission so that there is a larger pool from which to pull projects for any given funding opportunity. Again, because project proponents need to be able to relate their projects to Inyo-Mono Objectives and RMS, projects are not submitted that do not have relevance to the Inyo-Mono planning process.

Figure 13-1: Screenshot of online project upload form on Inyo-Mono IRWM website



Getting Started

The following form does NOT have a save option. You will NOT be able to complete the form partially and return to it later. All submissions must be completed within a single work session. We apologize for any inconvenience this may cause. We have worked diligently to reduce the length of the Project form, and hope you will find it more user friendly. This form is equipped with standard Copy (Ctrl +C) & Paste (Ctrl+ V) functionality, you may find it easier to draft your project description using you preferred word processor and simply past it into the associated box. Please pay attention to word limitations <500!

Project Name *

Please use descriptive name, we have several "Mainline Replacement Projects" so include your system or community name when possible

Your answer

Organization *

To submit a project you must be a MOU Signatory or have a project sponsor who is. Please contact the Program Office Staff for more information.

Choose

Primary Contact Name *

Your answer

Project Type *

- Implementation
- Planning
- Other

Would you like this project to be available for IRWMP-specific

The more in-depth project review occurs when projects are considered for inclusion in a particular funding application. That process will be discussed later in this chapter.

13.4 Procedure for Communicating List of Projects

The Phase I Plan project list was completely re-created for the Phase II Plan (see Chapter 14). Program Office staff communicated with project proponents to request that they re-submit projects using the new project upload form, or if the project has already been completed or is no longer relevant, to communicate that with the staff. The project upload form was made available to potential project proponents in April 2012. Projects that were submitted prior to June 22, 2012, are included in the Phase II Plan. This process resulted in 37 projects. The submission process was re-opened through September 30, 2012, in order to gather more project needs ahead of the Round 2 Implementation Grant application. These 13 additional projects were initially added to the IRWM Plan as an addendum to the Regional Projects chapter that was approved by the RWMG in early 2013. The project list and accompanying analysis are described in Chapter 14. The online upload form will remain open for project submissions indefinitely; however, any additional projects that are submitted will not be added to the IRWM Plan until there is a formal amendment process initiated or a revision of the Plan takes place (see Chapter 5 for information on adding projects to the Plan).

13.5 Evaluation of Projects for Inclusion in Funding Applications

Project proponents who wish to put forward projects for a particular funding opportunity are subjected to rigorous evaluation and ranking processes. Combined, these processes help to determine which projects are ready to be submitted for funding and allow the RWMG to express its preferences and priorities with respect to implementing the IRWM Plan.

An extensive evaluation/ranking process and request for proposals was utilized for the Round 1 Implementation Grant in 2010/early 2011. Although the outcome of this process was a ranked list of projects that reflected the greatest needs in the region, there were many flaws in the implementation of the process. After the Round 1 Implementation Grant application was submitted in early 2011, Program Office staff collected feedback about the project evaluation/ranking process with the intention of improving the process in future funding rounds.

In early 2012, a working committee began meeting to address potential revisions to the project evaluation/ranking process. The committee started by reviewing the Round 1 process as well as the feedback collected from RWMG Members after the Round 1 Implementation Grant submission. Much of the original document was preserved in the new process. One major changed that occurred early on was the development of project “bins” or categories. The RWMG was concerned that projects addressing ecosystem stewardship had difficulty competing with projects addressing basic water supply and quality needs. One way to alleviate this direct competition is by separating projects out into subject-based bins. The working committee recommended the creation of five project bins: Water Supply, Water Quality, Ecosystem Stewardship, Stormwater and Flood Management, and Groundwater.

The working committee also suggested developing Technical Advisory Committees (TACs) for each project bin. This group of people would have expertise in the subject of that bin and would review, score, and rank only those projects in that bin. With the development of the final Round 2 evaluation/ranking process, it was decided that the bins would only be used for the first round of review by the TACs. After the TACs developed their recommended scoring of projects, RWMG Members would complete their own review and scoring of projects (or may accept the TAC’s score for that project), and all of the projects would be considered together, regardless of bin. The overall process for scoring and ranking for this round, as well as the pre-proposal template, can be found in Appendix E.

For the final round of Prop. 84 Implementation funding, the RWMG developed a project evaluation and ranking process that largely reflected the priorities of the PSP. Participating RWMG Members reviewed pre-proposals and scored them based on eight criteria. These scores were then aggregated across reviewers to determine a total score and thus ranking of the pre-proposals. The RFP for this Implementation round, including the scoring criteria, can be found in Appendix D.

DWR prescribes several review factors that should be included in a RWMG's project evaluation and ranking process (see below for those factors relevant to the Inyo-Mono region). These review factors were included in both the Prop. 84 Round 1 and Round 2 evaluation/ranking processes (see Appendix D for the Round 2 process document). These factors will continue to be considered in future evaluation/ranking processes:

1) How the project contributes to the IRWM Plan objectives
2) How the project is related to resource management strategies
3) Technical feasibility of the project
4) Specific benefits to critical DAC water issues
5) Environmental Justice considerations
6) Project costs and financing
7) Economic feasibility
8) Project status
9) Strategic considerations for IRWM Plan implementation
10) Contribution of the project in adapting to the effects of climate change
11) Contribution of the project in reducing greenhouse gas emissions as compared to project alternatives
12) Status of project proponent's IRWM Plan adoption

In addition, DWR has suggested using the following criteria to consider and evaluate a project's contribution to climate change and in reducing greenhouse gases (as compared to project alternatives):

- Potential effects of climate change on the region and are adaptations to the water management system necessary
- Contribution of the project to adapting to identified system vulnerabilities to climate change effects on the region
- Changes in the amount, intensity, timing, quality, and variability of runoff and recharge
- Contribution of the project in reducing GHG emissions as compared to project alternatives
- Project's ability to help the IRWM region reduce GHG emissions as new projects are implemented over the 20-year planning horizon
- How the project reduces energy consumption, especially the energy embedded in water use, and ultimately reduce GHG emissions
- Specific benefits to critical water issues for Native American tribal communities

Project proponents are asked to provide information related to the review factors in a formal request by the RWMG and are given a deadline by which material needs to be submitted. Once all project information has been submitted, the RWMG Members then review the project information and score and rank the projects. Project rankings are submitted to the Program Office, which combines the rankings and develops an overall aggregate ranking to be approved by the RWMG during a regularly-scheduled (and public) meeting. The approved aggregate ranking is then used to shape the funding application.

Project review and ranking is a dynamic process, as regional and Statewide priorities shift, and as RWMG Members and Member representatives change, but this process should always reflect the most current thinking about water planning and management in the region. This will ensure that funding applications accurately and appropriately communicate the region’s values.

Chapter 14 : Inyo-Mono Phase II Projects

14.1 Phase I Projects

A list of projects was developed for the Phase I Inyo-Mono IRWM Plan based on submissions from Inyo-Mono RWMG Members and other regional stakeholders. The Phase I call for proposals was relatively straightforward and simply asked for project proponent name and contact information, project title, project description, and estimated project cost (if known). The process of soliciting project ideas began in the summer of 2009 and continued through most of the Phase I Plan writing process in 2010. Eventually, descriptions of 101 projects were collected, including the 15 that were submitted for Round 1 Implementation funding. Twenty-five of the projects underwent ranking by the RWMG to be included in the Implementation application, though only 15 were included in the final application due to various kinds of constraints. No other kind of analysis was performed on the information contained in the 101 project descriptions. The full list of projects can be found in the Phase I Plan.

14.2 Phase II Projects

14.2.1 Online Project Upload Form

For the Phase II IRWM Plan, the RWMG agreed that the project solicitation and project evaluation processes could be streamlined and made more efficient for project proponents. One way to do this could be through reducing the amount of redundant information being asked of project proponents in different steps of the process. Examples from other IRWM regions of online project upload forms were researched, and exemplary characteristics were noted. The goals of building an online project upload form for the Inyo-Mono region were three-fold: (1) to collect the necessary information from project proponents to assess regional water-related project needs and how they related to the Inyo-Mono regional Objectives and Resource Management Strategies; and (2) to determine how the regional project needs fit into the larger DWR State Water Plan strategies, priorities, and benefits; and (3) to provide a big-picture analysis of the financial needs of the region with respect to various categories of water resources projects.

The online upload form is password protected to provide basic quality control on the information being submitted. Potential users simply contact the Inyo-Mono Program Office for the password. The upload form will be available on an ongoing basis for project proponents to upload projects, and they can submit information for projects that are conceptual, in the planning phases, or shovel-ready. A partial screen shot of the upload form is shown in Figure 13-1 of Chapter 13. The complete upload form can be found at http://Inyo-Monowater.org/members/project-upload/.

14.2.2 Phase II Project List

The online project upload form was made available for entities to upload projects in April 2012. Written and oral instruction was provided by the Program Office on several occasions and in several different venues. Although the upload form is always available, a cutoff date for Phase II projects of June 22, 2012, was arbitrarily decided. At that point, 37 projects had been uploaded into the system, which was a substantial decrease from the 101 projects included in the Phase I Plan. It is suspected that the longer and more involved upload form used for the Phase II projects may have presented a challenge or barrier to some. The Program Office will continue working with project proponents in determining the best way to gather project-related information.

The Phase II Project List will be amended as necessary to include additional project needs that are gathered using the online upload form. Plan amendments will be considered and decided upon by the Inyo-Mono RWMG according to the process outlined in Chapter 1. Such an amendment was made in early 2013 to accommodate several more projects that were uploaded after the June 2012 deadline but before a secondary deadline of September 2012. Some of these projects were included in the Round 2 Implementation grant application.

The online upload form was shortened and simplified, and starting in 2015, projects were again added to the list for the Plan. As of early 2019, 147 projects reside on the list.

Figure 14-1, below, shows the locations of the original 36 Phase II Plan projects gathered between April and June 2012. Table 14-1 is a list of the entire suite of 147 projects. This list will be updated as needed in the form of an approved amendment, following the RWMG decision-making process, to the Inyo-Mono IRWM Plan.

Figure 14-1: Submitted IRWM Plan projects as of 2012

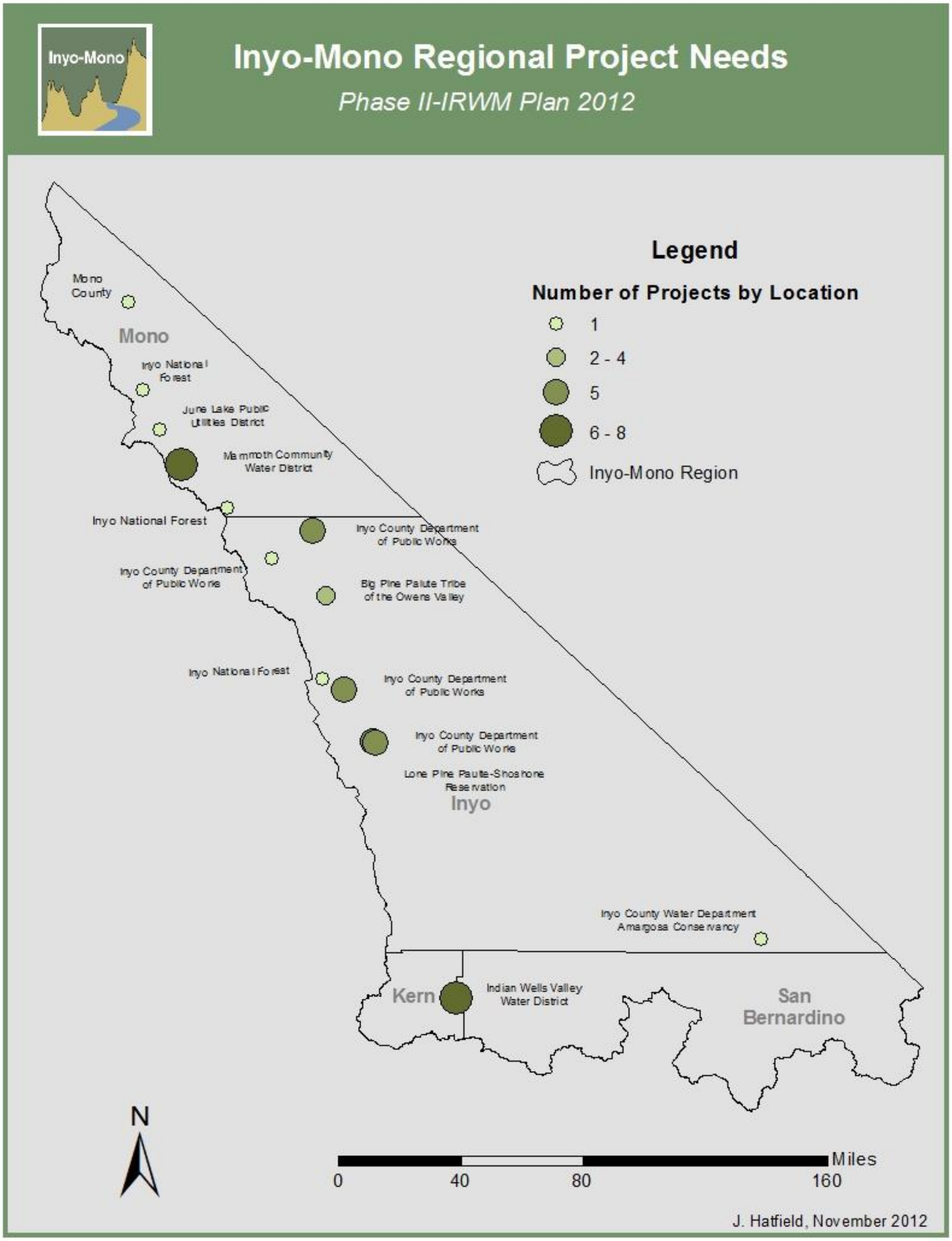


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Table 14-1: Phase II Plan projects (current as of Sept. 25, 2019)

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Amargosa Conservancy	Non-profit organization	Amargosa Basin Groundwater Studies	Perennial flow in the Wild and Scenic (W&S) Amargosa River is almost wholly groundwater dependent, but the sources and future sustainability of that flow are largely unknown. BLM's comprehensive W&S management plan is in preparation, will require a system water balance and federal reserved water right determination, which necessitates the collection and analysis of extensive hydrological and other information to protect the river and its unique and rich ecological resources. Collaborative studies, whose participants include the Amargosa Conservancy, the US Geological Survey, BLM, The Nature Conservancy and Inyo County, have resulted in a partial understanding of this geologically and hydrologically complex system, but much work remains to be done in the face of new demands on regional groundwater from utility scale solar plants. This grant would critically supplement and extend existing studies, provide essential information to the BLM W&S planning, and develop a greater understanding of the effects of climate change and proposed groundwater pumping in this overallocated interstate groundwater system. The work would be completed by the USGS and additional field work by Johnson Wright, Inc., (JWI) a hydrogeological consulting firm that has done substantial monitoring and analysis focused on the area. The USGS study would install monitors and complete the first two years of an evapotranspiration study. The JWI work would continue river and spring sampling and monitoring, including geochemical analysis, install and monitor several additional wells in key locations, and install a weather station to determine precipitation levels. Extensive partner matching funds are anticipated to be available. The grant request could be segmented or somewhat reduced in scale if needed and still achieve important goals.	Planning	Prop. 84 IRWM Implementation grant awarded; underway
2017	Amargosa Conservancy	Non-profit organization	Amargosa Canyon Restoration	Restoration in the Amargosa Canyon to improve habitat for migrating birds, especially the Southwestern Willow Flycatcher. This would include removal of invasive plants such as Tamarisk, and removing early-successional species while planting late-successional species to improve habitat for the Flycatcher.	Implementation	Planning Stage
2018	Amargosa Conservancy	Non-profit organization	Grimshaw Lake Amargosa River Headcut	The main stem of the Amargosa River hits multiple "headcuts" as it exits the Tecopa Marsh and Grimshaw Lake. As the headcut erodes, it threatens to drain the Marsh and Lake, threatening wildlife - in particular the primary habitat for the endangered Amargosa Vole. This is a complex project with many legal barriers but could be critical for the future survival of the Vole.	Planning	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Amargosa Conservancy	Non-profit organization	Safe Drinking Water and Fire Flow Feasibility Study for Tecopa, California	This proposal is to conduct a feasibility study of providing safe drinking water and establishing fire flow water storage facilities. The study will be conducted by a qualified, professional consultant. Regarding the water supply/water quality problem, instead of focusing on the delivery of potable water to every household, the study will analyze the feasibility of constructing public drinking water stations which would provide treated, potable water where residents could fill drinking water containers. Concerning the water fire water storage problem, the study will identify locations for above ground storage tanks for fire flow water that would best serve the two communities and identify the type of storage tanks that should be used. The study will be conducted in collaboration with Inyo County and with the local fire protection district. The outcome of the study will be: (1) a brief description of the current problems, (2) recommended feasible solutions, (3) estimates of the costs of the recommended solutions (including needed engineering/design, required equipment, construction costs, and ongoing operation and maintenance costs), (4) identification of any property rights (and associated costs) that will need to be obtained, (4) a description of any permits and environmental documentation that will be required to implement the recommended solutions, and (5) recommendations on the entity that would operate and maintain the recommended solutions. When the study is completed, the Amargosa Conservancy and/or the local fire district will apply for a follow-up grant for the implementation of the project.	Planning	Feasibility study completed through Round 1 Prop. 84 Implementation grant; subsequent kiosk built with SWRCB funding

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2019	Amargosa Opera House & Hotel	Non-profit organization	Amargosa Opera House and Hotel On-site Wastewater Treatment Retrofit	The current wastewater system at the Amargosa Opera House and Hotel in Death Valley Junction, CA, is the same age as the buildings in the town, which were built in 1924. Due to age of the system, the detrimental effect of established tamarisk tree roots, and possible broken underground piping, the Opera House and Hotel have constant problems with blocked drains and potential health concerns for residents and visitors. In conjunction with the Lahontan Regional Water Quality Control Board, the Amargosa Opera House has worked to find an alternative for current wastewater treatment due to public health concerns. Robison Engineering created a topographic drawing, conducted groundwater and percolation tests, and designed a wastewater treatment plan including installing a grease-trap for the cafe, installing a septic tank, and decommissioning the evaporation pond. Currently, the wastewater line exits the hotel, extends across the parking lot, through a causeway between part of the building and runs parallel to the south side of the building to the café where it continues across CA Hwy 127 to a macerating tank. Solid matter is broken down here and pumped out to the evaporation pond approximately 500 feet to the east. The new project would close off the sewer line at the café (where a grease-trap will be installed). The septic tank would be installed on the south side of the main building (see map) with leach lines heading off to the SSW. The sewer line would be replaced from the hotel along the existing line. The sewer line from the grease trap at the café would also be replaced along the existing line, however both pitches will be adjusted to flow in correct and relevant directions. No work affects any buildings as all sewer lines do not run under the buildings. In addition, the project includes removal of tamarisk trees on the south side of property adjacent to the building, and grading the earth away from the building. Using the engineer's plans, the earth removed will be repurposed to create berms on the property's south side, creating a buffer for water (and as a wind-break) to the building.	Implementation	Shovel-ready
2018	Big Pine CSD	Public water purveyor	BPCSD Sewer Plant Expansion	This project is an expansion of BPCSD sewer plant percolation ponds. Due to runoff cycles and changes, high ground water levels limit percolation of existing ponds. The added area of the new percolation pond will allow for evaporation of effluent during high runoff years. The project consists of: 1. Installing a 3rd monitoring well. 2.Land survey for DWP lease expansion 3. 2.14 acre evaporation/percolation pond. 4. Security fencing 5. Connection plumbing to existing facility 6 Permits and fees. 7. Engineering expenses	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2018	Big Pine Paiute Tribe	Native American Tribe	Big Pine Tribal Water System Generator	The Big Pine Tribal Water System Generator Project will provide a backup supply of power for the pumphouse which will enable it to continue providing water to the community water system in the event that there is an extended power outage caused by high wind events. Climate change impacts creating lower water availability and a rise in the presence of highly flammable, noxious vegetation has increased the risk of catastrophic wildfires. Due to recent wildfires caused by energy transmission infrastructure, electricity providers in the State of California are developing new policies to limit the transmission of energy during high wind events to reduce wildfire risk. The implementation of those policies will result in a loss of electricity to customers of electricity providers. The Big Pine Tribal Community Water System is dependent solely on wells and a loss of electricity for pumps will result in a severe reduction in water availability until electricity is restored. High wind events in the Owens Valley can last several days or be intermittent over a period of weeks increasing the likelihood of a shortage of water for the Big Pine Tribal Community Water System. This project will provide a secondary source of power to avoid water shortages.	Implementation	Shovel-ready
2012	Big Pine Paiute Tribe	Native American Tribe	Wellfield Radius of Influence Study	The Big Pine Indian Reservation is located in LADWP's Big Pine Wellfield, and, annually, approximately one-third of LADWP's groundwater pumping is from Big Pine. The Taboose-Thibault Wellfield is adjacent to the Big Pine wellfield and is annually pumped an almost equal amount. The Tribe would like to develop a model depicting a radius of influence of each DWP well in the Big Pine and Taboose-Aberdeen wellfields to better understand the impacts of pumping on the region. This study will assist in the management of groundwater resources in the Big Pine and Taboose-Aberdeen wellfields. There was a radius-of-influence study for Big Pine, but it was not completed so never provided to BPPT.	Planning	Shovel-ready
2010	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Future of Fish Hatcheries in Owens Valley	Huge amounts of water are exported from Owens Valley to produce non-native fish. This study would assess fish hatcheries in Owens Valley. Address: costs to the environment of fish rearing and planting. Evaluate the many conflicts between non-native fish and native species. Assess whether fish hatcheries could be privatized, reduced in size (but perhaps increased in number) or phased out. Assess the alternative of eliminating fish hatcheries while managing the naturalized local fish populations.	Planning	Still a need, though contentious
2012	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Hydrant Replacement	An analysis of the Tribe's water distribution system revealed that there are 62 hydrants throughout the system and the average hydrant age is 33 years old. Hydrants have a typical life expectancy of 40-60 years so hydrant replacement is of a high priority. In fact, 27 of the 62 hydrants have reached the end of their life expectancy or parts are no longer available if repairs are needed. This project will replace hydrants for the protection of the community and surrounding environment.	Implementation	Prop. 84 IRWM grant awarded; underway

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Irrigation Mainline Replacement	LADWP is required to annually deliver surface water to the Big Pine Indian Reservation. The surface water is diverted from Big Pine Creek and flows through an unlined ditch on LADWP land into an intake pond which ultimately feeds the Tribal irrigation system. Unfortunately, the irrigation mainline, located on LADWP property, has numerous leaks resulting in abundant water losses which are credited to the Tribe's uses but which the Tribe never actually receives. This project will replace the mainline from the irrigation holding pond to the standpipe located at Watson Street. The pipe will be 15" diameter and run 1,400 feet. Natural Resource Conservation Service has indicated interest in assisting with the funding of this task. This task may trigger the California Environmental Quality Act since the construction will take place off Reservation.	Implementation	Completed by LADWP 4/17
2010	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Refurbish Drinking Water Supply Backup Well	In 2002, the Tribe installed a new primary water supply well and relegated the previous main well to backup supply. This backup well has now fallen into disrepair, rendering it unsafe to operate. Examination indicated the well casing needs repair and older parts should be replaced.	Implementation	Completing with funding for new backup well
2010	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Water Line Replacement	In 2003, a fire flow study was conducted which determined that the existing water distribution system was not capable of providing the recommended 1,000 gpm for fire protection due to 4" piping along sections of the water distribution system. This project will increase the pipe size to 8" along the inadequate fire flow sections to maintain at least 1,000 gpm for fire flow.	Implementation	Completed
2012	Big Pine Paiute Tribe of the Owens Valley	Native American Tribe	Watermain Replacement Project	This project will replace approximately 9400 feet of old 4 inch PVC main which has had numerous repairs and has been proven to be undersized for the growing community of the Big Pine Paiute Tribe. The tribal utility operator found 7 leaks during the 2008 comprehensive study survey along the 4 inch portion of the water distribution system that he repaired, thus saving approximately 1 million gallons per month in water losses. Due to the historically high numbers of line breaks and lack of sufficient fire flows, all sections of 4 inch pipe need to be replaced with 6 inch or 8 inch pipe. There are no SDWA violations involved with the proposed project. However, without the needed fire protection, the safety risk to the community has been catastrophic household fires as well as potential for more catastrophic fires as long as the water mains remain undersized for proper fire flows. These areas identified as having undersized water mains have already experienced seven catastrophic household fires in the last nine years with the most recent one on March 31, 2012, one in December 2009, one in the summer of 2005, one in 2004, two in 2003, and one in the summer of 2002. Reasons for the catastrophic nature of these household fires have been noted as either due to a lack of fire hydrants within the proximity of the home or due to a lack of sufficient fire flow provided by the undersized 4 inch water mains required to suppress the fire.	Implementation	Completed by BPPT 4/17

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Birchim Community Services District	Public water purveyor	Infrastructure assessment and repair	The District's water delivery piping is very old. We need an engineering study to determine: a) what pipes are leaking, b) what pipes are asbestos and need replacing, c) what pipes are 4inch in diameter and need to be replaced with 6inch piping, d) what connections need to be made in order to make a complete looped system, d) what additional shut-offs are needed. With this study, the District can begin to replace that portion of piping as necessary.	Planning	Planning stage
2010	Birchim Community Services District	Public water purveyor	Secondary Water Tank Construction	A secondary water tank is needed to back up the primary water tank: during maintenance, better manage water resources, and provide additional water supplies for fire suppression in the greater area of Sunny Slopes, Pine Glade and Rock Creek, Tom's Place, Rock Creek campgrounds and Highway 395.	Implementation	Second water tank added in 2013 and existing water tank upgraded in 2015
2010	Birchim Community Services District	Public water purveyor	Test for copper content in water	Test all homes in Birchim Community Services District for copper content in water. Copper is not in the water, but it can leach copper from piping going into the house. This can vary radically from house to house. Ca. standards require that the District deliver to each house water whose copper content falls below the state standard. Presently we test only 10 houses,and we need to test every house to determine which houses have water above the copper standard.	Planning	Planning stage
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Creek Flood Mapping Project	Using the remote sensing technique of LIDAR, create a detailed topographic strip map of the lower perennial Bishop Creek in order to define topographic geometry of main and overflow channels in a section from SCE Hydro plan 6 through residental areas of West Bishop, Bishop Paute Reservation and City of Bishop. Funded project could leverage US Army Corps of Engineers hydrology and hydraulic services through Section 22 Water Resources Development Act of 1974 - Planning Assistance to States and Tribes to update flow routing models and increase accuracy of the extent of flooding in lower reaches and to predict the magnitude and reoccurance of naturally occuring flows from headwaters.	Planning	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Fire Hydrant Project	The Bishop Paiute Reservation currently has 61 working fire hydrants, and needs at least 56 more in order to provide hydrants in compliance with NFPA guidelines and to ensure our residents' safety. We have 16 of those being installed currently but need to fund the purchase and installation of at least 40 more: All public fire hydrants shall be installed at street intersections where possible. Public hydrant spacing shall be measured along vehicle access routes. In areas zoned for single-family residential use, public hydrants shall be spaced no more than 600 feet apart. If dead-end streets, or driveways, singly or in combination, are over 300 feet long, additional public hydrants shall be installed so that the public hydrant spacing is not over 600 feet. In areas other than single-family residential, public fire hydrants shall be spaced an average of 300 feet apart. If dead-end streets or driveways, singly or in combination, are over 150 feet long, additional public hydrants shall be installed so that the public hydrant spacing is not over 300 feet.	Implementation	Planning Stage
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Conservation Open Space Area Wetland Restoration Project	Project consists of rehabilitating Reservation agricutural drains and installing water distribution lines linked to Reservation irrigation systems to hydrate a portion of the Tribe's 24.8 acre Conservation Open Space Area for a native desert fish refuge. Two species of desert fish endemic to the Owens Valley are sought to be protected at the site: Owens Pupfish (Cyprinodon radiosus) and Owens Tui Chub (Siphateles bicolor snyderi); both of which are on the USFWS list of Threatened and Endangered species as well as the Owens Valley Speckled Dace (Ryinichthys osculus ssp.) and Owens Valley checkerbloom both a US Fisho and Wildlife Servece species of concern. Project will supply several alternate sources of water (drain, irrigation, well) to provide a robust supply of water to the area as well as interpretive and educational improvements including trails, boardwalks, signs and kiosks. Project has recieved some inital funding from US Bureau of Reclamation and Bishop Paiute Tribe for planning, design and implementaion of the first phase of the projects five (5) phases.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Bishop Paiute Tribe	Native American Tribe	BIshop Paiute Tribe Domestic Water Conservation Plan	Domestic Water Conservation Plan – A complete conservation plan for the existing domestic water system on the Bishop Paiute Reservation. Includes: i. Overall Assessment of Existing System ii. Future Demand and Needs Analysis iii. Analysis of Potential Water Savings iv. Rate Structure Analysis = Complete Domestic Water Rate Study v. Project Development for Domestic Water Conservation Projects a. Water Meter Replacement and Monitoring Program; b. Water Meter Supervisory Control And Data Acquisition (SCADA) System Upgrades: Cost Benefit and Needs Analysis; Conceptual-Level Drawings; Preliminary Engineering Analysis; Detailed Cost Estimates for a and b c. Water System Leak Survey: Preparation of Leak Survey Plan; Ultrasonic Testing of the Water Mains and Services; Follow-up Analysis and Testing after Initial Survey; Detailed Cost Estimates d. Water Fixture Replacement Program: Analysis of Water Savings; Preparation of Replacement Program Plan ; Detailed Cost Estimates e. Energy Conservation for Domestic Water System (Solar Energy for Three Well Pumps): Cost Benefit and Needs Analysis; Conceptual-Level Drawings; Preliminary Engineering Analysis; Detailed Cost Estimates	Planning	Prop. 84 IRWM grant awarded; underway
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Increase Water Pressure for Fire Hydrants	For current fire hydrants and for the proposed additional 56 fire hydrants needed on the Reservation (see Bishop Paiute Tribe Fire Hydrant proposal), approximately 8,000 linear feet of 4-inch water line must be replaced with 6-inch water line in order to provide adequate pressure for optimal hydrant output. Project includes 8,000 feet of 6" line, labor , gate valves, saddles, a meter, corporation stops, and connecting pipe.	Implementation	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Irrigation Replacement Project	Purpose A subsurface irrigation system was constructed in the 1940's by the BIA for the Bishop Paiute Reservation. The system (approx. 63,000 total lineal feet (12 miles)) is in moderate and in some places, poor condition. Much of the original concrete piping has outlived its useful life. Approximately 28,000 feet (5 miles) has been upgraded to PVC pipe (44% of total). There remains approximately 35,000 (56% of total) lineal feet (7 miles) to be rehabilitated. Several segments of lines are dead and many valves are frozen or poorly functioning. Project Description We propose to replace the remainder 35,000 feet (56% of total) of these aged irrigation lines with high pressure plastic irrigation piping (PIP) and new valves. This is a replacement/efficency improvement project that will increase the ability to control the water and use in efficient manner. Aged large diameter mainlines and valving will be the priority for replacement followed by laterals. Completion of this Project will employ local labor to ensure that irrigation water will flow to tribal assignments for years to come, enhancing agriculture, the environment, and the economy.	Implementation	Shovel-ready
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Irrigation Water Conservation Plan	Water Conservation Studies performed by a California Civil Engineer A. Irrigation Water Conservation Plan – A complete conservation plan for the existing irrigation system on the Bishop Paiute Reservation. Includes: i. Overall Assessment of Existing System ii. Future Demand and Needs Analysis iii. Project Development for Irrigation Projects a. Rehabilitation of Existing High Volume Flood Irrigation System; b. New Low-Volume Irrigation System Utilizing Yard Hydrants: Cost Benefit and Needs Analysis; Conceptual-Level Drawings; Preliminary Engineering Analysis; Detailed Cost Estimates for a and b	Planning	Prop. 84 IRWM grant awarded; underway
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Meter Implementation	The installation of domestic-water meters to 600 households with the outcome of reducing water use (amount unknown). A radio meter-reading wand to read all meters will save labor costs.	Implementation	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Bishop Paiute Tribe	Native American Tribe	Bishop Paiute Tribe Wastewater Conservation Plan	Wastewater Conservation Plan – A complete conservation plan for the existing wastewater system on the Bishop Paiute Reservation. Includes: i. Overall Assessment of Existing System ii. Future Demand and Needs Analysis iii. Analysis of Potential Water Savings a. Rate Structure Analysis/Complete Wastewater Rate Study b. Project Development for Domestic Water Conservation Projects 1. Leak, Infiltration and Flow Survey: Preparation of Leak and Infiltration Measuring Plan; Preparation of Flow Monitoring Plan; Ultrasonic Testing of the Water Mains and Services; Follow-up Analysis and Testing after Initial Survey; Analysis of Potential Water Savings; Detailed Cost Estimates 2. Manhole and Sewer Main Survey and Rehabilitation Plan: Preparation of Survey and Rehabilitation Plan; Detailed Cost Estimates	Planning	Prop. 84 IRWM grant awarded; underway
2015	Bishop Paiute Tribe	Native American Tribe	Ultra Low Flush Toilet (ULFT) Change Out Program	Project Need and Justification This project will increase the efficiency of water use primarily through the implementation of indoor conservation measures. Water leaks will be stopped via repairs and high efficiency fixtures will be installed via a voucher system administered by tribal public works department. The residents of the Bishop Paiute Reservation will directly benefit from the water savings through 1) reduced total sewage flow (more capacity for community sewage treatment) and 2) reduced user rates (reduced pumping costs due to water savings). Estimates of water saved were obtained directly by measuring water loss and by direct count of low-efficiency fixtures in 403 connections via a water audit survey conducted in 2004 and updated in 2006 (Bishop Paiute Reservation Water Audit and Drip Survey, 2006)). Project Summary This project replace and repair of leaking and low-efficiency fixtures. The result of these measures will be to save a minimum 24 Acre-ft/year of domestic water, enough for an additional 20 new domestic water connections without increasing domestic water production (Bishop Paiute Reservation Water Audit and Drip Survey, 2006). The project will also install six (6) water meters which will result in the 100% of all domestic water connections being metered on reservation.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Bishop Paiute Tribe	Native American Tribe	Wastewater Facilities Improvement Project	The Bishop Paiute Tribe desires to expand the treatment and wastewater disposal capacity of from 0.85 to 1.2 MGD (million gallons per day) by increasing efficiency of contract treatment operations or by constructing an interconnection to adjacent treatment facilities. It is proposed to increase the treatment capacity to provide for current and future needs of the Reservation for a total tribal capacity of 600,000 gallons per day. The estimated cost of the project is $1,400,000. Almost one half of this amount will be contributed by the Environmental Protection Agency Clean Water Act fund. The Tribe is currently seeking matching funds on the order of $750,000. Since 1996, the Bishop Paiute Tribe has periodically exceeded their purchased total flow capacity. The tribal growth rate of the last 50 years is 2.4% for population and 1.7% for sewer connections. Based on these rates, it is projected that the Bishop Tribe will need approximately 315,000gpd of additional capacity in the next 20 years. The current contract provider of treatment has no additional capacity to sell the Tribe because the treatment plant is presently at maximum capacity. All numbers are based on several feasibility studies that have been completed by the Bishop Paiute Tribe and Indian Health Service (IHS).	Implementation	Conceptual
2019	Crowley Lake Mutual Water Company	Mutual Water Company	Crowley Lake Emergency Backup Generator	The objective of the project is to provide backup power to the Crowley Lake Mutual Water System in case of emergency or shutoff by SCE. The project will be composed of the following steps: 1) Install 130 kWh generator set - propane powered, in noise enclosure to 75 dB at 23 feet away from the existing infrastructure that is located on the site. 2) Upgrade electrical by installing conduit and wire to generator set and meter to panel. 3) Install a large cabinet to house automatic transfer switch and other components will be installed. The automatic transfer switch would automatically start generator set if electrical power is lost from SCE. 4) Site improvements include grading and installation of a concrete pad.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Crystal Crag Water and Development Association	Mutual Water Company	Crystal Crag Water Quality Compliance	When our present water system was installed, it made use of a pre-existing 3000-gallon tank. They also installed a 7440-gallon tank in order to have a little over 10,000 gallons of storage—supposedly enough to have enough contact time to meet our CT requirement. The problem was with the design in that the water exited the larger tank at the bottom, entered the smaller tank at the bottom and also exited that tank at the bottom. This caused short-circuiting in the smaller tank so that we were not really getting the contact time that was figured. We have had to run our two tanks in parallel so that there will not be any short-circuiting. Therefore, water going through either tank is short on contact time. We have had to chlorinate at 1.0 mg/l which allows us to meet our CT requirement some of the time but not all. And it also is high enough that the chlorine can be tasted in the water. We have a near pristine source of water and it does not have the demand for that much chlorine. Another weakness in our system is our old 3000-gallon tank. Seven years ago it was rusting on the inside. We put in a liner which has kept the tank from leaking. However it has not kept the tank from rusting more between the liner and the inner surface. We have judged that that tank should not be part of our solution because it would only mean that we would face a large expenditure in a few years when the liner wears out. It would be cheaper in the long run to get a new tank and keep up the maintenance on it as we have done with the larger tank. We have hired an engineer recommended by the California Rural Water Association to come up with a solution. He has come up with the following recommendations: Petition the regulatory authorities to allow a baffling factor of 0.3 for larger tank and replace the old tank with a 7000 gal tank baffled for a factor of at least 0.5. This will allow the system to meet CT requirements with a residual chlorine concentration of 0.4 mg/l, under design conditions. Additional Recommendations: 1. Install a data recorder for the master flow meter for the system. This will allow the capture of peak flow data for the system, which is not currently captured. Peak flow data is needed for appropriate CT calculations. Install a data recorder for the tank levels. This is a required factor in CT calculations and should be recorded and documented for future calculations. 2. Install a flow meter in the piping to the new tank. This will allow the setting of an appropriate flow split between the two tanks using a throttling valve. By documenting an appropriate flow split, more accurate (and less conservative) CT calculations can be performed. 3. Modify the current CT spreadsheet so that the full flow is applied to the pipe volume. This will have the effect of reducing the CT calculation.		Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2018	Eastern Sierra Community Services District	Wastewater District	Eastern Sierra CSD Wastewater Plant Nutrient Removal and Plant Expansion	The Eastern Sierra Community Service District proposes to convert the existing earthen lagoon Water Resource Reclamation Facility to a mechanical plant using two each, parallel and partially redundant oxidation ditches followed by secondary clarification and improvements to the existing solids handling facilities. The oxidation ditches will be designed to allow the District to comply with the anticipated future nitrogen effluent limit that has been preliminarily determined to be a total nitrogen effluent limit of 10 mg/L or less. In addition to mitigating nitrogen in the effluent, the District also requires additional treatment capacity in order to serve the expected growth on the Bishop Paiute Tribe's reservation.	Implementation	Planning Stage
2010	Eastern Sierra Unified School District	School	Coleville High School Water Project	For over a decade, ESUSD has been working to comply with the State Drinking Water Regulations. The drinking water at the Coleville campus, which is provided by two wells on site, has been deemed a public health hazard because of the elevated levels of naturally occurring uranium. The district has tried to mitigate this issue in various ways. Point of use reverse osmosis units were successful but could not be installed at all necessary locations. Currently the campus is on bottled water, which the state views as a sub-standard, nonpermanent fix. The Coleville high school water project will meet the following objectives: (1) Reduce the levels of uranium to meet the State Drinking Water Regulations; (2) Install a water system that will insure that all buildings on the Coleville campus are provided with treated drinking water (including all potential points of use); (3) Isolate a majority of the campus irrigation from the treated water. ESUSD will expect to see the following outcomes: (1) Safe drinking water for students, faculty, and visitors coming to the Coleville campus; (2) Increased storage capacities for potable water; (3) Increased conservation and efficiency for the campus irrigation with the new variable frequency demand pumps; (4) Better fire protection.	Implementation	Completed through Round 1 Prop. 84 Implementation grant along with other funding from CDPH
2010	Fort Independence Indian Reservation	Native American Tribe	Oak Creek Watershed Fire/Flood Restoration Phase I	The tribe proposes to collaboratively restore, add flood protection and recovery, and establish a monitoring and sediment control program with its watershed partners. By meeting these objectives the Tribe will be able to protect the historical Tribal use, and public safety. This is a three-phase project design. Phase One is the study and engineering portion of the project which has begun with a Bureau of Reclamation grant to asses Watershed and Oak Creek irrigation system issues. The Tribe is requesting IRWMP funding to be used for the vast engineering of up to three flood diversions, two reservoirs, and three miles of creek restoration and up to 500 acres of irrigation system as a portion of Phase One. The beneficiaries of this project will be the Tribe, Oak Creek Stakeholders (private citizens), US Forestry, LADWP, public, area wildlife, and California in general.	Planning	Still a need 5/2017
2018	Fort Independence Indian Reservation	Native American Tribe	Paya Reservoir	Implementation of a off stream storage reservoir facility.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Indian Wells Valley Cooperative Groundwater Management Group	Public Utilities District	Developing Estimates of Recharge for Indian Wells Valley	The Basin Characterization Model (BCM) is a monthly regional water-balance model that was originally developed for use in the desert southwest to establish the dominant mechanisms responsible within basins that lead to recharge and runoff. The model calculates in-place recharge and runoff and is calibrated regionally for snow cover, solar radiation, and potential evapo-transpiration. The USGS California Water Science Center proposes to use historical maps of recharge and runoff for the Indian Wells Valley and develop local calibrations to historical observations of streamflow. The summation of estimated runoff and some proportion of recharge that returns to the stream as baseflow is used to calculate basin discharge at any downstream pour point coincident with a stream gage. The results will be used to assess potential patterns of stream channel gains and losses to better quantify the potential range of historical groundwater recharge in the valley. Historical time series of recharge will be evaluated to develop an understanding of precipitation thresholds that generate runoff and recharge, and how this differs spatially throughout the basin. Historical and future changes in climate, recharge, and evaporative demand defining irrigation needs will also be evaluated for a selection of future climate projections. This project is intended as a pilot project with no formal documentation to characterize recharge patterns and provide potential upper and lower bounds for spatially distributed recharge along with potential future changes. The results are to be considered a first approximation, and will provide a basis for additional work, including analyses of field data, chemical signatures of groundwater, and well levels for consideration of and application to geologic framework modeling and development or refinement of a groundwater flow model. The Basin Characterization Model can be used over very large areas, at very fine spatial resolution and for long time periods, and thus is very applicable for regional analyses or climate change studies that require long model runs or multiple projections over historical and future centuries. This model has been applied to numerous groundwater flow models in California, Nevada, Arizona and Utah. In its current form, the BCM is a research tool and requires calibration and hydrologic understanding for local applications.	Planning	5/2017 UPDATE: The USGS is under contract with Kern County to conduct a study to quantify and model recharge to the Indian Wells Valley basin. Funding is being shared by the USGS and Kern County through a Prop. 1 grant.
2010	Indian Wells Valley Water District	Public Utilities District	400,000 Gallon Reservoir	A new 400,000 gallon welded steel storage tank will be constructed in Ridgecrest, CA to increase storage in the District's "D" pressure zone.	Implementation	Completed
2012	Indian Wells Valley Water District	Public Utilities District	Aquifer Testing Program	This project involves a series of aquifer tests in areas where the groundwater flow model is lacking real data. Some of the aquifer data used in the model used geologic logs and driller reports. Actual aquifer tests will add certainty to the model and refine its use as a groundwater management tool.	Planning	May 2017 UPDATE: No activity. This may be performed through the IWVGA.

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Indian Wells Valley Water District	Public Utilities District	Brackish Water Resource Study	Groundwater is the sole source of potable water for the communities of Ridgecrest, Inyokern, Trona, the Naval Air Weapons Station at China Lake, and numerous private well owner living in unincorporated areas. Recharge of the aquifer is primarily from the Sierra Nevada range on the valley's west side. While scientists believe there is a great deal of groundwater in the aquifer, not all is potable. Although Indian Wells Valley Water District (IWVWD) actively promotes conservation, groundwater levels continue to decline. The need for alternative sources of potable water is inevitable. This project will identify source areas for brackish water that could be treated and provide a new source of potable water for the valley. By utilizing local brackish water supplies, the IWVWD could significantly delay the need to import water.	Planning	May 2017 UPDATE: A Cost Sharing Agreement has been signed to conduct a Brackish Water Resource Feasibility Study. Contract has been signed with to begin the study.
2012	Indian Wells Valley Water District	Public Utilities District	Brackish Water Treatment Plant	Construction of a brackish water treatment facility to utilize local non-potable water supplies as a supplemental source for the valley's water supply thereby delaying the need to consider importing water.	Implementation	May 2017 UPDATE: No activity. Future action to be determined by the Brackish Water Resource Feasibility Study and development of the GSP.
2015	Indian Wells Valley Water District	Public Utilities District	Indian Wells Valley "Cash for Grass" Program	With extended local drought conditions and dependency on groundwater as the sole source in the Indian Wells Valley, a "Cash For Grass" program should be expected to achieve measurable results within some reasonable time period. According to a five-year, multi-million-dollar study conducted by the Southern Nevada Water Authority, grass in a similar desert environment to ours requires 73 gallons of water per square foot per year to thrive while xeriscape only needs 17 gallons per square foot – a significant savings. With the average conversion in that study at approximately 1,000 square feet, each completed retrofit would save about 56,000 gallons of water annually – and would continue to do so as long as the conversion remained in place. A program of this nature requires adequate financial incentive to produce enough living turf conversion to substantially reduce water usage in the Indian Wells Valley. We believe that, for our purposes, an attractive buy-back price per square foot of turf would be $1.00 for up to 2,000 square feet. Research compiled by Mojave Water Agency and the Southern Nevada Water Authority suggests that there is a significant "bandwagon effect" resulting in increased awareness and conversion to more water efficient landscaping.	Implementation	Active; Prop. 84 IRWM Implementation grant awarded for $322,000; underway

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2016	Indian Wells Valley Water District	Public Utilities District	IWVWD AMI Project	IWVWD plans install Neptune automated metering infrastructure (AMI) meter registers to all 12,000 meters in the District. A primary benefit is having the reads automatically transported into the office daily so 1) leaks can be detected faster; 2) less time for vehicles on the road, an 3) frees up staff to work on leaks.	Implementation	May 2017 UPDATE: The AMI pilot project began February 1, 2017. The District plans to begin the final phase of the project September 1, 2017. Grant funding would be helpful
2012	Indian Wells Valley Water District	Public Utilities District	Main Line Replacement	Main line replacement enables the District to replace old or under-sized main line pipelines to improve operating efficiency, improve water quality, and improve fire flow.	Implementation	Planning Stage
2012	Indian Wells Valley Water District	Public Utilities District	Southwest Area Hydrogeologic Study	A follow-up study to the recent AB303 project that provided 8 new wells and sampling of over 75 sites. The 8 wells drilled generally showed fairly good water quality characteristics and could be a potential area for future production. Additional data is needed in the area south and west of existing monitor wells. Funding would also provide additional water sampling, future aquifer testing using AB303 project wells, and some shallow geophysical surveys.	Planning	May 2017 UPDATE: An application is being submitted for the Indian Wells Valley to be included in a study which would be basin-wide and provide information on depth to water, salinity, stratigraphy of the subsurface and identify geological features.
2012	Indian Wells Valley Water District	Public Utilities District	Storm Infiltration System	Study the feasibility of capturing surface water during significant rain events and percolating that water into the aquifer. Groundwater depths in the recharge areas of the valley are deep and percolation ponds may not be feasible due to vertical migration rates, evaporation rates, etc. Storm runoff could possibly be captured and percolated in the eastern part of the valley where groundwater levels are relatively shallow, but the water is of lower quality. This project could shed light on possibilities of water capture, retention, detention, infiltration, re-injection, treatment, and re-use of surface water flowing through the valley and not currently being utilized.	Planning	May 2017 UPDATE: Stakeholders in IWV have expressed interest in working with the Inyo-Mono IRWM on a grant application to study solutions and

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
						inclusion in the GSP.
2012	Indian Wells Valley Water District	Public Utilities District	Water Collection Galleries	A study to provide the feasibility of installing water collection systems along the Sierra Nevada front. Information could provide insight to the potential of recharging water migrating from the canyons to aquifer systems along the Sierra. Water collection systems at some key locations could supplement the existing supply with water that would otherwide be lost to evaporation or migration into the Sierra Nevada fault, etc. Key locations include Indian Wells Canyon, Grapevine Canyon, Sand Canyon, NoName Canyon, and Nine-Mile Canyon.	Planning	May 2017 UPDATE: No activity. This may be investigated with development of the Groundwater Sustainability Plan for the basin.
2012	Indian Wells Valley Water District	Public Utilities District	Water Quality Treatment Plant	Construction of a water treatment facility to be used by both the Indian Wells Valley Water District and the Navy's facilities at China Lake Naval Air Weapons Station (NAWS) to handle future water quality issues.	Implementation	May 2017 UPDATE: No activity. This will be part of the Brackish Water Resource Feasibility Study currently under way.
2010	Indian Wells Valley Water District	Public Utilities District	Well Plant for New Well	Construction of permanent pumping plant facilities for new Well 34. This project includes a masonry building and underground piping.	Implementation	Completed
2012	Inyo County	County Agency	Alternative Lone Pine Transmission Main Project	Lone Pine is a disadvantaged community. If the 4,300 lineal foot Lone Pine Transmission Main Project is not approved, this project may install about 2,000 lineal feet of 16" ductile iron pipe bypassing the tributaries ot Lone Pine creek, pass along public rights-of-way and pass into LADWP land and reconnect with ther existing transmission main west of the aqueduct preventing the need for a new aqueduct crossing. Approximately 800 lineal feet of the current transmission mainabandoned by this project are above ground parallelling the creek nearby, cross under the creek, or are adjacent to creek tributaries. It also has a sagging joint in mid-air. The main is about 1/8" thick. This alternative project would remedy the above defects but it would still require LADWP approval and possibly federal approval. The approximate estimate for this project is $1,500,000 and includes administrative costs.	Implementation	Preliminary phase; needs planning; high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Inyo County	County Agency	Bartell Parcel Recycled Water Regreening Demonstration Project	The County of Inyo proposes to use recycled water to provide surface irrigation to a 5.5 acre parcel on Main Street in Pine, CA. The Bartell parcel, has frontage on U.S. Highway 395, and is bordered on three sides by the Big Pine Paiute Reservation and on one side by the Big Pine Elementary and High School. This would be the first recycled water project in all of Inyo County. Because of its prominent location, this pilot project would serve as a highly visible demonstration project. Partners would likely include City of Los Angeles, Department of Water and Power (LADWP). Treated waste water from the Big Pine Community Service District's aeration peculation ponds would provide up to three acre feet of water, per year, for irrigation for pasture, orchard, or other crop that does not come in contact with the recycled water. The site is owned by LADWP. It was once productive pastureland, but is currently not supplied any water. The parcel is now an abandoned dirt field in the center of Big Pine, CA; it's an eyesore and dust hazard in this charming rural tourist town. Now, a considerable quantity of treated water from the waste ponds is simply left to evaporate. This project would put this water to good use, both to provide green cover, and provide additional recharge of local groundwater. No private or public wells are within 150 feet of the proposed project. Funding would be used to 1) complete a waste water engineering study to assure a level of disinfection that meets CDPH standards; 2) design and build a disinfection system and distribution system to convey recycled water from the waste treatment ponds to the Bartell Parcel; 3) develop efficient onsite irrigation and plant a crop on the parcel; 4) design and install interpretive signage promoting the concept of using recycled water.	Implementation	Prop. 84 IRWM grant awarded for project planning

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Inyo County		Consolidation of Owens Valley Groundwater Models	Under the Sustainable Groundwater Management Act of 2014, local agencies in groundwater basins designated by the California Department of Water Resources (CDWR) as medium or high priority are required to form groundwater sustainability agencies. Groundwater sustainability plans (GSP) must be developed to avoid undesirable effects such as declining groundwater levels, degraded water quality, reductions in groundwater storage, subsidence, or adverse effects on beneficial uses of surface water. CDWR has designated Owens Valley as a 'medium priority' groundwater basin, and the portions of the basin not managed under the Inyo/Los Angeles Water Agreement are subject to preparation of a GSP. Preparation and implementation of a GSP requires quantitative understanding of hydrogeology and basin water budgets; groundwater models are the principal tool available to develop this information on a basin-wide scale. The proposed model will also be useful in implementation of the Inyo/Los Angeles Water Agreement. This project will consolidate several existing groundwater models into a basin-wide model that can be used to support development and implementation of a GSP for Owens Valley. The purpose of the model would be to evaluate effects of groundwater pumping and surface water management on groundwater levels, groundwater storage, and groundwater-dependent resources. Required tasks are: 1. Acquisition and review of existing models. This task will acquire groundwater models that have been developed for portions of the Owens Valley (including Owens Lake) by the USGS, LADWP, Inyo County, and others. Model inputs and documentation will be assembled and reviewed. The models and data most suitable for inclusion into a basin-wide model will be determined. 2. Identify and address data gaps such as areas not included in existing models, or insufficient or out of date model inputs and data. 3. Development of basin-wide steady-state and transient water budgets. This task will include refinement of evapotranspiration estimates and quantification of recharge throughout the basin. 4. Reconciliation of existing models and data into a single basin-wide conceptual model. 5. Development of a single basin-wide numerical model based on results of Tasks 1-4. 6. Steady-state model calibration. 7. Transient model calibration. 8. Technology transfer to project proponent, IRWM members, and other stakeholders.	Planning	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Inyo County	County Agency	CSA-2 Sewer System Needs Assessment	The CSA-2 sewer collection system is in dire need of renovation because of continued seepage, reoccurring blockages and infiltration inflow. These conditions have created a situation where costs for system maintenance and effluent treatment are high and also create a potential for significant environmental impacts. The collection system has not been evaluated since the late 1970's and no accurate plans for the system exist. The proposed system evaluation would map and measure the entire system as well as camera the existing main lines to document the existing condition and problem areas in the sewer mains. Following the map and measure portion of the evaluation, plan and profile drawings would be created and these drawings would be used to develop recommendation for rehabilitation of the sewer system. The preliminary engineering report prepared as part of the proposed evaluation is often required for application for State and Federal Grant and Loan Programs. A rough estimate of the cost for preparation of the evaluation and report is $70,000. The system is a community owned and County operated sewer collection system and is located in Aspendell east of Bishop, CA.	Planning	No longer a need
2012	Inyo County	County Agency	CSA-2 Sewer System Upgrade Project - Phases 1 and 2	The proposed project is located in Aspendell, served by County Service Area #2 (CSA-2), west of Bishop, bordering Inyo National Forest and USFS campgrounds. The County manages the system on behalf of the Aspendell residents. The project will replace 3,000 ft. of existing sewer main. The system was installed in the late 1960s and consisted of a gravity sewer collector that discharged to a communal septic tank and leachfield. By the early 1970s the system began to exhibit various problems. In the mid 1970s an engineering study found that the leach field was poorly designed and the collector system had problems related to poor construction, hydraulics and inflow and infiltration (I&I). In 1977 the USFS was ordered by the RWQCB to remove pit toilets located in nearby campgrounds to eliminate impacts to water quality. In 1978 the USFS constructed a treatment facility to serve the campgrounds. At that time, CSA-2 abandoned the community septic and leach field system and connected the existing sewer collection system to the USFS system. The sewer collection system is now more than 40 years old, near the end of its useful life. Several hundred feet of the main need replacement due to reoccurring blockages and continuing I&I. Blockages occur from inconsistency of pipe diameters, uneven grade and root intrusion, and have resulted in overflow and spillage. Bishop Creek is downgrade from the sewer system, and runoff from a spill has the potential to contaminate the creek. Seeping mains also may affect groundwater in wetland areas near the creek and likely produce non-point source pollution. I&I are increasing as the system degrades and are impacting the treatment plant and increasing energy costs for treatment and reducing plant capacity, thereby resulting in rising costs charged to CSA-2. The USFS has complained about flow generated by the CSA-2 system.	Implementation	Prop. 84 IRWM grant awarded for Phase 1

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				The County intends to replace mains that have documented root intrusion or I&I first and then replace other portions of the system. Phase 1 included approximately 1,500 feet of 6" mains, and manholes. Phase II would include the remaining 1,500 ft of pipe		
2012	Inyo County	County Agency	Groundwater monitoring network for southeast Inyo County	This project will construct a network of six monitoring wells in southeastern Inyo County for the purpose of (1) complying with CASGEM monitoring requirements, (2) monitoring effects of groundwater development and use on groundwater users and groundwater dependent resources, (3) help determine interbasin flow paths in the Pahrump-Middle Amargosa-California Valley region, and (4) help determine sources of water to regional groundwater discharge features such as springs that provide water to the Amargosa River. The project involves siting and constructing six wells in Pahrump Valley, California Valley, Middle Amargosa Valley, and Mesquite Valley, sampling these wells for general water quality, equipping the wells with data loggers, initiating a data collection program, and submittal of a monitoring program to DWR to comply with CASGEM monitoring requirements. The project will be conducted in cooperation with the Amargosa Conservancy, USBLM, and USGS.	Planning	Prop. 84 IRWM grant awarded to Amargosa Conservancy; underway
2018	Inyo County	County Agency	Implementation of Bishop Creek Vision Project	CA Lahontan Regional Water Quality Control Board staff is in the process of addressing water quality impairments in Bishop Creek as part of the U.S. Environmental Protection Agency Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act (CWA) Section 303(d) List. Data from routine, then focused monitoring efforts revealed elevated concentrations of fecal bacteria in the middle portions of the Bishop watershed, beginning in the area known locally as West Bishop and extending to the east of the Bishop city limits. Bacteria concentrations consistently exceed the statewide water quality objective for E. coli bacteria, which are set to protect human health and to ensure that water contact recreation beneficial uses are protected. Multiple locations along Bishop Creek are used as water contact recreation venues during the warmer months, and elevated concentrations of fecal bacteria in the creek present a likely human health hazard. For future implementation of the Bishop Creek Vision Project, we want to foster watershed health and promote the implementation of best management practices throughout the variety of land uses which are present in the watershed. In collaboration with local partners, we plan to develop a series of educational and hands-on workshops focusing on watershed health and BMP implementation. One workshop outcome would be the development of ranch management plans, NRCS Conservation Plans or similar plans to promote good land stewardship and water quality restoration. These types of plans, once completed, are often a gateway for further implementation funding or cost-sharing.	Planning	Conceptual
2010	Inyo County	County Agency	Independence and Lone Pine Chlorination Tank Replacement Project	The communities of Independence and Lone Pine are disadvantaged communities. This project replaces 40 year old steel chlorination tanks buried underground. As these tanks age, the potential for leaks increase, especially as there are no sacrificial anodes in place to mitigate corrosion. The leaking tanks also pose a health and safety risk to the communities they serve. The estimated cost for this	Implementation	Still a need; not started; needs planning; medium-high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				project is about $1,300,000 and includes administrative costs.		
2010	Inyo County	County Agency	Independence Bypass Line Project	Independence is a disadvantaged community. This project will install about 300 lineal feet of 8 inch PVC main from the existing transmission main to the retention basin providing an orderly controlled means of discharging un-consumed water from the town into the concrete lined retention basin for evaporation when both water tanks need to be taken off-line. It protects the adjacent stream. The estimated cost for this project is approximately $20,000 and includes administrative costs.	Implementation	Still a need; not started; needs planning; low priority
2010	Inyo County	County Agency	Independence Crockett Street Loop Project	Independence is a disadvantaged community. This project installs about 750 lineal feet of 8 inch PVC pipe and a fire hydrant to loop the distribution system from East Wall Street south on Crockett around to North Clay Street. This project will remove a dead end in the system by creating a loop improving water quality and add a fire hydrant that will improve fire hydrant coverage. It also will reconnect two services to the new 8 inch main. It will abandon a 1 ½ inch copper service line that served two residences providing marginal flow. The estimated cost for this project is about $50,000 and includes administrative costs.	Implementation	Still a need; not started; needs planning; low priority
2012	Inyo County	County Agency	Independence Transmission Main Project	Independence is a disadvantaged community. This project would replace the transmission main from the tanks to the old chlorination vault, a distance of about 2,600 lineal feet. The current main has 2,135 feet of old steel main that was used material when it was installed in 1928. A leak in the main in 1991 started as a pin-hole diameter sized leak which grew eventually to 210 lineal feet replaced as none of the adjacent pipe was of sufficient integrity to permit attachment without causing more leaks. This project would also add a 12 inch meter providing more fire flow to the town than the existing 8 inch meter. The current transmission main is of 10", and 12" construction. This project would replace all 10"-12" pipe with 16 inch ductile iron pipe. The main crosses through a boulder field about 1000 feet wide with boulders maybe as large as 2 feet to 3 feet in diameter. In November 2017 the transmission main in the town of Independence, CA began failing at a rapid rate. There were multiple significant leaks beginning on November 4, 2017. Efforts to patch the pipe wall failures met with no success. After patching, the largest leak continued to flow in excess of 5 gallons per minute growing to 100+ gallons per minute by the time the pipe was taken out of service. Inyo County rented and installed approximately 2800 LF of 12" HDPE, above ground, on a two year lease as a temporary stop gap to continue water service. This work was completed on January 23, 2018. Curently, Inyo County is looking to find a permanent solution for this problem.	Implementation	Still a need; preliminary phase; needs planning; high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Inyo County	County Agency	Independence Transmission Main Project #2	Independence is a disadvantaged community. If the Independence transmission main project is not approved for round 2 funding, this project would survey the existing Independence TransmissionMain for elevation and at the high points and points of inflection on he main install double 2" air release valves. There is one known and several suspected high points trapping air within the transmission system. These defects impede the delivery of large volumes of water during times of high demand such as a fire. There is air in the distribution system potentially causing an air lock affecting a portion of the upper end of the distribution system. This project also adds a 12" meter to the existing 8" town demand meter which may provide more fire flow to the town.	Implementation	No longer a need
2010	Inyo County	County Agency	Independence Well 384 Transmission Main Project	Independence is a disadvantaged community. This project will install about 2,000 lineal feet of 12 inch ductile iron main from Well 384 to the end of the existing 12 inch main on Pavillion Street. The existing main is 6 inch and 8 inch and would be supplemented with the 12 inch main. This may increase flows to the upper corner of the distribution system enhancing fire flows and providing added reliability. The estimated cost for this project is approximately $750,000 and includes administrative costs.	Implementation	Still a need; not started; needs planning; medium-low priority
2010	Inyo County	County Agency	Inyo County Buildings and Grounds Backflow Device Repair or Replacement Project	Inyo County maintains public buildings and grounds in several Owens Valley towns, primarily in Independence, which have backflow devices. Many of these devices are non-operative. This project builds on the Backflow Device Survey project and repairs or replaces the defective backflow devices serving County buildings and grounds. This project directly benefits the employees and public who conduct business in county facilities as well as the public, both residents and visitors who use county grounds. The estimated cost for this project is about $50,000 and includes administrative costs.	Implementation	No longer a need

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2015	Inyo County	County Agency	Inyo/Mono Watersheds Invasive Weed Control Project	This project aims to control and eradicate invasive weeds including Perennial pepperweed (Lepidium latifolium), Canada thistle (Cirsium arvense), Spotted knapweed (Centaurea maculosa), Yellow starthistle (Centaurea solstitialis), Scotch thistle (Onopordum acanthium), and Russian knapweed (Acroptilon repens) that threaten the Owens, East Walker, and West Walker River watersheds. This biological pollution inflicts many adverse effects on watersheds including: • Water issues such as increased erosion leading to increased sedimentation, lowered quality and decreased flood control capacity • Native habitat issues such as lowered species diversity, damaged native plant communities and compromised wildlife habitat • Working landscape impacts such as lowered property values and a threatened local agricultural economy • Fire issues including changes in fire regimes and increased fire severity • Air quality issues such as increased dust events leading to public health impacts • Recreation impacts such as impediments to access, and aesthetic degradation. This project will employ an integrated pest control approach and best management practices to control invasive plant species for the benefit of our local population, recreationalists, those receiving water exports from Inyo and Mono counties, and the local native plant and wildlife communities. The Eastern Sierra Weed Management Area (ESWMA) group will collaborate with and contribute to this project. ESWMA includes: • Inyo and Mono Counties Agricultural Commissioner's Office • Inyo County Water Department • Inyo National Forest • Humboldt - Toiyabe National Forest • Bureau of Land Management Bishop Field Office • Bureau of Land Management California Desert District • Los Angeles Department of Water and Power • California State Parks • California Department of Food and Agriculture • California Department of Transportation District 9 • CalFire • Natural Resource Conservation Service • Inyo/Mono Resource Conservation District • Inyo/Mono Cattleman's Association • Bishop Paiute Tribe	Implementation	Shovel-ready; still viable as of May 2017, though dollar amount might be different

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Inyo County	County Agency	Laws and Lone Pine Tank Project	Inyo County owns and operates the water systems serving the unincorporated towns of Laws and Lone Pine. The combined population served by the water systems is approximately 1,500 people. The Lone Pine water system is supplied by water from a well and gravity head storage tank. A well and hydropneumatic storage tank supplies the Laws community water system. Laws and Lone Pine are Disadvantaged Communities. Ratepayer revenues for Lone Pine cover Operations & Maintenance (O&M) but are insufficient to build capital reserves for upgrades. The County has had limited success raising the water rates. The Laws water system supplies water for only 14 ratepayers. Monthly revenues are too small to operate the system in the black. Inyo County subsidizes the system operation and maintenance costs. The hydro-pneumatic tank in Laws is deteriorating and cannot reliably maintain system pressure. The manway hatch is showing signs of rusting out. The existing tank operates at 1,500 gallons. A 2,000 gallon fire truck can potentially drain the tank. An empty tank can introduce air into the water system resulting in water hammer that can severely damage the water system. The tank in Lone Pine was constructed without a cathodic protection system. The tank internal access ladder is not galvanized and was not coated during construction. An inspection performed by a diver in 2008 observed that the ladder and tank are rusting. The objective of this project is to a) install a new 10,000 gallon hydropneumatic tank in Laws and b) In Lone Pine, replace the interior ladder, add cathodic protection system, and recoat the interior ladder and tank.	Implementation	Still a need; not started; planning needed; medium-high priority
2010	Inyo County	County Agency	Laws Auxiliary Well Chlorination Building Project	The community of Laws is a disadvantaged community. This project installs a chlorination building at the auxiliary well site. Currently there are no chlorination facilities at the site. The well will be used during periods of high demand and when the domestic well is off-line for repairs, etc. The estimated cost for this project is about $30,000 and includes administrative costs.	Implementation	Still a need; not started; planning needed; low priority
2010	Inyo County	County Agency	Laws, Independence and Lone Pine Backflow Prevention Survey	Laws, Independence and Lone Pine are disadvantaged communities. This project will survey all services in the three towns and check for the presence of proper backflow devices or the necessity of backflow devices on premises served by the water systems. A similar survey was conducted in 2001 and several changes to commercial services have occurred in that time. This project directly impacts the health and well being of the public in all three towns. The estimated costs for this project are about $140,000 and include administrative costs.	Planning	Still a need; not started; planning needed; high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Inyo County	County Agency	Laws, Independence and Lone Pine Condition Assessment and Leak Detection Survey	Laws, Independence, and Lone Pine are disadvantaged communities. The Laws, Independence, and Lone Pine Condition Assessment and Leak Detection Survey shall provide a condition assessment of pipeline integrity and leak detection of all mains in the three town water systems. The project shall also provide funds to excavate and repair leaks and unmetered services discovered by this Project. The project may help to conserve water lost by leaks and un-metered services while the condition assessment may help to prioritize capital improvements. The estimated cost for the Condition Assessment and Leak Detection Survey may be $200,000 over the total of approximately 20 miles of mains in all three water systems. An additional $50,000 could be included to remedy the defects discovered. Administration of the project may cost approximately $50,000.	Planning	Still a need; not started; planning needed; medium-high priority
2010	Inyo County	County Agency	Laws, Independence and Lone Pine Geographical Information Systems Project	The communities of Laws, Independence and Lone Pine are disadvantaged communities. This project creates a Geographical Information System for all three Town water systems. Currently, most water systems data is on paper. Some CAD drawings exist. This project benefits the three town water systems by maintaining all the pertinent information electronically and assists in efficiently operating the system providing a one-stop spot for quickly accessing all information needed during events such as emergencies, repairs, upgrades etc. The estimated cost for this project is about $100,000 and includes administrative costs.	Planning	Still a need; not started; planning needed; low priority
2010	Inyo County	County Agency	Laws, Independence and Lone Pine Pressure and Air Relief Improvements Project	Laws, Independence and Lone Pine are disadvantaged communities. This project shall install a 4 inch pressure relief valve in both Independence and Lone Pine town water systems, install at least two air relief valves in all three Town distribution systems each and the community of Laws may receive an additional fire hydrant and a 2 inch blow off. These improvements shall increase reliability in all three Town water systems as their currently are no air release valves in any of the systems while both the Independence and Lone Pine systems may see pressures in excess of a customary pressure during emergencies. The estimated costs for this project may be $60,000.	Implementation	Still a need; not started; planning needed; medium priority
2012	Inyo County	County Agency	Laws, Independence and Lone Pine Rate Study	Laws, Independence, and Lone Pine are disadvantaged communities. The Laws, Independence, and Lone Pine Rate Study shall build upon the Water Master Plan / Needs Assessment Project and the Condition Assessment Project by preparing a Water Rate Study to investigate identified funding needs by the previous Projects and how to fund them. The estimated costs for this project, keeping in mind the previously completed studies, may be about $50,000 which also includes Administration costs. The Water Master Plan, Conditions Assessment, and Rate Study Projects may be completed within one round of funding.	Planning	No longer a need
2010	Inyo County	County Agency	Laws, Independence and Lone Pine Sample Site Project	The communities of Laws, Independence and Lone Pine are disadvantaged communities. This project installs dedicated sampling stations within the three Town water distribution systems which helps to comply with the Federal Groundwater Rule and the California Title 22 Water Quality regulations requiring dedicated sample sites within distribution systems. This project installs 25 stations in Independence and Lone Pine and 5 stations in Laws for a total of 55 stations at an estimated $40,000	Implementation	Still a need; not started; planning needed; medium priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				and includes administrative costs.		
2010	Inyo County	County Agency	Laws, Independence and Lone Pine Swing Check Valve Replacement Project	The communities of Laws, Independence and Lone Pine are disadvantaged communities. This project replaces deteriorated swing check valves at the well sites for all three systems. Currently the existing swing check valves at the well sites are old, mounting nuts and bolts have disintegrated and occasionally leak chlorinated water back into the well. This impacts LADWP's groundwater monitoring program. The disintegrated nuts and bolts pose a safety hazard to the communities. The estimated cost for this project is about $40,000 and includes administrative costs.	Implementation	Still a need; not started; planning needed; medium-high priority
2012	Inyo County	County Agency	Laws, Independence and Lone Pine ultra-low flush toilet replacement project	Laws, Independence, and Lone Pine are disadvantaged communities. The Laws, Independence, and Lone Pine ultra-low flush toilet replacement project shall provide a rebate to customers who purchase and install Ultra-Low Flush toilets in their homes as a water conservation measure. The program may be administered as follows: the customer would purchase a toilet from a pre-defined list of appliances with a rebate amount determined by the particular model chosen. After an inspection of installation by the County, a rebate would be applied to their water bill and carried forward until the rebate amount was exhausted. The estimated number of toilets replaced would be 1.25 toilets per service with a maximum rebate of $100 per replaced toilet applied to their water bill. Some residents may replace all their toilets while others may not replace any toilets. The estimated cost for the project could be $119,000 for 1.25 toilets for every 952 services and approximately $30,000 for project administration for a total project estimate of $149,000. Alternatively, rather than applying the rebate to the water bill, a rebate card valued at $100 may be issued after inspection of the installed toilet.	Implementation	Still a need; not started; planning needed; low priority
2012	Inyo County	County Agency	Laws, Independence and Lone Pine Water Systems Master Plan	Laws, Independence, and Lone Pine are disadvantaged communities. The Laws, Independence, and Lone Pine Town water systems are in need of a Master Plan / Needs Assessment which could answer basic questions about how to operate the systems effectively and economically but yet set aside enough reserves to meet both anticipated and unforeseen needs. The assessment would include a hydraulic analysis of the systems addressing fire flow needs and maximum day demand needs. The assessment may also include a staffing plan identifying the number of office and field staff necessary to carry out operations of the system and identify specific tasks to each staff member. The assessment should also identify all current and anticipated future regulatory requirements a water purveyor must meet. These regulations encompass California Occupational Safety and Health Administration requirements to Certified Unified Program Agency regulations to Air Quality regulations and Public Health Department regulations. Capital improvements could be identified over a five, ten and twenty year horizon. The estimated cost for the project is based upon cost estimates received for a hydraulic analysis and water rate study and the estimated costs of County personnel providing requested data to the successful contractor.	Planning	Still a need; not started; planning needed; medium priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Inyo County	County Agency	Lone Pine Distribution System Fairbanks Roy Rogers Loop Project	Lone Pine is a disadvantaged community. This project installs about 3,000 lineal feet of 12 inch ductile iron pipe from West Bush Street around Fairbanks Avenue to south Brewery St via Roy Rogers Road completing a loop of the main supply main into the distribution system. By installing this main, the system has a second means of providing the Town with water should an existing 1,500 lineal foot section of 16 inch main become unusable for any reason. This project improves the reliability of the Lone Pine water system and provides flexibility in operation. The estimate for this project is about $1,500,000 and includes administrative costs.	Implementation	Still a need; not started; planning needed; medium-high priority
2010	Inyo County	County Agency	Lone Pine East Locust Street Water Main Project	Lone Pine is a disadvantaged community. This project installs about 900 lineal feet of 8 inch ductile iron pipe along East Locust Street from the ally east of Main St passing two public schools to Lone Pine Avenue. It also reconnects the Southern Inyo Hospital domestic and fire services from the old 6" main in Locust Street to the new 8 inch main installed in 2002. Public school domestic services are also reconnected to the new main. By completing this project, the reliability of the system both in the northern part of Lone Pine and along East Locust Street to Southern Inyo Hospital will be improved as will the domestic services to the public schools and domestic and fire suppression services to the hospital. This project improves the reliability of the Lone Pine water system and directly benefits two public schools, the local hospital and provides flexibility in operation. The estimated cost of this project is about $110,000 and includes administrative costs.	Implementation	Still a need; not started; planning needed; medium-high priority
2012	Inyo County	County Agency	Lone Pine Transmission Main Project	Lone Pine is a disadvantaged community. This project would install about 4,300 lineal feet of 16 inch ductile iron pipe. Approximately 800 lineal feet of the current transmission main are above ground paralleling the creek within 2 feet of the creek, cross under thre creek bed or are adjacent to tributaries to Lone Pine Creek. The existing main has a joint in the pipe crossing a gully where the main is above ground and the joint is sagging in mid air. The steel pipe is very thin- about 1/8 inch thick. The new main would primarily be within public rights-of-way and as far from th creek as possible; while the existing main is entirely on public lands or LADWP land. The new main would also cross the LADWP aqueduct.	Implementation	Still a need; preliminary phase; needs planning; high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Inyo County	County Agency	Lone Pine, Independence and Laws Water Meter Project	Inyo County owns and operates three community water systems serving the unincorporated towns of Laws, Independence, and Lone Pine. The combined population served by the water systems is approximately 2,000 people. The proposed project will replace residential analog meters with automatic electronic read meters and renovate the Town Demand Meters. Laws, Independence, and Lone Pine are Disadvantaged Communities. Ratepayer revenues for Lone Pine and Independence cover operations and maintenance but are insufficient to build capital reserves for upgrades. The county has had limited success raising the rates. The Laws water system supplies water for only 14 ratepayers. Monthly revenues are too small to operate the system in the black. Inyo County subsidizes the system operation and maintenance costs. The aging analog meters were installed in the 1970s and are no longer accurate and produce unreliable readings for billing. The Town Demand meters have not been certified in ten years. The Independence Town demand meter is not turning freely and under reporting flows. The proposed project will replace the residential analog meters with automatic electronic read meters and renovate the Town Demand Meters. The project will provide for accurate measurement of individual water usage and efficient monitoring of the town's gross water demand. The improvements will provide better accounting and billing information and promote water conservation. Converting to automatic electronic read meters will reduce meter reading time from 10 days to 3 days, providing for more efficient operations and reduced costs.	Implementation	Still a need; not started; planning needed; high priority

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Inyo County	County Agency	Lower Owens River Conveyance Project	Inyo County seeks grant funding to perform a feasibility study for improved flow conveyance through the "Islands" area of the Lower Owens River Project (LORP). Los Angeles Department of Water and Power (LADWP) will likely match funds received by the County. The LORP is a large-scale habitat restoration project that is implemented jointly by Inyo county and LADWP. The centerpiece of the project is the restoration of 62 miles of the Lower Owens River (LOR) by providing flows to enhance fish, wetland, and riparian habitats. The majority of the river had been dry since 1913 when the river was diverted from its bed and into the Los Angeles Aqueduct. A flow of 40 cfs was established and maintained throughout the Lower Owens River beginning in December 2006. The LORP is an adaptive management project that has been monitored since 2007. In general the project is meeting goals; however, water quality has become an issue. The flow regime specified for the project has in places fostered the development of channel blockages and caused water spreading. As a result, sediments and muck have accumulated in the river bed, and when this material is stirred up and entrained during seasonal habitat flows, water quality, principally dissolved oxygen (DO), declines. Low DO has led to fish stress and fish kills in the river. The LOR is naturally a low gradient system, with a river-mile to linear-mile relationship of 2:1. One area in particular, the 450 acre "Islands," located 4.5 miles north of Lone Pine, CA, has backed up the river and created an enlarging wetland monoculture of emergent vegetation. There is no distinct channel through the Islands and the force and volume of the season habitat flow is attenuated for 25 miles downriver. It's this 25 mile stretch where water quality is most reduced by raising flows. This is likely in part because of the Islands influence; the organic load contributed by acres of dying and decaying plant material and diminished flows that are not adequate to scour sediments. Project consultants believe that channelizing flows through the Islands will provide a more efficient flow and improve downriver water quality. They have encouraged Inyo County and the LADWP to conduct a feasibility study to determine if a channel cleared through the islands would benefit the project. A grant from CA DWR would be used to commission the study.	Planning	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Inyo County	County Agency	Lower Owens River Monitoring Wells	The Lower Owens River project is a joint Inyo County/LADWP project that introduced flow into sixty miles of river channel to establish a health riverine-riparrian ecosystem. This project would construct eighteen shallow monitoring wells along three transects across the Owens River to monitor the water table in the Lower Owens River floodplain to assess effect of LORP baseflows and seasonal habitat flows on the water table in areas that are targeted for recruitment of woody riparian species. This would assist in the management of flows for maximum developement of a willow/cottonwood riparian corridor.	Implementation	Conceptual
2010	Inyo County	County Agency	Lower Owens River Tule Control	The Lower Owens River project is a joint Inyo County/LADWP project that introduced flow into sixty miles of river channel to establish a health riverine-riparrian ecosystem. Flow was introduced in the river in December 2006, and as the project has since evolved, it has become apparent that there has been excessive tule encroachment on the channel. This project will investigate tule control methods and implement the most cost effective means. The project will be phased as 1) investigation of methods, 2) testing of viable methods identified in 1), and 3) operational implementation.	Planning/Implementation	Conceptual
2012	Inyo County	County Agency	Owens Valley safe water project	This project tests and replaces, if necessary, about 50 backflow preventers to county facilities thereby protecting the public health; replaces leaking check valves at Laws, Indepencence, and Lone Pine which protects the groundwater; replaces disintegrating infrastructure in Laws protecting the water supply; installs a backflow preventer and a meter at the Laws Museum protecting the public supply; installs a bypass line in Independence protecting the creek, and installs about 800 lineal feet of pipe in Lone Pine benefitting three schools and the hospital.	Implementation	Conceptual
2010	Inyo County	County Agency	Pump Operation Redundancy and SCADA Improvements	Inyo County owns and operates three community water systems serving the unincorporated towns of Laws, Independence and Lone Pine. The combined population served by the water systems is approximately 2,000 people. The Lone Pine and Independence water systems are supplied by water from a well and gravity head storage tanks. A well and hydropneumatic storage tank supplies the Laws community water system. Transducers located at the tanks send high /low signals to the Supervisory Control And Data Acquisition System SCADA system to operate the pumps. Currently, there is no redundancy to activate the pumps should the transducers or SCADA system fail. Laws and Lone Pine are Disadvantaged Communities. Ratepayer revenues for Independence and Lone Pine cover Operations & Maintenance (O&M) but are insufficient to build capital reserves for upgrades. The County has had limited success raising the water rates. The Laws water system supplies water for only 14 ratepayers. Monthly revenues are too small to operate the system in the black. Inyo County subsidizes the system operation and maintenance costs. This project will install secondary pressure sensor switches on each water system as a back up to energize and operate the well pumps and maintain system pressure in case of transducer or SCADA system failures. Secondary Auto-dialers are also included for operator notification redundancy. The project also will upgrade the SCADA systems to include capability to program off-peak pumping capability to save energy.	Implementation	Completed through Round 1 Prop. 84 Implementation grant

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Inyo County	County Agency	Remote Sensing of Owens Valley Vegetation	Inyo County and Los Angeles have entered into a long-term water management agreement. One of the provisions of this agreement is to manage groundwater pumping to prevent declines in phreatophytic vegetation cover, and to prevent grass-dominated communities from converting to shrub-dominanted communities. In order to determine whether these goals are being met, it is necessary to conduct ongoing vegetation measurements in the Owens Valley. The Inyo/Los Angeles Technical Group has conducted annual vegetation surveys using ground based methods; however, these methods are time-consuming and expensive to implement in such a large management area. Remote sensing has the capability to provide spatially extensive measures of vegetation abundance and, if possible, species composition, would provide a more efficient, spatially extensive, and reproducible method of measuring vegetation. This project would be conducted by RFP/RFQ, so the estimated project cost is rough.	Implementation	Conceptual
2010	Inyo County		Saltcedar Control on Lower Owens River	Inyo County and LADWP have an ongoing effort to control saltcedar on the Lower Owens River and other LADWP lands to facilitate development of willow and cottonwood in the riverine/riparian corridor of the Owens River. This project would fund the program for three years. Inyo County is currently funding this work through a three-year $600,000 grant from the Wildlife Conservation Board that expires in 2010. The proposed grant would continue the program for an additional three years.	Implementation	Conceptual
2010	Inyo County	County Agency	Treatment and Reuse of Fish Hatchery Effluent	Phase I. Fish Hatcheries in Inyo and Mono Counties use large quantities of water and produce effluent of low quality. This study would determine the feasibility of treating hatchery effluent, thereby reducing water use by the hatcheries and improving water quality. The study would evaluate the water quality of hatchery discharges, investigate applicable technologies for treating hatchery effluent to a standard such that it could be reused by the hatcheries, and assess the costs and feasibility of implementing such technology at Inyo/Mono hatcheries. Phase II. Implementation and operation of technologies identified as feasible in Phase I.	Planning	Conceptual
2010	Inyo County	County Agency	Use of precipitation and groundwater by native phreatophytes	Water management on LADWP land in the Owens Valley is conducted to maintain certain vegetation standards. In order to manage groundwater pumping so that these standards are met, it is necessary to know the relative use of precipitation versus groundwater by phreatophytic plant communities that may be affected by groundwater pumping. This study would sample isotopes of oxygen and hydrogen to determine the ratio of precipitation to groundwater in plant tissue. The isotope measurements would be combined with micrometeorological measurements of overall evapotranspiration to determine the amount of groundwater used by plants.	Planning	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Inyo County	County Agency	Water system upgrade to meet current standards at Round Valley School	The Round Valley School is presently served by only one well. The well is shallow and the steal casing is deteriorating. Over the last two years the water system has failed three times forcing the school to bring in porta-potties, bottled water and the potentiality of closing school due to the lack of water. Current state water standards require new systems to have redundant sources. The proposed project will drill a new well, providing a secondary source, and line the existing well with new casing. Additionally the present system does not have capacity for fire protection and currently has less than 5% of minimal fire standard. We currently have 28 gallons per minute of capacity compared to the minimum fire standard of 500 gallons per minute for two hours. Currently the school is forced to shut down when there are water outages due to failure of the current well. This project will allow school to continue even when there is no power supply to the school. Round Valley School is an emergency evacuation site for both the American Red Cross and the residents of the power house located in the gorge operated by LADWP. Obviously a reliable water supply is needed during emergency conditions, such as power outages, and that is what the project will provide to the local residents. Likewise, in case of a fire, the school does not have an adequate, sustainable water supply in order to protect the structure. This project will provide adequate water for structural fire protection.	Implementation	Completed through Round 1 Prop. 84 Implementation grant
2015	June Lake Public Utility District	Public Utlitites District	June Lake Water Treament - Ion Exchange for Uranium Removal	The June Lake Public Utility District is confronted with a Water Quality issue as it relates to the uranium content in June Lake, which is an approved surface water source for the District. Over the last 3 years we have been experiencing higher uranium test results that have now exceeded what the State allows. We believe this is a result of reduced lake level due to the ongoing drought conditions and decomposing natural materials within the lake that increases uranium levels. We have attempted to use an alternative water source in blending the Snow Creek water plant and the June Lake water plant to reduce the uranium content in the blended waters. This has worked for the short term, however if the Snow Creek plant is offline for any reason we would be forced to use the June Lake water plant with uranium content that exceeds the State requirements. We have researched and been provided a proposal for an Ion Exchange system that could be installed as 1 unit that would connect to our incoming raw water supply, process the raw through the ion exchange filtration system then through our normal micro filtration process and subsequently pumped to our June Lake storage tank for domestic use. Current filtration rates are approximately 200 GPM and we are required to have an Ion Exchange system sufficient to treat raw water supply at this rate of flow. We believe this project is fairly straight forward in that there would be minimal construction since the unit could be set in place, connected for power, influent and effluent water connections then could be put into service. This project would require an amended special use permit from the US Forest Service to allow us to install the 20’ x 8’ x 9.5’ container or (POD) adjacent to our existing June Lake water plant. We would also be required to amend our current standard operating plan for the June Lake water treatment plant which would include the use of the Ion Exchange system, approval by CDPH (California Department of Public	Implementation	Prop. 84 IRWM grant awarded; underway

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				Health) would also be required. We expect that CEQA would be exempt through categorical exemption.		
2012	June Lake Public Utility District	Public Utlitites District	Wastewater Treatment Plant Upgrades	Our wastewater treatment plant has been in service for over 35 years and is in need of the upgrades identified below to enhance the treatment process. Currently we do not have a screening device at the head works. Screens are used in wastewater treatment to strain larger particles from the water stream and are usually the first components in the treatment system. The main objective of using a screen is to remove materials and large objects that could damage or cause blockage to downstream equipment, reduce the overall effectiveness and reliability of the treatment processes and ultimately contaminates the final discharge waterway. The objectives of this project are to protect and restore surface water and groundwater quality into the Mono Basin to safeguard public and environmental health and to secure water supplies for beneficial uses.	Implementation	Shovel-ready; study underway
2010	June Lake Public Utility District	Public Utlitites District	Water Meter Installation – Final Phase	In 2002 JLPUD adopted a water meter installation program for all existing commercial and residential properties for water conservation purposes in accordance with AB 1420 water meter compliance. We are in the final phase of this effort. By installing water meters for commercial and residential customers we have found that the overall water usage has been reduced by approximately 32 percent since 2002. Customers who were paying a flat rate fee are now on a tiered rate system and are more conscientious of the amount of water they are using. Additionally the JLPUD established a Water Management Program, ordinance; 2008-01 dated January 9, 2008 that promotes reduced water consumption through consumer awareness and involvement. Provide stewardship of our natural resource, protect, restore and enhance water quality; protect, conserve, optimize and augment water supply in the Mono Basin. One of the major effects that the implementation of water meters has on consumption is how much they can curb overall water usage. Environment Canada research has found that flat rate customers use 50 to 60 percent more water than metered customers. The 1999 research by Environment Canada found that households paying for water by volume (i.e., metered) used approximately 288 liters per person per day. Households paying a flat rate for water used 433 liters per person per day.	Implementation	completed

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Lee Vining Public Utilities District	Public Utlitites District	Lee Vining Sewage System Improvements	The Lee Vining sewer system is a gravity-flow system that drains to a large septic tank. The septic tank is pumped out periodically and the effluent drains to several open ponds for infiltration/evaporation. The sewer system experiences frequent plugs and failures that result in several sewage spills in Lee Vining each year. These spills negatively impact the town and have the potential to run down storm drains into Lee Vining Creek. In addition, the smell from the open effluent ponds negatively impacts users of the Lee Vining Community Center, Hess Park, the Lee Vining Creek Trail, and adjacent areas. The project will make improvements to the sewer system that will prevent and capture sewage spills and mitigate the severe odor problem near the Community Center.	Implementation	Still a need
2010	Lee Vining Public Utilities District	Public Utlitites District	Lee Vining Water Main Replacement	The Lee Vining water system is a gravity-flow system from springs in Lee Vining Canyon, to two water tanks near the Lee Vining Ranger Station, to the town of Lee Vining. On March 6, 2005 the water main broke at the top of the hill above the SCE substation. Water running down the hill caused a mudflow to cross the highway and reach Lee Vining Creek, closing the highway for a few hours and muddying the creek and disrupting water service. At other times water mains break in town, causing loss in water service and requiring emergency repairs. This threatens water quality, public safety due to disruptions in fire protection, and has negative effects on soil and water conservation along the route of the water main. The project objective is to replace all the aging and deteriorating water mains in the Lee Vining water system.	Implementation	Still a need
2010	Lee Vining Public Utilities District	Public Utlitites District	Lee Vining Water Meter Installation	Lee Vining does not have water meters. It currently has two water tanks along Lee Vining Creek near the Ranger Station. Due to lack of water meters, water users in Lee Vining have no incentive to conserve water. High water use during the summer resulted in the water level in the water tank becoming low at times, and caused the district to install a new water tank adjacent to the existing one along Lee Vining Creek, resulting in a loss of riparian habitat. New development proposals would increase peak demand and stress the existing water system. Install water meters for each water user. The district could then implement water conservation pricing and discourage excessive water use, resulting in a more reliable water supply without having to add new storage.	Implementation	Still a need

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Lone Pine Paiute-Shoshone Tribe	Native American Tribe	Hydrant Replacement on Zucco Road	The fire hydrants located throughout the reservation are in need of replacement. In a report created by SCS Engineers in June of 1999 titled Water Resources Management Plan and Irrigation Analysis: Lone Pine Paiute-Shoshone Indian Reservation, Lone Pine, California, it was noted that the majority of hydrants on LPPSR were nearing the end of their service life (based on a 40-60 year service life). Since 1999, none of the hydrants have been replaced; therefore, they are in need of replacement. The main objective of this project is to replace the existing fire hydrants on Zucco Road with newer, properly functioning, efficient models. Other subsequent objectives are safer conditions on Zucco Road due to improved operational efficiency of hydrants, lower leak potential due to replaced hydrants, fire suppression, and employment of Tribal Members from the LPPSR for completion of the project. The beneficiaries of this project are both Tribal and non-Tribal residents living on the reservation. The new hydrants on Zucco Road would create a safer area less prone to fire damage, which helps protect homes in and around the surrounding community of Lone Pine. Since the hired help will come from LPPSR, the Tribal Members are given an opportunity for work that otherwise would not have existed. Nov 2018 update: tribe would like to include the whole reservation in this project - not just Zucco Road.	Implementation	Conceptual; still a need as of May 2017
2012	Lone Pine Paiute-Shoshone Tribe	Native American Tribe	Irrigation system replacement	The irrigation system was installed in the 1940s by the Bureau of Indian Affairs as part of the 1934 Land Exchange. The system, well over 25 years old, is in serious need of rehabilitation and/or replacement. Pipe failures and cracking has been seen and affects the operation of the system. The overall project goal is system replacement. Currently, LPPSR's irrigation mainline runs approximately 5,200 feet from east to west and consists of many different pipe sizes. A replacement of the system would allow it to flow properly and provide the necessary amounts of water for assigned and tribal lands. The main objective is to replace the old system with newer parts to guarantee effective operation for meeting future demands.	Implementation	Conceptual; still a need as of May 2017

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Lone Pine Paiute-Shoshone Tribe	Native American Tribe	Main Line Replacement	The original distribution system was put in by the Bureau of Indian Affairs in the 1940s and consisted of various pipe widths: 5", 4", 3", 2" and ½" pipes, which ultimately failed after certain periods of time. In 1990, approximately 5 miles of the mainline were replaced with 4", 6" and 8" pipes to replace failing sections and to expand the system. According to a 1999 investigation, many of the main lines were reaching the end of their service life and were recommended for replacement. Today, it is very evident that the mainline needs to be replaced to not only adequately supply water to homes and tribal operations, but to also ensure the system does not fail if and when fire hydrants are used to suppress fires. Project goal is to repair or replace damaged mainlines to ensure their continued use and operation of the system to maintain its capacity to supply homes and tribal operations. Overall project objective is to meet the demands of a growing population and to allow access for new home construction and future economic development. 2012 update: mainline replacement has occurred on the western side of the reservation, but work remains to be completed. Funds needed are probably lower than the "grant ask" since a lot of the work has been completed.	Implementation	Conceptual; still a need as of May 2017
2012	Lone Pine Paiute-Shoshone Tribe	Native American Tribe	Water Storage Tank	Initial construction of water storage tanks for LPPSR took place at various stages. There are currently three (3) storage tanks that supply water for domestic use. These storage tanks are located within reservation boundaries and operate on a gravity flow and pressurized system. The pressurized system mainly feeds the western half of the reservation, which has resulted in expensive utility bills to keep the system operational. The main goal of the project is to move the water storage tanks 3000 feet west of their current location to the base of the Alabama Hills to enable the whole system to completely operate by gravity flow, thus reducing the costs to operate. An end result of relocating the water storage tanks is to ensure that LPPSR will/can meet the needs/demand of a growing population and allow for easier access when new homes are built.	Implementation	No longer a need
2012	Lone Pine Paiute-Shoshone Tribe	Native American Tribe	Well Rehabilitation	The construction of domestic wells took place more than 25 years ago. In 1999, an inventory and inspection of the wells was conducted and noted that all wells are either in need of being updated and/or replaced. Despite the repairs that have occurred throughout the years, they continue to be problematic. During the initial inspection of the wells in 1999, it was noted that no rehabilitation work or diagnostic testing has ever been done. The goal of the project is to improve the function and operation of the wells to improve water quality conditions. An overall objective of the project is to sustain an adequate supply of water that can meet the capacity of future demands and reduce the costs needed for untimely repairs.	Implementation	No longer a need

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Lundy Mutual Water Company	Mutual Water Company	Mono City Water Distribution System Assessment and Replacement	The water main distribution pipes under the street in Mono City are over 60 years old and subject to persistent leaks, line ruptures, and pressure problems. These problems could be solved by investigating the current condition of the water main distribution pipes, evaluating which sections are responsible, and replacing the damaged sections. The potable water distribution system in Mono City is antiquated and in disrepair. Persistent leaks from pipes over sixty years old are costly to ratepayers and contribute to an inefficient use of scarce water resources. In addition, water line ruptures endanger the entire distribution system with high pressure variability. The project will make improvements to the pipe distribution system that will prevent leaks and pipe ruptures and help solve continuing pressure problems.	Implementation	Planning stage
2010	Lundy Mutual Water Company	Mutual Water Company	Mono City Water Supply Improvements for Fire Suppression	There is only one electric supply power line to Mono City. This single line is susceptible to winter storms, ice storms, summer thunderstorms, and damage from fire. Loss of power during firefighting efforts jeopardizes the ability of fire trucks to refill when the electrical pump that runs the well and distribution stops working. In addition, Mono City has only one water storage tank. In the event of a major fire, the single water tank currently present does not meet the need for increased storage capacity. Power outages occur three to four times a year on average during wind, weather, and fire events. Power loss results in the water system losing pressure as the pump no longer functions to refill the water and pressurize the system. As a result, power loss at the fire station compromises an effective emergency response. This project will provide an emergency generator for the fire station operations and water pump during electrical failure to Mono City Volunteer Fire Department and add a second water storage tank to assure adequate fire suppression supply. The emergency generator system will provide the power needed to continue water supply operations in emergency events and power needed by emergency response operations including the initial siren and support operations that need electric power. There would also be an external outlet that an Operations for Emergency Services (OES) could plug into for communications and other necessary support services. This project will install a 40KW emergency standby generator for the Fire Station and a 50KW emergency generator for the Fire Water Pump. Two generators are needed as the water pump has a non-standard configuration. A second generator is needed at the Fire Station to power the siren and	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				to provide an energy source for emergency operations including a plug-in for support of computers, phones, and emergency operations. Installation will include all equipment, materials, electrical wiring, transfer switch gear, and enclosure to provide protection during inclement weather. A back up power source will be installed which will prevent loss of water for emergency operations and needs, and provide power to the fire station for emergency response. In addition, a secondary water tank will provide additional water supply storage for fire suppression. Beneficiaries include Mono City residents, visitors, and property owners. Mono City is a residential community of nearly 100 homes and residents. The small community relies on local volunteers to respond to structural fire incidents and other emergency events, sometimes without support from neighboring communities with more modern equipment and professionals with advanced skills. Providing this needed equipment to the Mono City Community will reduce risk of injury and loss of property.		
2010	Mammoth Community Water District	Public water purveyor	Customer Meter Replacement Program	This project will: • Encourage water conservation through tiered pricing incentives already in place • Decrease water loss to the distribution system • Assist in recognizing and alerting customers of potential leaks on their property. • Allow for improved monitoring of landscape irrigation practices and code compliance. • Improve monitoring and projections used in the District's Urban Water Management Plan (UWMP). The UWMP is used to integrate urban land planning with projected water supplies. • Identify improperly sized meters that are not accurate under the actual customer use rate. • Create a plan for an on-going meter replacement program for the District that will inspect meters for replacement on a 20 year cycle (CUWCC best management practice). The project will include field inspection of 200 meters for replacement or repair the first year and evaluate the efficacy of the program in terms of reduced water losses and increased billing revenue. The long-term objectives are to incorporate the program as an annual District program. A District rate study planned for 2011 will include the necessary adjustments to rates to support long-term funding for the customer meter inspection program. The District will provide a written report on the program that includes for each inspected meter, whether it was repaired or replaced, the type of meter, the customer class served by the meter, the connection size, and whether unaccounted losses were occurring.	Planning/Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2016	Mammoth Community Water District	Public water purveyor	Deep Monitoring Well Pair to Protect MCWD Groundwater Supply	Mammoth Community Water District serves the community of Mammoth Lakes, Mono County. A nearby geothermal plant is planning to increase their production capacity by moving their production well pumping closer to our domestic groundwater supply wells. We are seeking funding to drill a deep geothermal well and a nested shallow and medium depth well to monitor the extent pressure changes propagate towards our well field. MCWD is concerned that changes in pressure below the shallow cold water aquifer may impact the aquifer's water quality and quantity beyond the ability of MCWD to mitigate the impacts. The USGS is currently monitoring surficial changes due to the geothermal plant such as increased emissions of hydrogen sulfide and carbon dioxide; increases in soil temperature; and expansion of areas experiencing Jeffery Pine die off. In addition, the USGS has expressed concern that steam carrying reservoir contaminants and heat may migrate through faults and cracks as reservoir pressures decline and cause contamination of the potable water aquifer pumped by the water district. Declines in pressure could also slowly siphon water from the more shallow aquifers through the faulted layers between the two resources. To avoid the degradation of MCWD's groundwater supply, two deep monitoring well pairs are necessary. Ormat, the plant owner, has already installed a nested shallow and medium well and has agreed to fund the installation of one deep well. MCWD is seeking funding to construct the second well pair, a deep well with a shallow and medium depth nested well. MCWD's hydrogeologist and the USGS have supported the contention that at least two monitoring well pairs are necessary to adequately protect the potable groundwater resource.	Implementation	Planning Stage
2012	Mammoth Community Water District	Public water purveyor	Energy Efficiency and Self-Sufficiency	MCWD is keenly interested in reducing its carbon footprint and reducing energy costs by pursuing options for reducing its operational energy demands and producing renewable clean energy. The cost for energy is the District's second largest operations expense. With the completion in 2011 of a 1 MW solar array that provides 30% of the District's current annual electrical power supply, the District has demonstrated its determination to pursue sound energy generation and reduce its greenhouse gas emissions into the future. The District proposes implementing further renewable energy production and energy efficiency using the most appropriate technology available. This project would include two elements supporting expanded renewable energy production and maximum system efficiency; installation of variable frequency drives (VFD's) on all major power loads such as well pumps and wastewater plant blowers, and a technical/financial feasibility study for installation of micro-turbines at existing pressure reducing stations in the water distribution system. The VFDs have a secondary benefit of improved management of groundwater quality, when installed on wells. The micro-turbine concept is gaining rapid support within the energy sector as one of the largest potential sources of small, distributed generation sources. This project will confirm the feasibility of retrofitting the 3 largest pressure reducing stations with micro-turbines to generate power for feed in to the local SCE grid.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Mammoth Community Water District	Public water purveyor	Expansion of Mammoth Basin Groundwater Monitoring Array	MCWD relies on groundwater for up to 60 to 90% of its annual potable supply, and has a network of nine production wells and 14 monitoring wells. MCWD completed a groundwater model and report in 2009 (Wildermuth environmental Inc. 2009), to simulate the groundwater basin under existing and potential future groundwater use levels. This report identified geographic areas that lack adequate groundwater data and thus constrain the understanding of the hydrogeologic system and limit the accuracy of the groundwater model. To address these data gaps, MCWD proposes installation of new monitoring wells in the areas identified in the 2009 report, and a targeted set of pumping-induced short term "stress tests" to confirm key aquifer parameters, such as groundwater/surface water interactions. The proposed new well locations are: 1) four wells in the vicinity of Laurel Pond for water quality and shallow groundwater monitoring; 2) two wells between the Town of Mammoth Lakes and Hwy 395, adjacent to Mammoth Creek, to improve groundwater monitoring in the central-eastern areas of the aquifer; 3) one well near the crossing of Mammoth Creek and Hwy 395 to monitor areas of potential creek interactions with groundwater; and 4) one well in the vicinity of the Convict Creek watershed divide to confirm key boundary condition assumptions for the aquifer; and 5) one well between the geothermal wellfield and MCWD's groundwater production field to monitor potential interconnection with the geothermal production and injection operations. The collection of new groundwater data would be used to improve the Mammoth Basin Groundwater model and increase the understanding of the characteristics of the hydrogeological system.	Planning	Shovel-ready
2010	Mammoth Community Water District	Public water purveyor	Expansion of Recycled Water Distribution Pipe Project	The Mammoth Community Water District's ability to serve the community with a reliable water supply is currently challenged during multiple drought years. In May 2007, the Town of Mammoth Lakes completed a comprehensive update to their General Plan, reporting that land development under the approved General Plan would result in significant water supply deficiencies in a dry year. To help ensure that future water needs can be met in a reliable and sustainable manner--particularly during drought periods--the District has developed a recycled water program to provide treated wastewater for landscape irrigation which would otherwise create a demand on potable water supplies during the summer. The Mammoth Community Water District (MCWD) proposes to install six-inch diameter ductile iron pipe and associated appurtenances to expand the distribution of recycled water. Included in the project are installation of pumps, pipelines, meters and monitoring devices in compliance with the approved MCWD Recycled Water Project EIR and the requirements of Title 22. This project would significantly conserve potable water resources in the Mammoth Creek watershed through beneficial re-use of treated wastewater.	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mammoth Community Water District	Public water purveyor	Groundwater and Surface Water Supply Forecasting and Optimization Model	The District uses both local surface water from the Lakes Basin and groundwater from the Mammoth Groundwater Basin. The relative mix of each source varies widely year-to-year based on variability in the watershed snowpack and runoff patterns, as well as the groundwater levels influenced by the snowpack and runoff recharge timing. MCWD has a MODFLOW groundwater model, which runs on a 90-day time step to simulate well operations and aquifer response. The model was developed in 2009, prior to the five-year drought. A model update would benefit water reliability projections and water supply management decisions that rely on model simulations. The deliverables from this project will include an updated groundwater and surface water model. A technical report will be produced to document the models' development, calibration, and guidelines for use. An initial set of model runs, bracketing average, severe one-year, and multi-year drought water year conditions from historic hydrology, will be used to validate the reasonableness and accuracy of the forecasts and supply mix optimization.	Planning	Conceptual
2010	Mammoth Community Water District	Public water purveyor	Mammoth Basin groundwater and spring monitoring at UC Reserve	Increase the understanding of the Mammoth Creek groundwater basin and spring flow in the UC Valentine Reserve. Project will involve collaboration between UC Reserve Manager and the District to develop a groundwater and spring flow monitoring program by installing piezomenters and spring flow gauges. Data will be used to examine whether there are links between District water diversions and groundwater pumping and groundwater levels and spring flow on the Reserve property.	Planning	Conceptual
2012	Mammoth Community Water District	Public water purveyor	Mammoth Creek Data Collection Improvements	MCWD's water right licenses and permit require the District to refrain from diverting water when Mammoth Creek flows fall below specified monthly flow levels. These specified flows protect the creek fish habitat and downstream ranching operations. This project would improve the accuracy of two key gages for low flow conditions, and provide improved real-time monitoring at a third gage, for improved tracking and response to low flow conditions. This project would improve Mammoth Creek flow monitoring at three locations: • the Old 395 Gage downstream of the Mammoth Creek crossing of Hwy 395 bridge by installing a live link with MCWD's Supervisory control and Data Acquisition (SCADA) system • the Old Mammoth Road gage, by redesigning the placement of the gauge to improve flow hydraulics • the Twin Lakes Outlet Weir to measure low flows by installing a sharp crested weir plate	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2018	Mammoth Community Water District	Public water purveyor	Mammoth Lakes Wildfire Risk Reduction Project	The project area is located in the Mammoth Lakes Basin, watershed for the Town of Mammoth Lakes and tributary to the Owens Groundwater Basin. The Owens Groundwater Basin serves numerous communities in the Eastern Sierra and the City of Los Angeles. In addition to water supply, the Basin is economically essential to the community because it supports numerous recreational uses and facilities, and infrastructure to treat and distribute potable water. These existing uses limit the application of control burns to reduce wildfire risk and maintain a healthy and resilient forest. Manual tree removal and understory clearing is the only means to protect the watershed's natural and human values. Significant tree mortality caused by the recent drought has led to devastating wildfires in our neighboring forests. With the expectation of increasing temperatures and wildfire risk, this project will address a critical need to undertake measures that will reduce the risk of severe wildfires in our watershed. This project will lessen potential wildfire severity, protect drinking water resources, establish defensible space around infrastructure, and establish safe exit corridors along roads in the event of a wildfire. Project completion will: ● Increase the watershed resilience to wildfire and climate change, and decrease negative impacts caused by wildfire, ● Protect adjacent and downstream wet meadow and riparian ecosystem functionality, ● Increase residual tree vigor, and forest health to withstand: fire, pest and pathogen outbreaks, drought, and climate change, ● Decrease the potential for flooding induced impacts such as soil erosion into lakes and creeks, damage and loss of property adjacent to waterways, and reservoir sedimentation following a fire, ● Protect drinking water quantity and quality from the effect of fire-fighting activities and increased erosion in the burned areas, ● Increase firefighter and public safety in the event of a wildfire, ● Ensure a reliable and high quality water supply to populations relying on water resources from the Mammoth Lakes Basin including the Town of Mammoth Lakes, communities in the Owens Valley, and the City of Los Angeles, ● Reduce the risk of contaminating natural habitats from fire suppression chemicals, and ● Increase the chance of saving private and public property from fire and flooding.	Implementation	Underway through Sierra Nevada Conservancy grant

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mammoth Community Water District	Public water purveyor	Master plan to expand distribution of recycled water	The District's recycled water program included plans to deliver water to the two golf courses and Shady Rest Park in Mammoth. The District would like to develop a plan to optimize the distribution of recycled water resources in the greater MCWD service area. A plan will include consideration of the economic and supply aspects of expanding distribution. This plan will inform planning efforts to meet future water supply demands.	Planning	Conceptual
2012	Mammoth Community Water District	Public water purveyor	Recycled Water Master Plan	MCWD's recycled water distribution is limited to one current and one future customer, both golf courses with large irrigation demands. To optimize the future use of the recyceld water, the District proposes the development of a recycled water master plan. The plan would include consideration the economic and supply aspects of expanding recycled recycled water distribution to parks, schools, large commercial properties, and public landscape medians. For example, the plan will examine the current and future production and storage capacity for recycled water, areas of the service area that could best utilize reclaimed water, and the associated costs to expand the recuceled water distribution infrastructure. In addition, the plan would inform planning efforts to meet future water supply demands. The plan will also assist MCWD in applying for future federal USBR Title XVI program funds for construction of new recycled water distribution and treatment improvements.	Planning	Planning Stage
2012	Mammoth Community Water District	Public water purveyor	Sewer Main Replacement and Expansion Project	MCWD has aging sewer lines made of substandard materials and designed for lower flows than they are currently carrying; therefore, completion of this project will eliminate the potential overflow of sewage onto the streets. The project consists of replacing about 1,000 feet of aging sewer main pipeline and installing 6,500 feet of new sewer main pipeline in the Town of Mammoth Lakes. The pipeline replacement targets existing asbestos cement pipe threatened by structural failure due to hydrogen sulfide corrosion exasperated by low slopes and high flows. The proposed new pipeline alignment and installation would extend the existing sewer main along Meridian Boulevard and divert flows around old asbestos pipe currently in use.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mammoth Community Water District	Public water purveyor	Treatment Plant Arsenic Removal Project	The Mammoth Community Water District (MCWD) Groundwater Treatment Plants #1 and #2 are experiencing treatment failures resulting in arsenic levels as high as 13 ppb. The California Department of Public Health (CDPH) requires arsenic maximum contaminant levels (MCL) to be below 10 ppb at all times. Per CDPH requirements, MCWD has announced Teir II public notification of the exceedence of the arsenic MCL. Additionally, MCWD customers have seen a continued exceedence of the Safe Drinking Water Act (SDWA) Lead and Copper Rule. CDPH has mandated that MCWD implemant the results and recomendations of a recent Corrosion Control Study to achieve SDWA compliance for the Lead and Copper Rule. MCWD has already given Teir II public notification to District customers regarding non-compliance with the Lead and Copper Rule. To achieve compliance with the Lead and Copper MCL rule, MCWD proposes to add aeration systems to adjust the ph of the plant effluents. The Department of Public Health has initially approved this treatment alternative. To achieve compliance with the arsenic MCL rule, MCWD has retained the services of HDR engineering to evaluate the best available treatment option for arsenic removal. To achieve the most cost-effective and timely implementation, MCWD will incorporate both the ph control and the arsenic removal improvements into a single design and construction contract.	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mammoth Community Water District	Public water purveyor	Water Conservation Program	The District would like to implement a three part water conservation program. Part 1 would incentivize replacement and installation of indoor and outdoor water conservation fixtures by offering rebates. Rebate offers would be provided for high efficiency toilets, clothes washers, irrigation materials and weather sensitive irrigation controllers. The District has sporadically offered rebate programs but does not have a dedicated funding source. The District would review past programs for successful elements to be incorporated in this program. In Part 2, the District would provide irrigation auditing courses for contractors interested in pursuing certification and for property managers interested in reducing water demand. A water management course would also be offered for homeowners and landscapers. This course would focus on retrofitting existing irrigation systems and designing new water efficient landscapes and irrigation systems. The District would also like to create a highly visible low-water use demonstration landscape as Part 3 of program. The installation of a high quality xeriscape in downtown Mammoth Lakes is timely because the Town is in the process of developing a Downtown Redevelopment Neighborhood Plan that includes new street-side and median landscaping. Design of an attractive low-water use landscape would help establish design criteria for the redevelopment plan. In addition, the landscape would serve as a model of appropriate landscapes for residents and visitors to the Mammoth Lakes area.	Planning/Implementation	Conceptual
2010	Mammoth Community Water District	Public water purveyor	Water Main Replacement	The Mammoth Community Water District (MCWD) water distribution system includes several thousand feet of aging water distribution mains that are subject to increasing leakage and repairs. Unaccounted for water loss volumes within the MCWD water distribution system are estimated at about 15%, exceeding the industry standard of 5%-10%. The California Urban Water Conservation Council has identified leakage location and repair as a Best Management Practice that results in significant water conservation and more efficient use of available water supply. MCWD proposes to remove and replace 12,000 lineal feet of aging water distribution mains with new Ductile Iron Pipe and appurtenances per current AWWA standards. The pipeline replacement will result in decreased water losses and increased operational efficiency.	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	Mammoth Community Water District	Public water purveyor	Water Treatment Plant Corrosion Control	The properties of MCWD's water supply contribute to conditions that cause an exceedence of the Safe Drinking Water Act (SDWA) Lead and Copper Rule. California Department of Public Health (DPH) has mandated that MCWD implement the results and recommendations of a recent Corrosion Control Study to achieve compliance for the Lead and Copper Rule. The District has one surface water treatment plant and two groundwater treatment plants. The study recommended and the DPH has approved the installation of aeration systems to adjust the pH of the groundwater treatment plant (GWTP) effluents. The surface water treatment plant pH control is completed (2011-2012), and used caustic soda chemical feed to adjust the raw water pH. This project will implement the corrosion control improvements at groundwater treatment plant #2.	Implementation	Shovel-ready
2012	Mammoth Community Water District	Public water purveyor	Well Rehabilitation Phases 1 and 2	MCWD's groundwater production wells have varying levels of naturally occuring contaminants, which are regulated by state and federal drinking water standards. To produce safe water for the community, groundwater supplies from some wells must be reduced and diluted with other supplies. This need to reduce the amount of groundwater produced is a significant concern when surface water supplies are limited by environmental concerns or low water availability. Recent advances in well profiling have demonstrated that contaminants can be limited to specific layers within an aquifer and that the identification of the location of these layers and the rate of water produced from these layers can be used to develop actions that would reduce or eliminate contaminants from the well. Phase 1 of this proposal would conduct well profiling in four wells and develop recommendations to reduce contaminants. Phase 2 would consist of implementing recommended actions to reduce contaminants into the raw water system.	Implementation	Phase 2 is shovel-ready; Phase 1 completed through Prop. 84 IRWM grant
2010	Mammoth Mountain Ski Area	Business	June Beetle Tree Kill Erosion prevention	Mammoth Mountain owns and operates June Mountain. June Mountain is currently battling a sever Beetle infestation which is killing thousands of trees. In order to operate the ski area all dead hazardous trees adjacent to the runs must be removed. This season over 450 trees have already been removed. The removal of trees creates water quality issues due to sediment and erosion. JMSA is currently pursuing grant funding options with the USFS to try and combat this infestation and consequential problems.	Implementation	Conceptual
2010	Mammoth Mountain Ski Area	Business	MMSA, Town of Mammoth Erosion and Flood Improvements	MMSA is topographically above the Town of Mammoth Lakes. The elevation change and topography create severe erosion and channeling on unpermiable streets that then flood into lower lying areas of the Town. The Town has done initial studies to identify areas of improvement and the Mountain is willing to partner in improvements but the cost is prohibitive given the fact that these extreme events occur infrequently or in major flood events. However, they are still causing erosion and sediment issues when they occur and can be prevented given financial assistance to fun the infrastructure improvements.	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mammoth Mountain Ski Area	Business	Wastewater Pond Reclamation & Conveyance	MMSA currently operates its Main Lodge area waste facility through the system of wastewater settling ponds. Both the State Water Quality Division of Lahontan and the USFS agree that this is not the best and proper way of managing solid waste water and that conveyance to the municipal system is best. However, it is very costly to install the conveyance lines, pay the connection fees, and to reclaim the land. Therefore, Mammoth continues to meet all of the State standards for the management of settling ponds until a viable option or financial assistance is put in place.	Implementation	Conceptual
2010	Mono County	County Agency	Drainage Design Manual and Flood Plain Ordinance Update	The primary objective of the developing a Drainage Design Manual and updating the Mono County Flood Plain Regulations is to protect lands, structures, infrastructure and water bodies from degradation or contamination resulting from inadequate design of facilities. These documents are necessary to ensure that new development provides sufficient infrastructure and mitigates the impact of said development. They will provide consistent policy and guidance for determination of required improvements, along with accurate data for selection and design of storm drainage improvements. Having these documents in place with provide opportunities for the use of best management practices for temporary and permanent control and treatment of storm runoff. The work plan and document structure will be based upon existing drainage studies pertaining to Mono County, along with comparable documents utilized in communities and regions with similar topography, climate and population. This will allow Mono County to build upon the experiences and knowledge of other local governments in managing development. The final product from this project is a Drainage Design Manual that can be utilized during scoping, design and approvals for future developments, along with an update of the Flood Plain Ordinance aimed at reducing risks from flood losses. This project is also seen as an opportunity to educate the local development community and strengthen relationships between the County and developers.	Planning	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mono County	County Agency	Mono County Safe Water Systems Project	There are numerous small water systems in Mono County that are currently in violation of state and federal water quality standards. This is a result of aging infrastructure, archaic system designs, as well as advancing water quality mandates. Most of these systems do not possess the economy of scale to fund such projects, nor do they possess the resources to participate in the grant process afforded by the IRWMP. Because many of these improvements are of relatively slight costs ranging from $10,000 to $30,000, it makes the pursuit of grant opportunities very difficult to justify as substantial costs can be accrued in the process of writing of the grant, in some cases rivaling the total grant request. For this reason, Mono County feels it prudent to establish a fund from which eligible expenses can be reimbursed to these systems that correct existing water quality violations. Eligible expenses will strictly abide Prop 84 Implementation PSP. Only eligible expenses defined by the PSP will be reimbursed, and match requirements will be held at 50% as beneficiaries will be required to submit all eligible receipts for a 50% reimbursement. The objectives of the project are simple: to trigger improvements to small water systems that may otherwise not occur due to financial reasons, and to offer the funds on a first-come, first-serve basis that would elicit a sense of urgency among eligible participants to address these water quality issues.	Planning/Implementation	Conceptual
2012	Mono County	County Agency	Mono Well Sampling and Solution	Many wells in Mono County do not meet safe drinking water standards. This known problem is exacerbated by the lack of a suitable testing laboratory that private landowners can utilize to conduct the regular testing that is justified by these conditions. This project would be carried out in 2 phases--the first would provide a mobile laboratory to conduct testing in the outlying communities at a reduced cost to the consumer. The second phase of this project would be to provide appropriate treatment infrastructure (reverse osmosis, etc) for systems that have established problems.	Implementation	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mono County	County Agency	Mountain Gate Trailhead Parking and Restroom	The objective of the Mountain Gate Trailhead and Restroom project is provide parking and restroom facilities at the northern terminus of Mtn. Gate. The design will include a small parking area with opportunities for expansion as use of the site increases. Once parking is constructed, several dirt roads currently within the boundaries of Mtn. Gate can be closed and revegetated, eliminating a source of erosion and contamination into the river. Sanitary facilities will include a well, water system, onsite sewage disposal system and restroom structure. All facilities will be designed to meet requirements of the Americans with Disabilities Act and the California accessibility regulations. This project will result in the design and construction of the Mtn. Gate trailhead parking and restroom facilities, providing a minimum of ten parking spaces and sanitary facilities for those utilizing the West Walker River. Deliverables will include the final design documents and infrastructure on the site.	Planning/Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2017	Mono County RCD	Non-profit organization	Bridgeport Watershed Analysis & Water Quality Remediation	Purpose: Ameliorate Water Quality Problems in the Bridgeport Valley, Bridgeport, CA Strategy: Identify the contributing factors throughout the watershed, while moving ahead with a Wetlands application for the Bridgeport Reservoir. Tactics: 1) Midterm/Continuous. • Establish provisional Best Management Practices for inter-ranch and watershed-wide collaboration from Literature Search of the watershed and from previous on-ground practices by Bridgeport Rancher's Association. • Monitoring. a) Utilize existing studies. b) Continuation of earlier data collection. c) "Fingerprinting" by DNA processes to identify the sources. d) Expand the scope to the full watershed. e) Accommodate the Wetlands Implementation below to evaluate progress. 2) Immediately. • Wetlands Implementation. a) Secure access (fee, easement, lease) of lands upstream of the Bridgeport Reservoir . b) Consult on agency receptivity (CA and US F&W, US Corps of Engineers, CA & US EPA, Mono County). c) Research funding. d) Contract for design/costing of wetlands based remediation . I. Wetlands-only construction II. Wetlands plus woodchips (see file) III. Wetlands Floating Islands (see file) IV. Saturated Buffers (see file) e) Apply for implementation funding.	Implementation	Planning Stage; has received some seed money from Bridgeport Ranchers Association

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Mountain Meadows Mutual Water Company	Mutual Water Company	Well 5 Project	Currently the Mountain Meadows Mutual Water Company ("MMMWC") is under a compliance order from the County of Mono for noncompliance of the Uranium maximum compliance level ("mcl"). In an effort to avoid treatment for uranium removal and the associated long term costs, the MMMWC has identified a potential water source that would allow the Company to comply with the order. This water source, Well 5, is located on a recently purchased parcel owned by the MMMWC, near the intersection of South Landing and Highway 395 in Mono County. The well has been tested, with uranium levels proving to be undetectable. Testing will continue per State requirements. Supporting infrastructure must be installed, including power, telemetry, pump, and the installation of mains to connect it to the current water system. In addition, a relay pump must be installed to allow the pumping of water into another pressure zone, to the current storage tanks. The Company has obtained all necessary governmental approvals for the construction and installation of the infrastructure. The beneficiaries of the project will be the users of water within the boundaries of the Company, which includes approximately 100 single family residences, three multi-family condominium/townhome projects, Mono County Road Department, the Crowley Lake Community Center and a church.	Implementation	Complete: well was drilled many years ago
2015	Town of Mammoth Lakes	Municipal agency	Davison Road Storm Drain	Davison Road generally lacks engineered drainage infrastructure. The proposed project would construct surface collection and conveyance (curb and gutter or swale) along the edge of pavement and install inlets and storm drain piping. The proposed SD system would discharge storm water to detention/infiltration basins to be installed near the intersection of Davison Road and Lake Mary Road. Detention/Infiltration could also be installed in vacant parcels on the north side of Davison Road.	Implementation	Conceptual
2015	Town of Mammoth Lakes	Municipal agency	Forest Trail Storm Drain	Uncontrolled runoff from impervious surfaces around Hillside Drive and Forest Trail results in erosion and increased potential for flooding downstream. The proposed project will construct surface conveyance along Forest Trail and Hillside Drive with a series of inlets and infiltration/detention facilities designed to reduce peak flows from reaching downstream facilities.	Implementation	Conceptual
2015	Town of Mammoth Lakes	Municipal agency	Forest Trail, Hillside Drive, Crest Lane, and Crystal Lane	Existing cut slopes are severely eroding at five (5) locations. The proposed project will protect cut slopes from erosion using retaining walls and/or rock slope protection. Slopes vary between 1:1 and 2:1 H:V. The areas requiring mitigation extend 20 to 40 feet horizontally from the edge of pavement and range from 10 to 30 feet in height.	Implementation	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	Town of Mammoth Lakes	Municipal agency	Lower John Muir Slope Protection	Existing cut slopes at eight (8) locations on John Muir Road and Lee Road are moderately to severely eroding. The proposed project will protect cut slopes from erosion using retaining walls, rock slope protection, and/or revegetation. Slopes vary between 0.5:1 and 2:1 H:V. The areas requiring mitigation extend 20 to 40 feet horizontally from the edge of pavement and range from 10 to 60 feet in height.	Implementation	Conceptual
2015	Town of Mammoth Lakes	Municipal agency	Lower John Muir Storm Drain	John Muir Road generally lacks engineered drainage infrastructure. The proposed project would construct surface collection and conveyance (curb and gutter, AC swale, or PCC swale) along the edge of pavement and install inlets and storm drain piping. The proposed storm drain system would connect to the existing 36" storm drain which outfalls to an unprotected slope above Lake Mary Road. The 36" pipe would be extended to the bottom of the slope where a detention/infiltration basin would be installed near the intersection of Lee Road and Lake Mary Road.	Implementation	Conceptual
2015	Town of Mammoth Lakes	Municipal agency	Majestic Pines Storm Drain	Majestic Pines Road receives significant offsite flows from upstream development in addition to locally generated runoff. Existing drainage infrastructure requires improvement to adequately convey runoff and entrained sediment. The proposed project would construct curb and gutter or swale along the south side of Majestic Pines Road with inlets directing flows into an existing storm drain pipe. A series of check dams is recommended to create five (5) small infiltration basins along the channel receiving runoff from this system. Improvements are needed on Monterey Pine Road to relieve flooding issues.	Implementation	Conceptual
2012	Town of Mammoth Lakes	Municipal agency	Mammoth Lakes Stormwater Management Plan Phase 2	Much of the infrastructure in the Town of Mammoth Lakes (hereafter referred to as "Town"), including roads and drainage facilities, were built by Mono County prior to the incorporation of the Town in 1984. During this time, there was minimal emphasis placed on erosion control, water quality or facility design. As a result, the Town is now dealing with serious erosion issues, inadequate drainage facilities, numerous flood prone areas and a lack of water quality improvements. Several large storm events in 2006 and 2007 highlighted the existing problems in the Town and caused excessive erosion of slopes and ditches, flooding of Town facilities and private property, and discharged sediment and other pollutants to Hot Creek and Mammoth Creek. The project is located within the Town of Mammoth Lakes municipal boundary, which is the only incorporated city in Mono County, California. All stormwater from the Town drains into Mammoth Creek and Hot Creek, which are impaired streams. This project will develop policies and methods to control nutrient and sediment loads from entering nearby Mammoth Creek and Hot Creek. In addition a measurement and monitoring plan will be developed to evaluate the long term implementation of the plan and policies. The project will adopt measures that can be modified and used from other local best management practices. The Town is signatory to the Inyo-Mono Regional Water Management Group, and this project will be developed and completed in cooperation with this planning group. In addition, the Town will conduct	Planning	Shovel-ready; Stormwater master plan developed through Prop. 84 planning funding

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				outreach and meetings with the Town Council, Planning Commission, and other members of the public to solicit input and provide information and education regarding the importance of stormwater pollution to the community and the environment. Goal: Move the Town of Mammoth Lakes towards a more proactive approach to managing stormwater, improving water quality and minimizing the risk of flooding through the development and implementation of a Stormwater Management Plan. Objectives: 1. Develop a Stormwater Management Plan that includes provisions for improved management and policy; Capital Improvement Program (CIP); maintenance and operations; and education and outreach. 2. Build upon the work previously completed by the Town, including the integration of the findings and recommendations included in the Erosion, Drainage and Flooding Project Final Recommendations Report dated April 11, 2008. 3. Identify, delineate and prepare to implement CIP projects identified within the Stormwater Management Plan. There are several outcomes that will be developed and implemented with the project. 1. Public Education regarding stormwater pollution. 2. Development of local stormwater quality guidelines and local code revisions that address zoning and building activities 3. Development of a retrofit program and policy for existing development to improve stormwater quality 4. Development of a operations and maintenance plan for both public and private developments 5. Development of a monitoring, assessment, and reporting plan for both private and public development. 6. Prepare required CEQA review that will enable the final Stormwater Management Plan to be adopted by the Town Council. 7. Update the Municipal Code to incorporate guidelines and standards for stormwater pollution control and land use standards.		

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Town of Mammoth Lakes	Municipal agency	Storm drain improvements	Provide drainage improvements as shown in the storm drain master plan. Replacing existing corrugated metal pipes that require replacement due to corrosion. This would be performed over a 20-year period. Provide improvements to stormwater discharges and implement best management practices in strategic locations in Town. This includes preparation of updated design standards, stormwater master plan updates, development of water quality standards, as well as construction of improvements to improve stormwater quality and reduce erosion problems.	Implementation	This project is mentioned in the TOML Stormwater Master Plan from 2015
2015	Town of Mammoth Lakes	Municipal agency	Upper John Muir Slope Protection	Existing cut slope located above the hairpin turn in John Muir Road is severely eroding. The proposed project will protect cut slope from erosion using retaining wall and/or rock slope protection. The slope is very steep, at least 1:1 H:V, and vertical to overhanging in many places. The area requiring mitigation extends horizontally about 35' from the edge of pavement and ranges from 15 to 50 feet in height.	Implementation	Conceptual
2015	Town of Mammoth Lakes	Municipal agency	Upper John Muir Storm Drain	John Muir Road above the hairpin turn lacks engineered drainageinfrastructure. The proposed project would construct surface collection and conveyance (curb and gutter, AC swale, or PCC swale) along the edge of pavement and install inlets and storm drain piping. Detention/infiltration basins would be installed near the western terminus of Davison Road. Storm drain piping and rock lined channel would be installed to direct drainage from John Muir Road and Davison Road to these basins.	Implementation	Conceptual
2012	U.S. Forest Service	Federal Agency	Bishop Creek Sewage Treatment Plan	The Bishop Creek Wastewater Treatment Plant (WWTP) will be brought up to standard by streamlining effluent flow, increase energy efficiency and decommission unused assets. The sewage disposal ponds will be repaired to comply with the terms of the State Water Resources Control Board order, which governs the operation of the facility. The plant services 97 connectors including seven (7) campgrounds, an RV dump station and the community of Aspendell. The current operating condition of hte plant does not comply with the State issued discharge permit.	Planning	Planning Stage
2012	U.S. Forest Service	Federal Agency	Hilton Trail/Watershed Rehabilitation	This project proposes to repair and restore system trails impacting watershed health within the Hilton Lakes Watershed. Specific activities include: rerouting trails out of sensitive wet meadow areas then rehabilitating the old trail tread restoring meadow function; repairing meadow headcuts causing by trails and trail runoff; repair and/or enhance existing trail crossing of perennial streams and improving existing erosion control stuctures on the trail. The Forest proposes to restore up to six (6) meadow headcuts and re-route up to one (1) mile of trail. In addition, at least one (1) mile of trail would be restored.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2012	U.S. Forest Service	Federal Agency	Hilton Trails/Watershed Restoration	This project proposes to repair identified trail/watershed interaction problem areas within the Hilton Lakes Watershed. Specific actions include: repairing headcuts, re-routing system trails out of sensitive montane and subalpine meadow systems, restoring abandoned trails. In addition, this project proposes to maintain existing existing erosion control structures on the system trails, placement of additional erosion control structures and enhancing stream crossing. This project will assist in restoring meadow hydrologic function and provide a sustainable trail system that is compatible with watershed processes. This project will also provide ecosystem resiliency for the restored meadows by enhancing water capture, storage and summer base flows.	Implementation	Shovel-ready
2012	U.S. Forest Service	Federal Agency	Lee Vining Campground Watershed Evaluation	This project proposes to inventory campgrounds and associated roads for maintenance, improvement or removal in Lee Vining Canyon where they contribute to negative watershed effect, degraded water quality and impaired meadow hydrologic function. Priority campgrounds include Lower Lee Vining, Moriane, and Aspen campgrounds. There is an opportunity to take a broader look at issues within this watershed incorporating stakeholders such as Southern California Edison, Los Angeles Department of Water and Power, California State Parks, Mono Lake Committee and local citizens in Lee Vining and surrounding communities among others. The Forest collaborating with stakeholders would develop a preliminary proposed action to address identified issues, such as water quality and meadow hydrologic function, within the watershed.	Planning	Planning Stage
2012	U.S. Forest Service	Federal Agency	Oak creek Gully restoration Implementation	This project would implement restoration recommendations from the collaborative planning effort. The collaborative planning effort is being conducted jointly with the Ft. Independence Tribe and the Inyo National Forest. At this point, we don't know exactly what the restoration effort will consist. Potential projects including: engineering of up to three flood diversions, two reservoirs, three miles of creek restoration (Tribal, PVT and National Forest lands) and up to 500 acres of irrigation systems. Creek restoration could consist of reshaping the channel and improving bank stability, placing riprip in the channel to retard bank erosion and/or riparian plantings among other treatments. The collaborative planning effort contains a detailed account of history of the fire/flood sequence and consequences in the Oak Creek Watershed. This project would benefit the Tribe, Oak Creek Stakeholders (Private landowners), Mt. Whitney Fish Hatchery, Inyo National Forest, Ft. Independence Tribe as well as local Flora and fauna.	Implementation	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Undetermined. Possible proponents include Caltrans, Mono County, US Forest Service, and the Lee Vining Public Utilities District		Lee Vining Stormwater Management	Stormwater running off Lee Vining streets, sidewalks, parking lots, and other impervious surfaces is presently directed into several drain areas, some of which erode the hillside below town, wash out the Lee Vining Creek Trail, and reach Lee Vining Creek. This project will mitigate the erosion and sedimentation and pollution caused by these point sources. Location 1 at wall: When Caltrans widened the highway and built the wall at the south end of Lee Vining, it resulted in a new hillside and trail erosion problem. It mitigated the problem somewhat by installing a perforated pipe below the wall that infiltrates the first flush of stormwater into the soil, and after reaching capacity spills into a pipe that emits stormwater into a side channel of Lee Vining Creek at the bottom of the hill. On more than one occasion during rain events, foam has been observed being discharged from this drain into the creek side channel, which could discharge pollutants into the active channel. Location 2 at Shell Station: Currently the stormwater exiting the pipe at the bottom of the fill slope adjacent to the Shell Gas Station is discharged onto a flat terrace which absorbs most if not all of the flow. The drainage area below this pipe should be evaluated for capacity and potential problems. Location 3 at First Street: Caltrans installed a clarifier in the Caltrans Yard, which removes trash, oil, and sediment from stormwater running off the highway near First Street. This “clarified” water is joined by untreated stormwater from the drain at the corner of First St. and Mattly Ave, and the combined flow exits a pipe below the large turnout at the end of First St. This water flows through a small pipe under a dirt road on this terrace, which washes out frequently. It then runs down an actively-eroding gully, and exits the gully in a large alluvial fan which crosses the Lee Vining Creek Trail, at times washing it out, and discharges to Lee Vining Creek. The amount of trash reaching the trail and the creek has been reduced since Caltrans installed the clarifier, but the erosion, sedimentation, and pollution is still a problem. Location 4 at Community Center: When the Lee Vining Community Center was built, the drainage was directed over the side of the hill, and within a year or two a gully formed along with a fan of sediment on the terrace below adjacent to the sewer ponds. The drainage from the parking area has been directed elsewhere, however the drainage from behind the building still is directed down this gully, causing erosion and sedimentation. Location 5 at USFS Visitor Center: The drainage from the employee parking lot and access road is directed down a gully which ends in a fan adjacent to Lee Vining Creek. The Lee Vining Creek Trail	Implementation	Still a need 5/2017

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
				crosses this gully on a bridge, and the flow rarely reaches the fan at the bottom, however currently there appears to be significant erosion of the hillside below the employee parking lot and access road caused by poorly-directed drainage from the gutters along the road. This project will evaluate each location, develop alternatives for dealing with each problem, and construct the chosen alternatives. • Analysis of each problem area and alternative solutions will be presented in a report for decisionmakers to use in selecting the best alternatives. • Each solution will be constructed in order to prevent erosion, sedimentation, and pollution. • Each solution will be monitored for two years to determine its effectiveness and adaptive measures will be taken to improve the solutions during this time. • A plan will be developed to mitigate or eliminate any new sources of stormwater from new construction or redevelopment in Lee Vining through detention basins and construction of permeable surfaces.		
2010	Undetermined. Possible proponents include the L.A. Department of Water and Power, State Water Resources Control Board, the Great Basin Unified Air Pollution Control District, and the Mono Lake Committee		Mono Lake Evaporation Study	There is a need for an updated evaporation estimate for Mono Lake. Climate change has increased lake temperatures and presumably evaporation and a new estimate is needed for use in the Mono Lake water balance models. Mono Lake is currently rising to a stabilization level of 6392 feet above sea level. This level, ordered by the SWRCB and implemented by LADWP, is expected to bring air quality into compliance with federal standards. The GBUAPCD is required to bring air quality into compliance. Recent lake levels indicate a slow trend in lake level rise, however preliminary analysis suggests this is not out of the range of variation predicted by the models. A cooperative effort is underway to update the models and a new evaporation estimate is needed, since evaporation is not measured and it is the largest single component of the water balance. Update the evaporation estimates for Mono Lake for use in updated models that will provide updated lake level forecasts.	Planning	Conceptual

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2010	Undetermined. Possible proponents include the Los Angeles Department of Water and Power or the State Water Resources Control Board		Rush Creek Floodway Improvements	During Rush Creek flood events, Silver Lake can back up and flood Hwy 158 (and occasionally back up Reversed Creek as far as the Double Eagle Resort, such as the 1000 cfs 1967 flood, a 150-year event). Above a flow of roughly 500 cfs (downstream of Silver Lake), a 10-year flood, the culverts above Silver Lake under the highway are full. Higher flows to 750 cfs (a 7-year flood without SCE's control) would be beneficial for riparian habitat restoration downstream. SCE manages its reservoirs in order to minimize uncontrolled spills, which has the result of minimizing flows above 500 cfs. Higher flows do occur rarely, such as in 1967, and flood property and roads. Structural improvements to increase the capacity of the floodway at Silver Lake would allow SCE to release higher flows from its upstream reservoirs, which would benefit riparian habitat restoration downstream. Increase the capacity of the Rush Creek floodway at Silver Lake in order to minimize flooding and maximize peak flow events up to 750 cfs that benefit the riparian ecosystem.	Implementation	Conceptual
2010	Wheeler Crest CSD	Public water purveyor	New Hilltop Well	The objective of this project is to drill a new well and install a small reservoir/pressure system within the community proper. The existing well and reservoir are located approximately 2500 and 1000 feet respectively from the community. The objective is to establish a new system within the community to augment the single-source artesian well, eliminating the dependence upon such a long supply line, thus greatly increasing water supply, reliability and safety. An engineering study on alternative designs to the current supply system has been completed, and a design has been selected which has undergone preliminary engineering and costing. Phases of the project will include drilling the new well, bringing in electrical power, and construction of a small tank and pressure system to connect with the existing distribution network. A new, safe and more reliable water supply will be available to customers. Chances for bacterial contamination will be substantially reduced. Disinfectant insertion to, and monitoring of, the system will be substantially improved.	Implementation	Completed through Round 1 Prop. 84 Implementation grant

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2019	Wheeler Crest CSD	Public water purveyor	WCCSD - Reservoir 1 - Internal and External Painting	Inspection of the external and internal surfaces of the above ground steel reservoir was recently completed. This reservoir holds 100 thousand gallons from groundwater pumping to support the residents of Swall Meadows. A complete engineering report with a photo survey is available. An estimate of the corrective work was provided by the inspection company. Rust and large portions of paint are peeling on the inside the tank. This project includes external painting, internal sand blasting and painting, in addition to fixing several safety issues identified on the structure. A request for bid has been completed but has not yet been distributed. Due to the deer migration and the winter snow, there are limited windows where the work can and must be done.	Implementation	Shovel-ready

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	WRAMP Foundation	Non-profit organization	Antelope Valley "A"	The Antelope Valley of Mono County is amidst the high desert beauty of the Eastern Sierras. The Valley surrounds the communities of Coleville, Walker and Topaz in northernmost portion of the county. Yet water is drought-scarce, the National Fish & Wildlife Foundation is seeking County approval to export water to Nevada, groundwater is sinking in the Valley, the wreckage of the 1997 Flood remains evident in the West Walker River sedimentation (Otis Bay study, 2015) affecting the endangered Cutthroat trout and the once storied Valley sport fishery and the tourist-dependent local economy. Restoration of the wealth of the area needs data and coordination. Proposed: Local Water District. Restoring the moribund Antelope Valley Water District, working through LAFCO to enlarge its boundaries to include the scientifically-linked, full West Walker watershed, and petitioning both agencies to embrace groundwater as within the District’s purview. Regulatory Changes. Prepare and submit regulatory wording for approval by Mono County to facilitate conjunctive water use, sale of water dedications for in-stream use, water banking and payment for ecosystem services such as clean water trading. Additionally establish cooperative or assessment district arrangements between lodging/service and agricultural interests to benefit from developed fishing access. This will strongly invest the business economy in the health of the fishery. Public Land Exchanges. Work with the Bureau of Land Management and the Humbolt-Toiyabe national forest to recognize non-serving public land parcels in the Antelope Valley to exchange with land owners for public fee or easement rights on West Walker River frontage. Acquiring Data. 1. Commissioned water quality/quantity monitoring. (Monitoring in formats used by SWRCB (CEDEN for surface water). 2. Compile data and/or arrange for additive groundwater measuring through well water elevation tracking and other feasible technology. 3. Hydrology studies in general and for ground and surface water interface and groundwater storage potential in particular.	Implementation	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	WRAMP Foundation	Non-profit organization	Antelope Valley "B"	The Antelope Valley of Mono County is amidst the high desert beauty of the Eastern Sierras. The Valley surrounds the communities of Coleville, Walker and Topaz in northernmost portion of the county. Yet water is drought-scarce, the National Fish & Wildlife Foundation is seeking County approval to export water to Nevada, groundwater is sinking in the Valley, the wreckage of the 1997 Flood remains evident in the West Walker River sedimentation (Otis Bay study, 2015) affecting the endangered Cutthroat trout and the once storied Valley sport fishery and the tourist-dependent local economy. Restoration of the wealth of the area needs design vision and coordination. Proposed: Riverine Amelioration. Tested river amelioration strategies can be put to work immediately. • fish laddering. • screening against fish entrainment in the irrigation ditch intakes on the West Walker River. • establish legal cooperative or assessment district arrangements between lodging/service and agricultural interests to benefit in developing fishing access facilities. This will strongly invest the business economy in the health of the fishery. • critical bank stabilization made practical by new state streamlined permitting. • habitat restoration for the fishery by select river border plantings and recovery of existing oxbow fish refuges through easements when necessary. • facilitate public lands exchange of current non-servicing properties for public riverine fee land or easements. • assure minimum in-stream flow agreements with the Antelope Valley Mutual Water District (AVMWD) during vulnerable biotic seasons, targeting specific life stages for fish and other wildlife (Water Transaction study, 2014 Mono Co. RCD. • Seek county regulatory revision to facilitate conjunctive water use, sale of dedications of in-stream use and water banking.	Planning	Planning Stage

Year Submitted	Organization Name	Organization Type	Project Title	Project Description	Project Type	Project Status
2015	WRAMP Foundation	Non-profit organization	Antelope Valley "C"	The Antelope Valley of Mono County is amidst the high desert beauty of the Eastern Sierras. The Valley surrounds the communities of Coleville, Walker and Topaz in northernmost portion of the county. Yet water is drought-scarce, the National Fish & Wildlife Foundation is seeking County approval to export water to Nevada, groundwater is sinking in the Valley, the wreckage of the 1997 Flood remains evident in the West Walker River sedimentation affecting the endangered Cutthroat trout and the once storied Valley sport fishery and the tourist-dependent local economy. Restoration of the wealth of the area needs design vision and coordination. Proposed: Flood Control. Interlaced structures for flood calming by pre-determined flood diversions which will also benefit groundwater recharge. The Antelope Valley is veined with working ditches that historically extend back a century, but two of the agricultural ditches deliver the preponderance of the irrigation water on which the Valley relies. • By a slight repositioning and redesign, the Main Canal ditch diversion will accommodate a fishery on an oxbow in the immediate upstream reach. • Redesigning and replacing the agricultural diversion dam at the Big Slough ditch will assure its now tenuous ability to reliably provide the Valley's most essential irrigation artery. Design and construction of both these diversion facilities will also serve to redirect flood waters to avoid direct damage in Walker and Coleville and the serious sedimentation damage (Otis Bay study, 2015) that continues as a legacy of the 1997 flood. The existing irrigation ditch system will course the flood waters to easement-permitted settlement ponds. The sediment will remain in the ponds as the waters slow and those waters can be sent further along the ditch system to surface water impounds or to locations which studies will indicate as having maximal opportunity for water table recharge. Wildlife Habitat. • Greater Sage Grouse habitat facilitated by NRCS, the mutual water district and land trust easements providing for targeted seasonal habitat irrigation. • Migratory bird benefits from basins for sediment isolation and water infiltration.	Implementation	Planning Stage; has issues around adjudicated water rights

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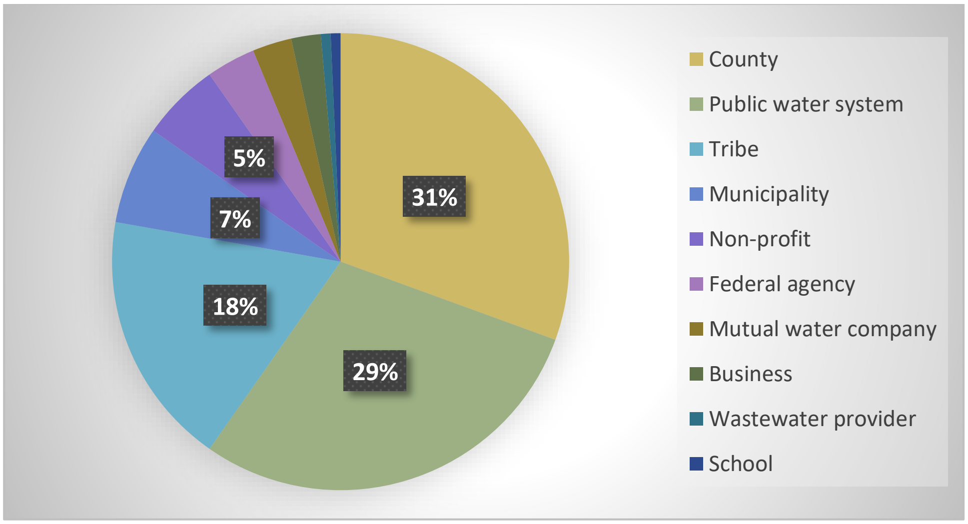
14.2.3 Phase II Project Needs Analysis

The information collected in the online project upload form allowed for more extensive analysis of the types of projects currently needed within the Inyo-Mono IRWM region than was possible in the Phase I Plan. One hundred forty-seven projects are part of this analysis.

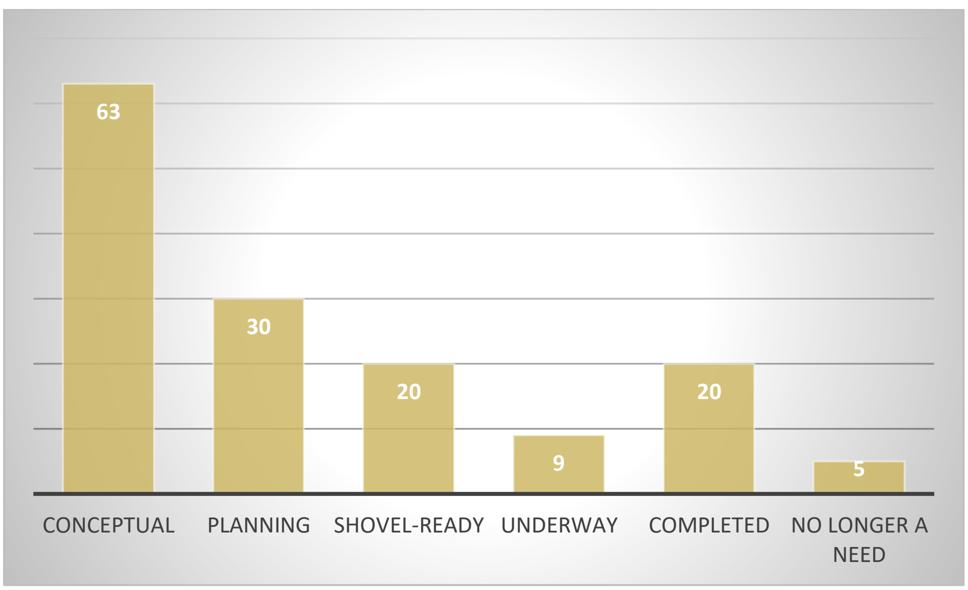
Counties, public water systems, and tribes have the largest number of projects in the database (80%). Inyo County has the most projects (40) of any one entity in the database.

Figure 14-2: Phase II projects by organization type



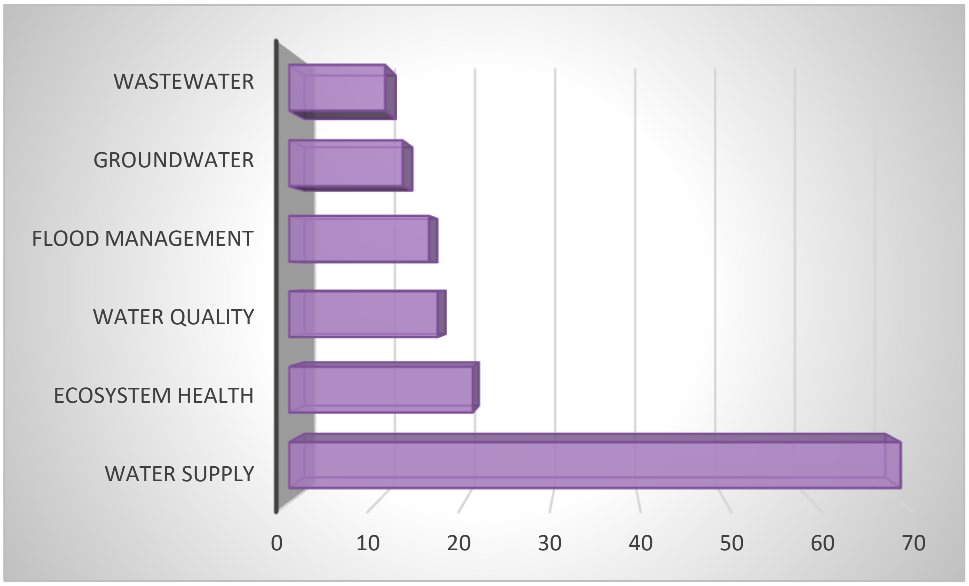
Many of the projects in the list are conceptual (63). Nine projects are currently underway with an IRWM grant. Twenty projects have been completed since they were added to the list. Some of these projects were completed with an IRWM grant, and other projects were completed by other means.

Figure 14-3: Phase II project status



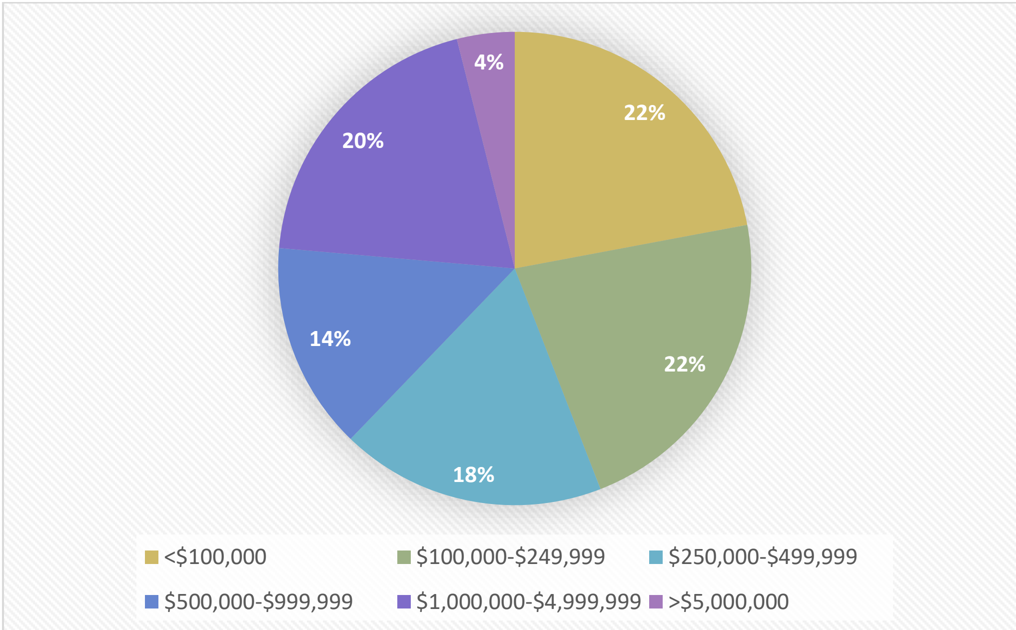
As part of the online project upload process, potential project proponents were asked to self-identify a primary project evaluation bin. These evaluation bins are used in the project evaluation and ranking process for grant funding (Chapter 13), and also perhaps for other types of project funding. For the purposes of this analysis, the self-selection of evaluation bins was used to determine the primary type of project. Not surprisingly given the overriding water-related concerns in the region, almost half of the projects were identified as Water Supply projects (Figure 14-4). The other five categories are small in comparison, but it is interesting to see that Ecosystem Health is the second most represented category.

Figure 14-4: Phase II project type by primary project evaluation bin



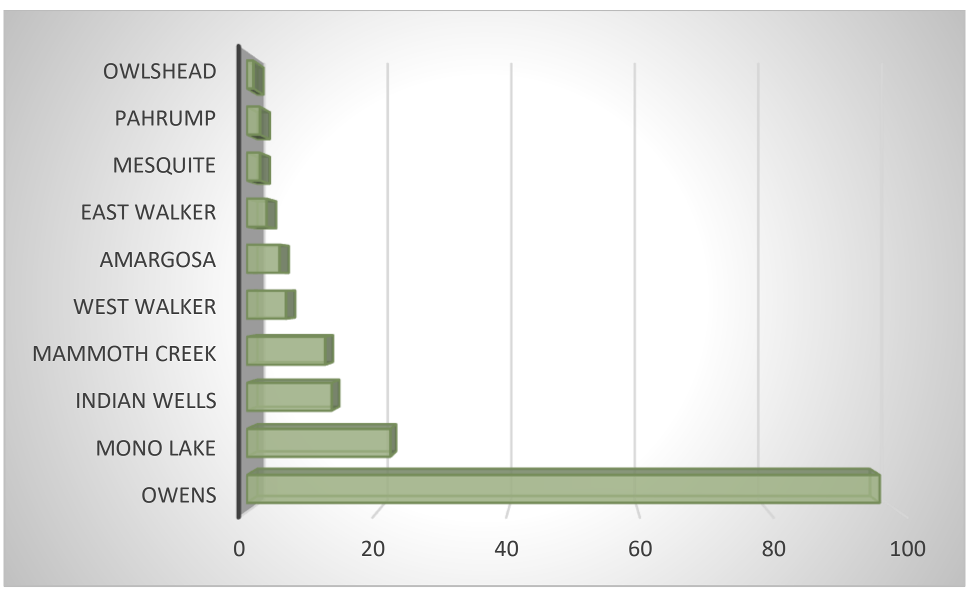
Another important factor to consider in the analysis of regional project needs is cost. Over the 147 projects in the list (not all of them were able to give estimates), there is an estimated project total of about $240,000,000. As seen in Figure 14-5, more than half the projects are relatively small – under $500,000.

Figure 14-5: Phase II project cost by category



Another aspect of the analysis was to examine the geographical distribution of the benefits of the Phase II projects. Through the online upload form, the project proponents were asked to identify which area watershed(s) their project(s) would address. The large majority (97) of projects are focused on the Owens watershed. The overall results from this analysis can be seen in Figure 14-6.

Figure 14-6: Phase II projects benefitting Inyo-Mono watersheds



The final part of the analysis is an examination of projects addressing water-related needs in DACs. Bringing financial and technical resources to Inyo-Mono DACs has been and continues to be a top priority for the RWMG. Understanding their needs will better allow the RWMG to seek out the appropriate resources. Only by building long-term relationships with DACs and working with them on a continual basis can we ensure that their needs are addressed in a timely manner. Furthermore, it is not enough to simply understand that there are project needs in these communities. In the Phase I Plan and subsequent Implementation application process, numerous DAC project needs were identified, and several DAC projects even went through the ranking process, but many DAC project proponents did not have the capacity to complete the long and complex DWR grant application. Subsequent rounds of funding have proved easier as the grant application process has improved and the RWMG is able to provide more resources to DACs.

Ninety-two, or 62%, of the 147 projects in the list are identified as benefitting one or more DACs.

Appendices

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Appendix A: Data Management Plan

Introduction

The need for a Data Management Plan has evolved alongside the Inyo-Mono Integrated Regional Water Management Program over the course of the last several years. As the program has matured, the need for a well-documented Data Management Plan has become evident. This plan was developed in response to that need, as well as to provide a mechanism to ensure quality assurance and control of data used in Integrated Regional Water Management Planning within the region.

Types of data

The various types of data are outlined in Chapter 4: Data Management of the Inyo-Mono Phase II IRWM Plan (2014 Update) and therefore will not be repeated as part of this plan. Please visit http://inyo-monowater.org/inyo-mono-irwm-plan-2/inyo-mono-irwm-plan/ to view Chapter 4.

Baseline Data Retrieval and Organization Standards

Spatial Data and Metadata Standards

All spatial data acquired will comply with Federal Geographic Data Committee (FGDC) guidelines so as to make all in-house data compatible with State and National databases. http://www.fgdc.gov/ Detailed guidance from the California Environmental Resources Evaluation System (CERES) further outlines how using the FGDC standard also qualifies data for automatic compatibility with CERES and the California Environmental Information Catalog (CEIC): http://www.ceres.ca.gov/prog_info/standards.htm. The FGDC Standards guidance from CERES provided above will be followed for all original IRWM program data and data housed within the DMS File Geodatabase.

When generated by the Inyo-Mono IRWM Program, spatial data will be housed in the Inyo-Mono Region's File Geodatabase that constitutes the spatial component of the Inyo-Mono Data Management System. All data housed in this File Geodatabase will be assigned the following spatial reference information (NAD 83, UTM Zone 11 N).

Spatial data acquired for specific analyses or base data will be reprojected using this spatial reference information such that it can be housed in the File Geodatabase. This will allow sharing of data with stakeholders who may not possess advanced GIS knowledge needed to remedy problematic alignment issues.

Aspatial Data

Aspatial data will be housed in the Inyo-Mono Regional Access Database, the second component of the Inyo-Mono Regional Data Management System. Where applicable, data will be input using a pre-designed form available on the switchboard (front end of the database). The forms will be designed such that users inputting data will need to know very little about Access. Additionally input masks and validations rules will be applied into the design of the tables so that Access has built in quality assurance and control measures. These measures insure the proper type of information is input into each field with error messages that specify when inappropriate data has attempted entry. These measures are not foolproof, but will allow some fundamental QA/QC control at the data entry level. The GIS/Data Management Coordinator will also provide routine maintenance to ensure data quality standards are being met and perform any updates or revisions needed to the database.

For program documents that are not suitable for entry into the database (i.e. WORD documents, PowerPoint Presentations, Etc…), a file naming convention has been designed to allow for easy file recognition and searching on the Program server.

All Program files should be begin with a capital “I” for Inyo and “M” for Mono. Underscores should be used as the only non-letter or number character in the file name (no spaces should ever be used within a file name). Next a 3 or 4 character grant identifier should be used (PG1 = Planning Grant 1, DAC =Disadvantaged Communities work, and IMP2 = Round 2 Implementation). The third file name component is a descriptive yet concise file name using camel casing (http://en.wikipedia.org/wiki/CamelCase) instead of spaces to make the name easily identifiable. Lastly the date in the format provided and authors initials should follow separated by and underscore. The examples below are offered for illustrative purposes.

IM_GrantAbbreviation_descriptiveFileName_Date(YYYYMMDD)_authorInitials(ifapplicable).filetype

IM_PG2_dataMgmtPlan_20141016_jh.docx (File name for the data management plan)

Online Data Retrieval

Relevant online water databases that may be utilized for data acquisition or data submission include but are not limited to; the aforementioned CERES California Environmental Information Catalog (CEIC), Environmental Data Exchange Network (CEDEN), California Data Exchange Center (CDEC), Surface Ambient Water Monitoring Program (SWAMP), Integrated Regional Water Information Systems (IRWIS), DWRs Water Data Library (WDL), California Statewide Groundwater Elevation Monitoring Database (CASGEM), and USGS National Water Information System (NWIS). Acquired data may not share metadata standards of internal regional original data, and the authority of the data source should be carefully considered prior to use by the Inyo-Mono IRWM Program.

When using data acquired from online sources, the staff member should ensure to also transfer any metadata associated with the data. If no official “metadata” file exists, the staff member should at a minimum record the data source, date and the intent for the data download in a text file and title the file in the following manner, *ReadMe_datafileName_Date.txt.* It is absolutely imperative that all data downloaded from the web contain a date within the file name. This will ensure that others who may seek information about the data source can ensure they have the most current dataset and provide them the potential to relocate the information source to check for updates, or verify some aspect of the data that may be in question.

Policies for access and sharing

The IRWM Program promotes collaboration and integration on many levels, including and especially with regards to data. Additionally, it is recognized that the IRWMP effort is funded with State dollars through Proposition 84. Thus, all original data generated by the Inyo-Mono RWMG, once finalized by the Program Office Staff will be made available for public use as requested. Data distribution may take place only once metadata standards are met to ensure the Inyo-Mono region maintains a reputable data source to other IRWMP Regions and Organizations. Sensitive data, if shared with the Inyo-Mono Program Staff for specific analytical reasons, will be carefully protected to maintain the security of the data entrusted to the Inyo-Mono program.

The recent release of ArcGIS Online http://www.arcgis.com/home/index.html has opened up a brand new arena for collaborative data transfer and lease in the geospatial realm. To the extent possible online web maps published by the GIS/Data Management Coordinator will be published to "*share with everyone*" so that local water-related data can be made available to the broadest interested audience available. When prudent, these public web maps will be embedded into the Inyo-Mono Website to facilitate RWMG member usage. The map publisher will follow advised sharing practices from ESRI available at the following link:
http://resources.arcgis.com/en/help/arcgisonline/#/Best_practices_for_sharing/010q00000011000000/

In some instances web maps may be published and made available only to specific user Groups within the IRWMP Organization when draft or proprietary data are involved, but should be limited to specific instances or short-term projects as a best management practice.

Policies and provisions for re-use, re-distribution

All data requests will be directed to the GIS /Data Management Coordinator or designee. The Staff will make every effort to disperse data requests in a timely manner and of professional quality. Spatial data can be sent as an independent Shapefile or the entire File Geodatabase may be shared. For aspatial data requests, the entire Access database could be emailed or specifically requested tables can be export to a variety of file formats to facilitate use by the requesting agency.

The Inyo-Mono IRWM Program assumes no liability for accuracy of data once it is transferred to a third party user. All users who utilize Inyo-Mono IRWMP data should reference the data used in the Source Data section of the published map documents as follows.

Source Data: Inyo-Mono IRWMP, 2012 (or whatever year is appropriate for the data being used)

At present, the Inyo-Mono IRWM Program does not serve data up to its users; therefore it is the responsibility of the third party user to ensure the most current version of the data is being used for analyses purposes.

Plans for archiving

Due to the immense time investment of data acquisition, archiving Inyo-Mono IRWMP data will occur on a quarterly basis. Working documents will be backed up on the GIS /Data Management Coordinator's external hard drive, with additional backups hosted on the Inyo-Mono Program Office network, and triplicate copies to the ESRI or Google Cloud when appropriate.

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INYO-MONO REGIONAL WATER MANAGEMENT GROUP
PLANNING AND IMPLEMENTATION MEMORANDUM OF UNDERSTANDING

Revised Version #1
Effective Date: September 1, 2011

WHEREAS, on November 21, 2008, a Memorandum of Understanding was entered into for the Pre-Planning Phase of the Inyo-Mono Integrated Regional Water Management Plan; and

WHEREAS, this Memorandum of Understanding reflects the further development of the Plan by establishing the basis for governance and consensus; and

WHEREAS, the parties to this Memorandum of Understanding seek to provide stability and consistency in the planning, management, and coordination of water resources within the watershed of the Inyo-Mono Region pursuant to the Integrated Regional Water Management Planning Act (California Water Code section 10530 et seq.); and

WHEREAS, the parties to this Memorandum of Understanding will identify projects, establish the priority of such projects and seek funding to implement such water-related projects in the Inyo-Mono Region as part of the development of an Inyo-Mono Regional Water Management Plan; and

WHEREAS, the parties to this Memorandum of Understanding are not limited in seeking other funding for water-related projects, nor does this Memorandum of Understanding impose legally binding requirements on the parties;

NOW, THEREFORE, the parties agree as set forth below to work together in the Inyo-Mono Regional Water Management Group for the Inyo-Mono Region to carry out the purposes of this Memorandum of Understanding and develop and advance the Inyo-Mono Regional Water Management Plan.

ARTICLE I

DEFINITIONS

Section 1.01 Definitions. Unless the context requires otherwise, the words and terms defined in this Article shall have the meanings specified.

"IRWM Planning Act" or "Planning Act" means the Integrated Regional Water Management Planning Act, Part 2.2 of Division 6 of the California Water Code commencing with section 10530.

"IRWM Plan" or "Plan" has the meaning set forth in Water Code section 10534, which is a comprehensive plan for a defined geographic area, the specific development, content and adoption of which shall satisfy requirements of the Planning Act.

"Regional Water Management Group" has the meaning set forth in California Water Code section 10539, which is a group of 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.

"Inyo-Mono Region" or "Region" generally includes Inyo and Mono Counties, northern portions of San Bernardino County and the northeastern portion of Kern County as depicted in the Map attached as Exhibit "A".

"Inyo-Mono Regional Water Management Group" or "Group" means the Regional Water Management Group for the Inyo-Mono Region.

"Member of the Inyo-Mono Regional Water Management Group" or "Member" means an entity identified in California Water Code §10541 (g) that is based in the Region, has members or chapters in the Region, or has water management authority in the Region, and is a signatory to this Memorandum of Understanding. Member Representative refers to the person or persons representing the Member at meetings of the Group.

"Admin Committee" means the Administrative Working Committee as defined in Section 2.05.

"Consensus" means approval of the Member Representatives to move forward with a particular action. "Consensus" does not mean that all Member Representatives support an action, but rather that no Member Representative has voted to oppose an action. A Member Representative may abstain or not vote and that will be considered as no opposition to the action. A Member Representative may verbally note disagreement with an action but still allow consensus without the Member Representative's support. To vote, a Member Representative must be present in person or by telephone or other electronic device that enables the Member Representative to participate in the discussion. It is understood by the Group that some actions will require a decision by the governing body of one or more Members.

"Chair and Vice-Chair" means the Chairperson and Vice-Chairperson of the Administrative Working Committee.

"Cooperating Entity" means a business, organization, individual or agency that is not a Member of the Inyo-Mono Regional Water Management Group but is selected to carry out a specific project.

"**Disadvantaged Community**" or "**DAC**" means any community within the Region qualifying as a Disadvantaged Community under California law using then-current U.S. Census data.

"Fiscal Year" means the period from July 1st to and including the following June 30th.

"MOU" means this Memorandum of Understanding, as existing or as subsequently amended.

"Program Office" means Staff - personnel directed by the Group to manage daily operations and other needs. The Program Office shall preside over Group Meetings unless recused in which case the Chair or Vice-Chair of the Admin Committee shall preside.

ARTICLE II

PURPOSE AND ORGANIZATION

Section 2.01 Purpose. This MOU is entered into in accordance with the Planning Act for the purpose of forming the Group that will (1) develop, implement and periodically update the Plan, and (2) coordinate planning and actions with connected Regions. The Group shall work to:

(a) Support regional objectives and the objectives of the California Water Plan.
(b) Promote communication and cooperation within the Region in support of these objectives.
(c) Facilitate investment in projects that can minimize costs and maximize regional benefits through cooperation between Members and Cooperating Entities, through economies of scale, through projects with multiple resource benefits, or through DAC projects.
(d) Endeavor to assure an element of geographic fairness in the ranking of projects.

This MOU does not impose legally binding requirements on its Members and is not an enforceable contract or agreement. It is a statement of principles for how the Group will conduct business.

Section 2.02 Term of MOU. This MOU shall replace the MOU dated November 15, 2010. This MOU shall continue in effect until terminated by all then-current Members. Inclusion of additional Members, and/or withdrawal of Members shall not terminate this MOU.

Section 2.03 Member Representatives. Each member shall designate a Member Representative to the Group. More than one Member Representative may be appointed, but each Member shall have only one vote. A Member may appoint someone as their Member Representative notwithstanding the fact that such person is also the Member Representative for another Member. In such instances, such person shall have one vote on behalf of each Member represented.

Section 2.04 Decision Making. Decision making by the Group is based upon consensus of those Member Representatives present in person, by phone, or electronically. Where action by the governing body of one or more Members whose representative is present is required, or desirable, the matter shall not be considered approved by the Group until a decision by those governing bodies has been obtained. A Member's governing body may, in its discretion, elect to note disagreement with but "not oppose" an action, rather than disapprove it, thereby allowing the action to move forward without its endorsement.

If the Group cannot reach consensus, the matter may be referred to the Admin Committee for further work and consideration. The Group or the Admin Committee may appoint a working committee for this task. The Admin Committee or the working committee shall then report back to the Group. If consensus by the Group cannot be reached at this point, the matter is taken off the agenda. At a later point, the matter may be placed on the agenda for further consideration.

Section 2.05 Administrative Working Committee. The Admin Committee and the Program Office shall be jointly responsible for the on-going administrative work of the Group. The Admin Committee shall consist of six (6) Members who shall serve a term of two years. Three Members of the first Admin Committee shall serve a term of one year, so that there will be an orderly transition of administrative business. Members of the Admin Committee shall serve on a rotating basis so that every Member has the opportunity to serve, notwithstanding that a Member may decline to serve. Members may serve consecutive terms with approval of the Group.

Membership of the Admin Committee shall be appointed by the Group. The Admin Committee shall select a Chair and Vice Chair. Decisions by the Admin Committee shall be by consensus. Decisions by the Admin Committee are always subservient to those of the Group.

Section 2.06 Other Working Committees. Other working committees shall be appointed by the Group, or by the Admin Committee as needed.

Section 2.07 Quorum. The presence of fifty percent of the Members of the Group shall constitute a quorum for the transaction of business, except that less than a quorum may adjourn a meeting from time to time.

Section 2.08 Meetings. The various meetings of the organization shall be as follows:

(a) Members shall meet at least quarterly in a regularly scheduled meeting.
(b) The Admin Committee shall meet at least twice a year.
(c) All Member and Admin Committee meetings are open to the public and shall be publicly noticed.
(d) Other working committees shall meet as needed at a location of their own choosing and shall select their own chair as needed.
(e) Attendance at all meetings may be in person or by electronic connection.
(f) Location of meetings shall rotate throughout the planning region whenever feasible.

Section 2.09 Minutes and Agenda. The Program Office shall be responsible for maintaining a record of the activities of the Group and the Admin Committee, noticing all Group meetings, Admin Committee meetings and working committee meetings. Minutes of Group and Admin Committee meetings, and any special reports or documents, shall be distributed to the Group. Group and Admin Committee agendas shall be prepared by the Program Office in collaboration with the Admin Committee Chair or her/his designee. Any Member may request an item to be placed on the Group Agenda.

Section 2.10 Organization, Bylaws and Policies and Procedures. The Group may take another organizational form necessary to support the Inyo-Mono RWMG. The Group may amend the MOU and establish Bylaws and/or Policies and Procedures as necessary.

Section 2.11 Fiscal Agent. The Admin Committee, with approval by the Group, is responsible for establishing a Fiscal Agent with appropriate qualifications to receive, disburse and account for funds related to this MOU. Funding received by the Fiscal Agent to carry out projects shall be disbursed to Members or to Cooperating Entities only after the Fiscal Agent enters a funding agreement with the Member or Cooperating Entity as may be appropriate or required. The Fiscal Agent shall be responsible for any necessary financial reporting, including reports needed to comply with the terms of any grant agreement. The Fiscal Agent shall report annually to the Group and monthly to the Admin Committee. All fiscal reports shall be distributed to the Group.

Section 2.12 Program Office. The Group may employ professional staff or consultants as needed and within prudent fiscal constraints. The Group may accept staffing funded by members of the Group or others.

Section 2.13 Annual Budget. The Admin Committee shall develop an annual budget for each fiscal year for administrative expenses. The budget shall be based upon funds available or pledged as of

May 31st of the previous year. The budget may be modified during the fiscal year as necessary with approval by the Group. Each annual budget shall be approved by the Group.

Section 2.14 Annual Operational and Fiscal Report. The Admin Committee is responsible for preparing an annual operation and fiscal report for presentation to the Group at the end of each fiscal year. The annual report of the Fiscal Agent is part of this report.

Section 2.15 Member Withdrawal. A Member may withdraw from the Group and MOU at any time. A letter, resolution, or similar document signed by the Member's designated representative or other appropriate authority within the Member's organization shall be provided to the Group to complete the withdrawal.

Section 2.16 Member Financial Responsibility. A Member shall have no financial obligation to the Group or the Plan unless otherwise agreed to by the Member in writing. Each Member is responsible for individually contracting with the Fiscal Agent for its own project grant funding. The Group will contract separately for any grants or monies it receives.

Date: ____

Organization:____

Name and position (print):____

____

Name (signature): ____

Primary Representative:

Name: ____

Email: ____

Telephone: ____

Address: ____

Alternative Representative:

Email: ____

Telephone: ____

Address: ____

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Appendix C: CCFC Water Programs Funding Mechanism

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Energy Commission									
Geothermal Resources Development Account (GRDA)	The funds from this account come from revenues paid by geothermal developers for leases on federal land in California. Practically all aspects of geothermal research, resource development, demonstration, commercialization, planning, environmental enhancement and impact mitigation are eligible for funding.	Grant	Private entities, including individuals and private for-profit organizations; local jurisdictions including cities, counties, school districts and special districts, regional planning agencies, and public utility districts; EXCEPTION: any public utility that generates more than 50MW of electricity for sale is not eligible to apply	Solicitations are generally offered every other year. A solicitation is planned for 2014. The latest solicitation was held in May 2014, with a Notice of Proposed Awards issued in August 2014.	Approximately $3 million available per solicitation. There is no maximum or minimum award level established. Awards vary according to the application requests and the amount of funds available during a specific solicitation. In general, approximately $3 million is available per solicitation.	Public Resources Code section 3800 et seq. created the Geothermal Resources Development Account (GRDA) .		$5.8 million	www.energy.ca.gov/contracts/geothermal.html Contact: Cheryl Closson Cheryl.Closson@energy.ca.gov 916-651-0315

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Electric Program Investment Charge (EPIC)	The Energy Commission is one of four administrators of energy innovation funded by the Electric Program Investment Charge. The other administrators are the state' s three largest investor-owned utilities: Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company. The Electric Program Investment Charge was created to fund public interest investments in clean energy technologies and approaches for the benefit of electricity ratepayers of California' s three largest electric investor-owned utilities.	Grant	Public entities, educational facilities, private entities, research organizations, national laboratories.	A solicitation shedule has been posted on the Energy Commission Research page, and solicitations will be issued starting early 2014.	Funding will vary, but project funding levels are expected to range between $250,000 and $5 million.	The California Public Utilities Commission established the purposes and governance for the Electric Program Investment Charge in Decision 12-05-037 for Rulemaking 11-10-003 on May 24, 2012.	$159 million approved in FY 13/14 and $172.5 million in FY 14/15.	$70 million.	http://www.energy.ca.gov/research/epic/ Contact: Mike Gravely Mike.Gravely@energy.ca.gov 916-327-1370
Public Interest Energy Research (PIER) - Natural Gas Funding	The funds are collected from natural gas ratepayers of California Investor Owned Utilities. These funds are administered by the California Energy Commission to provide public interest natural gas research programs. The Energy Commission's PIER program supports energy related research, development and demonstration for research not adequately provided by competitive and regulated markets and that will advance science and technology and will help meet California's energy policy goals.	Grant	Public entities, educational facilities, private entities, research organizations, national laboratories.	Periodic solicitations	Varies depending on solicitation. Recent solicitations have accepted awards up to $2 million.	SB 1250 (Perata) Chapter 512, Statutes of 2006. Annual funding approved by CPUC, and funds are transferred from CPUC Gas Consumption Surcharge Fund	$24 million per year	$12 million	http://www.energy.ca.gov/research/epic/ Contact: Mike Gravely Mike.Gravely@energy.ca.gov 916-327-1370

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Energy Innovations Small Grant Program (EISG)	The Energy Innovations Small Grants Program awards grants to target one or more of the R&D energy research areas. Additionally, the awards must establish the feasibility of new, innovative energy concepts and provide a potential benefit to California electric and natural gas ratepayers.	Grant	Individuals, small business, non profit organizations, and academic institutions	Periodic solicitations, typically three times a year	$150,000 for hardware projects and $100,000 for modeling projects.	Public Goods Charge Account	$1.5 million per year	$1 million	http://www.energy.ca.gov/research/epic/Contact: Mike Gravely Mike.Gravely@energy.ca.gov916-327-1370
Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP)	Assembly Bill 118, (Nunez, Chapter 750, Statutes of 2007), amended by Assembly Bill 109 (Nunez, Chapter 313, Statutes of 2008), and Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) created the ARFVT Program which provides approximately $100 million annually to promote innovative transportation technologies that increase the use of alternative and renewable fuels, advancing California's efforts to curb greenhouse gas emissions, reduce petroleum use, improve air quality, and stimulate sustainable production and use of biofuels in California.	Grant	Vehicle and technology entities, businesses, public-private partnerships, fleet owners, consumers, academic institutions, and public agencies	Various times through each fiscal year	Varies by individual solicitation	Alternative and Renewable Fuel and Vehicle Technology Fund	As of September 16th, 2014, $77.5 million is available. FY 13/14 - $19.5 million, and FY 14/15 - $58 million.	TBD	http://www.energy.ca.gov/drive/funding Contact: Jim.McKinney jim.mckinney@energy.ca.gov 916-654-3999

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Renewable Energy and Conservation Planning Grant (RECPG) Program	The Renewable Energy and Conservation Planning Grant (RECPG) program provides funding to California counties for the development or revision of rules and policies that facilitate the development of eligible renewable energy resources, and their associated electric transmission facilities, and the processing of permits for eligible renewable energy resources.	Grant	California Counties of Fresno, Imperial, Inyo, Kern, Kings, Los Angeles, Madera, Merced, Riverside, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Stanislaus, and Tulare.	The last RECPG solicitation released was 2/2014.	Maximum amount $400,000.	AB x1 13, (PRC Section 25619 identifies the Renewable Resource Trust Fund (RRTF).The appropriation was made from the RRTF in the 2012 Budget Act (AB 1464, Blumenfield, Chapter 21, Statutes of 2012).	As of June 2014, $0.8 million is available.	TBD	www.energy.ca.gov/contracts Contact: Pablo S. Gutierrez Pablo.Gutierrez@energy.ca.gov 916-654-4663
Energy Conservation Assistance Act (ECAA) Low Interest Loans (3%)	Funds are available for low-interest loans for energy efficiency and renewable energy generation projects. This is a continuously appropriated, revolving loan program. Funds are made readily available under the solicitation as they become available through loan repayments and interest earnings or new funding.	Loan	The Energy Commission accepts loan applications on a first-come, first-served basis. Local jurisdictions, public schools, and public hospitals are all eligible to apply. State owned buildings will be able to apply by 2015.	Ongoing	The maximum loan amount is $3 million per application. There is no minimum loan amount.	Energy Conservation Assistance Act (ECAA) funds, Renewable Resources Trust Funds, American Recovery and Reinvestment Act (ARRA) funds, and bond proceeds from ECAA Tax-exempt Revenue Bonds, Proposition 39.	On-going ECAA program: $1 million available, wait list of 4 applications ($11.8 in projects). Proposition 39 - ECAA-Ed program: $2 million available, no wait list. ECAA Cap and Trade: $20 million for state-owned buildings, CSUs and UCs.	ECAA-Ed: FY 2013/2014 $25 million and FY 2014/2015 $25 million. ECAA Cap & Trade: FY 2014/2015 $25 million.	http://www.energy.ca.gov/efficiency/financing/index.html Contact:Joji Castillo jcastillo@energy.ca.gov 916-653-6471

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Department of Fire and Forestry Protection									
State Responsibility Area Fire Prevention Fund (SRAFPF) Fire Prevention Grant Program	The purpose of all SRAFPF Fire Prevention Grant Program projects is to undertake fire prevention activities aimed at reducing the risk of the effects of wildfire on habitable structures in SRAs. Projects funded by the Fire Prevention Fund will reduce the risk of fire ignition, reduce the potential for fire related damage to communities in the SRA and the natural resources of the State, and educate owners of habitable structures in the SRA about wildland fire hazards.	Grant	Local government, fire districts, community services districts, water districts and special districts with SRA within their jurisdiction, certified local conservation corps, fire safe councils, or other 501(c)(3) nonprofit organizations	Fall 2014	None	State Responsibility Area Fire Prevention Fund	$9.5 million	$9.5 million	http://calfire.ca.gov/fire_prevention/fire_prevention_fund_grants.php Contact: Sam Walker sam.walker@fire.ca.gov
California Forest Improvement Program (CFIP) Fuels Reduction	The California Forest Improvement Program (CFIP) is a forestry incentive program (cost share) that provides funds to forest landowners for management plans, RPF supervision, site preparation, tree planting, thinning, pruning, follow-up, release, land conservation, and improvement of fish and wildlife habitat. CFIP' s purpose is to encourage private and public investments in forestlands and resources within the state to ensure adequate future high quality timber supplies, related employment and other economic benefits, and to protect, maintain, and enhance the forest resource for the benefit of present and future generations.	Grant (cost share) with landowners responsible for as little as 10% of project cap rate costs	Landowners with more than 20 acres but less than 5000 acres of forestland	Continuous	Minimum acres 5, maximum $50,000 to $100,000 for reforestation projects	Various federal sources, General Fund, and Greenhouse Gas Reduction Fund	To be announced	To be announced	http://calfire.ca.gov/resource_mgt/resource_mgt_forestryassistance_cfip.php Contact: Stephen Smithstephen.smith@fire.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Forest Legacy Program (FLP)	The purpose of the Forest Legacy Program (FLP) is to protect environmentally important forestland threatened with conversion to non-forest uses, such as subdivisions for residential or commercial development. To help maintain the integrity and traditional uses of private forestlands the FLP promotes the use of permanent conservation easements. The program is entirely voluntary. Landowners who wish to participate may sell or transfer particular rights, such as the right to develop the property or to allow public access, while retaining ownership of the property and the right to use it in any way consistent with the terms of the easement. The agency or organization holding the easement is responsible for managing the rights it acquires and for monitoring compliance by the landowner. Forest management activities, including timber harvesting, hunting, fishing, and hiking are encouraged provided they are consistent with the program's purpose.	Grant	Scope: Forestlands Applicants: Landowners	Continuous but must be in before July 30 for the next available federal funding cycle	$7 million	Federal Forest Legacy Program and the Greenhouse Gas Reduction Fund	Federal is renewed each year as funding varies via federal budget process. GGRF has approximately $4 million for 2014/15.	$4-5 million	http://calfire.ca.gov/resource_mgt/resource_mgt_forestryassistance_legacy.php Contact: Jeff Calvert jeff.calvert@fire.ca.gov
Forest Pest Control	Greenhouse Gas Reduction Fund Forest Pest Control projects ensure California's forests continue to be a significant carbon storage "sink" and to reduce or avoid GHG emissions due to wildfire, loss of forest cover and pest damage. The objectives of the Forest Pest Control grant program include maintaining or increasing carbon sequestration in trees planted and retained on the project site, reduction of wildfire hazards to reduce wildfire emissions, reduction of forest pest caused tree damage and mortality, protection of forest from pest spread and future forest pest attacks, overall improvement of forest health, and utilization of biomass to offset use of fossil fuels.	Grant	Scope: Forestlands Applicants: Landowners, Native American Tribes, non federal government agencies, universities, and 501 c (3) non-profit organizations	October 1-November 21, 2014	Minimum $50,000	Greenhouse Gas Reduction Fund	$1.5 million	$1.5 million	http://calfire.ca.gov/resource_mgt/resource_mgt_pestmanagement_grants.php Contact: Tom Smith tom.smith@fire.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Urban & Community Forestry (U&CF)	Greenhouse Gas Reduction Fund Urban Forest Management projects ensure California’ s urban forests continue to be a significant carbon storage “ sink” and reduce or avoid GHG emissions by reducing energy usage in buildings.	Grant	Local government, special districts, and 501 c (3) nonprofit organizations. Projects within census defined urban areas in CA. Preference given to Cal Enviro Screen disadvantaged communities.	September 11 - November 13, 2014	Varies	Greenhouse Gas Reduction Fund	$15.7 million	$15.7 million	http://calfire.ca.gov/resource_mgt/resource_mgt_urbanforestry_grants.php# Contact: John Melvin john.melvin@fire.ca.gov
Fuel Reduction Grant Program	Greenhouse Gas Reduction Fund grants for selective removal and utilization of vegetation to reduce wildfire hazards (i.e. Fuel Reduction). Projects include thinning, pruning, brush removal, and biomass utilization. Reduce potential greenhouse gas emission from wildfires, stabilize forest carbon stocks through improved forest health and forest resilience, and reduce damage to carbon stocks.	Grant	Scope: Non-federal forestland. Applicants: Native American Tribes, non-federal agencies, or 501 c (3) nonprofit organizations.	October 1, 2014-November 21, 2014	No maximum award	Greenhouse Gas Reduction Fund	$8.3 million	$8.3 million	http://calfire.ca.gov/resource_mgt/resource_mgt_fuelreduction_grants.php Contact: Tony Mediatitony.mediati@fire.ca.gov
Watershed Reforestation and Restoration	Greenhouse Gas Reduction Fund grants for large scale reforestation and watershed restoration resulting from catastrophic wildfire or other catastrophic events. Projects include site preparation, seedlings production, planting forest trees, maintaining seedlings (release), thinning for wildfire fuel reduction, and utilization of biomass. Tree growth results in removing carbon dioxide and storing the carbon in trees. Will also reduce potential greenhouse gas emission from wildfires, stabilize forest carbon stocks through improved forest health and forest resilience, and reduce damage to carbon stocks.	Grant	Scope: Forestland. Applicants: Native American Tribes, non-federal agencies, or 501 c (3) nonprofit organizations.	October 1, 2014-November 21, 2014	No maximum award	Greenhouse Gas Reduction Fund	To be announced	To be announced	http://www.fire.ca.gov/resource_mgt/resource_mgt_GGRF_Watershed-Reforestation.php Contact: Stephen Smith Stephen.Smith@fire.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
California Association of Resources Conservation Districts (CARCD) California Forest Improvement Program (CFIP) Reforestation	Greenhouse Gas Reduction Fund California Forest Improvement Program (CFIP) cost share agreements for small forest landowners for site preparation, seedlings, planting forest trees, and release. CFIP cost share agreements administered by California Association of Resource Conservation Districts (CARCD).	Cost share agreements with landowners responsible for as little as 10% of project cap rate costs	Scope: Non-federal forestland. Landowners must own between 20 and 5,000 acres. Applicants: Landowners	October 1, 2014-December 31, 2014	State pays up to 75% to 90% of the total reforestation costs to a maximum of $100,000	Greenhouse Gas Reduction Fund	$3 million	$3 million	http://calfire.ca.gov/resource_mgt/resource_mgt_forestryassistance_cfip.php http://www.carcd.org/reforestation.aspx Contact: Stephen Smith Stephen.Smith@fire.ca.gov
Program Timberland Environmental Impact Reports (EIRs)	Greenhouse Gas Reduction Fund grants for Program Timberland Environmental Impact Reports designed to increase carbon sequestration and reduce carbon emission from wildland fires. Encourage private investment and improved long-term management of timberland resources, while promoting carbon sequestration and reducing carbon emissions through fire resiliency.	Grant	Scope: Non federal Timberlands. Applicants: Smaller nonindustrial landowners owning 5,000 acres or less of timberland in California.	To be announced - Pending BOF rulemaking	No maximum award	Greenhouse Gas Reduction Fund	$1.2 million	$0	http://www.fire.ca.gov Contact: Matthew Reischman matthew.reischman@fire.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Demonstration State Forest Research	Greenhouse Gas Reduction Fund research grants for greenhouse gas reduction projects and carbon sequestration enhancement. Develop research and monitoring on: Carbon inventory, yield and measurement methods, development of forest resiliency to fire, tradeoffs between carbon efficient healthy forests and senescent forest stands, and forest resiliency to climate change.	Grant	Scope: Forestland, State Demonstration Forests, or other off forest sites. Applicants: Universities, state and federal agencies, and other organizations or persons. Applicants must have the scientific capacity to complete a proposed research or monitoring project.	October 1, 2014-November 21, 2014	No maximum award	Greenhouse Gas Reduction Fund	$1.5 million	$1.5 million	http://calfire.ca.gov/resource_mgt/resource_mgt_stateforests_GGRF.php Contact: Helge Eng helge.eng@fire.ca.gov
Department of Fish and Wildlife									
Fisheries Restoration Grants Program	The Program supports grants restoring anadromous salmon and steelhead habitat in coastal streams and watersheds from San Diego to Del Norte counties. Grants target projects that will directly contribute to the restoration and recovery of salmon and steelhead trout. The program supports a wide array of project types including riparian and stream restoration, sediment reduction, fish passage improvement, technical and public education, water conservation, and organizational support.	Grant	public agencies, Native American Indian Tribes, and nonprofit organizations.	Applications accepted in February of each year.	None	Federal grant funds (Pacific Coast Salmon Recovery Fund) and State funds (Proposition 84, Steelhead Report Card Program, Salmon Stamp Program)	Amount of funds available each year depends on Federal grant funds received and State funds available. Funds are awarded in a competitive proposal process.	Funds are awarded approximately 12 months after proposals are received, following review, ranking, and Director approval.	http://www.dfg.ca.gov/fish/Administration/Grants/FRGP/index.asp Contact: Patty Forbes patty.forbes@wildlife.ca.gov 916-327-8842

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Ecosystem Restoration Program (ERP)	The program is a multi-agency effort aimed at improving and increasing aquatic and terrestrial habitats and ecological function in the Sacramento-San Joaquin Delta and its tributaries. The ERP implements restoration projects through grants administered by the ERP Grants Program. The vast majority of these projects focus on fish passage issues, species assessment, ecological processes, environmental water quality, or habitat restoration.	Grant	public agencies, Native American Tribes, nonprofit organizations	Ongoing	None	Propositions 204, 50, and 84	Current funding allows for a limited competitive soliciation. Currently seeking competive applications for Fish Predator Research. A total of $1 milliion has been identified for this purpose.	Up to $1 million may be awarded withiin FY14/15. Funds are awarded after going through independent scientific review, review by Implementing Agency Managers, and Director approval.	http://www.dfg.ca.gov/erp/grants_projects.asp Contact: Kevin Fleming kevin.fleming@wildlife.ca.gov 916-445-1739

California State Parks

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Local Assistance Quagga and Zebra Mussel Infestation Prevention Grant Program	The Department of Parks and Recreation, Division of Boating and Waterways' (DBW) mission is to provide safe and convenient public access to California's waterways. DBW can fulfill this mission, in part, through the Quagga and Zebra Mussel (dreissenid mussel) Infestation Prevention Grant Program. This grant program assists cities, counties, districts, marinas and other governmental agencies, in the prevention, through education, monitoring and management of recreational activities in reservoirs from the infestation of the quagga and zebra mussel. Defined under California Water Code, Division 3, Part 1, Chapter 1, Section 6004.5, a " reservoir" is referred to as " any reservoir which contains or will contain the water impounded by a dam."	Grant	Includes, but not limited to; cities, counties, districts, marinas, and other governmental agencies and authorities, including private entities, nonprofit organizations (501)[c][3], and federally-recognized Indian Tribes.	August 20 each year.	$200,000	Harbors and Watercraft Revolving Fund	$2.5 million	FY 2014/15 funding for the program is $2.5 million	http://dbw.parks.ca.gov/Funding/QZGrant.aspx Robin Turgeon 916.327.1851 Robin.Turgeon@parks.ca.gov
DBW Local Assistance Floating Restroom Grant Program	The Floating Restroom Grant Program provides floating restroom units to lakes and reservoirs across California. The Division of Boating and Waterways (DBW) procures, delivers, and grants the DBW-designed and developed specialized floating restroom to the recipient. The grant recipient then places the floating restrooms at on-water locations convenient to boaters and maintains the units for a minimum of 10 years. The Clean Vessel Act grant program also offers maintenance and rehabilitation funds for the floating restrooms.	Grant	Local, State, and Federal governmental entities that operate public boating facilities on inland lakes or reservoirs.	Applications accepted on a continuous basis	Average grant for a floating restroom is approximately $70,000	Combination of Harbors and Watercraft Revolving Fund and federal Clean Vessel Act funds	Annual Program - Future funding is dependent on Federal and State appropriations.	FY2014/15 funding for the program is $1.425 million	www.dbw.ca.gov/Funding/Pumpout.aspx Contact: Ron Kent Ron.Kent@parks.ca.gov 916-327-1819

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Local Assistance Pumpout Facility Grant Program	The Pumpout Facility Grant Program funds the construction and maintenance of pumpout and dump stations to service recreational vessels. The program also includes an education component to promote public awareness about boat sewage and its proper disposal. The funding source is the federal Clean Vessel Act (CVA) fund. Boating and Waterways is the designated state entity responsible for implementing the CVA program in California and the US Fish and Wildlife Service is the responsible federal agency.	Grant	Local and State governmental entities and private businesses that own and operate boating facilities that are open to the general public.	Beginning of every month	Average grant for a Pumpout facility is between $20,000 and $50,000.	Clean Vessel Act fund from the federal Sport Fish Restoration and Boating Trust Fund (formally known as Wallop-Breaux). CVA funding requires a minimum 25% local match.	Annual Program - Future funding is dependent on Federal appropriations.	FY2014/15 funding for the program is $637,000 for Pumpout Facility Grants and $615,000 for education	www.dbw.ca.gov/Funding/Pumpout.aspx Contact: Ron KentRon.Kent@parks.ca.gov 916-327-1819
National Boating Infrastructure Grant Program, administered by DBW	The Boating Infrastructure Grant program is designed to provide transient dockage for recreational boats 26 feet or more in length for recreational opportunities and safe harbors, as well as: 1.enhance access to recreational, historic, cultural and scenic resources; 2.strengthen community ties to the water' s edge and economic benefits; 3. promote public/private partnerships and entrepreneurial opportunities; 4. provide continuity of public access to the shore; and, 5.promote awareness of transient boating opportunities	Grant	Local government agencies and private businesses	September 15 of each year	Tier I, up to $100,000. Tier II, up to $1.5 million	federal Sport Fish Restoration and Boating Trust Fund.	Annual Program - Future funding is dependent on Federal appropriations.	FY2014/15 funding for the Boating Infrastructure Grant Program is $-0-	http://www.dbw.ca.gov/Funding/BIG.aspx Email: Ron.Kent@parks.ca.gov Phone: 916-327-1819

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Local Assistance Boat Launching Facility Grant Program	In accordance with Section 72.5 of the Harbors and Navigation Code, Boat Launching Facility (BLF) grants are provided to local government agencies for the construction or improvement of boat launching ramps, restrooms, boarding floats, shore protection, parking for vehicles and boat trailers, utilities, landscaping, irrigation, and ancillary items. Also included in the grant are monies to pay for engineering, construction inspection, permits from regulatory agencies, special studies, contract advertising, construction contingency, and other project related costs. The primary purpose of the grant is to provide and improve access to California' s waterways by the recreational boating public using trailer able watercraft.	Grant	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications due in February of each year.	No Minimum or Maximum.	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $5.075 million	http://www.dbw.ca.gov/Funding/Facilities.aspx#BLFG Contact: Keren Dill keren.dill@parks.ca.gov 916-327-1809
DBW Local Assistance, Statewide Ramp Repair and Modification Grant Program	The Statewide Ramp Repair and Modification Grant Program provides grant funding to public agencies to make minor repairs or necessary expansions to boat ramps at public boat launching facilities. The intent of this program is to quickly restore safe and convenient public boating access by correcting public health and safety issues found at boat launching facilities or by widening or extending existing boat ramps as needed at DBW-funded launching facilities. Typical grant-funded items include repairing or replacing boat ramps, boarding floats, restroom and parking facilities and repairing erosion and other damage resulting from winter storms, accidents, and wildfires, etc.	Grant	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications accepted on a continuous basis	Maximum available is $1,000,000. Typical grants are between $10,000 and $250,000.	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $1,000,000	http://www.dbw.ca.gov/Funding/ Contact: Keren Dill Keren.Dill@parks.ca.gov 916-327-1809

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Local Assistance, Statewide Ramp Repair and Modification Grant Program	The Statewide Ramp Repair and Modification Grant Program provides grant funding to public agencies to make minor repairs or necessary expansions to boat ramps at public boat launching facilities. The intent of this program is to quickly restore safe and convenient public boating access by correcting public health and safety issues found at boat launching facilities or by widening or extending existing boat ramps as needed at DBW-funded launching facilities. Typical grant-funded items include repairing or replacing boat ramps, boarding floats, restroom and parking facilities and repairing erosion and other damage resulting from winter storms, accidents, and wildfires, etc.	Grant	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications accepted on a continuous basis	Maximum available is $1,000,000. Typical grants are between $10,000 and $250,000.	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2013/14 budget appropriation is $1 million	http://www.dbw.ca.gov/Funding/ Contact: Steve.WatanabeSteve.Watanabe@parks.ca.gov 916-327-1785
DBW Local Assistance, Statewide Non-Motorized Boat Launching Facility Grant Program	The Statewide Non-Motorized Boat Launching Facility Grant Program provides funding to create or improve public non-motorized boating access. Typical grant-funded items include the construction of small, hand-launched boat ramps, small parking lots, and restrooms.	Grant	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications due in February of each year.	Maximum available is $1,000,000. Typical grants are between $10,000 and $500,000 depending on the project	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $1,000,000	http://www.dbw.ca.gov/Funding/ Contact: Keren Dill Keren.Dill@parks.ca.gov 916-327-1809

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Local Assistance, Statewide Sign Grant Program	The Statewide Sign Grant Program installs and replaces signs for previously funded Boating and Waterways projects that are either obsolete, display incorrect information, badly worn and unattractive, missing or damaged, are needed for safety, or are required as a condition of receiving federal funds.	Grant	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications accepted on a continuous basis	Typical grants are from $1,000 - $7,000 depending on the project	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $150,000	http://www.dbw.ca.gov/Funding/ Contact: Keren Dill Keren.Dill@parks.ca.gov 916-327-1809
DBW Local Assistance Public Small Craft Harbor Loan Program	In accordance with Section 71.4 of the Harbors and Navigation Code, the Local Assistance Public Small Craft Harbor Loan Program provides loans to local government agencies for the construction of new small craft harbors or for the expansion or improvement of existing marina facilities. Typical project features that can be funded include boat berthing, breakwater construction, construction dredging, harbormaster buildings, fuel docks, boat sewage pump-out facilities, restrooms, utilities and landscaping. Facilities that will be rented or leased to commercial or concession enterprises are not eligible to receive public loan funds.	Loan	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications due in February of each year.	No Minimum or Maximum.	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $7.9 million	http://www.dbw.ca.gov/Funding/Facilities.aspx#BLFG Contact: Keren Dill keren.dill@parks.ca.gov 916-327-1809

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
DBW Private Small Craft Harbor Loan Program	In accordance with Article 5 of the Harbors and Navigation Code, the Private Small Craft Harbor Loan Program provides loans to private marina owners to develop or improve privately owned boating facilities that are open to the public. Project features that can be funded include boat berthing, breakwater construction, construction dredging, harbormaster buildings, fuel docks, boat sewage pump-out facilities, restrooms, and utilities.	Loan	Private Business	Applications due in February of each year.	Maximum available in FY2014/15 is $-0-	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $-0-	http://www.dbw.ca.gov/Funding/Facilities.aspx#BLFG Contact: Keren Dill keren.dill@parks.ca.gov 916-327-1809
DBW Local Assistance Public Small Craft Harbor Loan Program - Statewide Planning Loans	The Local Assistance Statewide Planning Loan Program provides loans to local government agencies for the preparation of small craft harbor feasibility reports and permits. Feasibility reports generally contain preliminary engineering and economic studies of the proposed project.	Loan	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications due in February of each year.	Maximum available in FY2014/15 is $-0-	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $-0-	http://www.dbw.ca.gov/Funding/Facilities.aspx#BLFG Contact: Keren Dillkeren.dill@parks.ca.gov 916-327-1809
DBW Local Assistance Public Small Craft Harbor Loan Program - Statewide Emergency Loans	The Local Assistance Statewide Emergency Loan Program provides loans to local government agencies to repair damage to marinas caused by unforeseen events such as acts of nature. Project features that can be funded include boat berthing, breakwater construction, construction dredging, harbor master buildings, fuel docks, boat sewage pump-out facilities, restrooms, and utilities. Facilities that will be rented or leased to commercial or concession enterprises are not eligible to receive public loan funds.	Loan	Local government agencies including cities, counties, the federal government, recreation districts, irrigation districts, and tax districts, among others.	Applications accepted on a continuous basis	Maximum available in FY2014/15 is $-0-	Harbors and Watercraft Revolving Fund	Annual Program - Future funding is dependent on State appropriations.	FY2014/15 budget appropriation is $-0-	http://www.dbw.ca.gov/Funding/Facilities.aspx#BLFG Contact: Keren Dill keren.dill@parks.ca.gov 916-327-1809

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Aquatic Center Boating Safety Education Grants	Section 668.2 of the Harbors and Navigation Code allows the Division of Boating and Waterways to distribute funding to enhance boaters' knowledge of boating laws, practical handling of vessels on the water, weather and water conditions, rules of the road, equipment requirements and environmental stewardship.	Grant	Local public agencies,nonprofit organizations, and colleges and universities operating within California.	Every two years in the Fall.	Maximum of $42,000 per year.	US Coast Guard Federal Trust Funds	Approximately $1.1 million is available each year	Approximately $1.1 million	www.dbw.ca.gov Contact: Amy.Rigby@parks.ca.gov Joleane.King@parks.ca.gov
Law Enforcement Financial Aid Program	This program provides state financial aid to local government agencies whose waterways have high usage of boaters and insuffuciate tax base to fully fund a marine law enforcement boating safety program.	Cooperative agreement	Local government agencies (county's and/or cities that fall within that county)	Must submit application 14 months prior to the start of the fiscal year.	Agencies have a set allocation and receive the same amount yearly. Varies by agency based on size of waterways.	Harbors and Watercraft Revolving Funds Local assistance	10.6 million annually to 36 County's and 2 City's.	10.6 million for 2014/2015 FY	http://www.dbw.ca.gov/Funding/subvention.aspx Contact: Corrina Dugger corrina.dugger@parks.ca.gov 916-327-1834
Abandoned Vessel Turn -In Program (VTIP)	Public agencies may apply for grants to remove, store and dispose of abandoned and surrendered recreational vessels and other navigational hazards.	Grant	Local government agencies (county's and/or cities that fall within that county)	Must submit application 14 months prior to the start of the fiscal year.	Agencies have a set allocation and receive the same amount yearly. Varies by agency based on size of waterways.	Harbors and Watercraft Revolving Funds Local assistance	Budgeted amounts range from $75,000-500,000 annually	$1,350,000 for FY 14/15	http://www.dbw.ca.gov/Funding/AWAF.aspx Contact: Susan Sykes susan.sykes@parks.ca.gov 916 327-1825

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Boating Law Enforcement Training	The program provides training courses statewide to law enforcement officers, lifeguards, harbor patrol officers, and others that work in a marine patrol environment.	Grant	Local public agencies that provide marine patrol and meet federal grant requirements	Continuous	Varies	Federal Grant Recreational Boating Safety Program	Approx. $400,000 per year	$500,000	http://www.dbw.ca.gov/LawEnforce/LawEnfTrain.aspxContact: Brian Carrollbrian.carroll@parks.ca.gov916-327-1835
Law Enforcement Equipment Grant Program	This program provides grants to local governement agencies for the purchase of boating saftey and law enforcement marine patrol equipment (patrol boats, personal watercrat, engines, search and rescue equipment, dive gear etc)	Grants	Local government agencies	April 30th of each year	$80,000 per agency	Federal funds; USCG/Homeland Secuirty	$900,000 -$ 2.1 million	$1,075,000	http://www.dbw.ca.gov/Funding/bseqgrant.aspx Contact: Corrina Dugger corrina.dugger@parks.ca.gov 916-327-1834

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Habitat Conservation Fund Program	The California Wildlife Protection Act of 1990, Chapter 9, Fish and Game Code 2780-2799.6 was enacted to provide funding in the Habitat Conservation Fund. Funding categories include the following: (a) The acquisition of habitat, including native oak woodlands, necessary to protect deer and mountain lions. (b) The acquisition of habitat to protect rare, endangered, threatened, or fully protected species. (c) The acquisition of habitat to further implement the Habitat Conservation Program. (d) The acquisition, enhancement, or restoration of wetlands. (e) The acquisition, restoration, or enhancement, of aquatic habitat for spawning and rearing of anadromous salmonids and trout resources. (f) The acquisition, restoration, or enhancement of riparian habitat. (g) The acquisition or development of wildlife corridors and urban trails, which bring urban residents into park and wildlife areas. (h) Nature interpretation, educational, or other enrichment programs that bring urban residents into park and wildlife areas.	Grant	Cities, counties, districts.	On an annual basis, applications are due on the first work day in October.	No minimum or maximum amounts.	California Wildlife Protection Act of 1990, Chapter 9, Fish and Game Code 2780-2799.6	Annual Program which expires in 2020. Approximately $2 million is available each year.	Approximately $2 million.	http://www.parks.ca.gov/?Page_id=21361 Contact: Barbara.Baker barbara.baker@parks.ca.gov 916-651-7743

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Land and Water Conservation Fund Program	The program, which is administered nationally by the National Park Service was established in September 1964, initially authorized for a 25-year period, and has been extended for another 25 years, to January 2015. Under the provisions of the California Outdoor Recreation Resources Plan Act of 1967, the expenditure of funds allocated to California is administered by the State Liaison Officer, who is the Director of the State Department of Parks and Recreation. Projects under this program may include: Acquisition or development of outdoor recreation areas and facilities. Priority development projects include trails, campgrounds, picnic areas, natural areas and cultural areas for recreational use. Property acquired or developed under the program must be retained in perpetuity for public outdoor recreation use.	Grant	Counties, cities, recreation and park districts, special districts with authority to acquire, develop, operate, and maintain public park and recreation areas.	On an annual basis, application are due on the first workday in February.	No minimum or maximum amounts.	National Park Service (Federal) - Federal Trust Fund	Annual Program	Approximately $1.7 million.	http://www.parks.ca.gov/default.asp?Page_id=21360 Contact: Richard.Rendon richard.rendon@parks.ca.gov 916-651-7600
Recreational Trails Program (Motorized)	Motorized Recreational Trails Program funds are provided for the acquisition, development, rehabilitation, construction or maintenance of motorized trails. Funds can also be used to develop or rehabilitate trailside and trailhead facilities, purchase and lease trail equipment, and develop and disseminate safety and enviornmental protection publications and programs. The Moving Ahead for Progress in the 21st Century (MAP-21) provides the RTP funidng and sunsets on September 30, 2014. Grant applications are due January 6, 2014 for the upcoming cycle.	Grant	Cities, counties, districts, state agencies, federal agencies, and non-profit entities.	The new cycle will begin January 6, 2014. Future cycles are dependent upon Federal and State appropriations.	No minimum or maximum amounts.	Federal Highway Funds - Recreational Trails Fund	Annual Program - Future funding is dependent upon Federal and State appropriations.	$1.6 million in the current cycle.	http://ohv.parks.ca.govContact:Noelle Nicholsnoelle.nichols@parks.ca.gov916-322-3085

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Certified Local Government Program (CLG)	A minimum of ten percent of California's annual allocation of federal funds received through the Historic Preservation Fund Grants Program must be sub granted to certified local governments. Funds must be used for local preservation planning.	Grant	Certified Local Governments	On an annual basis, beginning in February and extending through April.	$2,500 Minimum $24,900 Maximum	Historic Preservation Fund - Federal Trust Fund	Annual Program based on the federal budget.	$170,000	http://ohp.parks.ca.gov Contact: Lucinda Woodward lucinda.woodward@parks.ca.gov 916-445-7028
OHV Grants Program	The program provides for well-managed, sustainable, off-highway vehicle recreation in California by providing financial assistance to eligible agencies and organizations. Grants are available for Operation and Maintenance, Restoration, Law Enforcement, and Education and Safety.	Grant and Cooperative Agreements	Local, state and federal agencies, educational institutions, districts, federally recognized Native American Tribes, and non-profit entities.	On an annual basis, the application period begins the second Monday of January and extends through the first Monday of March.	Maximum awards range from $200K to $1.5M depending on the category, with the exception of restoration grants which have no maximum. Minimum award amount is $10K.	OHV Trust Fund	$26 million	$26 million	http://ohv.parks.ca.gov Contact: Sixto Fernandez sixto.fernandez@parks.ca.gov 916-324-1572
OHV Grants Program	The program provides for well-managed, sustainable, off-highway vehicle recreation in California by providing financial assistance to eligible agencies and organizations. Grants are available for Operation and Maintenance, Restoration, Law Enforcement, and Education and Safety.	Grant and Cooperative Agreements	Local, state and federal agencies, educational institutions, districts, federally recognized Native American Tribes, and non-profit entities.	On an annual basis, the application period begins the second Monday of January and extends through the first Monday of March.	Maximum awards range from $200K to $1.5M depending on the category, with the exception of restoration grants which have no maximum. Minimum award amount is $10K.	OHV Trust Fund	$10 million	$10 million	http://ohv.parks.ca.gov Contact: Sixto Fernandez sixto.fernandez@parks.ca.gov 916-324-1572

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Department of Water Resources									
Flood Corridor Program	This statewide program funds multi-objective, flood risk reduction projects that protect and restore floodplains and preserve or enhance wildlife habitat and agriculture. The program funds primarily non-structural projects, including acquiring and conserving floodplains, removing structures and precluding development in flood prone areas, and constructing earthen detention basins, along with restoring habitat and protecting agricultural land. Setback levees are also included when they enable a more naturally functioning floodplain. Flood Corridor Program includes three flood protection grant programs: • Flood Protection Corridor Program (Propositions 13 and 84); • Floodway Corridor Program (Proposition 1E); and • Central Valley Nonstructural Grants Program (Proposition 1E).	Grant	Local public agencies (county, city, district or joint powers authority), nonprofit organizations, California Native American Tribes registered as a nonprofit organization or partner of a nonprofit or local public agency. Also, direct expenditure funding to other government agencies (local, State, or federal), nonprofit organizations, or contractors for projects proposed by DWR that are in the State' s interest to fulfill program goals.	Proposal Solicitation Package expected in Spring 2015	Maximum - $5 million (which may be increased with Director's approval if necessary to achieve the goals of the program). No minimum.	Propositions 13, 84, 1E	Approximately $14 million	0	http://www.water.ca.gov/grantsloans/grants/corridor.cfm Contact: David Wright david.wright@water.ca.gov 916-574-1191
Drainage Reuse Grant Program	Funded projects must contribute to the improvement of drainage management methods and enhance existing knowledge of drainage mitigation opportunities. Funding is for programs that develop beneficial uses of agricultural drainage water, including desalination, removal of toxic trace elements, reuse of drainage water, and recycling or harvesting of salts.	Grant	Local agencies including any city, county, district, joint powers authority, or other political subdivision of the state (including public universities) involved with water management.	October 2014	$300,000 per project	Prop 204	$2 million	$2 million	www.water.ca.gov/drainage Contact: Jose Faria jose.faria@water.ca.gov 559-230-3339

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Integrated Regional Water Management (IRWM)	Grant funds for development and revisions of IRWM Plans, and implementation of projects in IRWM Plans. Goals of Projects: to assist local public agencies to meet long-term water management needs of the State, including the delivery of safe drinking water, flood risk reduction, and protection of water quality and the environment.	Grant	Applicant must be a local public agency or nonprofit representing an accepted IRWM Region. Other IRWM partners may access funds through their own agreements with the applicant/grantee.	Round 3 implementation grant is tentatively scheduled for fall 2015.	Bond funding allocation for entire program is $1 billion Prop 84 allots grant funding to 11 funding areas. Guidelines contain information on how potential funding of multiple IRWM efforts within a funding area will occur and maximum grant amount per funding area. The Proposal Solicitation Package will have predetermined amount of funds available.	Proposition 84 (Chapter 2, § 75026)	$251 million remains unawarded. This amount is already appropriated to DWR.	No awards will occur in the next 6 months	www.water.ca.gov/irwm/grants/index.cfm Contact: Zaffar Eusuff Muzaffar.Eusuff@water.ca.gov 916-651-9266

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Local Levee Assistance Program (LLAP)	LLAP funds flood risk reduction projects for evaluation, design, and repair of levees and other flood control structures statewide. The program utilizes two primary strategies to provide assistance, the Local Levee Critical Repair (LLCR) and Local Levee Evaluation (LOLE).	Grant	Local public agencies Levees located outside of the Delta Levees that are not part of the State Plan of Flood Control (SPFC).	LLAP plans to solicit for new projects in late 2014	LOLE - $2 million per application; LLCR - $5 million per application	Prop 84	At least $13 million	up to $13 million.	http://www.water.ca.gov/floodsaf e Contact: David Wright david.wright@water.ca.gov 916-574-1191
Flood Control Subventions Program (FCSP)	Implementation of federally-authorized flood control projects (minor or major) and Watershed Protection Flood Prevention Projects	Funds (Claims Reimb.)	Local public agencies not part of State Plan of Flood Control	Claim submittals accepted on continuous basis Claims paid based on available State funding	Projects receive reimbursement of State cost-share as approved by the Legislature for the specific project.	Prop 84 and 1E	$255 million	$50 million will be awarded/committed to existing projects in Spring 2015.	http://www.water.ca.gov/flood mgmt/fpo/sgb/fcs/ Contact: Nahideh Madankar Nahideh.Madankar@water.ca.g ov 916-574-1459
Urban Streams Restoration Program	Program provides grants for stream restoration projects that reduce flooding or erosion and associated property damages; restore, enhance, or protect the natural environment; and promote community involvement, education, and stewardship in urban streams.	Grant	Combined sponsorship between Local government agencies and citizens groups/nonprofits	Solicitation will begin in September/October of 2014.	$1 million per eligible project	Prop 84 and Prop 13	$8 million in combined Prop 84/13 funds.	$8 million will be awarded in the next 6 months.	http://www.water.ca.gov/ur banstreams/ Contact: Amy Young Amy.Young@water.ca.gov 916-651-9626

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Water Security, Clean Drinking Water Coastal and Beach Protection Act of 2002	Contaminant treatment or removal technology pilot and demonstration studies	Grant	Eligible applicants are public water systems under the regulatory jurisdiction of CDPH.	Ongoing	Up to $5 million per grant	Proposition 50 (Chapter 6 Section 79545(b))	$10 million available	$3 million	http://www.water.ca.gov/grantsloans/grants/prop50sdw.cfm Contact: Steve Giambrone Steven.Giambrone@water.ca.gov 916-653-9722
Water Security, Clean Drinking Water Coastal and Beach Protection Act of 2002	Drinking water disinfecting projects using UV technology and ozone treatment	Grant	Eligible applicants are public water systems under the regulatory jurisdiction of CDPH	Ongoing	Up to $5 million per grant	Proposition 50 (Chapter 6 Section 79545(c))	$15 million remaining. (25% of funds will be allocated to disadvantaged communities)	$2 million	http://www.water.ca.gov/grantsloans/grants/prop50sdw.cfm Contact: Steve Giambrone Steven.Giambrone@water.ca.gov 916-653-9722
Small Community Flood Risk Reduction (SCFRR)	Projects to reduce flood risk in small, communities in the Central Valley. Funds support non-routine O&M, O&M plan updates, evaluations, feasibility studies, design, and construction of proactive repairs to flood control facilities of the SPFC and appurtenant non-SPFC levees.	Grant	Local Agencies: evaluate SPFC facilities that protect small communities in the Central Valley designated by the CVFPP to have a High or Moderate-High Flood Threat Level.	SCFRR is preparing Guidelines and plans to solicit projects in spring 2015.	No limit has been established at this time	Prop 1E	$40 million	0	http://www.water.ca.gov/floodsafe/ Contact: Constantin Mercea Constantin.mercea@water.ca.gov 916-574-1429

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Urban Flood Risk Reduction (UFRR)	Levee repair or improvement projects within the Central Valley that are located within the urban area and are State Plan of Flood Control facilities.	Grant	Eligible applications are local public agencies or Joint Powers Authority	Draft Guidelines and solicitation package were released for public comment period in summer 2014. Final Guidelines and solicitation package expected to be released winter 2014.	$200 million max per project.	Prop 1E	$155 million	Up to $155 million	http://www.water.ca.gov/floodsafe/ Contact:Kelly Fucciolo kfucciol@water.ca.gov 916-574-0918

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
California Safe Drinking Water Bond Law of 1988	Projects that help meet the Safe Drinking Water Standards	Grant/Loan	Private Systems: Any person, partnership, corporation, association, tribes, or other entity or political subdivision of the state which owns or operates a domestic water system. Public Agencies: Any city, county, city and county, district, joint powers authority, or other political subdivision of the state which owns or operates a domestic water system.	Ongoing	Please contact program staff for funding limits	Prop 81	$6 million	$1 million	http://www.water.ca.gov/ Contact: Jeremy Callihan Jeremy.Callihan@water.ca.gov 916-653-4763
Water-Energy Grant Program	The Water-Energy Grant Program provides funds to implement water efficiency programs or projects that reduce greenhouse gas emissions, and reduce water and energy use.	Grant	Local agencies,Joint powers authorities,Nonprofit organizationsCalifornia Native American Tribes are eligible if they meet the above requirements.	Release of Final Proposal Solicitation Package anticipated in October 2014 with applications due in December 2014	Max -$2.5 million per proposal; $5.0 million per applicant	Greenhouse Gas Reduction Fund (Health and Safety Code § 39710 et seq.)	$19 million	No awards will occur in the next 6 months (Awards anticipated in early May 2015)	http://www.water.ca.gov/waterenergygrant/index.cfm Contact: Laura Peters(916) 653-7912

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Regional Flood Management Planning	The Regional Flood Management Planning (RFMP) effort will work with local entities to collect existing information and data to formulate and assess flood management solutions and strategies that reflect the vision, feasibility projects, assess the performance of the projects, and develop a plan that reflects the vision of local entities in reducing flood risks in their region. DWR is providing guidance as well as technical and financial assistance to local agencies to prepare regional flood management plans that formulate and prioritize the proposed projects and strategies in each region. The RFMP goals are: * Encourage regional governance * Promote multibenefit solutions to flood problems * Identify solutions and set regional priorities *Assess costs/benefits of proposed solutions and set financial strategies to implement	Direct Funding	A California local public agency with responsibility for flood management in the region that is a part of the area protected by the facilities of the SPFC that is willing to participate in, coordinate, and collaborate with other interested parties in the region that are participating in the development of their RFMP.	October 2012	Up to $10 million	Prop 1E	$10 million	Up to $10 million	http://www.water.ca.gov/cvfmp/regionalplan Email: rfmp@water.ca.gov David Wright 916-574-1191
Flood Emergency Response Grants Program: Statewide Grants	The Statewide Grants are led through the FloodSAFE initiative which is designed to improve flood management in the State. The objective of the grant is to improve local flood emergency response in California and contribute to increased public safety.	Grant	California Public Agencies with primary responsibility for flood emergency response and coordination.	Varies	Varies	Prop 84	$10 million. The total amount allocated for Statewide Grants is $15 million; the first round of $5 million has been awarded, the second round is at the beginning of the process and will be followed by round 3.	$5 million.	http://www.water.ca.gov/floodsafe/grants/ Contact: John Paasch john.paasch@water.ca.gov 915-574-2611

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Flood Emergency Response Grants Program: Delta Flood ER Grant	The objective of the Flood Emergency Response Grant is to improve local flood emergency response in California and contribute to increased public safety. The " Disaster Preparedness & Flood Protection Bond Act of 2006" (Proposition 1E) makes funding available to improve local flood emergency response. Examples of eligible projects include: • Preparing or updating the local flood emergency plan, • Coordinating flood emergency planning and preparedness, including training and exercises, • Developing processes to effectively communicate and coordinate response to flood emergencies, • Collecting and exchanging flood information, and • Purchasing and installing equipment needed for emergency communication and more.	Grant	California Public Agencies within the legal delta including primary and secondary zones with primary responsibility for flood emergency response and coordination.	Varies	Varies	Prop 1E ($10M) Prop 84 ($5 million, which has already been rewarded)	$10 million. The total amount allocated for the Delta Grants is $15 million; the first round of $5 million was awarded using P84 funds. The remaining $10 million will be from P1E funds.	$5 million	http://www.water.ca.gov/floodsafe/grants/ Contact: John Paasch john.paasch@water.ca.gov 915-574-2611

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Flood Emergency Response Grants Program:F-CO Grants	This is a direct Grant Program designed only for the implementation of the Forecast-Coordinated Operation Program. The typical activities funded under this Grant Program include:• Improvement of watershed and reservoir operation data collection, dissemination, and exchange.• Purchase and installation of equipment needed for data collection, storage, exchange, and for operation of the DSS.• Enhancement of watershed and river forecasting tools including watershed models, reservoir operation models, river routing models, and development of ensembles in forecasting and other tools.• Flood emergency training and exercises to improve coordinated reservoir operation and to ensure efficiency in the use of tools, models and processes developed for F-CO.	Grant	Federal agencies, State agencies, or California Local Public agencies with responsibility for operating a reservoir that has a flood control reservation pool and is willing to participate in the Forecast-Coordinated Operations program and willing to coordinate its reservoir releases with other reservoir operators in the river system during flood events.	Varies	Varies	Prop 1E	$4.184 million	$1.7 million	http://www.water.ca.gov/floodsafe/grants/Contact: Sudhakar Talankisudhakar.talanki@water.ca.gov915-574-2612
State Water Resources Control Board									
Water Recycling	The Program promotes the beneficial use of treated municipal wastewater (water recycling) in order to augment or offset fresh water supplies in California by providing technical and financial assistance to agencies and other stakeholders in support of water recycling projects and research.	Grants/ Loans	Planning: Public Agencies; Construction: Public Agencies	Applications are accepted on a continuous basis	Planning Grants: 50% of total study costs ($75,000 max); Construction Grants: 25% of total project costs ($4 million max); Construction Loans: none	Proposition 13	$8 million combined for Planning and Construction Grants. Construction Grants currently committed.	Approx $6 million	http://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/ Contact: Dan Newton daniel.newton@waterboards.ca.gov 916-324-8404

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Agricultural Drainage Loan Program	The Program loans funds for treatment, storage, conveyance, or disposal of agricultural drainage water	Loan	City, county, district, joint powers authority or other political subdivision of the State involved with water management	Continuous	$20 million max for implementation; $100,000 max for feasibility study	Water Conservation and Quality Bond Law of 1986	$5.1 million	TBD	www.waterboards.ca.govContact: Conny Mitterhoferconny.mitterhofer@waterboards.ca.gov916-341-5720
Agricultural Drainage Management Loan Program	The Program loans funds for treatment, storage, conveyance, or disposal of agricultural drainage water	Loan	City, county, district, joint powers authority or other political subdivision of the State involved with water management	Continuous	Varies	Proposition 204	$11.9 million	TBD	www.waterboards.ca.gov Contact: Conny Mitterhofer conny.mitterhofer@waterboards.ca.gov 916-341-5720
Federal Clean Water Act Section 319	The Program grants funds to implement watershed based plans to control nonpoint sources of pollution to restore impaired waterbodies.	Grant	Public agencies, non-profit organizations, federally recognized tribes	Annual solicitation late summer of early fall	Varies (see yearly solicitation)	CWA 319(h)	Approximately $4 million per year	Approximately $4 million	http://www.waterboards.ca.gov/water_issues/programs/grants_loans/319h/index.shtml Contact:Patricia Leary Patricia.Leary@waterboards.ca.gov 916-341-5167

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Cleanup and Abatement Account	The Program provides public agencies, as well as certain not-for-profit organizations and tribal governments with grants for the cleanup or abatement of a condition of pollution when there are no viable responsible parties available to undertake the work.	Grant	Public agencies, certain not-for-profit organizations and tribal governments with authority to clean up or abate a waste.	Continuous	None	Cleanup and Abatement Account (Water Code Sections 13340-13443)	Approximately $5 million	TBD	www.waterboards.ca.gov Contact: Conny Mitterhofer conny.mitterhofer@waterboards.ca.gov 916-341-5720
Orphan Site Cleanup Fund	Program grants funds to eligible applicants to cleanup Brownfield sites impacted by leaking petroleum USTs where there is no viable financially responsible party	Grant	All entities with exception of Federal/State Agencies	On-going	Max award is $1.5 million per occurrence	Orphan Site Cleanup Fund	Approximately $10 million	TBD	http: www.waterboards.ca.gov Contact: Kelli Garver kelli.garver@waterboards.ca.gov 916-341-5714
Replacing, Removing, or Upgrading Underground Storage Tanks Program	Program provides grant and loan funds to small business gas station owners to upgrade underground storage tanks to comply with continuing regulatory requirements.	Grants/Loan	Eligible small business gas station owners or operators of project tanks	Applications are accepted on a continuous basis	Grant - $50,000 Loan - $750,000 (SB 445 pending; proposes to incraase grant amount to $70K)	Petroleum Underground Storage Tank Financing Account (PUSTFA)	$6.2 million	Approximately $6.2 million	www.waterboards.ca.gov Contact: Janice Clemons Janice.clemons@waterboards.ca.gov 916-341-5657
Emergency, Abandoned & Recalcitrant Account	Program provides funding to the State Regional Water Quality Control Boards and local agencies to initiate correction action at sites impacted by leaking petroleum USTS where the site is either abandoned, the responsible party is recalcitrant or there is no need for emergency funding.	Grant	State Regional Water Board and local agencies (CUPAS)	Annual Site Nomination process begins Jan ends in July with adoption of Annual Site List	Max Award $1.5 million per occurrence	UST Cleanup Fund	$5 million annual funding	TBD	http: www.waterboards.ca.gov Contact: Kelli Garver kelli.garver@waterboards.ca.gov 916-341-5714

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Areas of Special Biological Significance	The program provides funding to assist local agencies to comply with the discharge prohibition into Areas of Special Biological Significance contained in the California Ocean Plan	Grant	Local Public Agencies, state agencies	Solicitation anticipated Winter Summer 2014 - 15	$2.5 million maximum; $150,000 minimum	Propositions 50 and 84	Approximately $15 million	0	http://www.waterboards.ca.gov/water_issues/programs/grants_loans/asbs/index.shtml Contact: Patricia Leary patricia.leary@waterboards.ca.gov 916-341-5167
Stormwater	The Program grants funds for projects that reduce or prevent stormwater contamination of rivers, lakes and streams.	Grant	Local public agencies	Money is 100% allocated to projects	$3 million maximum; $250,000 minimum	Proposition 84	$0	$0	http://www.waterboards.ca.gov/water_issues/programs/grants_loans/prop84/index.shtml Contact:Patricia Learypatricia.leary@waterboards.ca.gov916-341-5167
Clean Water State Revolving Fund Program	The Federal Water Pollution Control Act (Clean Water Act or CWA), as amended in 1987, established the Clean Water State Revolving Fund (CWSRF) program. The CWSRF program offers low interest financing agreements for water quality projects such as construction of publicly-owned facilities and expanded use projects.	Loan/Grant	Public agencies, tribal governments, designated and approved management agency under Section 208 of the Clean Water Act.	Continuous	None	Clean Water State Revolving Fund	Funding is offered continuously based on cash flow.	TBD	http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/index.shtml Contact: CleanWaterSRF@waterboards.ca.gov 916-327-9978

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Drought Response Outreach Program for Schools (DROPS)	The Program provides funds for stormwater capture projects to reduce stormwater pollution and increase infiltration. All projects must include a student education aspect to teach students about the water quality benefits of the installed project.	Grant	K-12 school districts, county offices of education, Federally Recognized Tribes (only Proposition 13 Watershed funds), and K-12 charter schools located on publicly-owned property.	Application period opened 9/11/14 with a deadline of 1/15/15.	Sliding scale depending on applicant size: $50,000-$2.5 million	Proposition 13 & Proposition 40	Approximately $25.5 million	$25.5 million to be awarded in April 2015	http://www.waterboards.ca.gov/drops/ Contact: Jeffrey Albrecht Jeffrey.Albrecht@waterboards.ca.gov 916-341-5717
Legal Entity Formation Assistance (LEFA) Program	Pilot program whose purpose is to assist communities that do not have access to safe drinking water, and public water system not eligible for Safe Drinking Water State Revolving Fund (SDWSRF) funding due to the lack of an eligible entity. Funds are to assist with the formation of a legal entity with the necessary authority to enable access to SDWSRF funds for these communities.	Grant	All of the following types of entities are eligible to submit an application on behalf of affected communitites: public entities such as citities, counties, special districts, existing public water systems, public colleges, public universitites, non-profit organizations, and Joint Powers Authorities	Solicitation	Maximum: $250,000	Federal Safe Drinking Water State Revolving Fund Capitalization Grant	$1,992,592	TBD	Lorri Silva: 916-449-5639 Lorri.Silva@waterboards.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Public Water System Drought Emergency Response Program	This program provides emegergency funding to address drought related drinking water emergencies, or threatened drought related drinking water emergencies.	Grant	Community water systems and public water systems owned by a public school district.	Open	$500k max funding; can exceed $500K subject tocertain requirements.	General Fund	$8,958,250	TBD	Brian Kinney: 916-449-5630 brian.kinney@waterboards.ca.gov
Prop 84 Section 75021	Safe Drinking Water Emergency Funding - Funding to assist in the abatement of public health emergencies.	Grant	Public Water Systems	Open (continuous)	$250k maximum ($50k maximum for interim water supplies)	Proposition 84	$2,514,306.00	TBD	Noel Gordon (916) 445-7290 noel.gordon@waterboards.ca.gov
Prop 84 Section 75022	Small Community Infrastructure Improvements for Chemical and Nitrate Contaminants	Grant	Permitted, small Public Water Systems	application cycle is closed. Applications by invitation	maximum for construction; $500k maximum for feasibility	Proposition 84	$40,636,274.00	TBD	Noel Gordon (916) 445-7290 noel.gordon@waterboards.ca.gov
Prop 84 Section 75025	Prevention and Reduction of Groundwater Contamination ($60M)	Grant	Permitted Public Water Systems	Closed	$10M per project	Proposition 84	$0	TBD	Noel Gordon (916) 445-7290 noel.gordon@waterboards.ca.gov
Prop 50 Chapter 3	Drinking Water Security	Grant	Public Water Systems	Closed	Minimum: $50,000 Maximum: $10M	Proposition 50	$365,973	TBD	Brian Kinney: 916-449-5630 brian.kinney@waterboards.ca.gov

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Prop 50 Chapter 4a	Small Community Water System Facilities, Community Water System Monitoring Facilities, Drinking Water Source Protection, and Disfenction Byproduct Treatment Facilities	Grant	Community Water Systems and Public Water Systems	Closed	Minimum: $5,000 Maximum: $2M	Proposition 50	$6,553,748	TBD	Brian Kinney: 916-449-5630 brian.kinney@waterboards.ca.gov
Prop 50 Chapter 4b	Southern California Projects to Reduce Demand on Colorado River	Grant	Public Water Systems with service area entirely or partly within Southern California counties: San Diego, Imperial, Riverside, Orange, Los Angeles, San Bernardino, Santa Barbara, or Ventura.	Closed	Minimum: $50,000 Maximum: $20M	Proposition 50	$3,957,430	TBD	Brian Kinney: 916-449-5630 brian.kinney@waterboards.ca.gov
Drinking Water State Revolving Fund	The Federal Safe Drinking Water Act, as amended in 1997, established the Safe Drinking Water State Revolving Fund (SDWSRF) program. The SDWSRF program offers low interest financing agreements for drinking water quality projects such as treatment and distribution systems, as well as consolidation of water systems.	Loan/Grant	Community and non-profit, non-community public water systems that are owned by public agencies or private entities.	Spring and Fall solicitations	$500K max for planning project; $20 million max for construction project unless additional corpus funds available, subject to additional loan terms.	Drinking Water State Revolving Fund	Funding is offered continuously based on cash flow.	TBD	http://www.waterboards.ca.gov/drinking_water/services/funding/SRF.shtml. Contact: dwpfunds@cdph.ca.gov 916-449-5600

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Wildlife Conservation Board									
California Riparian Habitat Conservation Program	This program supports a coalition of state, federal, local and private organizations whose mission is to develop a coordinated approach to the protection of riparian ecosystems. Grants are awarded for the protection, restoration and enhancement of riparian habitat systems.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Habitat Conservation Fund	Under HCF receive approximately $3 million annually for restoration and acqusitions until the year 2020	$1 million	www.wcb.ca.gov Contact: Peter Perrine peter.perrine@wildlife.c a.gov 916-445-1109
Forest Conservation Program	The goal of this program is to promote the ecological integrity and economic stability of California's diverse native forests for all their public benefits through forest conservation, preservation and restoration of productive managed forest lands, forest reserve areas, redwood forests and other forest types, including the conservation of water resources and natural habitat for native fish and wildlife and plants found on these lands.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Proposition 84	$68 million	$15 million	www.wcb.ca.gov Contact: Dave Means dave.means@wildlife.ca.gov 916-445-1095
Inland Wetlands Conservation Program	The program was created to assist the Central Valley Joint Venture in its mission to protect, restore and enhance wetlands and associated habitats in the Central Valley. The public/private partnership works to increase the populations of wintering and breeding waterfowl, shorebirds, water birds, and riparian songbirds.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Proposition 12, Habitat Conservation Fund, Inland Wetland Conservation Fund	Under HCF receive approximately $2 million annually for restoration and acqusitions until the year 2020	$750,000	www.wcb.ca.gov Contact: Brian Cary brian.cary@wildlife.ca.g ov Phone: 916-445-8448

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Ecosystem Restoration on Agricultural Lands	The purpose of this program is to assist landowners in developing wildlife friendly practices on their agricultural properties that can be sustained and co-exist with agricultural operations. A large number of wildlife species are dependent on privately owned agricultural lands for habitat. These lands can provide significant habitat and connectivity with protected wildlife areas.	Grant	Nonprofit organizations	Continuous	None	Proposition 84	$1.0 million	$500,000	www.wcb.ca.gov Contact: Peter Perrine peter.perrine@wildlife.ca.gov 916-445-1109
Oak Woodlands Conservation Program	This program offers landowners, conservation organizations, cities, and counties an opportunity to obtain funding for projects designed to conserve and restore California's oak woodlands. The program is designed to assist local efforts achieve oak woodland protection and provides a mechanism to bring ranchers and conservationists together in a manner that allows both to achieve sustainable ranch and farming operations and healthy oak woodlands.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Proposition 40, Proposition 84	$500,000	$350,000	www.wcb.ca.gov Contact: Dave Means dave.means@wildlife.ca.gov 916-445-1095

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Habitat Enhancement and Restoration Program	Consistent with Fish and Game Code Section 1301, this program provides assistance for the restoration and enhancement of fish and wildlife resources. Eligible projects include native fisheries restoration, restoration of wetlands, restoration of coastal, tidal, or fresh water habitat, other native habitat restoration projects including coastal scrub oak, grasslands, and threatened and endangered species habitats, in-stream restoration projects, including removal of fish passage barriers and other obstructions, and other projects that improve the quality of native habitat throughout the state.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Propositions 84, 50, 40, 12 and Habitat Conservation Fund	$15 million under Propositions 84, 50, 40 and 12. Under HCF receive approximately $1 million annually for wetland restoration outside the Central Valley until the year 2020	$1 million	www.wcb.ca.gov Contact: Peter Perrine peter.perrine@wildlife.ca.gov 916-445-1109
Land AcquisitionProgram	Statewide - This program acquires real property or rights in real property on behalf of the Department of Fish and Game (DFG) and also awards grants to other governmental entities or nonprofit organizations to acquire real property or rights in real property. All acquisitions are made on a "willing seller" basis pursuant to the appraised fair market value. The acquisition activities are carried out in conjunction with the DFG, which generally entails DFG evaluating the biological values of the property through development of a Land Acquisition Evaluation (LAE, used for a single piece of property) or a Conceptual Area Protection Plan (CAPP, used for multiple properties). Once these evaluations are completed, they are submitted to DFG's Regional Operations Committee for review and approval. If approved, they are sent to WCB with a recommendation to fund. Concurrently, the WCB meets with DFG to evaluate and set acquisition priorities as new opportunities arise.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Propositions 84, 50, 40, 12, and the Habitat Conservation Fund (HCF)	$42 million under Propositions 84, and 40; Under HCF receive approximately $14.5 million annually for acqusitions until the year 2020	$20 million	www.wcb.ca.govContact: Dave Meansdave.means@wildlife.ca.gov916-445-1095

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Land Acquisition Program - Natural Community Conservation Plans (NCCPs)	Funding for acquisition projects to assit with implementation of Natural Community Conservation Plans	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Proposition 84	$11 million	$1.5 million	www.wcb.ca.gov Contact: Dave Means dave.means@wildlife.ca.gov 916-445-1095
Natural Heritage Preservation Tax Credit Program	The purpose of the Tax Credit Program is to protect wildlife habitat, parks and open space, archaeological resources, agricultural land and water by providing state tax credits for donations of qualified land (fee title or conservation easement) and water rights. The program objectives include the fostering of public/private partnerships to resolve land use and water disputes; assisting habitat stewardship; and demonstrating the state's commitment to protect natural resources by rewarding landowners who perceive habitat as an asset rather than a liability.	Tax Credit	Cities, counties, nonprofit organizations, special districts and state entities may apply under the program - landowners eligible for state tax credits may receive the credits.	Continuous	The program requires any reductions to the General Fund resulting from the tax credit be reimbursed by the sponsoing entity; For WCB projects, WCB would use one of its eligible bond funds to reimburse the GF.	Proposition 12,40,50 and 84	Most of WCB's remaining bond funds under Prop 40, 50 and 84 can be used to reimburse the General Fund tax credits taken under this program	$2 million	www.wcb.ca.gov Contact: Dave Means dave.means@wildlife.ca.gov 916-445-1095

Program Name	Program Summary	Type	Who is Eligible to Apply	Application Cycle Begins	Max/ Min Award Amounts	Funding Source	How much funding is left to award in total?	How much $ might be awarded in the next 6 months?	Contact Information
Public Access Program	This program is designed to provide assistance to local agencies for the development of public access facilities designed to facilitate and encourage the public's access to hunting, fishing or other wildlife oriented recreation. Financial assistance is available to cities, counties and public districts or corporations for development of facilities such as fishing piers or floats, public access roads, boat launching ramps, trails, boardwalks, interpretive facilities and lake or stream improvements. Support facilities such as restrooms and parking areas are also eligible for funding under this program.	Grant	Cities, counties, nonprofit organizations, special districts and state entities	Continuous	None	Wildlife Restoration Fund, Proposition 40	$7.0 million	$1 million	www.wcb.ca.govContact: Peter Perrinepeter.perrine@wildlife.ca.gov916-445-1109
Sierra Nevada Conservancy									
Sierra Nevada Conservancy Proposition 84 Grants Program	Program awards grants to projects that protect and restore rivers, lake and streams, their watersheds and associated land, water and other natural resources, consistent with the terms of Proposition 84 focused on restoration of areas affected by the 2013 Rim Fire, awarded beginning in Fiscal Year 2013-14.	Grant	Public agencies, qualifying nonprofit 510(c)(3) organizations, and eligible tribal organizations	Spring 2014	None	Proposition 84	$1.0 million	$1.0 million	http://www.sierranevada.ca.gov/other-assistance/sncgrants Contact: Matthew Daley matthew.daley@sierranevada.ca.gov 530-823-4698

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Appendix D: Project Review Process & Instructions

Prop. 84 Round 2 Implementation

General Information and Preparation of Pre-proposals

- You are *strongly* encouraged to review all relevant documents including the *draft* Round II Implementation Proposal Solicitation Package (PSP), Draft IRWMP Plan Guidelines, and the guidance included in this Request for Proposals (RFP).
- Please pay particular attention to required procedures and deadlines. Refer to the attached timeline for more information about the review and ranking process, fiscal agent selection, and proposal development.
- All project proponents who wish to have their projects considered for Round 2 Implementation funding must submit their project(s) using the online upload form first (unless you have already done so): http://inyomonowater.org/members/project-upload/.
- **Round 2 Implementation pre-proposals** (those proposals used for internal ranking) **are due to the Program Office.** Also become familiar with the Implementation PSP before starting your pre-proposal so that you understand what is expected of projects and project proponents. **Please submit pre-proposals as Word documents. We suggest using the attached application worksheet (starting on p. 5) as a template for your pre-proposal.**
- With regards to the Implementation PSP section in the pre-proposal, a fully-developed proposal is not necessary. Reviewers will be looking for the minimal amount of information necessary to respond to the questions in the Implementation PSP Table starting on Page 4. However, providing responses to all of the scoring criteria/questions is highly recommended.

Scoring of Proposals and Allocation of Funding

- **Category-specific TACs will meet and evaluate proposals for that category only.** *TACs will evaluate the entire Implementation PSP section of each pre-proposal up to 80 points.* TACs are encouraged, in addition to providing the scores of each project evaluated, to provide a narrative explanation of its scoring/ranking of the proposals. TAC members do not necessarily need to be RWMG Members.
- **TACs will provide their scoring and rankings to the Program Office.** Program Office will then provide this information to project proponents and the RWMG. If project proponents wish to respond to the TAC rankings, they may do so any time before November 1, 2012, and those responses will be made available to the group of project reviewers.
- RWMG ranking of projects will occur within bins (or categories). There will be no overall ranking of projects. (Conditional upon decision below)
- Expenses required by fiscal agent to implement and administer the Grant Agreement with DWR will be subtracted from the total grant award with remaining funds going directly to support implementation projects.
- **Funding can be allocated in one of three ways:**
  - **a)** Implementation projects will be prioritized for funding based on the project's evaluation score, regardless of bins. Projects will be ranked from the highest score to the lowest score, and funding will be allocated accordingly. When there is insufficient grant money to fully fund the next project, the Program Office will discuss with funded project proponents how best to maximize the remainder amount so as to fund as many projects as possible. If needed to help resolve conflict, the Program Office will consult the Administrative Committee.

b) Implementation award will be allocated to the highest ranked projects within each bin. Bins will be randomly prioritized, and the highest ranking project from the first priority bin will receive full funding and then the highest ranked project in the second priority bin will receive funding for their project and so on until the total award is allocated. When there is insufficient grant money to fully fund the next project, the Program Office will discuss with funded project proponents how best to maximize the remainder amount so as to fund as many projects as possible. If needed to help resolve conflict, the Program Office will consult the Administrative Committee.

c) Implementation award will be allocated to the highest ranked projects within each bin. Bins will be prioritized by the RWMG *before project ranking begins*, and the highest ranking project from the highest-prioritized bin will receive full funding and then the highest ranked project in the second-highest bin will receive funding for their project and so on until the total award is allocated. When there is insufficient grant money to fully fund the next project, the Program Office will discuss with funded project proponents how best to maximize the remainder amount so as to fund as many projects as possible. If needed to help resolve conflict, the Program Office will consult the Administrative Committee.

- Only RWMG Members are eligible to review and rank projects. Members wishing to review and rank projects must commit to reviewing and ranking ALL projects. RWMG reviewers may accept the TAC scoring for those specific sections for a particular project, or they may do their own scoring. If you accept the TAC scores, you must also review and score the other sections of the proposal not scored by the TAC.
- The highest aggregate score per bin will receive highest ranking for that bin. (Conditional upon process above)
- Contact the Program Office with any questions or for more information:
  - ➢ Mark Drew, Program Director

    mdrew@caltrout.org; 760-924-1008
  - ➢ Holly Alpert, Program Manager

    holly@inyo-monowater.org; 760-709-2212
  - ➢ Janet Hatfield, Program Assistant

    janet@inyo-monowater.org; 760-387-2747

Round 2 Implementation Pre-Proposal Application

General Project Information

Project proponent:

❑Yes ❑No Is the project proponent a signatory of the planning/implementation MOU? If not, are there plans in place to become an MOU signatory on or before deadline for pre-proposal submission, or is the project proponent partnering with an MOU signatory? If project proponent is partnering with an MOU signatory, please list the name of the signatory. *As an MOU signatory, you have by default adopted the Inyo-Mono IRWM Phase II Plan.*

MOU Signatory Partner:

Contact person:

Phone:

E-mail:

Name of project:

County(ies) where the project will be implemented:

Watershed(s) where the project will be completed:

This project best fits into the following category (choose one, based on the Inyo-Mono regional Objectives [see p. 10 below for a list of Objectives]):

❑ Water Quality

❑ Water Supply

❑ Ecosystem Health

❑ Flood Management

❑ Groundwater

Project Abstract:
Provide a 300-word (or less) abstract summarizing the project

Scoring

The maximum amount of points available per proposal is 115. Pay particular attention to the allocated scoring for each section below and instructions pertinent to that section.

Implementation PSP **(80 points for entire section; see individual scoring criteria for scoring guidance)**

If you have difficulty reading the Scoring Criteria text, you can refer directly to Table 5 in the Implementation PSP: http://www.water.ca.gov/irwm/integregio_implementation.cfm

Table 5 – Supplemental Scoring Criteria and Scoring Standards

Scoring Criteria	Weighting Factor	Range of Points Possible	Score	Scoring Standards
Work Plan *Scoring will be based on whether the applicant has presented a detailed and specific Work Plan that adequately documents the Proposal (i.e., suite of projects).* Does the Work Plan contain an introduction that includes: a) goals and objectives of the Proposal and how the Proposal helps achieve the goals and objectives of the adopted IRWM Plan? c) a map showing relative project locations; and Are tasks for each project of adequate detail and completeness so that it is clear that the project can be implemented? Do the tasks include appropriate deliverables and reporting submittals (i.e., quarterly and final reports)? Is the proposal consistent with the applicable Basin Plan? Is this a study or part of a larger – multi-phased project effort? If so, will the proposed project(s) be operational as a standalone project(s) without the completion of the end project(s)? Does the Work Plan include a listing of required permits and their status including CEQA compliance? Does the Work Plan include Data Management and Monitoring Deliverables consistent with the IRWM Plan Standards and Guidance - Data Management Standard?	3	0–15	0–5	Standard Scoring Criteria See 2012 Guidelines, Section V.G
Budget *Scoring will be based on whether the applicant has presented a detailed and specific budget that adequately documents the Proposal.*	1	0–5	5	A score of 5 points will be awarded where the Budgets for all the projects in the Proposal have detailed cost information as described in Attachment 4; the costs are reasonable, and all the Budget categories of Exhibit B are thoroughly supported.

Table 5 – Supplemental Scoring Criteria and Scoring Standards				
Scoring Criteria	**Weighting Factor**	**Range of Points Possible**	**Score**	**Scoring Standards**
Are the tasks shown in the Budget consistent with the work items shown in the Work Plan and Schedule? Are the detailed costs shown for each project reasonable? Does the budget attachment contain an explanation of how the project costs were estimated?			4	A score of 4 points will be awarded where the Budgets for all the projects in the Proposal have detailed cost information as described in Attachment 4 and the costs are considered reasonable but the supporting documentation for some of the Budget categories of Exhibit B are not fully supported or lack detail.
			3	A score of 3 points will be awarded where the Budgets for most of the projects in the Proposal have detailed cost information as described in Attachment 4, but not all costs appear reasonable or supporting documentation is lacking for a majority of the items shown in the Budget categories described in Exhibit B.
			2	A score of 2 points will be awarded where the Budgets for less than half the projects in the Proposal have detailed cost information as described in Attachment 4, many of the costs cannot be verified as reasonable, or supporting documentation is lacking for all of the Budget categories described in Exhibit B.
			1	A score of 1 will be awarded where there is no detailed Budget information provided for any of the proposed projects.
			0	A score of 0 will be awarded where there is no Budget information provided.
Schedule *Scoring will be based on whether the applicant has presented a detailed and specific schedule that adequately documents the Proposal and on the readiness to proceed with the Proposal. Readiness will be measured by construction cycles following the anticipated award date of September 2013. It is assumed in the Scoring Standards that the first construction cycle will begin April 2014, the second cycle will begin April 2015, and the third cycle will begin April 2016.* Are the tasks in the schedule consistent with the tasks described in the Work Plan? Given the task descriptions in the Work Plan, does the schedule seem reasonable? How many construction cycles occur between the assumed agreement execution date and the start of construction or implementation for the	1	0–5	5	A score of 5 points will be awarded if the schedule is consistent with the Work Plan and Budget, reasonable, and demonstrates a readiness to begin construction or implementation of at least one project of the Proposal no later than May 2014.
			4	A score of 4 points will be awarded if the schedule is consistent with the Work Plan and Budget, demonstrates a readiness to begin construction or implementation of at least one project of the Proposal no later than May 2015.
			3	A score of 3 points will be awarded if the schedule is consistent with the Work Plan and Budget, reasonable, and demonstrates a readiness to begin construction or implementation of at least one project of the Proposal no later than May 2016.
			2	A score of 2 points will be awarded if the schedule is consistent with the Work Plan and Budget, demonstrates a readiness to begin construction or implementation of no project of the Proposal earlier than May 2016.

Table 5 – Supplemental Scoring Criteria and Scoring Standards				
Scoring Criteria	**Weighting Factor**	**Range of Points Possible**	**Score**	**Scoring Standards**
earliest of the Proposal's projects?			1	A score of 1 point will be awarded if the Schedule is not consistent with the tasks presented in the Work Plan and Budget, is clearly not reasonable. Readiness to begin construction or implementation will be disregarded.
			0	A score of 0 will be awarded if the schedule was not included in the application.
Monitoring, Assessment, and Performance Measures *Scoring will be based on whether the applicant has presented an adequate monitoring and assessment program including performance measures that will allow a determination of whether the objectives are met.* Do the output indicators effectively track project output? Are the outcome indicators adequate to evaluate change resulting from the project's implementation? Is it feasible to meet the targets within the life of the project(s)?	1	0–5	0-5	Standard Scoring Criteria See 2012 Guidelines, Section V.G
Technical Justifications of Projects *Scoring will be based solely on the technical justifications of project(s) with respect to claimed physical benefits. Magnitude of physical benefits will not be scored under this criterion. However, physical benefits must be clearly described and quantified (if applicable) as points will be allocated based on the quality of the technical analysis and supporting documentation in consideration of the type of benefit claimed. Scoring is designed to not bias types or sizes of projects with respect to each other.* Did the applicant provide information that clearly identifies and describes the physical benefits of each project included in the Proposal? Is the technical analysis appropriate and justified considering the size of the project and the type of benefit claimed?	2	0–10	4-5	A proposal that includes clearly identified and well described physical benefits and supporting documentation that demonstrates the project(s) is technically justified to achieve the claimed benefits will be awarded a score of 4 or 5 points based on the adequacy of the technical justification of the project(s).
			3-4	A proposal that includes clearly identified and well described physical benefits, but lacks sufficient supporting documentation to demonstrate the project(s) is technically justified to achieve the claimed benefits will be awarded a score of 3 or 4 points based on the adequacy of the technical justification of the project(s).
			2-3	A proposal that includes physical benefits that are not clearly identified and/or well described and lacks sufficient supporting documentation to demonstrate the project(s) is technically justified to achieve the claimed benefits will be awarded a score of 2 or 3 points based on the adequacy of the technical justification of the project(s).
			1-2	A proposal that includes physical benefits that are not clearly identified and/or well described and little to no supporting documentation to demonstrate the project(s) is technically justified to achieve the claimed benefits will be awarded a score of 1 or 2 points based on the adequacy of the technical justification of the project(s).

Table 5 – Supplemental Scoring Criteria and Scoring Standards				
Scoring Criteria	**Weighting Factor**	**Range of Points Possible**	**Score**	**Scoring Standards**
			0	A score of zero will be awarded to proposals that do not include supporting documentation to demonstrate the project(s) is technically justified to achieve the claimed benefits.
Benefits and Costs Analysis *Scoring will be based on the magnitude of benefits and quality of analysis. Magnitude will be evaluated relative to total proposal costs. For proposals where a cost effectiveness evaluation is provided, these evaluations will also be scored based on the quality and completeness of the evaluation. Scoring is designed to not bias types of projects with respect to each other.* Points will be allocated based on: 1) the benefits realized through implementation of the Proposal relative to proposal costs and 2) the quality of the analysis and supporting documentation demonstrating those benefits. [redacted] Are the costs and benefits claimed supported with clear and complete documentation? Is the benefit analysis appropriate considering the size of the project and the type of benefit claimed? [redacted] Note the following: • Applicants may not split a single project into multiple smaller components or phases in order to be eligible for the Cost Effectiveness Analysis Option (Section D1). • Points may be reduced if DWR determines that the benefits described in the Non-Monetized Benefit Analysis (Section D2) could readily be quantified in dollar terms. This judgment may involve the type of benefit, the size of the project, and the availability of information. • If DWR determines that FDR project benefits can be monetized, but the applicant did not present the benefits, the applicant risks losing points.	3	0-30	8-10	Collectively the proposal is likely to provide a high level of benefits in relationship to cost and this finding is supported by detailed, high quality analysis and clear and complete documentation.
			7-8	Collectively the proposal is likely to provide a high level of benefits in relationship to cost, but the quality of the analysis or clear and complete documentation is lacking.
			5-7	Collectively the proposal is likely to provide a medium level of benefits in relationship to cost and this finding is supported by detailed, high quality analysis and clear and complete documentation.
			4-5	Collectively the proposal is likely to provide a medium level of benefits in relationship to cost, but the quality of the analysis or clear and complete documentation is lacking.
			1-4	Collectively the proposal is likely to provide a low level of benefits in relationship to cost. Varying degree of quality of the analysis and supporting documentation.
			0	A score of zero will be awarded to proposals that do not demonstrate any level of benefit.

Table 5 – Supplemental Scoring Criteria and Scoring Standards				
Scoring Criteria	Weighting Factor	Range of Points Possible	Score	Scoring Standards
Program Preferences *Scoring will be based on whether the Proposal will implement one or more of the specified IRWM Grant Program Preferences (See Section II.F). Proposals that demonstrate significant, dedicated, and well-defined projects that meet multiple Program Preferences will be considered more favorably than Proposals that demonstrate a significant potential to meet a single Program Preference or demonstrate a low degree of commitment or certainty to meeting Program Preferences.* Did the applicant demonstrate a high degree of certainty that the Proposal will implement the Program Preferences claimed? Did the applicant document the magnitude and breadth of Program Preferences that the Proposal will achieve? Did the applicant include a project(s) that will address critical water supply or water quality needs of disadvantaged communities within the IRWM region?	2	0–10	0-5	One half point will be awarded for each Program Preference (including the Statewide Priorities listed in Table 1 of the 2012 Guidelines) that will be met through the implementation of the Proposal, with one exception. One full point will be awarded if the Proposal includes a project(s) that will meet the Preference: "Address critical water supply or water quality needs of disadvantaged communities within the IRWM region" (DAC Program Preference). The maximum score of 5 points will be awarded only if the Proposal, upon implementation, will meet at least 8 non-DAC Program Preferences AND includes a project(s) that will meet the DAC Program Preference. If the Proposal does not include a project that will meet the DAC Program Preference, the maximum score that may be awarded is 4 points. Program Preference points will be granted if it is clear that the preference will be met upon implementation of the Proposal.
Total Range of Points Possible Without Tie Breaker Points =		**0 – 80**		

Statewide Priorities (3 points for entire section)

State Water Plan Strategic Objectives

Please indicate which of the following objectives from the Water Plan Update 2009 this project addresses (check all that apply).

❑ Reduce Water Demand
❑ Improve operational efficiency and transfers
❑ Increase water supply
❑ Improve water quality
❑ Practice resource stewardship
❑ Improve flood management

Inyo-Mono Regional Priorities and Preferences (32 points for entire section)

Inyo-Mono IRWM Planning Priorities (20 points for entire section)

1. In the table below, put an "X" by each Inyo-Mono IRWM Plan Objective and Resource Management Strategy that the project supports. Include a one-sentence description justifying your answer for each. (5 points)

Regional Objective	Resource Management Strategies
☐ **Protect, conserve, optimize, and augment water supply while maintaining ecosystem health**	☐ Improve water supply reliability. ☐ Improve system flexibility and efficiency. ☐ Support compliance with current and future state and federal water supply standards. ☐ Address local water supply issues through various techniques, including, but not limited to: groundwater recharge projects, conjunctive use of water supplies, water recycling, water conservation, water transfers, and precipitation enhancement. ☐ Optimize existing storage capacity. ☐ Conserve and adapt water uses to future conditions. ☐ Capture and manage runoff where feasible. ☐ Incorporate and implement low-impact development design features, techniques, and practices. ☐ Promote public education about water supply issues and needs. ☐ Promote planning efforts to provide emergency drinking water to communities in the region in the event of a disaster. ☐ Promote water efficiency in fish hatcheries. ☐ Protect water supplies that support public recreational

	opportunities.
☐ **Protect, restore, and enhance water quality**	☐ Support achieving compliance with current and future state and federal water quality standards. ☐ Improve the quality of urban, agricultural, and wildland runoff and/or mitigate their effects in surface waters and groundwater. ☐ Support monitoring to better understand major sources of erosion and causes and, where feasible, reduce erosion and sedimentation. ☐ Protect public and aquatic ecosystem sustainability. ☐ Match water quality to water use. ☐ Support appropriate recreational programs that minimize and/or mitigate impacts to water quality.
☐ **Provide stewardship of water dependent natural resources**	☐ Protect, restore, and enhance natural processes, habitats, and threatened and endangered species. ☐ Protect, enhance, and restore ecosystems. ☐ Support science-based projects to protect, improve, assess, and/or restore the region's ecological resources, while providing opportunities for public access, education, and recreation where appropriate. ☐ Support research and monitoring to better understand the impacts of water-related projects on environmental resources. ☐ Identify, develop , and enhance efforts to control invasive species.
☐ **Maintain and enhance water, wastewater, emergency response, and power generation infrastructure efficiency and reliability**	☐ Promote rehabilitation and replacement of aging water and wastewater delivery and treatment facilities in rural communities, including tribal lands. ☐ Ensure adequate water for fire protection and emergency response. ☐ Promote and improve energy efficiency of water systems and uses. ☐ Promote water efficiency in power generating facilities. ☐ Provide for development and improvement of emergency response plans.

☐ **Address climate variability and reduce greenhouse gas emissions**	☐ Increase understanding of water related greenhouse gas emissions. ☐ Increase understanding of impacts of climate change on water supplies and water quality. ☐ Manage and modify water systems to respond to increasing climate variability. ☐ Support efforts to research and implement alternative energy projects and diversify energy sources to move and treat water within the region. ☐ Support efforts to reduce greenhouse gas emissions in the region. ☐ Promote public education about impacts of climate change, particularly as it relates to water resource management in the region.
☐ **Enhance participation of disadvantaged communities and tribal entities in IRWM process**	☐ Engage regional communities and tribes in collaborative water and natural resource management related efforts. ☐ Provide assistance for tribal and DAC consultation, collaboration, and access to funding for development, implementation, monitoring, and long-term maintenance of water resource management projects. ☐ Promote public education and training programs in disadvantaged communities and tribal areas about water resource protection, pollution prevention, conservation, water quality, watershed health, and climate change. ☐ Promote social resilience in disadvantaged communities and tribes to more effectively respond to social, economic or environmental disturbances impacting water-related resources.
☐ **Promote sustainable stormwater and floodplain management that enhances flood protection**	☐ Characterize current stormwater and flood management situations and challenges. ☐ Promote region-wide integrated stormwater and flood management planning. ☐ Improve stormwater and flood management infrastructure and operational techniques/strategies. ☐ Promote projects and practices to protect infrastructure and property from flood damage. ☐ Integrate ecosystem enhancement, drainage control, and natural recharge into construction projects. ☐ Develop and implement public education, outreach, and advocacy on stormwater and flood management matters.

☐ **Promote sound groundwater and surface water monitoring, management, and mitigation in cooperation with all affected parties**	☐ Support and implement state-mandated groundwater and surface water monitoring requirements, and other groundwater monitoring efforts. ☐ Promote efforts to monitor, manage, and mitigate effects of groundwater-dependent projects. ☐ Develop and support projects that mitigate for the effects of groundwater extraction. ☐ Protect and improve the quality and quantity of stored groundwater supplies and recharge areas. ☐ Promote conjunctive use projects. ☐ Identify existing gaps in groundwater and surface water quantity data and undertake appropriate assessments/characterization studies. ☐ Collect data and monitor groundwater and surface water supply variability. ☐ Promote efforts to manage/design groundwater projects so that future impacts requiring mitigation are avoided.

2. Will this project benefit disadvantaged communities? If yes, list DACs that will benefit. Will the project benefit *only* DACs? If not, please give an estimated proportion of funding that would be used to benefit DACs. (If uncertain which communities quality as DACs, contact Program Office staff.) (10 points)

3. Will this project involve or benefit Native American Indian Tribes? If yes, list which Tribes. Will the project benefit *only* Tribal communities? If not, please give an estimated proportion of funding that would be used to benefit Tribes. (5 points)

Project Status & Technical Feasibility (6 points for entire section, scored as a whole)

1. Is this a project under CEQA?
   a. ❏Yes ❏No
   b. If yes, what level of CEQA is required?
   c. What is the proposed schedule for completing CEQA?
2. Is this a project under NEPA?
   a. ❏Yes ❏No
   b. If yes, what level of NEPA is required?
   c. What is the proposed schedule for completing NEPA?
3. Is the project proponent able to commit a 25% funding match as required by the PSP, or will the proponent be seeking a DAC match waiver?
4. What are the local and regional permitting requirements (if any), and have they been met? If not, what is the current status of compliance and/or plan for complying with the requirements? If permits are required, when do they expire?

5. Will there be staff available for project implementation, or will they need to be hired?
6. What kinds of planning documents, outside of permitting, are necessary for the project, and are they complete? For example, engineering designs or blueprints, work plan, etc.
7. What other financial resources (internal and/or external) will be available to undertake the project and sustain it beyond the IRWM grant?
8. Does the project proponent have the authority or approval to implement the project (such as landowner approval; approval from governing board; or fee, easement, or license rights)?
9. What will be the status of achieving the appropriate approvals by September 1, 2013 (anticipated final award date)?
10. If approvals have not been granted by September 1, 2013, what is the proposed schedule for achieving such approvals?
11. Is there a labor compliance program in place?

Subjective Evaluation Narratives (limit responses to 100 words or fewer) (6 points for entire section, scored as a whole)

1. Will this project result in reduced greenhouse gas emissions? If yes, explain how.
2. Will this project contribute to developing or implementing adaptation strategies to respond to climate variability impacts on water resources? If yes, explain how.
3. Are there any expected negative economic or environmental impacts of the project? Please describe.
4. Does the project address public health and safety concerns? Please describe.
5. Will this project contribute to achieving compliance with regulatory requirements?
6. Does the project mitigate existing negative environmental conditions? Please explain.
7. What other sources of money will be used to contribute to the project?
8. What economic impacts will the project have to the project proponent and/or other involved stakeholders?
9. How will this project further implementation of the IRWM Plan and contribute to increased integration in the region?

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Appendix E: Technical Analysis & References

Introduction

This iteration of the Inyo-Mono IRWM Plan is a result of six years of collaborative efforts to pool local and state-level knowledge regarding water resources in the region. In a region of this size, the sheer amounts of data and the variety of sources are extensive. Although references included in the second half of this appendix are the more comprehensive list of data used, we have created the table below in an effort to more concisely summarize data sources used to create the tables and figures contained herein.

Technical Analysis

According to our definition of "technical analysis", Chapter 3 is the only chapter in the Plan that contains technical analytical work. As such, a thorough methods section was included in section 3.2.1 "Changes in the Climate: Methodology". Otherwise, data were simply acquired and aggregated into an output format that best suited the dataset. This resulted in numerous graphs, tables and maps that helped to articulate a specific point as described in the Plan.

Data Type by Chapter	Figure #	Page #	Data Source
Chapter 1: Development Process for IRWM Program			
Boundaries of Eastern California IRWM Planning Regions	Figure 1-1		*California Dept. Of Water Resources*
Inyo-Mono Program Contact List Organizations	Table1-1		*Inyo-Mono IRWMP*
Disadvantaged communities of the region	Figure 1-4		*U.S. Census Bureau, Mono County GIS Dept.*
Inyo-Mono DACs	Table 1-2		*U.S. Census Bureau, California Dept. of Water Resources*
Chapter 2: Regional Description			
Inyo-Mono IRWM Region Watersheds (HUC8)	Table 2-1		*United States Geological Survey,*
Inyo-Mono IRWM Region Watersheds (Calwater)	Table 2-2		*State Water Resources Control Board (Calwater 2.2)*
Correspondence between USGS and Calwater Naming Conventions	Table 2-3		*United States Geological Survey, State Water Resources Control Board (Calwater 2.2)*
DWR Bulletin 118 Groundwater basins in the Inyo-Mono	Table 2-4		*California Dept. of Water Resources(Bulletin 118)*

Data Type by Chapter	Figure #	Page #	Data Source
planning region.			
DWR Bulletin 118 groundwater basins of the planning region	Figure 2-1		*California Dept. Of Water Resources, Los Angeles Dept. of Water and Power, Federal Emergency Management Agency, Mammoth Community Water District*
Land ownership of the Inyo-Mono planning region	Figure 2-2		*Mono County GIS Department*
Air temperature (°F) for several stations in the northern Mojave Desert	Table 2-5		*Western Regional Climate Center (http://www.wrcc.dri.edu/)*
Population of Inyo and Mono Counties between 1970 and 2010	Table 2-6		*U.S. Census Bureau*
Water balance for part of the Owens Valley aquifer system	Table 2-7		*United States Geological Survey*
Annual flow for five upper Owens River tributaries	Table 2-8		*California Dept. of Fish and Game*
Diversion effects on streams in the upper Owens River watershed	Table 2-9		*California Dept. of Fish and Game*
Groundwater availability in Hilton Creek/Crowley Lake	Table 2-10		*Triad/Holmes Associates (http://thainc.com/index.html)*
Principle Water Systems of the Inyo-Mono Region	Table 2-11		*United States Environmental Protection Agency (SDWIS, http://iaspub.epa.gov/enviro/sdw_form_v2.create_page?state_abbr=CA)*
Water bodies in the Inyo-Mono planning region on the 2010 impaired water bodies list from SWRCB	Table 2-12		*State Water Resources Control Board*
Spot measurements of conductivity made in various portions of the upper Owens River watershed during October 1985	Table 2-13		*California Dept. of Fish and Game*
Conductivity measurements	Table 2-14		*Los Angeles Department of Water and Power, Jones and Stokes Associates (1993b)*
Rush Creek nutrient concentrations as measured in 1994	Table 2-15		*United States Geological Survey*

Data Type by Chapter	Figure #	Page #	Data Source
Chapter 3: Climate Change			
Water demand forecast with average weather variability	Figure 3-1		*Los Angeles Department of Water and Power (2005 Urban Water Management Plan)*
Climate change impacts & vulnerabilities in the Inyo-Mono region by category	Table 3-1		*Inyo-Mono RWMG stakeholders and IRWM Program Office staff*
General circulation models used by the Climate Action Team and Inyo-Mono RWMG	Table 3-2		*DWR. 2010. Climate change characterization and analysis in California water resources planning studies. Sacramento, CA: Natural Resources Agency.*
Geographic area for each downscaled climate model analysis	Figure 3-2		*World Climate Research Programme's (WRCP's) Coupled Model Intercomparison Project Phase 3 (CMIP3); Inyo-Mono IRWMP*
Temperature & precipitation projections	Figures 3-3 thru 3-14		*World Climate Research Programme's (WRCP's) Coupled Model Intercomparison Project Phase 3 (CMIP3)*
Direct and indirect water-related emission sources	Table 3-3		*Sierra Nevada Alliance*
Stages of energy use in water	Figure 3-15		*Sierra Nevada Alliance*
IWVWD GHG inventory 2011	Figure 3-16		*Indian Wells Valley Water District*
IWVWD monthly GHG inventory 2011	Figure 3-17		*Indian Wells Valley Water District*
IWVWD GHG inventory by activity 2011	Figure 3-18		*Indian Wells Valley Water District*
June Lake GHG inventory 2011	Figure 3-19		*June Lake Public Utilities District*
June Lake monthly GHG inventory 2011	Figure 3-20		*June Lake Public Utilities District*
June Lake GHG emissions from purchased electricity 2011	Figure 3-21		*June Lake Public Utilities District*
MCWD GHG inventory 2008-2011	Figure 3-22		*Mammoth Community Water District*
MCWD monthly GHG inventory 2011	Figure 3-23		*Mammoth Community Water District*
MCWD GHG inventory by activity 2011	Figure 3-24		*Mammoth Community Water District*
Comparison of emissions inventories for the three water systems	Figure 3-25		*Indian Wells Valley Water District, June Lake Public Utilities District, Mammoth Community Water District, Sierra Nevada Alliance*

Data Type by Chapter	Figure #	Page #	Data Source
Chapter 4: Data Management			
Organizational structure of Inyo-Mono file geodatabase	Figure 4-1		*Inyo-Mono IRWMP*
Historic Groundwater Data Acquisition	Figure 4-2		*United States Geological Survey, National Water Information Systems, State Water Resources Control Board GAMA Geotracker, California Dept. of Water Resources CASGEM data from CA Water Data Library, Mono County, Inyo County Water Department, Kern Co. Water Agency, Mammoth Community Water District*
Recent Groundwater Data Acquisition	Figure 4-3		*United States Geological Survey, National Water Information Systems, State Water Resources Control Board GAMA Geotracker, California Dept. of Water Resources CASGEM data from CA Water Data Library, Mono County, Inyo County Water Department, Kern Co. Water Agency, Mammoth Community Water District*
USDA Forest to Faucets: Surface Drinking Water Importance Index	Table 4-1		*United States Dept. of Agriculture (DWII, HUC), United States Environmental Protection Agency (SDWIS)*
Regional Surface Water Data Availability	Figure 4-4		*United States Geological Survey, National Water Information Systems, State Water Resources Control Board Surface Water Ambient Monitoring Program (CEDEN)*
Small Water System Online Survey	Figure 4-5		*Inyo-Mono IRWMP*
Chapter 5: Governance			
MOU signatories as of June 30, 2012	Table 5-1		*Inyo-Mono IRWMP*
MOU signatories	Figure 5-1		*Inyo-Mono IRWMP*
Chapter 6: Outreach & Engagement			
IRWMP outreach meetings conducted 2008-2013	Table 6-1		*Inyo-Mono IRWMP*
Geographic snapshot of two years of outreach	Figure 6-1		*Inyo-Mono IRWMP*
Chapter 7: Objectives & Resource Management Strategies			
Objective 1 (-8) RMS and evaluation metrics	Tables 7-1 thru 7-8		*Inyo-Mono IRWMP*

Data Type by Chapter	Figure #	Page #	Data Source
Relationship between CA Water Plan Update 2009 and Inyo-Mono IRWM Resource Management Strategies	Table 7-9		*California Water Plan Update 2009, Inyo-Mono IRWMP*
Chapter 9: Finance			
Round 1 Planning Grant tasks and associated budgets	Table 9-1		*Inyo-Mono IRWMP, California Dept. Of Water Resources*
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Funded Round 1 Implementation projects	Figure 9-1		*Inyo-Mono IRWMP, California Dept. Of Water Resources*
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This chapter does not include tables and figures per se. However, the entire chapter highlights the existence of water and land use planning documents throughout the region, as well as steps taken to align those Plans with IRWM planning processes when it comes to water resources. These documents themselves are a valuable data source and even more importantly, draw on an extensive data network themselves to provide the most pertinent data to the region. Please refer to Appendix D. for the complete list of planning documents as well as the source data and a brief summary of the document contents.			
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References

Ajami, N.K. and C. Truelove, 2014. A water-energy research agenda: Building California's policy foundation for the 21st Century. Water in the West, Stanford University.

Aitken S., S. Yeaman, J. Holliday, T. Wang, and S. Curtis-McLane. 2008. Adaptation, migration or extirpation: climate change outcomes for tree populations. Evolutionary Applications 1: 95-111.

Alpert, H., R. Kattelmann, M. Drew, J. Hatfield, and H. Crall, 2014. Disadvantaged Communities and the Inyo-Mono IRWM Program. Inyo-Mono RWMG, Mammoth Lakes.

Babb, D.E. 1992. History of early water diversions and their impact on Owens Lake. In: The History of Water in the Eastern Sierra Nevada, Owens Valley and White Mountains, C.A. Hall, V. Doyle-Jones, and B. Widawski (eds.). Los Angeles: University of California Press, pp. 263-267.

Bailey, R.A., G.B. Dalrymple, and M.A. Lanphere. 1976. Volcanism, structure, and geochronology of Long Valley caldera, Mono County, California. Journal of Geophysical Research 81(5): 725-744.

Bauer Environmental Services. 1998. Draft environmental impact report and environmental assessment: Mammoth Community Water District proposed reclaimed water project. State Clearinghouse number 95121029. Mammoth Lakes, CA: Mammoth Community Water District.

Bean, R.T. 1989. Hydrogeologic Conditions in Indian Wells Valley and Vicinity. Prepared for California Department of Water Resources. Contract No. DWR B- 56783. 51 pgs.

Benham, 2018. Still hot in the Schade. The Sheet. December 22, 2018. page 7.

Bennett, B., L. Park, and R. Wilkinson, 2010. Embedded energy in water studies, Study 1: Statewide and regional water-energy relationship. Report prepared for the California Public Utilities Commission by GEI Consultants, Inc. and Navigant Consulting, Inc. accessed at: http://www.waterenergyinnovations.com/publication/view/cpuc-embedded-energy-in-water-studies-1-statewide-and-regional-water-energy-relationship/

Boyle Engineering Corporation. 2004. June Lake Public Utility District 2004 master water plan update. Bakersfield, CA: Boyle Engineering Corporation.

Boyle Engineering Corporation. 2005. June Lake Public Utility District wastewater system evaluation. Bakersfield, CA: Boyle Engineering Corporation.

Brown, R.L. 1979. Water quality study -- June Lake loop. Sacramento: California Department of Water Resources.

Brown and Caldwell and Triad Engineering. 1984. Mammoth Lakes storm drainage master plan. Prepared for Mono County Public Works Department.

Buckmelter, N. 2000. Gasoline spill at MMSA -- fuel spill remediation might take years. Mammoth Times, June 1, 2000.

Burton, J.F., and M.M. Farrell. 1992. Cultural resources of the Arcularius Ranch, Long Valley, California. Contributions to Trans-Sierran Archaeology No. 29. Tucson, AZ: Trans-Sierran Archaeological Research.

California Agricultural Water Stewardship Initiative, 2016. Accessed at:

http://agwaterstewards.org/index.php/practices/water_energy

California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry. 2010. Local Government Operation Protocol for the quantification and reporting of greenhouse gas emissions inventories Version 1.1. accessed 5/13/2012 at: http://www.arb.ca.gov/cc/protocols/localgov/pubs/lgo_protocol_v1_1_2010-05-03.pdf.

California Climate Action Team. 2008. Water-Energy Sector Write-up for Public Distribution. accessed 5/31/2012 at: http://www.climatechange.ca.gov/climate_action_team/reports/CAT_subgroup_reports/Water Sector_Summary_and_Analyses.pdf.

California Department of Fish and Game. 1990. Interim management plan, Pickel Meadow and Little Walker River. Bishop, CA: DFG fisheries files.

California Energy Commission, 2005. California's water-energy relationship. Final Staff Report Prepared in Support of the 2005 IEPR Proceeding. CEC-700-2005-011-SF. Sacramento.

California Rural Water Association. 2011. IRWMP needs assessments and technical assistance support outline for Inyo/Mono Region. Sacramento, CA.

Carson River Basin Council of Governments. 1974. Regional storm drainage plan, Walker River phase I inventory. Carson City, NV.

Casazza, M.L., C.T. Overton, M.A. Farinha, Alicia Torregrosa, J.P. Fleskes, M.R. Miller, J.S. Sedinger, and Eric Kolada. 2009. Ecology of greater sage-grouse in the Bi-State Planning Area Final Report, September 2007: U.S. Geological Survey Open-File Report 2009-1113, 50 pgs.

Cayan D.R., E.P. Maurer, M.D. Dettinger, M. Tyree, and K. Hayhoe. 2008. Climate change scenarios for the California region. Climatic Change 87: (Suppl 1):S21-S42.

Chalfant, W.A. 1933. Story of Inyo. Bishop, CA: Chalfant Press.

Chen, Y., S. Parmenter, and B. May. 2007. Introgression between Lahontan and endangered Owens tui chubs, and apparent discovery of a new tui chub in the Owens Valley, California. Conservation Genetics, v. 8(1): 221-238.

Clifford, H., 2002. Downhill Slide. Sierra Club Books, San Francisco, CA. 282 pp.

Climate Change Technical Advisory Group, 2015. Perspectives and guidance for climate change analysis. California Department of Water Resources. Sacramento.

Cohen, R., Nelson, B., and G. Wolff, 2004. Energy down the drain: The hidden costs of California's water supply. Natural Resources Defense Council and Pacific Institute. New York.

Collopy, M.W. and J.M. Thomas. 2010. Restoration of a desert lake in a agriculturally dominated watershed: The Walker Lake Basin. Reno, NV: University of Nevada and Desert Research Institute.

Cooley, H., J. Fulton, and P.H. Gleick, 2011. Water for energy: Future water needs for electricity in the intermountain west. Pacific Institute. Oakland.

Costa-Cabral, M., Coats, R., Reuter, J. et al. Climatic Change. 2013. 116: 1. accessed at:

https://doi.org/10.1007/s10584-012-0630-2

Couch, R.F., K. Monks, and R. Knapp. 2003. Groundwater management in the Indian Wells Valley Basin, Tetra Tech EM Inc., 104 pgs.

Curry, R.R. 1996. Delineation report: Development of specific plans and policies to avoid or mitigate the impacts of future development in certain Mono County wetlands. South Lake Tahoe, CA: California Regional Water Quality Control Board--Lahontan Region.

Danskin, W.R. 1998. Evaluation of the Hydrologic System and Selected Water-Management Alternatives in the Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-H. 175 pgs.

DeDecker, M. 1966. Mines of the eastern Sierra. Glendale, CA: LaSiesta Press.

Deinstadt, J.M., G.F. Sibbald, J.D. Knarr, and D.M. Wong. 1986. Survey of fish populations in streams of the Owens River drainage: 1985. Inland Fisheries Administrative Report 86-3. Rancho Cordova, CA: California Department of Fish and Game.

DWR. 1964. West Walker River investigation. Bulletin 64. Sacramento, CA.

DWR. 1973. Mammoth basin water resources environmental study (final report). Sacramento, CA.

DWR. 1981. June Lake area water assessment study. Sacramento, CA: Department of Water Resources.

DWR. 1992. Walker River Atlas. Sacramento, CA.

DWR. 2004. California's groundwater: Update 2003. Bulletin 118. Sacramento, CA

DWR. 2008. Managing an uncertain future: Climate change adaptation strategies for California's water. Sacramento, CA: California Department of Water Resources.

DWR. 2009. California Water Plan Update 2009. Sacramento, CA: California Department of Water Resources.

DWR. 2010. Climate change characterization and analysis in California water resources planning studies. Sacramento, CA: Natural Resources Agency.

DWR, 2015. California Climate Science and Data for Water Resources Management. Sacramento. accessed at: http://www.water.ca.gov/climatechange/docs/CA_Climate_Science_and_Data_Final_Release_June_2015.pdf

DWR. 2016. California's groundwater: Working toward Sustainability. Bulletin 118 — Interim Update 2016. Sacramento, CA. accessed at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/B118-Interim-Update-2016.pdf

Ebasco Environmental, Water Engineering and Technology, and W. Davis and Associates. 1993. Instream flow and habitat restoration investigations for the upper Owens River, Mono County, California. Stream Evaluation Report 93-1. Sacramento, CA: California Department of Fish and Game.

ECO:LOGIC Consulting Engineers and Wagner & Bonsignore Consulting Civil Engineers. 2006. June Lake Public Utility District water resource assessment. Reno, NV: ECO:LOGIC Consulting

Engineers.

EDAW. 2005. Initial study / notice of preparation for the State Water Resources Control Board's on-site wastewater treatment system regulations. Sacramento, CA: EDAW.

Elkins, K.A. 2002. Spatial and temporal variability of nutrient and fecal coliform export from East Walker River watershed: Implications for pollutant source areas. M.S. thesis, Civil and Environmental Engineering, University of California, Berkeley.

Elmore, A.J., J.F. Mustard, and S.J. Manning, 2003. Regional patterns of plant community response to changes in water: Owens Valley, California. Ecological Applications 13(2):443-460.

Environmental Sciences Associates. 1984. Draft environmental impact report: Mammoth Lakes general plan update. Novato, CA: Environmental Sciences Associates.

Environmental Protection Agency, 2013. Strategies for saving energy at public water systems. Office of Water. Washington, D.C. accessed at: http://water.epa.gov/type/drink/pws/smallsystems/upload/epa816f13004.pdf

EPA, DWR. 2011. Climate Change Handbook for Regional Water Planning. Sacramento, CA.

Federal Energy Regulatory Commission. 1986. Owens River basin: Seven hydroelectric projects, California. Final environmental impact statement. Washington, DC: Federal Energy Regulatory Commission, Office of Hydropower Licensing.

Ficklin, Darren & Stewart, Iris & Maurer, Edwin. 2012. Effects of Projected Climate Change on the Hydrology in the Mono Lake Basin, California. Climatic Change. 116. 10.1007/s10584-012-0566-6.

Fletcher, T.C. 1987. Paiute, Prospector, Pioneer: The Bodie-Mono Lake Area in the Nineteenth Century. Lee Vining, CA: Artemisia Press.

Gaines, D. 1989. Mono Lake Guidebook. Lee Vining, CA: Kutsavi Press.

Garfin, G., A. Jardine, R. Merideth, M. Black, and S. LeRoy (eds.). 2013. *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*. A report by the Southwest Climate Alliance. Washington, D.C.: Island Press.

GBUAPCD. 2008. Great Basin Unified Air Pollution Control District, Owens Valley PM_{10} Planning Area Demonstration of Attainment State Implementation Plan - 2008 Revision, GBUAPCD, Bishop, California, January 2008.

GEI Consultants, Inc., 2012. California's water-energy nexus: Pathways to implementation. Report prepared for the Water-Energy Team of the Governor's Climate Action Team.

Gerstung, E. 1988. Status, life history, and management of the Lahontan cutthroat trout. American Fisheries Society Symposium 4: 93-106.

Gilbert, C.M. 1938. Welded tuff in eastern California. Geologic Society of America Bulletin 49: 1829-1862.

Glancy, P.A. 1971. Water resource appraisal of Antelope Valley and East Walker area, Nevada and California. Nevada Department of Conservation and Natural Resources, Water Resources

Reconnaissance Series, Report 53. Carson City, NV: U.S. Geological Survey.

Gleick, P.H., 1994. Water and energy. Annual Review of Energy and the Environment 19: 267-99.

Gram/Phillips Associates, Inc. 1977. Final environmental impact report: Proposed sewerage system for the community of Hilton Creek Community Services District, Mono County, California. State Clearing House #77050933. Pasadena, CA: Gram/Phillips Associates, Inc.

Gram/Phillips Associates, Inc. 1980. Draft environmental impact report for a proposed 80 acre Crowley Lake subdivision (tentative tract map 37-26), Mono County, California. State Clearing House #80041404. Pasadena, CA: Gram/Phillips Associates, Inc.

Gregory, G. 2011. Re-watering Walker Lake. High Country News 43(13): 7, 21. August 8, 2011.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummings. 1991. An ecosystem perspective of riparian zones. BioScience 41(8): 540-51.

Groeneveld, D.P. and D. Or, 1994. Water table induced shrub-herbaceous ecotone: Hydrologic management implications 1. Journal of the American Water Resources Association 30(5):911-920.

Gurdak, J.J., R.T. Hanson, and T.R. Green. 2009. Effects of climate variability on groundwater resources of the United States: U.S. Geological Survey Fact Sheet 2009-3074, 4 p.

Hall, M.C. 1984. Obsidian, paleoeconomy, and volcanism in the eastern Sierra Nevada. Paper presented at the Great Basin Anthropological Conference, 19th biennial meeting, Boise. Cited by Burton and Farrell, 1992.

Hansford, Catherine. 2006. June Lake Public Utility District Water Resource Assessment, Technical Memorandum No. 2, Rodeo Grounds Water Demands. accessed at: http://monocounty.ca.gov/cdd%20site/Planning/Documents/JuneLakeWaterStudy_TechnicalMemorandum2.pdf; accessed 6/1/2012.

Hanson R.T., M.D. Dettinger, and M.W. Newhouse. 2006. Relations between climatic variability and hydrologic time378 series from four alluvial basins across the southwestern United States. Hydrogeology Journal 14(7): 1122–1146379.

Harrington, B. 2009. Comments on Public Review Draft of the California Water Plan Update 2009. Independence, CA: County of Inyo Water Department.

Hart, J. 1996. Storm over Mono: The Mono Lake battle and the California water future. Berkeley, CA: University of California Press.

Hashimoto, H.S. and I. Qazi. 1981. Water action plan for the Owens-Mono area. Department of Water Resources, Southern District, Los Angeles.

Hayhoe K., et al. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America 101: 12422-12427.

Hereford, R., R.H. Webb, and C.I. Longpre. 2003. Precipitation history of the Mojave Desert region, 1893-2001. USGS Fact Sheet 117-03. Carson City, NV: U.S. Geological Survey, Nevada Water Science Center.

Herbst, D.B., and J.M. Kane. 2004. Responses of stream channels, riparian habitat, and aquatic invertebrate community structure to varied livestock grazing exposure and management in the West Walker River watershed (Mono County, California). Final report to Lahontan RWQCB, South Lake Tahoe, CA.

Hill, M. 1975. Geology of the Sierra Nevada. California Natural History Guide 37. Berkeley, CA: University of California Press.

Hoffmann, A. 1981. Vision or villainy: Origins of the Owens Valley – Los Angeles water controversy. College Station: Texas A&M Press. 308 pgs.

Hollett, K.J., W.R. Danskin, W.F. McCaffrey, and C.L. Walti. 1991. Geology and Water Resources of Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-B. 77 pgs.

Horne, A.J., J.C. Roth, M. Beutel, R. Barth, K. Elkins, S. Stoller, R. Muneepeerakul, J. Berlin, J. Truitt, S. Huang, and J. Kane. 2003. Report on Bridgeport Reservoir beneficial use impairment: Limnology in the summer-fall 2000 and comparisons with 1989. Department of Civil and Environmental Engineering, University of California, Berkeley.

Horton, G. 1996. Walker River chronology: A chronological history of the Walker River and related water issues. A publication in the Nevada Division of Water Planning's Nevada Water Basin Information and Chronology Series, available on the Nevada Division of Water Planning's website: www.water.nv.gov. Carson City, NV: Department of Conservation and Natural Resources.

Howald, A. 2000a. Valentine Camp. Part 1 of A flora of Valentine Eastern Sierra Reserve. MSE Environmental Report 16. Santa Barbara, CA: University of California, Museum of Systematics and Ecology.

Howald, A. 2000b. Plant communities. in Sierra East: Edge of the Great Basin, G. Smith, ed. California Natural History Guide 60. Berkeley, CA: University of California Press. 94-207.

Hubbs, C.L., and R.R. Miller. 1948. The zoological evidence: correlation between fish distribution and hydrographic history in the desert basins of western United States. Bull. Univ. Utah 38:17-166.

Humberstone, J.A. 1999. Walker River basin water quality modeling. M.S. thesis. Reno, University of Nevada.

Indian Wells Valley Cooperative Groundwater Management Group. 2006. Cooperative groundwater management plan for the Indian Wells Valley. Ridgecrest, CA.

Indian Wells Valley Water District. 2002. Indian Wells Valley Water District 2000 Urban Water Management Plan. Cited by Couch, et al. 2003.

Indian Wells Valley Water District, 2011. Indian Wells Valley Water District 2010 Urban Water Management Plan. prepared by Krieger & Stewart, Inc. Engineering Consultants

Ingram, S. 2008. Cacti, Agaves, and Yuccas of California and Nevada. Los Olivos, CA: Cachuma Press.

Inyo County and City of Los Angeles. 1991. Agreement Between the County of Inyo and the City of Los Angeles and Its Department of Water and Power on a Long Term Groundwater Management

Plan for Owens Valley and Inyo County. accessed at: http://www.inyowater.org/Water_Resources/water_agreement/default.html

Inyo National Forest. 1987. Land and resource management plan. Bishop. CA: USDA Forest Service.

Inyo National Forest. 1988. Draft environmental impact statement for the Sherwin Ski Area, Mono County, California. Bishop, CA: USDA-Forest Service, Inyo National Forest.

Inyo National Forest. 2011. A summary of current trends and probable future trends in climate and climate-driven processes in the Inyo National Forest and adjacent lands. accessed at: https://inyo-monowater.org/wpcontent/uploads/2011/09/InyoNF_ClimateChangeTrendSummary_1-27-11.pdf.

IPCC. 2007. Summary for Policymakers in Solomon S, D. Qin, M. Manning, Z. Chen, M. Marquis, D.B. Averyt, M. Tignor, and H.L. Miller, ed. Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

IPCC. 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Irwin, S. 1991. California's Eastern Sierra: A visitor's guide. Los Olivos, CA: Cachuma Press.

IWVWD. 2011. The Water Line. accessed 5/28/2012 at: http://www.iwvwd.com/Newsletter/Water-Summer-11%20Web%20Version.pdf.

Jayko, A.S., 2010. Fish Slough, a geologic and hydrologic summary, Inyo and Mono counties, California. Administrative Report prepared for BLM Bishop Field Office. U.S. Geological Survey, Reston, VA. 30 pp.

Jellison, R., and D.R. Dawson. 2003. Restoration of riparian habitat and assessment of riparian corridor fencing and other watershed best management practices on nutrient loading and eutrophication of Crowley Lake, California. Final report, SWRCB # 9-175-256-0. Sacramento, CA: State Water Resources Control Board.

Jellison, R.J., D.R. Dawson, and J.O. Sickman. 2003. Arsenic sources and the feasibility of using nitrogen isotopes to determine nitrogen sources to Crowley Lake, California. Final Report, Sacramento, CA: State Water Resources Control Board, September 1, 2003.

Jennings, M.R. 1996. Status of amphibians. In Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chapter 31, 921-944. Davis, CA: University of California, Centers for Water and Wildland Resources.

Johnson, M.J., C.J. Mayers, C.A. Garcia, and B.J. Andraski. 2007. Selected micrometeorological, soil-moisture, and evapotranspiration data at Amargosa Desert Research Site in Nye County near Beatty, Nevada 2001-5. U.S. Geological Survey Data Series 284, 29 pgs.

Jones and Stokes Associates. 1993a. Draft Mono Basin environmental impact report. Sacramento, CA:

Jones and Stokes Associates.

Jones and Stokes Associates. 1993b. Mono Lake basin and Owens River valley water quality data report. Mono Basin EIR auxiliary report 17. Sacramento, CA: Jones and Stokes Associates.

JRP Historical Consulting Services and California Dept. of Transportation. 2000. Water conveyance systems in California: Historic context development and evaluation procedures. Davis and Sacramento, CA.

Kahrl, W. 1982. Water and power. Berkeley and Los Angeles: University of California Press.

Kattelmann, R. 1992. Historical floods in the eastern Sierra Nevada. In: The History of Water in the Eastern Sierra Nevada, Owens Valley and White Mountains, C.A. Hall, V. Doyle-Jones, and B. Widawski (eds.). Los Angeles, CA: University of California Press, pp. 74-86.

Kattelmann, R. 1996. Hydrology and water resources. In: Sierra Nevada Ecosystem Project: Final report to Congress. Volume 2, chapter 30. Davis, CA: University of California, Centers for Water and Wildland Resources. pp. 855-920.

Kattelmann, R. 2007a. Mono basin watershed assessment. Mammoth Lakes, CA: Community Development Department, County of Mono.

Kattelmann, R. 2007b. Upper Owens River basin watershed assessment. Mammoth Lakes, CA: Community Development Department, County of Mono.

Kattelmann, R. 2007c. West Walker River basin watershed assessment. Mammoth Lakes, CA: Community Development Department, County of Mono.

Kattelmann, R. and A. Johnson. 2012. East Walker River basin watershed assessment. Bishop, CA: Eastern Sierra Land Trust.

Kattelmann, R., and D. Dawson. 1994. Water diversions and withdrawal for municipal supply in the eastern Sierra Nevada. In: Effects of Human-Induced Changes on Hydrologic Systems, R.A. Marston and V.R. Hasfurther (eds.). Bethesda, MD: American Water Resources Association, pp. 475-483.

Kattelmann, R. and M. Embury. 1996. Riparian areas and wetlands. In: Sierra Nevada Ecosystem Project: Final report to Congress. Volume 3, chapter 5. Davis, CA: University of California, Centers for Water and Wildland Resources. pp. 201-273.

Kenny, J.F., N.L. Barber, S.S. Hutson, K.S. Linsey, J.K. Lovelace, M.A. and Maupin. 2009. Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 pgs.

King, M.J. and J.D. Bredehoeft. 1999. Death Valley Springs Geochemical Investigation. Prepared for Inyo County Planning Department, Independence, CA.

Knapp, R.A. 1996. Non-native trout in natural lakes of the Sierra Nevada: An analysis of their distribution and impacts on native aquatic biota. In: Sierra Nevada Ecosystem Project: Final report to Congress, vol. 3, pp. 363-407. Davis, CA: University of California, Centers for Water and Wildland Resources.

Knapp, R.A., and K.R. Matthews. 2000. Nonnative fish introductions and the decline of the mountain yellow-legged frog from within protected areas. Conservation Biology 14:428-438.

Krieger & Stewart, Inc. 1998. Domestic Water System 1997 General Plan. Prepared for the IWVWD. Cited by Couch, et al., 2003.

Krieger & Stewart, Inc. 2011. Indian Wells Valley Water District 2010 Urban Water Management Plan. Ridgecrest, CA.

Kurtak, J.M. 1998. Mine in the Sky. Publication Consultants.

Kuss, A.J.M. and J.J. Gurdak. 2014. Groundwater level response in U.S. principal aquifers to ENSO, NAO, PDO, and AMO. Journal of Hydrology, 519: 1939-1952. doi:10.1016/j.jhydrol.2014.09.069.

LADWP. 1987. Mono Basin geology and hydrology. Aqueduct Division, Hydrology Section. Los Angeles, CA.

LADWP. 2010. Urban Water Management Plan. Los Angeles, CA: Los Angeles Department of Water and Power.

LADWP. 2011a. Annual Owens Valley Report. Los Angeles, CA.

LADWP. 2011b. California Statewide Groundwater Elevation Monitoring (CASGEM) - Monitoring Plan for the Inyo County Portion of the Owens Valley Groundwater Basin (DWR Groundwater Basin 6-12).

LADWP, 2019. Annual Owens Valley Report. Los Angeles, CA.

Lahontan Regional Water Quality Control Board. 1975. California Regional Water Quality Control Board--Lahontan Region, 1995. Water Quality Control Plan for the Lahontan Region. South Lake Tahoe, CA.

Lahontan Regional Water Quality Control Board. 1994. Water body fact sheets for Crowley Lake and Hot Creek. South Lake Tahoe, CA: Lahontan Regional Water Quality Control Board.

Lahontan Regional Water Quality Control Board. 1998. Watershed management initiative, draft chapter. South Lake Tahoe, CA: Lahontan Regional Water Quality Control Board.

Larson, D., C. Lee, S. Tellinghuisen, and A. Keller, 2007. California's energy-water nexus: Water use in electricity generation. Southwest Hydrology Sept/Oct 2007: 20-21, 30.

Lawton, H. W., P.J. Wilke, and W. M. Mason. 1976. Agriculture among the Paiute of Owens Valley. Journal of California Anthropology 3: 13–50.

Lee, W.T. 1906. Geology and water resources of Owens Valley, California. Water Supply Paper 181. Washington, D.C.: U.S. Geological Survey.

Lee, C.H. 1912. An intensive study of the water resources of a part of Owens Valley, California. Water Supply Paper 294. Washington, D.C.: USGS.

Lee, C.H. 1915. Report on hydrology of Owens Lake Basin and the natural soda industry as affected by the Los Angeles Aqueduct Diversion. Berkeley: University of California, Water Resources Center Archives. 105 pgs.

Lee, K. 1969. Infrared exploration for shoreline springs at Mono Lake, California test site. Stanford Remote Sensing Laboratory, Technical Report 69-7.

Lenihan J.M., R. Drapek, D. Bachelet, R.P. Neilson. 2003. Climate change effects on vegetation distribution, carbon, and fire in California. Ecological Applications 13: 1667-1681.

Libecap. G.D. 2007. Owens Valley Revisited: A Reassessment of the West's First Great Water Transfer. Stanford: Stanford University Press.

Lipshie, S.R. 1979. Geology overview. In: An environmental overview of geothermal development: The Mono-Long Valley KGRA, edited by C.L. Strojan and E.M. Romney, 29-92. Los Angeles, CA: Laboratory of Nuclear Medicine and Radiation Biology, University of California.

Lipshie, S.R. 2001. Geologic guidebook to the Long Valley - Mono Craters region of eastern California. Santa Ana, CA: South Coast Geological Society.

Lopes, T.J. and K.K. Allander. 2009. Water budgets of the Walker River basin and Walker Lake, California and Nevada. Scientific Investigations Report 2009-5157. Carson City, NV: U.S. Geological Survey.

Lucich, K. 2004. Scoping letter regarding Mill Creek habitat improvement project. Bridgeport, CA: USDA-Forest Service.

Machado, A., 2019. The people of color who keep outdoorsy towns running. Sierra Magazine. March 24, 2019. accessed at: https://www.sierraclub.org/sierra/people-color-who-keep-outdoorsy-towns-running

Mammoth County Water District. 1981. Draft water plan. Mammoth Lakes, CA.

Mammoth Community Water District. 2005. Mammoth Community Water District water assessment amendment Town of Mammoth Lakes general plan update. September 27, 2005.

Mammoth Community Water District. 2011a. 2010 Urban Water Management Plan. Mammoth Lakes, CA.

Mammoth Community Water District. 2011b. Final EIR Mammoth Creek fishery bypass flow requirements, watershed operations constraints, point of measurement, and place of use, SCH # 1977032082. Mammoth Lakes, CA.

Mammoth Community Water District. 2017. 2015 Urban Water Management Plan. Mammoth Lakes, CA.

Mammoth Times. 2002. Contamination found in Crowley water. Mammoth Times, November 28, 2002.

Martin, E. 1992. Water's role in early history of Inyo National Forest. In: The History of Water in the Eastern Sierra Nevada, Owens Valley and White Mountains, C.A. Hall, V. Doyle-Jones, and B. Widawski (eds.). Los Angeles, CA: University of California Press, pp. 285-293.

Meixner, T., A.H. Manning, et al. 2016. Implications of projected climate change for groundwater recharge in the western United States. Journal of Hydrology 534: 124-138. doi.:10.1016/j.jhydrol.2015.12.027.

Melack, J.M., and L. Lesack. 1982. Long Valley reservoir research program, progress report 1. Prepared for Los Angeles Department of Water and Power (cited by Jellison and Dawson, 2003).

Melack, J.M., J.O. Sickman, F.V. Setaro, and D. Engel. 1992. Long-term studies of lakes and watersheds in the Sierra Nevada, patterns and processes of surface-water acidification. Final report to the California Air Resources Board, contract A932-060. Santa Barbara, CA: University of California.

Millar, C.I., et al. 1996. The Mammoth-June ecosystem management project, Inyo National Forest. In Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chapter 50. Davis, CA: University of California, Centers for Water and Wildland Resources, pp. 1273-1346.

Miller, R.R. 1973. Two new fishes, *Gila bicolor snyderi* and *Catostomus fumeieventris,* from the Owens River Basin, California. Occasional Paper of the Museum of Zoology, University of Michigan 667: 1-19.

Milliron, C. 1997. A Fisheries Management Plan for Crowley Lake and Tributaries, Mono County, California. Sacramento, CA: California Department of Fish and Game.

Milliron, C., P. Kiddoo, M. Lockhart, and R. Ziegler. 2004. Aquatic biodiversity management plan for lakes in the West Walker basin of the Sierra Nevada, Mono County, California, 2004-2014. Bishop, CA: Department of Fish and Game, Eastern Sierra and Inland Deserts Region.

Minnich, R.A. 2007. Climate, paleoclimate, and paleovegetation. in: M.G. Barbour, T. Keeler-Wolf, and A.A. Schoenherr (eds.), Terrestrial Vegetation of California. Chapter 2, pp. 43-70. Berkeley, CA: University of California Press.

Mono County. 1992. Master environmental assessment. Bridgeport, CA.

Mono County. 2011. Water Level Monitoring Plan for the Groundwater Basins of Mono County. Mono County. Bridgeport, CA.

Mono County LAFCO. 2009. Municipal Service Review and Sphere of Influence Recommendation, June Lake Public Utility District, Mono County, California. accessed at: http://www.monocounty.ca.gov/cdd%20site/Planning/Documents/JuneLakePublicUtilityDistrict_02.2009.pdf; accessed 6/7/2012.

Mono County Planning Department. 2004. Supplement to the Mono County general plan land use amendments, final environmental impact report, prepared for the Benton Crossing landfill. SCH #98122016 and #2004082091. Bridgeport, CA: Mono County Planning Department.

Mono County Resource Conservation District. 1990. Long range program. Bridgeport., CA.

Mote P.W., A.F. Hamlet, M.P. Clark, and D.P. Lettenmaier. 2005. Declining mountain snowpack in western north America. Bulletin of the American Meteorological Society 86: 39.

Mulvihill, Tom. 2008. July GM Column, Aquifer Storage Recovery. IWVWD Press Release. accessed 5/28/2012 at: http://www.iwvwd.com/Articles/07-08%20GM%20Column%20Aquifer%20Storage%20Recovery.pdf.

Mulvihill, Tom. 2010. General Manager Column, The Water District is a BIG Operation. IWVWD Press Release. accessed 5/28/2012 at: http://www.iwvwd.com/Articles/10-18-10%20GM%20Column%20Water%20District%20Big%20Operation.pdf.

National Research Council. 1992. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. Washington, DC: National Academy Press.

National Research Council. 1995. Wetlands: Characteristics and Boundaries. Washington, DC: National Academy Press.

Navigant Consulting, Inc. 2006a. Refining Estimates of Water - Related Energy Use in California. California Energy Commission, PIER Industrial/Agricultural/Water End Use Energy Efficiency Program. CEC-500-2006-118. Sacramento.

Navigant Consulting, Inc. 2006b. Statewide Small Hydropower Resource Assessment. California Energy Commission, PIER Program. CEC-500-2006-065. Sacramento.

Nolte Associates, Inc. 2008a. City of Bishop Water Master Plan. Prepared for The City of Bishop Department of Public Works.

Nolte Associates, Inc. 2008b. City of Bishop Wastewater Master Plan. Prepared for The City of Bishop Department of Public Works.

Null S.E., J.H. Viers, and J.F. Mount. 2010. Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada. PLoS ONE 5(4): e9932. https://doi.org/10.1371/journal.pone.0009932.

Park, L. and P. Kellen, 2013. California's water-energy-climate nexus: Energy and greenhouse gas emissions embedded in water. The Climate Registry and Water Energy Innovations. accessed at: http://www.theclimateregistry.org/wp-content/uploads/2014/12/California-Water-Energy-Climate-Nexus-White-Paper.pdf

Perrault, J.R. 1995. Mill Creek report. in Mono Basin Waterfowl Habitat Restoration Plan, Los Angeles Department of Water and Power. Appendix E to Appendix 1 (Drewien, Reid, and Radcliff), 20 pgs.

Perrine, R.L., et al. 1973. Water quality and recreation in the Mammoth Lakes Sierra. Los Angeles, CA: University of California, Environmental Science and Engineering.

Pister. P. 1995. Fish. In: Deepest Valley: Guide to Owens Valley. J. Putnam and G. Smith, eds. Mammoth Lakes, CA: Genny Smith Books. pp. 213-224.

Powell, D. and H. Klieforth. 2000. Weather and climate. In: Sierra East: Edge of the Great Basin, Genny Smith, editor. California Natural History Guides 60. Berkeley, CA: University of California Press. pp. 70-93.

Provost & Pritchard Consulting Group, 2015. Wastewater Treatment Plant Facility Plan, City of Ridgecrest, CA. accessed at https://www.ridgecrest-ca.gov/uploadedImages/Departments/Public_Works/WWTPFP_Review_Draft__102015.pdf

Quad Knopf, Inc. 2004. Crystal Geyser Roxane: Beverage bottling plant, light industrial project. Draft environmental impact report SCH #2002121051. Submitted to Inyo County Planning Department.

R2 Resource Consultants. 2000. Feasibility study for sediment bypass on Lee Vining, Walker, and Parker Creeks, Mono Basin, California. Redmond, Washington.

Rachowitz, L.J., R.A. Knapp, J.A.T. Morgan, M.J. Stice, V.T. Vredenburg, J.M. Parker, and C.J. Briggs. 2006. Emerging infectious disease as a proximate cause of amphibian mass mortality. Ecology 87: 1671-1683.

Reger, K. 2012. Inyo Mono regional water management group needs assessment report. California Rural Water Association, Sacramento, CA.

Reisner, M. 1986. Cadillac Desert: The West and Its Disappearing Water. New York: Viking Penguin, Inc.

Rinehart, D. 2003. Geologic story, in Mammoth Lakes Sierra (G. Smith, ed.), pp. 117-132. Mammoth Lakes, CA: Genny Smith Books.

Rowlands, P.G. 1995. Regional bioclimatology of the California Desert, in, Latting, J., and Rowlands, P.G., eds., The California Desert—An Introduction to Natural Resources and Man's Impact. Riverside, CA: University of California Press, pp. 95-134.

Sada, D.W. and D.B. Herbst. 2001. Macroinvertebrates and Environmental Characteristics of Owens Valley Springs, Inyo County, California. Prepared for Los Angeles Department of Water and Power, Bishop, CA.

Scanlon, B. R., K.E. Keese, A.L. Flint, L.E. Flint, C.B. Gaye, W.M. Edmunds, I. and Simmers. 2006. Global synthesis of groundwater recharge in semiarid and arid regions. Hydrological Process., 20: 3335-3370. doi:10.1002/hyp.6335

Sehlke, G. and P. Wichlacz, 2009. U.S. Department of Energy's role in the energy-water nexus. Journal of Contemporary Water Research and Education 143: 56-62.

Seiler, R.L., M.S. Lico, S.N. Wiemeyer, and D.C. Evers. 2004. Mercury in the Walker River basin, Nevada and California--Sources, distribution, and potential effects on the ecosystem. Scientific Investigations Report 2004-5147. Carson City, NV: U.S. Geological Survey.

Setmire, J.G. 1984. Water-quality appraisal of Mammoth Creek and Hot Creek, Mono County, California. Water Resources Investigations Report 84-4060. Sacramento, CA: U.S. Geological Survey. 50 pgs.

SGI. 2011. 2011 State of the Basin Report: Amargosa River Basin. Prepared for the Amargosa Conservancy.

Sharpe, S., M.E. Cablk, and J.M. Thomas. 2008. The Walker Basin, Nevada and California: Physical environment, hydrology, and biology. Desert Research Institute Technical Report #41231, Rev. 01. Reno, NV: Desert Research Institute, 63 pgs.

Shumway, M. 1985. An inventory of recorded water diversions in the Owens and Mono basins. Report on file in Bishop office of California Department of Fish and Game.

Smeltzer, M.W., and G.M. Kondolf. 1999. Historical geomorphic and hydrologic analysis of the Owens River gorge. CEDR-01-99. Berkeley, CA: Center for Environmental Design Research, University of California.

Smith, G.E. and M.E. Aceituno. 1987. Habitat preference criteria for brown, brook, and rainbow trout in eastern Sierra Nevada streams. Stream Evaluation Report 87-2, California Department of Fish and Game, Sacramento, CA.

Smith, G. and G. James. 1995. History. In: Deepest Valley: Guide to Owens Valley. J. Putnam and G. Smith, eds. Mammoth Lakes, CA: Genny Smith Books, pp. 231-268.

Snyder M.A., L.C. Sloan, J.L. Bell. 2004. Modeled regional climate change in the hydrologic regions of California: A CO_2 sensitivity study. Journal of the American Water Resources Association 40: 591-601.

Steinkampf, W.C. and W.L. Werrell. 1998. Groundwater Flow to Death Valley, as inferred from chemistry and geohydrology of selected springs in Death Valley, California and Nevada. USGS WRI 98-4114, U.S. Geological Survey. Denver, CO.

Steward, J. 1934. Ethnography of the Owens Valley Paiute. American Archaeology and Ethnology 33: 233–324.

Stewart I.T., D.R. Cayan, and M.D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a 'business as usual' climate change scenario. Climatic Change 62: 217-232.

Stine, S. 1994. Extreme and persistent drought in California and Patagonia during mediaeval time. Nature 369: 546-549.

Stine, S. 1995. Restoration of degraded riparian, wetland, and deltaic environments on Mill Creek, Mono County, California. In: Mono Basin Waterfowl Habitat Restoration Plan, Los Angeles Department of Water and Power. Appendix E to Appendix 1 (Drewien, Reid, and Radcliff), 23 pgs.

Swanson, F.J., S.V. Gregory, J.R. Sedell, and A.G. Campbell. 1982. Land-water interactions: The riparian zone. In: Analysis of Coniferous Forest Ecosystems in the Western United States, edited by R.L. Edmunds. Stroudsburg, PA: Hutchinson Ross Publishing Company, pp. 267-291.

SWRCB. 2012a. Groundwater Ambient Monitoring and Assessment. accessed 5/24/2011 at: http://www.swrcb.ca.gov/water_issues/programs/gama/.

SWRCB. 2012b. Groundwater Ambient Monitoring and Assessment, GeoTracker, water data retrieval tool. accessed at: http://geotracker.waterboards.ca.gov/gama/.

SWRCB. 2012c. California Environmental Data Exchange Network. accessed at: http://ceden.org/.

Taylor, R.G., B. Scanlon, P. Döll, M. Rodell, R. van Beek, Y. Wada, L. Longuevergne, M. Leblanc, J.S. Famiglietti, M. Edmunds, L. Konikow, T.R. Green, J. Chen, M. Taniguchi, M.F.P. Bierkens, A. MacDonald, Y. Fan, R.M. Maxwell, Y. Yechieli, J.J. Gurdak, D.M. Allen, M. Shamsudduha, K. Hiscock, P.J.-F. Yeh, I. Holman and H. Treidel. 2012. Ground water and climate change, *Nature Climate Change*, 10.1038/nclimate1744, 3, 4: 322-329.

Thomas, R. 1984. The West Walker deer herd management plan. Bishop, CA: California Department of Fish and Game.

Todd Engineers, 2014. Indian Wells Valley resource opportunity plan: Water availability and conservation report. Prepared for Kern County Planning and Community Development Department. Alameda: Todd Engineers. accessed at: http://www.co.kern.ca.us/planning/pdfs/IWV_Water_Availability_and_Conservation_doc.pdf

Town of Mammoth Lakes. 2007. General Plan Update: 4.9 Population, Housing, and Employment. accessed 7/17/2012 at: http://www.ci.mammoth-lakes.ca.us/documents/10/45/53/72/4.09%20Population%20Housing%20and%20Employment.PDF.

Triad Engineering. 1987. Drainage and flood hydrology study, Conway Ranch.

Triad Engineering. 1994. Engineer's report for Mountain Meadows Mutual Water Company. Mammoth Lakes, CA.

Triad/Holmes Associates. 2004. Rodeo Grounds water and sewer system improvement project. Prepared for Intrawest and June Lake Public Utility District. Mammoth Lakes, CA: Triad/Holmes Associates.

Tweed, W.C. and L. Davis. 2003. Death Valley and the northern Mojave: A visitor's guide. Los Olivos, CA: Cachuma Press.

United States Census. 2010. http://2010.census.gov/2010census; accessed July 17, 2012.

U.S. Census Bureau. 2010. American FactFinder. accessed at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t.

USDA. 2011a. Watershed Condition Framework. accessed at: http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf.

USDA. 2011b. Watershed Condition Classification Technical Guide. accessed at: http://www.fs.fed.us/publications/watershed/watershed_classification_guide.pdf.

USDA. 2011c. E. Weidner, A. Todd. From the Forest to the Faucet. Drinking Water and Forests in the US. Methods paper. Ecosystem Services & Markets Program Area, State and Private Forestry. accessed at: http://www.fs.fed.us/ecosystemservices/pdf/forests2faucets/F2F_Methods_Final.pdf.

USDA - Forest Service. 1988. Draft environmental impact statement for the land and resource management plan. Bishop, CA: Inyo National Forest.

USDA - Forest Service. 1989. Environmental Assessment, Lahontan cutthroat trout restoration project, Silver Creek and Wolf Creek, Mono County. Sparks, NV: Toiyabe National Forest.

USDA - Forest Service, 1992. Old growth management strategy. Bishop, CA: Inyo National Forest.

USDA - Forest Service. 1994. Dry Creek well and pipeline project environmental assessment. Mammoth Lakes, CA: Inyo National Forest.

USDA - Forest Service. 2003. North Mono Basin report. Bishop, CA: Inyo National Forest.

USDA - Forest Service. 2004. Draft West Walker landscape strategy. Bridgeport, CA: Humboldt - Toiyabe National Forest.

USDA - Forest Service. 2011. Humboldt -Toiyabe National Forest climate change vulnerability report. Bridgeport, CA: Humboldt -Toiyabe National Forest. accessed at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5294901.pdf.

USDA-Forest Service, 2017. Removal Action Memorandum: Time-critical removal action, Mammoth stamp mill site, Inyo National Forest. Pacific Southwest Region, Vallejo.

USDA Nevada River Basin Survey Staff, 1969/1975. Water and related land resources - central Lahontan basin - Walker River subbasin - Nevada - California. U.S. Deparment of Agriculture.

U.S. Department of Energy, 2006. Energy demands on water resources. Report to Congress on the interdependency of energy and water. Washington, D.C.

U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. accessed 5/31/2012 at: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf.

U.S. Fish and Wildlife Service. 2011. Revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. 222 pp.

USGS. 2012. National Water Information System. accessed at: http://waterdata.usgs.gov/nwis.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences 37: 130-37.

von Geldren, Jr., C.E. 1989. A fisheries management plan for the Mammoth Lakes basin and certain adjacent waters, Mono and Madera counties, California. Administrative Report 89. CA Dept of Fish and Game, Sacramento, CA.

Vorster, P. 1985. A water balance forecast model for Mono Lake, California. Master's thesis, California State University, Hayward.

Vorster, P. 1992. The development and decline of agriculture in the Owens Valley. In: The History of Water in the Eastern Sierra Nevada, Owens Valley and White Mountains, C.A. Hall, V. Doyle-Jones, and B. Widawski (eds.). Los Angeles, CA: University of California Press, pp. 268-284.

Water in the West, 2013. Water and energy nexus: A literature review. Stanford University.

Whitney, S. 1979. A Sierra Club naturalist's guide to the Sierra Nevada. San Francisco, CA: Sierra Club Books.

Wildermuth Environmental, Inc. 2003. Investigation of groundwater production impacts on surface water discharge and spring flow. Report to Mammoth Community Water District.

Wood, S.H. 1977. Distribution, correlation, and radiocarbon dating of late Holocene tephra, Mono and Inyo Craters, eastern California. Geological Society of America Bulletin 88: 89-95.

Zdon, A., K. Rainville, N. Buckmaster, S. Parmenter, and A.H. Love. 2019. Identification of source water mixing in the Fish Slough spring complex, Mono County, California, USA. Hydrology 6(26).