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UPPER PIT RIVER WATERSHED
INTEGRATED REGIONAL WATER MANAGEMENT PLAN

Adopted December 5, 2013

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Northeastern California Water Association

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UPPER PIT WATERSHED IRWMP
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CHAPTER 1. INTRODUCTION

1.0 HISTORY

After decades of water management discussion, in 2000 a diverse group of Pit River watershed stakeholders – primarily agricultural operators, conservation interests, water purveyors and municipalities, and public land managers – came together to form the Pit River Watershed Alliance (PRWA). The mission of the PRWA was: "To foster partnerships that achieve long-term cultural, economic, and environmental health of the watershed through active community participation."

Since its formation, PRWA has successfully completed several watershed plans and assessments in cooperation with other local entities. The aim of these assessments was to respond to increasingly complex water management issues and regulation, and to assure that water management interests were coordinating to provide reliable water supplies and water quality to serve diverse interests. The North Cal-Neva Resource Conservation and Development Council, Inc. (RC&D) has often served as the grant applicant and fiscal agent for PRWA, and provided staff support and leadership.

Facing both the 303(d) impairment listing of the Pit River and several of its tributaries, and initiation of the California Irrigated Lands Regulatory Program (ILRP), the Northeastern California Water Association (NECWA) decided to bring to the watershed additional resources to address critical water issues. So in 2010, NECWA partnered with PRWA and the RC&D to undertake development of an Upper Pit River Integrated Regional Water Management Plan (IRWMP) under state IRWM guidelines, with NECWA serving as the grant applicant, the RC&D serving as the fiscal agent, and PRWA serving as the Regional Watershed Management Group (RWMG).

In early 2011, the California Department of Water Resources (DWR) awarded a grant to NECWA to fund local creation of an Upper Pit River watershed IRWMP. The IRWMP currently includes the Upper Pit River, Burney Creek, Hat Creek, and Fall River sub-watersheds. The Goose Lake sub-watershed is assessing the level of its participation in this IRWM effort as well. The IRWMP builds on all of the previous PRWA and sub-watershed efforts, and will provide the IRWM region with state-compliant objectives and strategies, and an integrated, adaptive, updatable forum for watershed enhancement projects over the next 20 years.

1.1 Brief Description of the Planning Area

The Upper Pit River is the primary drainage in northeastern California. The river system drains portions of four counties – Modoc, Siskiyou, Lassen, and Shasta – and is fed by a watershed of nearly three million acres. Several groundwater basins provide not only domestic and agricultural supply, but recharge the watershed's spring-fed streams and geothermal resources. Hot, dry summers and cold winters prevail over a region typified by level mountain valleys surrounded by mountainous terrain. Four sub-watersheds – the Upper Pit River, Fall River, Hat Creek, and Burney Creek – are the major components of the surface water system.

Over 60 percent of the watershed is publicly owned, primarily at the higher elevations, while lower elevations are predominantly in private agricultural and residential ownership. The Pit River Tribe manages several properties in the region as well. Population densities are generally less than ten persons per square mile, thus rural lifestyles and pursuits prevail. The largest city in the watershed

is Burney with a current population of 3,154. The rural nature of the watershed has led to a strong culture of self-reliance and wariness of government.

The economy is largely supported by agriculture, timber production, and tourism. Much of the Plan area has been identified under DWR income criteria as disadvantaged, which presents additional challenges for funding and implementing projects and programs.

The area's beauty and open lands attract hunters, recreationists, tourists, and urban refugees. Residents and visitors share the watershed with a diverse range of wildlife species whose habitat includes conifer forests, sagebrush, juniper, and chaparral, as well as grasslands, wet meadows, riparian vegetation, and aspen stands.

1.2 Development of the Upper Pit IRWMP

The intent of this IRWMP is to promote voluntary integrated regional water management to ensure better water quality, sustainable water uses, including reliable water supplies, and enhanced environmental stewardship. By developing and adopting an IRWMP, the watershed is able to identify its greatest water management needs, coordinate that management, and develop projects to address identified issues. Further, the watershed is then eligible to apply for state project funding under the IRWM program.

A brief history of the IRWM program follows:

2002 – Senate Bill 1672 creates the Integrated Regional Water Management Act to encourage local agencies to work cooperatively to manage local and imported water supplies to improve the quality, quantity, and reliability.

November 2002 – California voters pass Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, which provides $500,000,000 (CWC §79560-79565) to fund competitive grants for projects consistent with an adopted IRWM Plan.

November 2006 – California voters pass Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act, which provides $1,000,000,000 (PRC §75001-75130) for IRWM Planning and Implementation.

November 2006 – California voters pass Proposition 1E, the Disaster Preparedness and Flood Prevention Bond Act, which provides $300,000,000 (PRC §5096.800-5096.967) for IRWM Stormwater Flood Management.

Development of the Upper Pit IRWM Plan was made possible by an IRWM Planning grant administered by NECWA. In February 2011, NECWA hired Burdick & Company to prepare the Plan. Initial data gathering was followed by regional and sub-regional public involvement meetings in September and October 2011. Subsequently, draft sections of the Plan were developed under the guidance of stakeholder subcommittees for climate change, project development, and Plan review. Tribal interests were incorporated with extensive outreach and engagement. Numerous water management entities and interests were integrated via individual and coordinated interviews and technical assistance. The Scripps Institute at the University of San Diego provided substantial pro bono technical input for the climate sections of the Plan. In February 2013, a public review draft was released and public comments subsequently incorporated into the document, as directed by the RWMG. After consideration and incorporation of comments, a final draft was released for public review, public notice given, and the Plan unanimously adopted by the RWMG on December 5, 2013.

At the latter stages of the planning process, the Goose Lake area requested and was approved to join the Upper Pit watershed IRWM planning area. Over the next few years, information for the Goose Lake addition will be generated and be added into revisions of this Plan if public support and adequate resources exist for that effort.

1.2.1 Oversight of the Planning Process

Short-term Process

Pit River Watershed Alliance formally accepted the role as the interim group to oversee drafting of the IRWMP. Recognizing the need to separate its long-term role as a watershed-wide group with diverse interests and projects, PRWA formed a specific subcommittee known as the Regional Water Management Group to direct and oversee preparation and adoption of the IRWMP. After adoption of the Plan by the RWMG, decision making will transition to the identified long-term governance entity (see Long-term Process, below).

Roles and Responsibilities of RWMG:

- oversaw the consultants' work effort (content, not budget);
- directed consultants' work efforts;
- reviewed and refined IRWMP sections;
- participates in and approves participants of working groups and/or subcommittee as required;
- takes information back to its stakeholder groups about progress of the work effort;
- ensures public review of the Plan;
- reports back to PRWA, but PRWA cannot change any decisions;
- determines structure of long-term RWMG; and
- adopted the finished Plan and will adopt any future updates.

The RWMG met between fall 2011 and spring 2014 to oversee Plan preparation.

Long-term Structure for Plan Implementation

During Plan development, the RWMG undertook a recruitment process to attract additional stakeholder representatives who have an interest in the region's water management planning. This recruitment process did not yield substantial additional representation, so a more concerted recruitment process is planned for 2014.

Once additional recruitment is completed, it is anticipated that the long-term RWMG would be made up of the RWMG *plus* additional recruited members.

Into the future, at a minimum, the RWMG will be responsible for:

- tracking the proposal submittal for a 2013 implementation grant by staying in contact with DWR;
- assuring all project sponsors have adopted the Plan;
- coordinating and adopting annual (or other set interval) revisions or updates to the Plan;
- annual review of performance measures;
- assuring Plan implementation (e.g., revising or updating Plan, ongoing project development, pursuit of funding for project implementation);
- securing funding for staffing, or a strategy for implementation grant preparation; and
- securing staff or a strategy for internal communications and public involvement.

1.2.2 Public Involvement

Several regional and sub-regional meetings took place throughout the watershed, from fall 2011 through winter 2013. Extensive stakeholder, agency, Tribal, and non-governmental organizational involvement has also informed Plan development. A partial list of the many entities involved is presented below:

Table 1-1.
Regional Entities Involved in Plan Development

Big Valley Water Users Group
Bureau of Indian Affairs (represented by the Pit River Tribe)
Bureau of Land Management
Burney Water District
California Department of Fish and Game
Central Modoc Resource Conservation District
Central Valley Regional Water Quality Control Board
City of Alturas
Fall River Conservancy
Fall River Resource Conservation District
Fall River Valley Community Service District
Lassen County Board of Supervisors
Lassen County Fire Safe Council, Inc.
Lassen County Water Works District #1
Modoc County Board of Supervisors
Modoc County Planning Department
Modoc County Public Works
Modoc National Forest
Natural Resources Conservation Service
North Cal-Neva RC&D Council, Inc.
Northeastern California Water Association
Pit River Resource Conservation District
River Center
Shasta County Water Agency
Sierra Pacific Industries
South Fork Irrigation District
Trout Unlimited
U.C. Cooperative Extension Agency
U.S. Forest Service

Several individuals volunteered their time as well.

1.2.3 Plan Adoption and Implementation

The Plan was adopted by the RWMG on December 5, 2013. The Plan will be used primarily by the RWMG to guide implementation of projects that carry out the Plan's goals and objectives. Secondly, the Plan could be used by project sponsors as a springboard for project development and funding, and by water management agencies to foster cooperation. The Plan will be periodically revised or

updated; public participation is encouraged and will be an essential part of the implementation of projects and refinement of the IRWM Plan.

1.3 A Walk-through of the Plan

The first chapters of the Plan orient the reader to the processes employed to obtain diverse stakeholder involvement for IRWMP development, both within the Upper Pit watershed and in neighboring IRWM regions. A region description follows, discussing and displaying the natural resources and cultural, social, and economic setting of the watershed. Maps are included for reference.

Regional water issues and conflicts, and water and land use planning are then examined to determine what water-related problems need to be addressed by the Plan. These sections inform resource management strategies and goals and objectives relevant to address the identified issues. A chapter on climate change is required by the state to provide a weather record and projections that may help inform water management objectives and strategies for the future.

Solutions to regional needs are displayed under project implementation in the form of direct actions proposed by project sponsors to implement the many proposed goals and objectives.

Impacts and benefits of the Plan, both on a regional and interregional basis, are subsequently displayed. A blueprint for measuring Plan performance and monitoring project outcomes follows.

Technical analysis and data management chapters describe the expertise and data used to prepare the Plan, while IRWMP management and governance explains the organizational structure and protocols used both to develop the Plan and guide its long-term performance. IRWMP implementation provides a blueprint for getting projects on the ground, as well as for coordinated Plan administration and water management into the future.

To obtain a copy of this document, go to:

- www.upperpit.org;
- Visit your local public library where both discs and hard copies are available for review; and/or
- Request an electronic version from: northcalnevarcd@hdo.net.

CHAPTER 2. STAKEHOLDER INVOLVEMENT AND COORDINATION

1.0 INTRODUCTION

This chapter presents the variety of ways that stakeholders were involved in the development of the Upper Pit IRWMP. Outreach across the lightly populated region was persistent and focused. A communications plan was developed and implemented with outreach to Disadvantaged Communities (DACs), and with the Pit River Tribe as a key focus. The section explains the efforts used to engage the constituencies across the Plan area, as well as efforts directed to adjacent IRWM regions and stakeholders.

2.0 STAKEHOLDER COMPOSITION

Plan development was informed by extensive water management stakeholder, agency, Tribal, and non-governmental organizational involvement, engaged to represent a balance in viewpoints. As stated in the Region Description, the Plan area is lightly populated and largely in open space (60 percent publicly owned), with a few scattered communities, the vast majority of which are DACs. Five distinct groups of stakeholders emerged within the region: federal and state agencies with land management responsibilities, owners and managers of privately held agricultural and forest lands, recreational interests, a few relatively small non-profit organizations that focus on resource management and protection, and small, widely separated DAC service districts and resource conservation districts that serve communities across the region.

Identification of these groups was greatly facilitated by the fact that the majority of stakeholders belonged to and participated in the Pit River Watershed Alliance (PRWA), which wrote the grant application, or were members of Northeastern California Water Association (NECWA), the applicant for the IRWM planning grant. So the IRWM effort began with many key regional stakeholders already participating in the early stages of regional identification via IRWM's Regional Acceptance Process (RAP) of 2009. These individuals were, therefore, well informed about IRWM and the activities associated with Plan preparation. Additionally, a meeting sponsored by the National Fish and Wildlife Foundation and hosted by American Rivers was held in the region prior to Plan development, to address potential issues and opportunities associated with mountain meadow restoration and management on public and private lands. Local timber companies were well represented at this meeting, and the IRWMP process was explained and contact information provided.

Several water purveyors serve the watershed, including: Burney Water District, Fall River Valley Community Services District, Lassen County Waterworks District #1, California Pines Community Services District, Hot Springs Valley Irrigation District, Del Oro Water Company, City of Alturas, and South Fork Irrigation District. These entities were involved either through participation in the RWMG, Project Review Committee (PRC), during land use and water planning interviews conducted by the Project Team, or were contacted by the Project Team and elected not to participate.

A partial list of the many regional water management entities and volunteers involved in the IRWMP preparation is presented below:

Table 2-1. Stakeholder Composition	
Big Valley Water Users Group (water purveyor)	Natural Resources Conservation Service (federal agency)
Burney Water District (DAC water purveyor)	North Cal-Neva RC&D Council, Inc. (community organization)
California Department of Fish and Game (state agency)	Northeastern California Water Association (community organization)
Central Modoc Resource Conservation District (local agency)	Pit River Resource Conservation District (local agency)
Central Valley Regional Water Quality Control Board (state agency)	Pit River Tribe (DAC water purveyor and Native American Tribe)
City of Alturas (DAC municipal water purveyor and flood control agency)	Pit River Watershed Alliance (community organization and environmental stewardship)
Fall River Conservancy (environmental stewardship)	River Center (environmental stewardship)
Fall River Resource Conservation District (local agency)	Shasta County Water Agency (county gov't)
Fall River Valley CSD (DAC water purveyor)	Sierra Pacific Industries (industry)
Lassen County Board of Supervisors (county gov't)	South Fork Irrigation District (water purveyor)
Lassen County Water Works (DAC water purveyor)	Trout Unlimited (environmental stewardship)
Modoc County Board of Supervisors (county gov't)	U.C. Cooperative Extension Agency (university)
Modoc County Planning Department (county gov't)	U.S. Bureau of Land Management (federal agency)
Modoc County Public Works (county gov't)	U.S. Forest Service (federal agency)

3.0 PROCESS USED TO ID STAKEHOLDERS AND BARRIERS TO INVOLVEMENT

The Project Team drafted a communications plan early in the planning effort to assure broad stakeholder representation and to overcome barriers to involvement in the planning process. This was approved by the RWMG and followed throughout the planning effort (see **Appendix 2-1 Communications Plan and DAC Capacity Building**). The communications plan identified six key strategies for delivering both IRWM information and soliciting stakeholder participation in the Plan preparation process: use of traditional print media, development of a Website, creation of a contacts list to support systematic outreach and coordination and tracking of communications, personal communications by RWMG and other team members, use of targeted meetings and workshops, and use of written materials for distribution at meetings and workshops. Central to the communications strategy was the direct and personalized outreach to DAC and Tribal communities, shifting meeting times to accommodate stakeholders, and convening public meetings so that the general public could provide input at critical stages of Plan development. Direct and personalized involvement was used to overcome the barrier of lack of meeting travel budgets for some stakeholders. (See also **5.0 Technology and Information Access**).

As a result of the broad representation of the initial contingent of stakeholders (via PRWA and NECWA membership, as discussed above), outreach and implementation of the communication plan was greatly simplified.

Given the small population of the area, many individuals serve on multiple boards and committees, and/or serve as staff to relevant agencies. It is not uncommon for the key stakeholders to meet multiple times in any given month as a result of their various role(s) in the region. These meetings serve the collateral purpose of giving stakeholders opportunities to engage in 'side bar'

conversations about other activities, issues, or processes occurring in the region – in this case IRWM activities. Numerous times RWMG members would come to a meeting having already engaged in informal discussion, and brought back with them divergent viewpoints or opinions from other stakeholders. In this way, additional individuals with potential interests in joining the work effort were identified – either though the RWMG or committees.

This informal communication and social networking process is common in the region and is an integral and accepted aspect of information transfer in the Plan area. Agency staffs and county governments were also easily accessible. The resource conservation districts and community service districts were most interested in participating in Plan and project development, while county governments exhibited less interest, although recruitment of their participation has and will continue (see **Chapter 15 IRWMP Management, Governance, and Implementation)**.

Representatives of DACs were identified via local knowledge and contacted directly by phone or through a meeting to inform them of the IRWM process and cultivate their participation. All of the contacted DAC service districts or public works departments chose to actively participate through the PRC. The general public was involved through a series of 11 public regional and sub-regional meetings that took place throughout the Plan area, from fall 2011 through winter 2013 (see public meeting synopses on upperpit.org).

Contacts with the Pit River Tribe were initiated via a series of hard-copy mailings, followed by email and phone contacts. The list of Tribal contacts was developed by the California Indian Environmental Alliance, and included not only Tribal bands with a current physical presence in the area, but also Tribes with historic roots or presence in the region. All contacts were initially through the various Tribal governments. The Pit River Tribe (also representing the Bureau of Indian Affairs) was contacted through its Tribal Council and ultimately designated its Environmental Coordinator and a Tribal Council member as representatives to the RWMG in summer 2012 (see Tribal outreach materials in 15-1).

In summary, the majority of stakeholders self-identified early on in the process by four primary methods: they were members of the entities listed in section **2.0 Stakeholder Composition**, they attended sub-regional meetings during issues/objectives identification and learned about the process, they became engaged as project sponsors, or they were recruited or solicited by personal contact after being identified as interested parties by outreach efforts or by other stakeholders.

Many stakeholders chose to participate as members of subcommittees, as discussed below. As stated above, particular outreach efforts were made to include under-represented constituencies, especially Tribal interests.

The RWMG communicated with the public through traditional and electronic media at key points in the Plan development process to ensure adequate opportunities for public input and document review. This included press releases and an outreach flier (see **Appendix 15-1**), personal communications by phone and email, creation of a blog followed deployment of an Upper Pit IRWMP Website, PSAs, paid advertising, attendance by the Project Team at meetings throughout the region to announce IRWMP progress (e.g., NECWA meetings, Tribal Council meetings, Burney-Hat Creek Forest Initiative, RCD meetings), technical advisory groups and subcommittees, and several sub-regional meetings).

4.0 OUTREACH TO DISADVANTAGED COMMUNITIES

Of the 17 communities in the Plan area, four are categorized as DACs and nine as severely disadvantaged (SDACs), as identified in **Table 3-9**. All but one of these communities (Alturas) is unincorporated. All have limited financial resources. Many do not support any governmental structures, so are under the appropriate county jurisdiction. However, for critical water supply needs, many of the larger communities (e.g., Burney, Fall River Mills, McArthur, Bieber) have formed community service districts that provide drinking water to area residents. So outreach was focused on the City of Alturas, Burney, and the community service districts which served DACs across the region. The relative absence of a governmental entity meant that communities with no service district or other governmental unit in place to manage water resources were coordinated through their respective counties. While DAC outreach was extremely successful, it was supplemented by outreach to local water and land use planners to identify additional community needs and strategies for improvement (see **Chapter 5 Water and Land Use Planning**).

Direct support and outreach to DACs was provided by the Project Team and through the PRC, which became the primary outreach and support for most of the regional DACs. Alturas and Burney staffs proved to be well able to identify and develop infrastructure and other types of projects and did not request direct support from team members, although they did participate in the PRC. Many of the community service districts also were well able to define their community needs and develop specific projects to address those needs; however, the support of team members greatly enhanced their ability to produce project-related material for the Plan. Some of the smaller districts requested direct support, provided either by team members, or through the ongoing activities of the PRC.

Primary outcomes of the PRC for DACs included: development of templates to ensure consistency of project development activities (i.e., work plans, schedules, budgets, identification of project outcomes, and performance measures), a system for collaborating on options for integration of projects over time, a strategy for sharing resources to advance conceptual projects to a more ready-to-proceed status, and opportunities to realize an economy of scale when purchasing some hardware, computer-based mapping capabilities, and other project components or coordinating construction phasing. In addition, two fundraising workshops were conducted – one within the PRC venue and another a two-day training given by an outside trainer. These trainings were specifically targeted at the DAC members of the PRC though other project sponsors also took advantage of the opportunity to attend. It is important to note that, as a result of the PRC, many of the affected DACs began to participate in other Plan development activities, including Plan document review.

In addition to direct outreach during Plan preparation, the IRWM effort produced several guides and workshops that were/are specifically aimed at building capacity for DACs: a funding workshop to increase understanding of project funding sources, a grant preparation workshop, a project development manual (see **Appendix 9-1**) to assist in development and integration of infrastructure and other beneficial projects into the future, a training on how to complete cost/benefit analyses to complete these sometimes complicated but vital studies, and a DAC Capacity Building Program that looks at methods and strategies for continuing to build future project development and fundraising capacity (see **Appendix 2-1**).

4.1 Tribal Outreach

The Tribal outreach, though ultimately successful, started slowly. A combination of changing Tribal leadership, staff transitions, and the passing of two Tribal elders at a critical point in the process delayed the overall effort. However, during the planning effort, team members attended Tribal Council meetings where issues and concerns were identified and processes for ensuring project development were discussed. The Project Team also met with five Tribal staff numerous times in person and over the phone, and conducted two field visits – one with Tribal staff and one with the Council and staff to identify priority projects. In turn, Tribal representatives participated in numerous PRC meetings, attended RWMG meetings, provided substantial input into Plan preparation (both through lengthy written comments as well as personal communications and attendance at key meetings), and worked with the assistance of team members to develop project materials to ensure that several Tribal projects would be eligible for inclusion in the Plan (see **Chapter 9 Project Development and Implementation** and **Appendix 15 -1 under Tribal Outreach**).

5.0 TECHNOLOGY AND INFORMATION ACCESS

One barrier to involvement is that the Plan area does not have consistent access to internet or electronic media, cellphone coverage can be spotty, and, where Internet service is available, many individuals do not want to be contacted via email. As a result, alternative strategies were necessary to support outreach. In some cases, such as for meeting notices, the local media was used, either by supplying press releases or (when it became obvious the press releases did not always result in articles) through ads placed in the local newspapers. When a public review draft of the Plan became available, Public Service Announcements (PSAs) were used to ensure that the general public knew where and how to get copies and when and how to submit comments. A concerted effort to get computers into local libraries proved to have limited success – out of ten computers offered, only one library (in Alturas) consented to have an IRWM-networked computer installed.

Again, the informal network of interlocking committee memberships and the local social network proved to be very effective for soliciting input and publicizing the IRWM process. There is no public transportation system that serves the region, so instead efforts were made to facilitate carpooling to meetings. The stakeholders in the Plan area are well accustomed to driving and carpooling to more centrally located communities to conduct meetings. This locational strategy was used throughout the planning activities – with all PRC and RWMG meetings held in either Bieber or Adin. Contacts from participating stakeholders were many and varied and included emails, phone calls, conference calls, formal meetings, informal and spontaneous meetings, and occasional use of hard-copy mailings or faxes.

A reverse strategy was used when outreach was aimed at the general public or watershed-specific stakeholders. In those cases, the final total of 11 meetings was held in the primary community within the sub-watershed: in Burney for the Burney Creek watershed, at the Hat Creek fire station for the Hat Creek watershed, at the fairgrounds in McArthur for the Fall River watershed and in various locations in Alturas for the Upper Pit watershed. Notice of meetings was through Website notices, press releases to local papers (a system which worked very well initially but had intermittent success thereafter), emails to participants who had legibly submitted their addresses on sign-in sheets, hard-copy mailings to those who requested such and provided an address, PSAs, and legal notices.

At each meeting, regardless of location or purpose, the phone numbers, mailing addresses, and email addresses of key team members, PRWA or RWMG, and NECWA contacts were made available. Over the life of the Plan preparation period, only one team member received communication from the general public outside of public meetings (i.e., a direct phone call); however, informal and direct public contact was made with several RWMG and NECWA members and was communicated in that way to the Project Team.

The constituency identified as most commonly under-represented was the Pit River Tribe. Extensive efforts were made to invite, inform, and involve this constituency and to identify how its needs and perspectives differed from the majority's (please see also **Chapter 4 Issues and Conflicts**). Tribal outreach was conducted as discussed above, and in **Appendix 2-1** and **15-1**.

6.0 DECISION-MAKING PROCESS

Stakeholders who chose to participate in the RWMG or in a committee, followed the decision-making process set forth in **Chapter 15 IRWMP Management, Governance, and Implementation** (i.e., consensus with a 75 percent supermajority vote when needed). Opportunities to contribute took the form of technical contributions, decisions that affected the overall planning process and content, and project development and refinement.

Over the course of the planning process, three committees were approved by the RWMG and actively participated in developing Plan content and decision-making: the PRC, Climate Variability Working Group, and Plan Review Committee.

Stakeholders were able to contact Project Team members, NECWA, RWMG members, North Cal-Neva RC&D staff, or other individuals to request involvement in the committee process. Agendas and materials for these meetings were made available to a wide email list, as were agendas for the RWMG meetings. Contact was available initially through the blog and then the Website, as well as by using the contact information supplied at each public and committee meeting. Water management-related stakeholders were recruited by the RWMG and Project Team, and while not everyone contacted chose to participate, the knowledge about the Plan preparation activities and options for involvement were widely known and understood. Again, it is important to remember what a relatively small number of people the watershed includes, the few entities that represent an interest in water management, and the limited percentage of people who are available to participate in a long-term process such as IRWM. It is not an exaggeration to state that the participation of 20 key stakeholders would represent virtually all of the constituencies with an interest in water management and watershed resource management within the region.

6.1 Project Review Committee

The Project Review Committee (PRC) was established to develop a list of projects for inclusion in the Plan and a means of ranking those projects as required by the 2012 IRWM Guidelines. The PRC was composed of the following members:

Table 2-2. Project Review Committee	
Andrew Braugh, Trout Unlimited	Edie Asrow, PRWA
Tom Esgate, Pit RCD	Todd Sloat, Fall River RCD
Marissa Fierro, Pit River Tribe	Marty Yamagiwa, Modoc National Forest
Willie Rodriguez, Burney Water District	Mike Millington, Fall River RCD
Kate Hall, Central Modoc RCD	Dennis Heiman, Sacramento River Watershed Program
Kim Hunter, Modoc County and City of Alturas	Bill Reading, Modoc National Forest
Jim Irvin, Alturas City Council	Eric Wedemeyer, Shasta County Water Agency
Steve Jackson, Lassen County Water Works	Tim Keesey, Honey Lake Valley RCD
John Van den Bergh, Fall River Valley CSD	Shawn Wheelock, Lassen National Forest
Tracey Eleck, Pit River Tribe	Mark DePerio, Modoc National Forest

For a full discussion of the activities, contributions, and decision-making process of the PRC, please see **Chapter 9 Project Development and Implementation**.

6.2 Climate Variability Working Group

The Climate Variability Working Group (Group) was convened to assist in developing technical information and providing local review and approval of climate data into the climate analyses used in this Plan. **Table 2-3** shows the membership of this group.

Table 2-3. Climate Variability Working Group	
Edie Asrow	Pit River Watershed Alliance
Marty Yamagiwa	Modoc National Forest
Kate Hall	Central Modoc Resource Conservation District
Tim Burke	U.S. Bureau of Land Management
Sean Curtis	Modoc County
Dan Marcum	U.C. Extension
Ben Letton	Regional Water Quality Control Board
Mike Millington	Fall River Resource Conservation District

6.3 Plan Review Committee

The Plan Review Committee was composed of:

Edie Asrow, Pit River Watershed Alliance
Dennis Heiman, Sacramento River Watershed Program
Pam Giacomini, Rancher and Northeastern California Water Association
Kate Hall, Central Modoc Resource Conservation District (early reviews)
Todd Sloat, Pit River RCD (later reviews)

Initial draft Plan sections began to be submitted to the RWMG for review at the beginning of 2012. After addressing substantive comments on initial sections, the RWMG determined that it would continue to have substantive discussion on each section, but would delegate editing, wordsmithing, and coming to consensus on how to handle approach to a Plan Review Committee. This committee

was appointed in spring 2012 and represented diverse interests. It participated with the Project Team by phone conference calls and reviewed all draft materials associated with the Plan at appropriate intervals during document preparation.

7.0 INVOLVING STAKEHOLDERS

Ongoing and future involvement of stakeholders will continue via any of the following methods: formal recruitment of water-related interest groups (see **Chapter 15 IRWMP Management, Governance, and Implementation**), advertised sub-regional meetings, personal contact by stakeholders, electronic and printed media, the Website, or by members of the RWMG. Involvement of stakeholders, especially in Plan committees, will be crucial to recruiting projects that address issues and implement Plan objectives and resource management strategies.

As noted elsewhere in this document, sub-regional meetings were held throughout the watershed in the falls of both 2011 and 2012. During the first set of public meetings, a vocal minority who opposed the planning effort emerged, often interrupting the presentations and other participants. Intimidation tactics of videotaping participants, loud and aggressive behavior, and personal threats were made during meetings. As a consequence, some stakeholders told the Project Team they would not participate in the process under such circumstances. The Project Team used a circuit-rider strategy to continue obtaining feedback from stakeholders between the two sets of sub-regional meetings

8.0 COORDINATION

8.1 Coordination of Projects and Activities

The PRC served as the primary coordination venue for all project-related activities. This group allowed for project sponsors to: avoid duplication of effort; take advantage of opportunities for implementing goals and objectives and resource management strategies, and benefitting from economics of scale; and identifying and developing projects to address data gaps.

8.2 Coordination of Activities within the IRWM Region

Early in Plan preparation, the RWMG determined that the PRC would serve as the primary venue for local project proponents to coordinate IRWM-related activities such as project development, integration, collaboration, and identification of both project gaps and redundancies. While the RWMG retained decision-making aspects of submitting projects for particular funding sources (such as DWR/Proposition IRWM Implementation Grants), it was felt that the project sponsors and proponents would have a much greater technical capacity to identify and eliminate overlapping efforts, potential conflicts, and issues or goals/objectives that might lack an implementation project.

As a result, while the RWMG decided to review project development update reports from the PRC as a standing agenda item following Plan adoption, the primary venue coordinating project development and activities will remain the PRC. PRC meetings were noticed via email to project sponsors – that is to entities with the capacity to develop, apply for funding for, and manage implementation projects. Project development materials were posted on the Website.

8.3 Coordination with Agencies and Stakeholders to Avoid Conflict

Conflict resolution mechanisms have been adopted as part of this Plan. In **Chapter 4 Issues and Conflicts**, strategies for resolving conflicts at the Plan level are arrayed under the conflict resolution discussion. In **Chapter 9 Project Development and Implementation**, the PRC formulated a project-specific conflict resolution process, subsequently affirmed by the RWMG.

It should be noted that issues involving formal Consultation with the Tribe are yet to be resolved between the Tribes and the state. This issue will be addressed by the responsible parties during Plan implementation and integrated into the Plan as outcomes are made known.

8.4 Neighboring Regions and Interregional Communications

As part of the 2010 planning grant, the Upper Pit RWMG has taken responsibility for convening both formal and informal conversations with the immediately adjacent IRWMP/RWMG groups to discuss identification of emerging and standing issues and conflicts, issues of mutual concern, joint project development, and reconsideration of Plan area boundaries.

8.4.1 Adjacent IRWMP Regions – Issues and Conflicts

Five IRWM regions lie directly adjacent to the Upper Pit IRWM: North Coast, Upper Sacramento River–McCloud, North Sacramento Valley Group, the Upper Feather River Watershed, and the Lahontan Basins (please see **Appendix 2-2**).

Of these, all but the North Sacramento Valley share many water management issues with the Upper Pit region. All but the North Sacramento are predominantly rural, have mountainous topography interspersed with valleys which support a limited variety of agriculture with grazing and specialty crops such as wild rice or alfalfa/hay as the focus. The populations in these regions are widely dispersed and largely self-reliant. Infrastructure in these regions is provided mainly by community service districts or by privately owned wells and septic systems.

The North Sacramento Valley lies below the primary reservoir facilities and is served by the Sacramento River, as well as groundwater and other local surface water sources. It shares management issues with the Upper Pit, Upper Sacramento-McCloud, and North Coast only in its most northeasterly zones. The flat valley areas which begin just south of Redding share little in common with the northern mountainous and forested area region, except for a lack of municipalities and a widely scattered population that is largely in DACs.

The headwaters in the Upper Sacramento-McCloud, Upper Feather, and Upper Pit regions are all separated from the lower reaches of their primary rivers by large, federally managed reservoirs – Lake Shasta and Lake Oroville, respectively. A review of the preliminary and/or adopted issues lists for the adjacent IRWM Plans indicates a clear overlap: source-area water rights protection, high percentage of DACs, water supply focus on small community service districts or private water supply systems, concerns over fuel load reduction and forest management practices (public and private), maintenance of economic diversity and sustainability, agricultural operations that focus largely on cattle/grazing or the supply of very specialized crops (such as wild rice) and hay and feed grain, presence and spread of invasive species, erosion and sedimentation of rivers and

tributaries, concerns about salmon reintroduction above the two major impoundments, and disruption of habitat values and function. The potential reintroduction of salmon is a source of mutual conflict in these three regions, with stakeholders both opposed and in favor of such action.

8.4.2 Joint Project Development Opportunities

Across all of the subject IRWM regions, with the exception of North Sacramento Valley's municipalities, Redding and Red Bluff, communities are primarily small and self-sufficient regarding water supply and wastewater treatment, and are frequently DACs. As a result, joint projects to benefit infrastructure are not readily identifiable. However, information transfer describing methods or strategies to address common issues is a distinct opportunity. In response to this, the outcomes of implemented projects will be made available across IRWMP regions via Sacramento River Watershed Information Module (SWIM) or IRWMP Websites.

While adjacent IRWM regions share natural resource-related issues, such as fuel load reduction, restoration of mountain meadows, strategies for endangered species, reintroduction of salmon above Lake Shasta or Lake Oroville, and invasive species, projects that span IRWM boundaries have not emerged. Potential cross-boundary invasive species projects probably show the most promise at present.

8.4.3 Reconsider IRWM Regional Boundaries

While the overlap of issues across the northern arc of the state is remarkably similar, each of the IRWM regions has a clear and distinct identity. These distinct identities have been bolstered by generations of relationships within the respective regions and by the characteristics of local government, private industry, and historic impediments to travel (sheer travel distances, intemperate weather, and topography). Further, no coalescing force or issue has arisen as an impetus for redesign of regions. Having said that, the RWMG and the Goose Lake RCD are jointly considering adding that portion of the Goose Lake area within California to the Upper Pit IRWMP region (see **Chapter 3 Region Description**).

8.4.4 Inter-IRWM Coordination

Contacts within and between the adjacent IRWMs were largely phone-based, due to the long travel times between regions, or conducted in one-on-one settings. Informal phones calls, organized conference calls, meetings piggy-backed onto other DWR meetings (that is, meetings of opportunity) and email correspondence were the primary methods of contact. During the RAP, the various regions had already discussed their boundaries and to date no additional issues surrounding these boundaries have been identified, despite specific conversations aimed at considerations of boundary adjustment.

The delay in establishing a governance structure for the Upper Sacramento-McCloud region in turn delayed the interregional coordination schedule. In November 2012, a conference was convened by the Sacramento River Watershed Program that involved all adjacent IRWM regions. An Upper Pit Project Team representative met with regional representative in spring 2013 to confirm they would be willing to attend a 2013 meeting, and to confirm agenda topics. Agenda topics included: sharing issues and conflicts lists, opportunities for joint inter-IRWMP development of projects, early warning of emerging issues in the headwater or receiving water areas, management of natural

resources (e.g., the reintroduction of salmon above Shasta Dam), co-sponsorship of a cost-benefit workshop and final confirmation of boundaries.

A representative of the RWMG attended a meeting in 2013 to formalize the efficient and cost-effective ways to communicate and collaborate in the post-IRWMP preparation period, when funding to support outreach will be constrained.

The Upper Pit River is participating in two other IRWM-focused venues: the Round Table of Regions (RTOR) and the Sacramento Region Funding Area (SRFA) groups. The RTOR, an ad hoc group, including representatives of each of the IRWM regions in the state, has been meeting since 2007. The group meetings are generally via phone, roughly once a quarter, and have proven to be a valuable venue for IRWM regions to discuss issues of both statewide and regional concern. This venue will continue to be available to all the IRWMs as an informal venue for discussion and problem solving, as well as early warning for emerging issues or problems.

The SRFA group, convened by the Cosumnes American Bear Yuba (CABY) IRWM region, has met several times a year since 2008. This group is a forum for discussion that serves all eight IRWM areas within the Sacramento Region Funding Area. This group offers opportunities for joint fact-finding, collaboration on projects, development of interregional projects, early identification of emerging issues, and problem solving on issues of mutual concern but differing perspectives. CABY will continue to convene these meetings into the future as part of its organizational program.

8.5 Agency Coordination

State, federal, and local agencies have been and are represented in PRWA and the RWMG, and have participated in the activities of the PRC. This collaboration is expected to continue and includes not only project development, but also regular exchange of data and identification of any changes to listed issues or conflicts (see **Table 2-4 Agency Coordination**).

Table 2-4. Agency Coordination	
Agency/Entity	**Relevance to Plan Development**
Sovereign Nations	
Pit River Tribe	Represents Tribal interests Manages community water systems Manages natural resources on Tribal lands Stewards cultural and paleontological resources
Federal	
Bureau of Indian Affairs	Responsible agency for Indian Trust Lands
Modoc National Forest	Manages natural resources on federal lands
U.S. Bureau of Land Management – Alturas Office	Manages natural resources on federal lands
Natural Resources Conservation Service	Aids landowners in agricultural and natural resource stewardship
State	
California Department of Fish and Game	Manages state fish and wildlife and their habitat, and provides enforcement of fish and game laws
Central Valley Regional Water Quality Control Board	Provides guidance and technical support for water laws and regulations, and enforces such laws and regulations
U.C. Cooperative Extension Agency	Technical and educational support for the agricultural community
Local	
Burney Water District	Provides public water supply
City of Alturas	Provides public water supply, public wastewater treatment, and flood control
Central Modoc Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Fall River Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Lassen County Board of Supervisors	Jurisdiction over land use, resource management, water supply, and wastewater treatment in unincorporated communities
Lassen County Water Works District #1	Jurisdiction over water supply within the district
Modoc County Board of Supervisors	Jurisdiction over land use, resource management, water supply, and wastewater treatment in unincorporated communities
Pit River Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Sacramento River Watershed Program	Provides information/outreach, financial and administrative services to numerous locally directed watershed management programs in the region
Shasta County Water Agency	Develops water resources for the beneficial use of the people of Shasta County
South Fork Irrigation District	Supplies irrigation water within the district

The IRWM Guidelines also encourage RWMGs to stay involved in the California Natural Resource Agency's Adaptation Strategy process, and to join/sign on to the California Climate Action Registry at http://www.climateregistry.org/.

CHAPTER 2. STAKEHOLDER INVOLVEMENT AND COORDINATION

1.0 INTRODUCTION

This chapter presents the variety of ways that stakeholders were involved in the development of the Upper Pit IRWMP. Outreach across the lightly populated region was persistent and focused. A communications plan was developed and implemented with outreach to Disadvantaged Communities (DACs), and with the Pit River Tribe as a key focus. The section explains the efforts used to engage the constituencies across the Plan area, as well as efforts directed to adjacent IRWM regions and stakeholders.

2.0 STAKEHOLDER COMPOSITION

Plan development was informed by extensive water management stakeholder, agency, Tribal, and non-governmental organizational involvement, engaged to represent a balance in viewpoints. As stated in the Region Description, the Plan area is lightly populated and largely in open space (60 percent publicly owned), with a few scattered communities, the vast majority of which are DACs. Five distinct groups of stakeholders emerged within the region: federal and state agencies with land management responsibilities, owners and managers of privately held agricultural and forest lands, recreational interests, a few relatively small non-profit organizations that focus on resource management and protection, and small, widely separated DAC service districts and resource conservation districts that serve communities across the region.

Identification of these groups was greatly facilitated by the fact that the majority of stakeholders belonged to and participated in the Pit River Watershed Alliance (PRWA), which wrote the grant application, or were members of Northeastern California Water Association (NECWA), the applicant for the IRWM planning grant. So the IRWM effort began with many key regional stakeholders already participating in the early stages of regional identification via IRWM's Regional Acceptance Process (RAP) of 2009. These individuals were, therefore, well informed about IRWM and the activities associated with Plan preparation. Additionally, a meeting sponsored by the National Fish and Wildlife Foundation and hosted by American Rivers was held in the region prior to Plan development, to address potential issues and opportunities associated with mountain meadow restoration and management on public and private lands. Local timber companies were well represented at this meeting, and the IRWMP process was explained and contact information provided.

Several water purveyors serve the watershed, including: Burney Water District, Fall River Valley Community Services District, Lassen County Waterworks District #1, California Pines Community Services District, Hot Springs Valley Irrigation District, Del Oro Water Company, City of Alturas, and South Fork Irrigation District. These entities were involved either through participation in the RWMG, Project Review Committee (PRC), during land use and water planning interviews conducted by the Project Team, or were contacted by the Project Team and elected not to participate.

A partial list of the many regional water management entities and volunteers involved in the IRWMP preparation is presented below:

Table 2-1. Stakeholder Composition	
Big Valley Water Users Group (water purveyor)	Natural Resources Conservation Service (federal agency)
Burney Water District (DAC water purveyor)	North Cal-Neva RC&D Council, Inc. (community organization)
California Department of Fish and Game (state agency)	Northeastern California Water Association (community organization)
Central Modoc Resource Conservation District (local agency)	Pit River Resource Conservation District (local agency)
Central Valley Regional Water Quality Control Board (state agency)	Pit River Tribe (DAC water purveyor and Native American Tribe)
City of Alturas (DAC municipal water purveyor and flood control agency)	Pit River Watershed Alliance (community organization and environmental stewardship)
Fall River Conservancy (environmental stewardship)	River Center (environmental stewardship)
Fall River Resource Conservation District (local agency)	Shasta County Water Agency (county gov't)
Fall River Valley CSD (DAC water purveyor)	Sierra Pacific Industries (industry)
Lassen County Board of Supervisors (county gov't)	South Fork Irrigation District (water purveyor)
Lassen County Water Works (DAC water purveyor)	Trout Unlimited (environmental stewardship)
Modoc County Board of Supervisors (county gov't)	U.C. Cooperative Extension Agency (university)
Modoc County Planning Department (county gov't)	U.S. Bureau of Land Management (federal agency)
Modoc County Public Works (county gov't)	U.S. Forest Service (federal agency)

3.0 PROCESS USED TO ID STAKEHOLDERS AND BARRIERS TO INVOLVEMENT

The Project Team drafted a communications plan early in the planning effort to assure broad stakeholder representation and to overcome barriers to involvement in the planning process. This was approved by the RWMG and followed throughout the planning effort (see **Appendix 2-1 Communications Plan and DAC Capacity Building**). The communications plan identified six key strategies for delivering both IRWM information and soliciting stakeholder participation in the Plan preparation process: use of traditional print media, development of a Website, creation of a contacts list to support systematic outreach and coordination and tracking of communications, personal communications by RWMG and other team members, use of targeted meetings and workshops, and use of written materials for distribution at meetings and workshops. Central to the communications strategy was the direct and personalized outreach to DAC and Tribal communities, shifting meeting times to accommodate stakeholders, and convening public meetings so that the general public could provide input at critical stages of Plan development. Direct and personalized involvement was used to overcome the barrier of lack of meeting travel budgets for some stakeholders. (See also **5.0 Technology and Information Access**).

As a result of the broad representation of the initial contingent of stakeholders (via PRWA and NECWA membership, as discussed above), outreach and implementation of the communication plan was greatly simplified.

Given the small population of the area, many individuals serve on multiple boards and committees, and/or serve as staff to relevant agencies. It is not uncommon for the key stakeholders to meet multiple times in any given month as a result of their various role(s) in the region. These meetings serve the collateral purpose of giving stakeholders opportunities to engage in 'side bar'

conversations about other activities, issues, or processes occurring in the region – in this case IRWM activities. Numerous times RWMG members would come to a meeting having already engaged in informal discussion, and brought back with them divergent viewpoints or opinions from other stakeholders. In this way, additional individuals with potential interests in joining the work effort were identified – either though the RWMG or committees.

This informal communication and social networking process is common in the region and is an integral and accepted aspect of information transfer in the Plan area. Agency staffs and county governments were also easily accessible. The resource conservation districts and community service districts were most interested in participating in Plan and project development, while county governments exhibited less interest, although recruitment of their participation has and will continue (see **Chapter 15 IRWMP Management, Governance, and Implementation)**.

Representatives of DACs were identified via local knowledge and contacted directly by phone or through a meeting to inform them of the IRWM process and cultivate their participation. All of the contacted DAC service districts or public works departments chose to actively participate through the PRC. The general public was involved through a series of 11 public regional and sub-regional meetings that took place throughout the Plan area, from fall 2011 through winter 2013 (see public meeting synopses on upperpit.org).

Contacts with the Pit River Tribe were initiated via a series of hard-copy mailings, followed by email and phone contacts. The list of Tribal contacts was developed by the California Indian Environmental Alliance, and included not only Tribal bands with a current physical presence in the area, but also Tribes with historic roots or presence in the region. All contacts were initially through the various Tribal governments. The Pit River Tribe (also representing the Bureau of Indian Affairs) was contacted through its Tribal Council and ultimately designated its Environmental Coordinator and a Tribal Council member as representatives to the RWMG in summer 2012 (see Tribal outreach materials in 15-1).

In summary, the majority of stakeholders self-identified early on in the process by four primary methods: they were members of the entities listed in section **2.0 Stakeholder Composition**, they attended sub-regional meetings during issues/objectives identification and learned about the process, they became engaged as project sponsors, or they were recruited or solicited by personal contact after being identified as interested parties by outreach efforts or by other stakeholders.

Many stakeholders chose to participate as members of subcommittees, as discussed below. As stated above, particular outreach efforts were made to include under-represented constituencies, especially Tribal interests.

The RWMG communicated with the public through traditional and electronic media at key points in the Plan development process to ensure adequate opportunities for public input and document review. This included press releases and an outreach flier (see **Appendix 15-1**), personal communications by phone and email, creation of a blog followed deployment of an Upper Pit IRWMP Website, PSAs, paid advertising, attendance by the Project Team at meetings throughout the region to announce IRWMP progress (e.g., NECWA meetings, Tribal Council meetings, Burney-Hat Creek Forest Initiative, RCD meetings), technical advisory groups and subcommittees, and several sub-regional meetings).

4.0 OUTREACH TO DISADVANTAGED COMMUNITIES

Of the 17 communities in the Plan area, four are categorized as DACs and nine as severely disadvantaged (SDACs), as identified in **Table 3-9**. All but one of these communities (Alturas) is unincorporated. All have limited financial resources. Many do not support any governmental structures, so are under the appropriate county jurisdiction. However, for critical water supply needs, many of the larger communities (e.g., Burney, Fall River Mills, McArthur, Bieber) have formed community service districts that provide drinking water to area residents. So outreach was focused on the City of Alturas, Burney, and the community service districts which served DACs across the region. The relative absence of a governmental entity meant that communities with no service district or other governmental unit in place to manage water resources were coordinated through their respective counties. While DAC outreach was extremely successful, it was supplemented by outreach to local water and land use planners to identify additional community needs and strategies for improvement (see **Chapter 5 Water and Land Use Planning**).

Direct support and outreach to DACs was provided by the Project Team and through the PRC, which became the primary outreach and support for most of the regional DACs. Alturas and Burney staffs proved to be well able to identify and develop infrastructure and other types of projects and did not request direct support from team members, although they did participate in the PRC. Many of the community service districts also were well able to define their community needs and develop specific projects to address those needs; however, the support of team members greatly enhanced their ability to produce project-related material for the Plan. Some of the smaller districts requested direct support, provided either by team members, or through the ongoing activities of the PRC.

Primary outcomes of the PRC for DACs included: development of templates to ensure consistency of project development activities (i.e., work plans, schedules, budgets, identification of project outcomes, and performance measures), a system for collaborating on options for integration of projects over time, a strategy for sharing resources to advance conceptual projects to a more ready-to-proceed status, and opportunities to realize an economy of scale when purchasing some hardware, computer-based mapping capabilities, and other project components or coordinating construction phasing. In addition, two fundraising workshops were conducted – one within the PRC venue and another a two-day training given by an outside trainer. These trainings were specifically targeted at the DAC members of the PRC though other project sponsors also took advantage of the opportunity to attend. It is important to note that, as a result of the PRC, many of the affected DACs began to participate in other Plan development activities, including Plan document review.

In addition to direct outreach during Plan preparation, the IRWM effort produced several guides and workshops that were/are specifically aimed at building capacity for DACs: a funding workshop to increase understanding of project funding sources, a grant preparation workshop, a project development manual (see **Appendix 9-1**) to assist in development and integration of infrastructure and other beneficial projects into the future, a training on how to complete cost/benefit analyses to complete these sometimes complicated but vital studies, and a DAC Capacity Building Program that looks at methods and strategies for continuing to build future project development and fundraising capacity (see **Appendix 2-1**).

4.1 Tribal Outreach

The Tribal outreach, though ultimately successful, started slowly. A combination of changing Tribal leadership, staff transitions, and the passing of two Tribal elders at a critical point in the process delayed the overall effort. However, during the planning effort, team members attended Tribal Council meetings where issues and concerns were identified and processes for ensuring project development were discussed. The Project Team also met with five Tribal staff numerous times in person and over the phone, and conducted two field visits – one with Tribal staff and one with the Council and staff to identify priority projects. In turn, Tribal representatives participated in numerous PRC meetings, attended RWMG meetings, provided substantial input into Plan preparation (both through lengthy written comments as well as personal communications and attendance at key meetings), and worked with the assistance of team members to develop project materials to ensure that several Tribal projects would be eligible for inclusion in the Plan (see **Chapter 9 Project Development and Implementation** and **Appendix 15 -1 under Tribal Outreach**).

5.0 TECHNOLOGY AND INFORMATION ACCESS

One barrier to involvement is that the Plan area does not have consistent access to internet or electronic media, cellphone coverage can be spotty, and, where Internet service is available, many individuals do not want to be contacted via email. As a result, alternative strategies were necessary to support outreach. In some cases, such as for meeting notices, the local media was used, either by supplying press releases or (when it became obvious the press releases did not always result in articles) through ads placed in the local newspapers. When a public review draft of the Plan became available, Public Service Announcements (PSAs) were used to ensure that the general public knew where and how to get copies and when and how to submit comments. A concerted effort to get computers into local libraries proved to have limited success – out of ten computers offered, only one library (in Alturas) consented to have an IRWM-networked computer installed.

Again, the informal network of interlocking committee memberships and the local social network proved to be very effective for soliciting input and publicizing the IRWM process. There is no public transportation system that serves the region, so instead efforts were made to facilitate carpooling to meetings. The stakeholders in the Plan area are well accustomed to driving and carpooling to more centrally located communities to conduct meetings. This locational strategy was used throughout the planning activities – with all PRC and RWMG meetings held in either Bieber or Adin. Contacts from participating stakeholders were many and varied and included emails, phone calls, conference calls, formal meetings, informal and spontaneous meetings, and occasional use of hard-copy mailings or faxes.

A reverse strategy was used when outreach was aimed at the general public or watershed-specific stakeholders. In those cases, the final total of 11 meetings was held in the primary community within the sub-watershed: in Burney for the Burney Creek watershed, at the Hat Creek fire station for the Hat Creek watershed, at the fairgrounds in McArthur for the Fall River watershed and in various locations in Alturas for the Upper Pit watershed. Notice of meetings was through Website notices, press releases to local papers (a system which worked very well initially but had intermittent success thereafter), emails to participants who had legibly submitted their addresses on sign-in sheets, hard-copy mailings to those who requested such and provided an address, PSAs, and legal notices.

At each meeting, regardless of location or purpose, the phone numbers, mailing addresses, and email addresses of key team members, PRWA or RWMG, and NECWA contacts were made available. Over the life of the Plan preparation period, only one team member received communication from the general public outside of public meetings (i.e., a direct phone call); however, informal and direct public contact was made with several RWMG and NECWA members and was communicated in that way to the Project Team.

The constituency identified as most commonly under-represented was the Pit River Tribe. Extensive efforts were made to invite, inform, and involve this constituency and to identify how its needs and perspectives differed from the majority's (please see also **Chapter 4 Issues and Conflicts**). Tribal outreach was conducted as discussed above, and in **Appendix 2-1** and **15-1**.

6.0 DECISION-MAKING PROCESS

Stakeholders who chose to participate in the RWMG or in a committee, followed the decision-making process set forth in **Chapter 15 IRWMP Management, Governance, and Implementation** (i.e., consensus with a 75 percent supermajority vote when needed). Opportunities to contribute took the form of technical contributions, decisions that affected the overall planning process and content, and project development and refinement.

Over the course of the planning process, three committees were approved by the RWMG and actively participated in developing Plan content and decision-making: the PRC, Climate Variability Working Group, and Plan Review Committee.

Stakeholders were able to contact Project Team members, NECWA, RWMG members, North Cal-Neva RC&D staff, or other individuals to request involvement in the committee process. Agendas and materials for these meetings were made available to a wide email list, as were agendas for the RWMG meetings. Contact was available initially through the blog and then the Website, as well as by using the contact information supplied at each public and committee meeting. Water management-related stakeholders were recruited by the RWMG and Project Team, and while not everyone contacted chose to participate, the knowledge about the Plan preparation activities and options for involvement were widely known and understood. Again, it is important to remember what a relatively small number of people the watershed includes, the few entities that represent an interest in water management, and the limited percentage of people who are available to participate in a long-term process such as IRWM. It is not an exaggeration to state that the participation of 20 key stakeholders would represent virtually all of the constituencies with an interest in water management and watershed resource management within the region.

6.1 Project Review Committee

The Project Review Committee (PRC) was established to develop a list of projects for inclusion in the Plan and a means of ranking those projects as required by the 2012 IRWM Guidelines. The PRC was composed of the following members:

Table 2-2. Project Review Committee	
Andrew Braugh, Trout Unlimited	Edie Asrow, PRWA
Tom Esgate, Pit RCD	Todd Sloat, Fall River RCD
Marissa Fierro, Pit River Tribe	Marty Yamagiwa, Modoc National Forest
Willie Rodriguez, Burney Water District	Mike Millington, Fall River RCD
Kate Hall, Central Modoc RCD	Dennis Heiman, Sacramento River Watershed Program
Kim Hunter, Modoc County and City of Alturas	Bill Reading, Modoc National Forest
Jim Irvin, Alturas City Council	Eric Wedemeyer, Shasta County Water Agency
Steve Jackson, Lassen County Water Works	Tim Keesey, Honey Lake Valley RCD
John Van den Bergh, Fall River Valley CSD	Shawn Wheelock, Lassen National Forest
Tracey Eleck, Pit River Tribe	Mark DePerio, Modoc National Forest

For a full discussion of the activities, contributions, and decision-making process of the PRC, please see **Chapter 9 Project Development and Implementation**.

6.2 Climate Variability Working Group

The Climate Variability Working Group (Group) was convened to assist in developing technical information and providing local review and approval of climate data into the climate analyses used in this Plan. **Table 2-3** shows the membership of this group.

Table 2-3. Climate Variability Working Group	
Edie Asrow	Pit River Watershed Alliance
Marty Yamagiwa	Modoc National Forest
Kate Hall	Central Modoc Resource Conservation District
Tim Burke	U.S. Bureau of Land Management
Sean Curtis	Modoc County
Dan Marcum	U.C. Extension
Ben Letton	Regional Water Quality Control Board
Mike Millington	Fall River Resource Conservation District

6.3 Plan Review Committee

The Plan Review Committee was composed of:

Edie Asrow, Pit River Watershed Alliance
Dennis Heiman, Sacramento River Watershed Program
Pam Giacomini, Rancher and Northeastern California Water Association
Kate Hall, Central Modoc Resource Conservation District (early reviews)
Todd Sloat, Pit River RCD (later reviews)

Initial draft Plan sections began to be submitted to the RWMG for review at the beginning of 2012. After addressing substantive comments on initial sections, the RWMG determined that it would continue to have substantive discussion on each section, but would delegate editing, wordsmithing, and coming to consensus on how to handle approach to a Plan Review Committee. This committee

was appointed in spring 2012 and represented diverse interests. It participated with the Project Team by phone conference calls and reviewed all draft materials associated with the Plan at appropriate intervals during document preparation.

7.0 INVOLVING STAKEHOLDERS

Ongoing and future involvement of stakeholders will continue via any of the following methods: formal recruitment of water-related interest groups (see **Chapter 15 IRWMP Management, Governance, and Implementation**), advertised sub-regional meetings, personal contact by stakeholders, electronic and printed media, the Website, or by members of the RWMG. Involvement of stakeholders, especially in Plan committees, will be crucial to recruiting projects that address issues and implement Plan objectives and resource management strategies.

As noted elsewhere in this document, sub-regional meetings were held throughout the watershed in the falls of both 2011 and 2012. During the first set of public meetings, a vocal minority who opposed the planning effort emerged, often interrupting the presentations and other participants. Intimidation tactics of videotaping participants, loud and aggressive behavior, and personal threats were made during meetings. As a consequence, some stakeholders told the Project Team they would not participate in the process under such circumstances. The Project Team used a circuit-rider strategy to continue obtaining feedback from stakeholders between the two sets of sub-regional meetings

8.0 COORDINATION

8.1 Coordination of Projects and Activities

The PRC served as the primary coordination venue for all project-related activities. This group allowed for project sponsors to: avoid duplication of effort; take advantage of opportunities for implementing goals and objectives and resource management strategies, and benefitting from economics of scale; and identifying and developing projects to address data gaps.

8.2 Coordination of Activities within the IRWM Region

Early in Plan preparation, the RWMG determined that the PRC would serve as the primary venue for local project proponents to coordinate IRWM-related activities such as project development, integration, collaboration, and identification of both project gaps and redundancies. While the RWMG retained decision-making aspects of submitting projects for particular funding sources (such as DWR/Proposition IRWM Implementation Grants), it was felt that the project sponsors and proponents would have a much greater technical capacity to identify and eliminate overlapping efforts, potential conflicts, and issues or goals/objectives that might lack an implementation project.

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It should be noted that issues involving formal Consultation with the Tribe are yet to be resolved between the Tribes and the state. This issue will be addressed by the responsible parties during Plan implementation and integrated into the Plan as outcomes are made known.

8.4 Neighboring Regions and Interregional Communications

As part of the 2010 planning grant, the Upper Pit RWMG has taken responsibility for convening both formal and informal conversations with the immediately adjacent IRWMP/RWMG groups to discuss identification of emerging and standing issues and conflicts, issues of mutual concern, joint project development, and reconsideration of Plan area boundaries.

8.4.1 Adjacent IRWMP Regions – Issues and Conflicts

Five IRWM regions lie directly adjacent to the Upper Pit IRWM: North Coast, Upper Sacramento River–McCloud, North Sacramento Valley Group, the Upper Feather River Watershed, and the Lahontan Basins (please see **Appendix 2-2**).

Of these, all but the North Sacramento Valley share many water management issues with the Upper Pit region. All but the North Sacramento are predominantly rural, have mountainous topography interspersed with valleys which support a limited variety of agriculture with grazing and specialty crops such as wild rice or alfalfa/hay as the focus. The populations in these regions are widely dispersed and largely self-reliant. Infrastructure in these regions is provided mainly by community service districts or by privately owned wells and septic systems.

The North Sacramento Valley lies below the primary reservoir facilities and is served by the Sacramento River, as well as groundwater and other local surface water sources. It shares management issues with the Upper Pit, Upper Sacramento-McCloud, and North Coast only in its most northeasterly zones. The flat valley areas which begin just south of Redding share little in common with the northern mountainous and forested area region, except for a lack of municipalities and a widely scattered population that is largely in DACs.

The headwaters in the Upper Sacramento-McCloud, Upper Feather, and Upper Pit regions are all separated from the lower reaches of their primary rivers by large, federally managed reservoirs – Lake Shasta and Lake Oroville, respectively. A review of the preliminary and/or adopted issues lists for the adjacent IRWM Plans indicates a clear overlap: source-area water rights protection, high percentage of DACs, water supply focus on small community service districts or private water supply systems, concerns over fuel load reduction and forest management practices (public and private), maintenance of economic diversity and sustainability, agricultural operations that focus largely on cattle/grazing or the supply of very specialized crops (such as wild rice) and hay and feed grain, presence and spread of invasive species, erosion and sedimentation of rivers and

tributaries, concerns about salmon reintroduction above the two major impoundments, and disruption of habitat values and function. The potential reintroduction of salmon is a source of mutual conflict in these three regions, with stakeholders both opposed and in favor of such action.

8.4.2 Joint Project Development Opportunities

Across all of the subject IRWM regions, with the exception of North Sacramento Valley's municipalities, Redding and Red Bluff, communities are primarily small and self-sufficient regarding water supply and wastewater treatment, and are frequently DACs. As a result, joint projects to benefit infrastructure are not readily identifiable. However, information transfer describing methods or strategies to address common issues is a distinct opportunity. In response to this, the outcomes of implemented projects will be made available across IRWMP regions via Sacramento River Watershed Information Module (SWIM) or IRWMP Websites.

While adjacent IRWM regions share natural resource-related issues, such as fuel load reduction, restoration of mountain meadows, strategies for endangered species, reintroduction of salmon above Lake Shasta or Lake Oroville, and invasive species, projects that span IRWM boundaries have not emerged. Potential cross-boundary invasive species projects probably show the most promise at present.

8.4.3 Reconsider IRWM Regional Boundaries

While the overlap of issues across the northern arc of the state is remarkably similar, each of the IRWM regions has a clear and distinct identity. These distinct identities have been bolstered by generations of relationships within the respective regions and by the characteristics of local government, private industry, and historic impediments to travel (sheer travel distances, intemperate weather, and topography). Further, no coalescing force or issue has arisen as an impetus for redesign of regions. Having said that, the RWMG and the Goose Lake RCD are jointly considering adding that portion of the Goose Lake area within California to the Upper Pit IRWMP region (see **Chapter 3 Region Description**).

8.4.4 Inter-IRWM Coordination

Contacts within and between the adjacent IRWMs were largely phone-based, due to the long travel times between regions, or conducted in one-on-one settings. Informal phones calls, organized conference calls, meetings piggy-backed onto other DWR meetings (that is, meetings of opportunity) and email correspondence were the primary methods of contact. During the RAP, the various regions had already discussed their boundaries and to date no additional issues surrounding these boundaries have been identified, despite specific conversations aimed at considerations of boundary adjustment.

The delay in establishing a governance structure for the Upper Sacramento-McCloud region in turn delayed the interregional coordination schedule. In November 2012, a conference was convened by the Sacramento River Watershed Program that involved all adjacent IRWM regions. An Upper Pit Project Team representative met with regional representative in spring 2013 to confirm they would be willing to attend a 2013 meeting, and to confirm agenda topics. Agenda topics included: sharing issues and conflicts lists, opportunities for joint inter-IRWMP development of projects, early warning of emerging issues in the headwater or receiving water areas, management of natural

resources (e.g., the reintroduction of salmon above Shasta Dam), co-sponsorship of a cost-benefit workshop and final confirmation of boundaries.

A representative of the RWMG attended a meeting in 2013 to formalize the efficient and cost-effective ways to communicate and collaborate in the post-IRWMP preparation period, when funding to support outreach will be constrained.

The Upper Pit River is participating in two other IRWM-focused venues: the Round Table of Regions (RTOR) and the Sacramento Region Funding Area (SRFA) groups. The RTOR, an ad hoc group, including representatives of each of the IRWM regions in the state, has been meeting since 2007. The group meetings are generally via phone, roughly once a quarter, and have proven to be a valuable venue for IRWM regions to discuss issues of both statewide and regional concern. This venue will continue to be available to all the IRWMs as an informal venue for discussion and problem solving, as well as early warning for emerging issues or problems.

The SRFA group, convened by the Cosumnes American Bear Yuba (CABY) IRWM region, has met several times a year since 2008. This group is a forum for discussion that serves all eight IRWM areas within the Sacramento Region Funding Area. This group offers opportunities for joint fact-finding, collaboration on projects, development of interregional projects, early identification of emerging issues, and problem solving on issues of mutual concern but differing perspectives. CABY will continue to convene these meetings into the future as part of its organizational program.

8.5 Agency Coordination

State, federal, and local agencies have been and are represented in PRWA and the RWMG, and have participated in the activities of the PRC. This collaboration is expected to continue and includes not only project development, but also regular exchange of data and identification of any changes to listed issues or conflicts (see **Table 2-4 Agency Coordination**).

Table 2-4. Agency Coordination	
Agency/Entity	**Relevance to Plan Development**
Sovereign Nations	
Pit River Tribe	Represents Tribal interests Manages community water systems Manages natural resources on Tribal lands Stewards cultural and paleontological resources
Federal	
Bureau of Indian Affairs	Responsible agency for Indian Trust Lands
Modoc National Forest	Manages natural resources on federal lands
U.S. Bureau of Land Management – Alturas Office	Manages natural resources on federal lands
Natural Resources Conservation Service	Aids landowners in agricultural and natural resource stewardship
State	
California Department of Fish and Game	Manages state fish and wildlife and their habitat, and provides enforcement of fish and game laws
Central Valley Regional Water Quality Control Board	Provides guidance and technical support for water laws and regulations, and enforces such laws and regulations
U.C. Cooperative Extension Agency	Technical and educational support for the agricultural community
Local	
Burney Water District	Provides public water supply
City of Alturas	Provides public water supply, public wastewater treatment, and flood control
Central Modoc Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Fall River Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Lassen County Board of Supervisors	Jurisdiction over land use, resource management, water supply, and wastewater treatment in unincorporated communities
Lassen County Water Works District #1	Jurisdiction over water supply within the district
Modoc County Board of Supervisors	Jurisdiction over land use, resource management, water supply, and wastewater treatment in unincorporated communities
Pit River Resource Conservation District	Provides diverse services and support for protection of natural resources within its district
Sacramento River Watershed Program	Provides information/outreach, financial and administrative services to numerous locally directed watershed management programs in the region
Shasta County Water Agency	Develops water resources for the beneficial use of the people of Shasta County
South Fork Irrigation District	Supplies irrigation water within the district

The IRWM Guidelines also encourage RWMGs to stay involved in the California Natural Resource Agency's Adaptation Strategy process, and to join/sign on to the California Climate Action Registry at http://www.climateregistry.org/.

CHAPTER 3. REGION DESCRIPTION

1.0 INTRODUCTION

The Pit River is the primary river in northeastern California, a significant tributary to the Sacramento River, and an integral hydrologic feature for the region. The Upper Pit River watershed comprises four primary sub-watersheds including the Upper Pit River, Fall River, Burney Creek, and Hat Creek sub-watersheds in northeastern California. The northern, eastern, and southern boundaries are defined by the Upper Pit River sub-watershed, and the western boundary is defined by the Fall River, Burney Creek, and Hat Creek sub-watersheds. The watershed location and sub-watershed boundaries are shown on **Figure 1**. The watershed is 2,891,575 acres and covers portions of Modoc, Siskiyou, Lassen, and Shasta Counties. **Please note: Information contained in this chapter does not incorporate statistics and other detailed information from the addition of the Goose Lake area to the IRWM region. Please see Figure 8 and section 1.5.1 for further information on Goose Lake.**

The climate of the Upper Pit River watershed is characterized by hot, dry summers and cold winters. Temperature and precipitation ranges differ from the lower elevations to the higher elevations. The Warner Mountains receive an average of 20 to 30 inches of precipitation (mainly snowfall) per year, whereas the lower-elevation valley floors receive less than ten inches of precipitation per year. The Fall River sub-watershed receives less than ten inches per year in the valley and up to 65 inches per year on the western boundary. The Hat Creek and Burney Creek sub-watersheds receive approximately 15 inches per year at the lower elevations and up to 85 to 95 inches of precipitation per year near Lassen Peak.

The Pit River Tribe is a federally recognized Tribe composed of 11 autonomous bands located in northeastern California since time immemorial. The territory of the Tribe consists of all ancestral lands recognized by the Indian Claims Commission on July 29, 1959;[i] findings of the Claims Commission assert the Tribe's jurisdiction over its territory's lands, waters, properties, air space, fish, wildlife, and other resources (see **Figure 2**). The region provides myriad ecological resources for a vibrant Native American culture. (For additional discussion of the Pit River Tribe's history and culture, please see **Section 1.4**).

Rural resource-based economies generally characterize the Upper Pit River watershed. Since the colonization of the West, agriculture and timber production are the industries upon which the watershed has primarily depended.

Figure 1
Region Location
Upper Pit River IRWMP

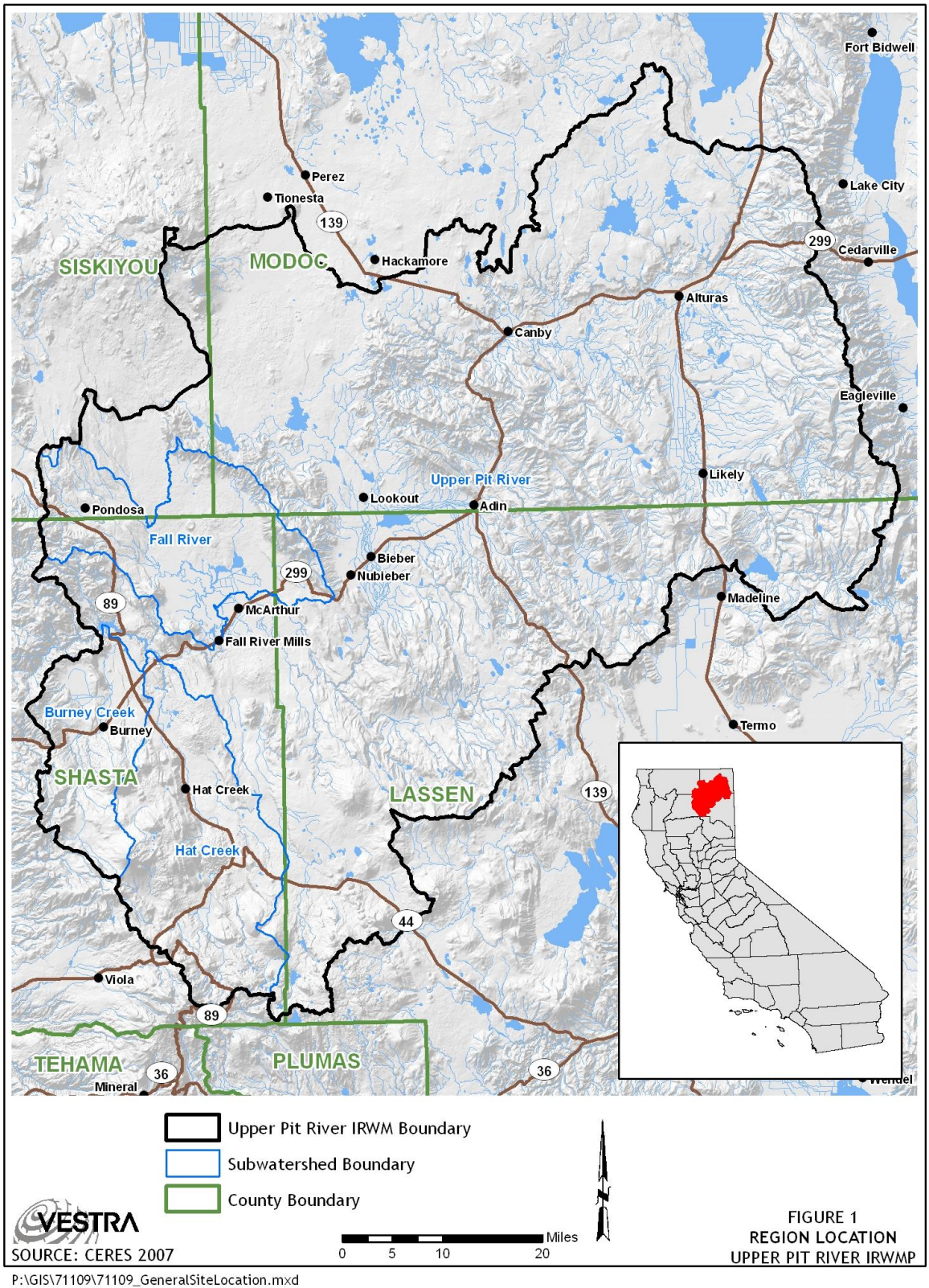

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Figure 2
Tribal Territory
Upper Pit River IRWMP

Permission:
Pit River Tribe

VESTRA
SOURCE: COLLEGE OF THE SISKIYOUS

FIGURE 2
TRIBAL TERRITORY
UPPER PIT RIVER IRWMP

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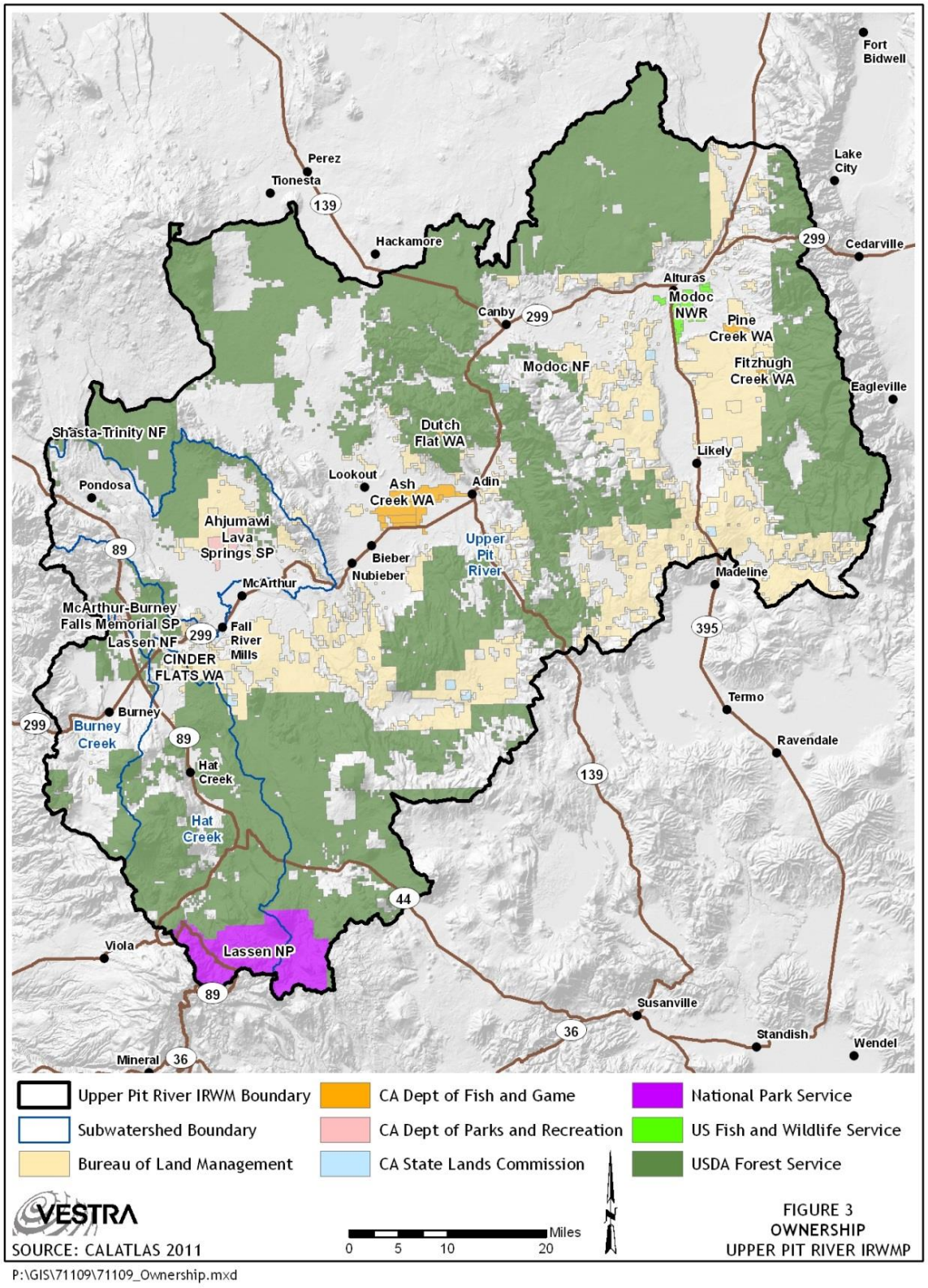
Land use in the watershed is heavily influenced by ownership. Over 60 percent of the watershed is publicly owned. Most of the low- and mid-elevation lands are privately owned and used primarily for agriculture (ranching and farming) and residential purposes, while commercial timber companies and the U.S. Forest Service (USFS) or Bureau of Land Management (BLM) hold the majority of land in the upper elevations. Acreages of public lands and the administering agencies are shown in **Table 3-1**. Ownership in the watershed is shown on **Figure 3**.

Table 3-1.
Public Ownership

Agency	Acres	Percent of Watershed
U.S. Forest Service	**1,268,443**	**43.9%**
Lassen National Forest	*465,386*	
Modoc National Forest	*781,071*	
Shasta-Trinity National Forest	*21,986*	
Bureau of Land Management	**381,635**	**13.2%**
Alturas Field Office	*378,469*	
Redding Field Office	*513*	
Surprise Field Office	*2,653*	
National Park Service	**57,702**	**2%**
Lassen National Park	*57,702*	
U.S. Fish and Wildlife Service	**7,031**	**<1%**
Modoc National Wildlife Refuge	*7,031*	
Bureau of Indian Affairs	**11,294**	**<1%**
California Department of Fish and Game	**19,975**	**<1%**
Ash Creek Wildlife Area	*14,773*	
Cinder Flats Wildlife Area	*729*	
Dutch Flat Wildlife Area	*164*	
Fall River Mills Ecological Reserve	*2*	
Fitzhugh Creek Wildlife Area	*2,262*	
Pine Creek Reservoir Public Access	*15*	
Pine Creek Wildlife Area	*2,030*	
California State Lands Commission	**6,915**	**<1%**
California Department of Parks and Recreation	**6,598**	**<1%**
Ahjumawi Lava Springs State Park	*5,967*	
McArthur-Burney Falls Memorial State Park	*631*	

Source: California Natural Resources Agency 2011 and Pit River Tribe 2012.

Figure 3
Ownership
Upper Pit River IRWMP



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The Native American pre-colonization population is estimated to be much higher than early federal census data show.[1] Today, overall population density is generally less than ten persons per square mile. The largest city in the watershed is Burney (Shasta County) with a population of 3,154;[2] Alturas with a current population of 2,827[3] is the Modoc County seat.

Sixty-five jurisdictional dams exist in the watershed, primarily for agricultural uses. The database of jurisdictional dams and their locations is maintained by the Department of Water Resources (DWR) and is the source of the location points on **Figure 4**. Many of these are local impoundments for stock water, but many of them are directly linked to water diversion for irrigation. Because the waters of the Pit River are lowest when irrigation needs are greatest, groundwater resources are used to augment surface supplies.

The watershed is home to a diverse range of wildlife species. The vegetation that characterizes the watershed is highly varied, ranging from conifer forests, sagebrush, juniper, and chaparral to agricultural and grassland areas, wet meadows, riparian vegetation, and aspen stands.

1.1 Description of Watersheds/Water System

1.1.1 Hydrology

The quantity, quality, and availability of water resources are vital to the health of the watershed, both for the function of its natural systems and for human activities, such as swimming, fishing, and consumption of drinking water. Irrigation and grazing needs also place demands on local water supplies. Historically, flows in the Upper Pit River decrease significantly during the summer season when water for irrigation is at its highest demand. Sixty-five jurisdictional, directional dams within the watershed divert an estimated 227,000 acre-feet of surface water per year. Jurisdictional dams are defined as artificial barriers, together with appurtenant works, which are 25 feet or more in height or have an impounding capacity of 50 acre-feet or more. Any artificial barrier under six feet, regardless of storage capacity, or that has a storage capacity less than 15 acre-feet, regardless of height, are not considered jurisdictional.[4]

Although a detailed water budget has not been conducted for the Upper Pit River watershed, annual consumptive use is estimated at 170,000 acre-feet for surface water and 50,000 acre-feet for groundwater. Based on the preliminary water balance, this represents 33 percent of the total available surface water and 13 percent of the available groundwater. In both cases, irrigation is the primary water use. If the number of irrigation wells is an indicator, groundwater usage in the Upper Pit River watershed has increased approximately tenfold in the last 40 years. For example, the number of irrigation and municipal wells within the Alturas Basin increased 3.6 times between 1960 and 1979 and 2.3 times between 1979 and 1997. Within the Big Valley Basin, the number of municipal and irrigation wells increased by 5.9 times between 1960 and 1979 and 1.8 times between 1979 and 1997.

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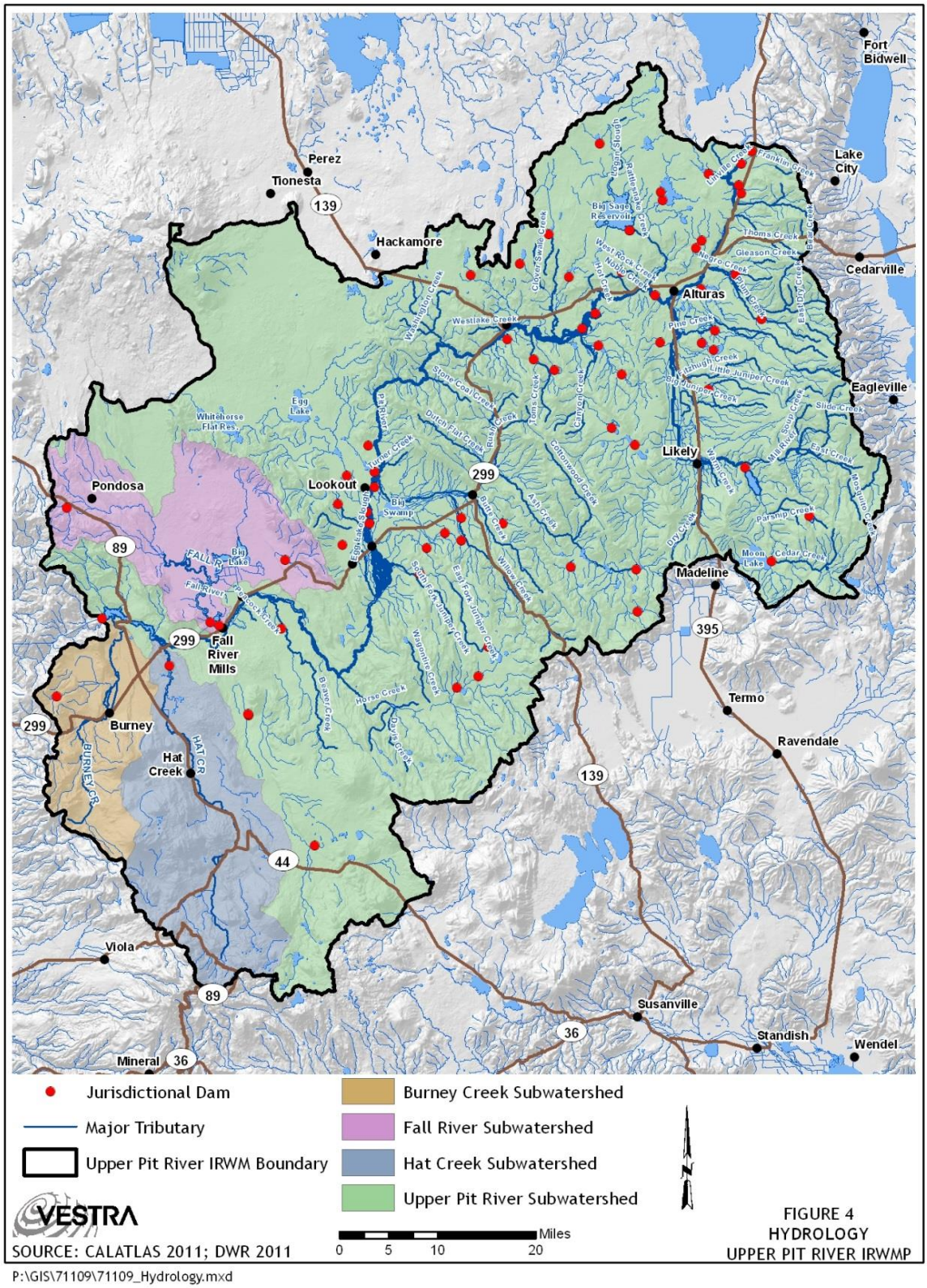
[1] The Pit River Native History in the Federal Archives, 1850 to 1940. Jason C. Newman PhD thesis., U.C. Davis March 2004.

[2] U.S. Census Bureau. *Census 2010*. Washington, D.C. 2011. 15 August 2011. Available from: http://2010.census.gov/2010census/index.php

[3] U.S. Census Bureau. *Census 2010*. Washington, D.C. 2011. 15 August 2011. Available from: http://2010.census.gov/2010census/index.php

[4] VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.

Figure 4
Hydrology
Upper Pit River IRWMP



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Drought conditions in the 1970s and 1980s increased competition for surface water and led to groundwater development to supplement irrigation needs. Hydrology of the watershed and dam locations are shown on **Figure 4**.

Streams in the watershed include the North and South Forks of the Pit River, including their many tributaries, (i.e., Big Juniper Creek, Cedar Creek, Dry Creek, East Creek, Fitzhugh Creek, Gleason Creek, Joseph Creek, Linville Creek, Little Juniper Creek, Mile Creek, Mill River, Negro Creek, Parker Creek, Pine Creek, Shields Creek, Stony Canyon Creek, and Thomas Creek). These contribute to the mainstem of the Pit River. Tributaries to the mainstem of the Pit River include: Ash Creek, Burney Creek, Butte Creek, Dutch Flat Creek, Fall River, Hat Creek, Horse Creek, Juniper Creek, Rush Creek, Stone Coal Creek, Turner Creek, and Willow Creek. Other smaller springs and seeps contribute additional flow throughout the watershed.

The Fall River is unique in that the primary source of flow is from springs within the Fall River Valley. Hydromodification has played an important role in the Fall River Valley. Primary hydrologic features in the watershed include both manmade and natural features. At the time of early settlement, Fall River was naturally obstructed, causing the waters of Big Lake to encompass an area that reached just north of present-day McArthur. The impeded water created a large swamp that covered several thousand acres with an expanse of tules and a wet-meadow-fringed marsh fed by a network of springs. Blasting equipment was used to form a channel through the barrier at Manning's Falls, and two large gates were built to lower the water level of the river. A levee and drainage canal system were later constructed to direct the water from the swamp to the Pit River. Pacific Gas & Electric (PG&E) began construction of the Pit 1 Powerhouse in 1920 and began using it to generate power in 1922. The Pit 1 diversion redirected the entire unallocated flow of the Fall River for electric energy. PG&E purchased the swamplands in 1924 and sealed the irrigation gates and levees. The former swampland now includes 1,400 acres of open water, mainly consisting of Big Lake, Tule River, and some canals along with adjacent pastureland, which is leased for grazing. The majority of the Fall River flow continues to be diverted for Pit 1 power generation.[5]

Nearly 70 percent of total storage capacity in the Upper Pit River watershed is associated with four reservoirs. These reservoirs include Big Sage (77,000 acre-feet), Moon Lake (39,500 acre-feet), West Valley (23,000 acre-feet), and Dorris (11,100 acre-feet). The Tule Lake dam (Moon Lake) was constructed on Cedar Creek in 1904, and Big Sage dam was constructed in 1921. The West Valley and Dorris dams were constructed in the 1930s.

Several water districts in the watershed receive water from these reservoirs as the mainstem and many tributaries of the Pit River are used as a conveyance for irrigation water. These reservoirs increase summer flows in the Pit River during June, July, August, and September.[6]

Some stakeholders have advocated for additional storage of surface water, with timely releases to supplement (especially) late-season flows. A feasibility study for the construction of the Ostrom Point Dam in Modoc County on the Pit River partially made its way through the California Legislature in 2008. It had broad support from Modoc County leaders at the time. Efforts to fund a feasibility study, estimated to cost in excess of $150,000, were unsuccessful. The dam would have been located upstream from Lookout and about a mile downstream from the once proposed Allen Camp Dam, brought forward between 40 and 50 years ago. (Allen Camp Dam purportedly was not

[5] VESTRA Resources, Inc. *Fall River Watershed Assessment and Watershed Management Plan*. 2010.
[6] VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.

built because the soil was too porous to support a dam.) Supporters of Ostrom Point Dam cited the need for water storage for irrigation, flood control, hydroelectric power, recreation, and improved water quality. Plans called for 90,000 acre-feet of storage with 20,000 feet set aside for flood control.[7]

Water rights in the watershed are largely either appropriated or riparian. Appropriated water rights spell out the intent of the water use, the diversion or control of the water, reasonable and beneficial use of the water, and priority of appropriation. Most water rights in the region were adjudicated between 1870 and 1940. Groups with appropriated water rights in the watershed include the South Fork Irrigation District, the State of California, PG&E, Pit River Tribe, and Big Valley Irrigation District; individuals and corporations own the remainder. The Pit River was adjudicated during a wet climate cycle, and now often there is insufficient water to meet demand and need.

A riparian right is the right to use water based on the ownership of property that abuts a natural watercourse. Water claimed by virtue of a riparian right must be used on the riparian parcel. Such a right is generally attached to the riparian parcel of land except where a riparian right has been preserved on non-contiguous parcels after the land has been subdivided. In general, riparian users are entitled to enough water to make beneficial use of the water on the land as long as no other riparian rights are harmed by such use. Use of the waters of the Pit River under riparian rights for irrigation in Fall River Valley constitutes the major consumptive use of water between Big Valley and Lake Shasta. This use is affected by several diversions from the river near McArthur for irrigation on a narrow strip of land bordering the river. These rights to the use of Pit River water are not on record with the State Water Rights Board.

The Pit River Tribe looks to the Winters Doctrine as the basis for their Tribal water rights. The Winters Doctrine, also known as the "implied reservation of water doctrine," has been consistently upheld by the Supreme Court. The priority of Indian water rights is never later than the date on which the Reservation was created, even if many years pass before the Tribe begins using this water.

1.1.2 Groundwater

In the mountain valleys and basins of the Upper Pit River watershed, groundwater has been developed to supplement surface water supplies. Most of the rivers and streams of the watershed have water rights that were adjudicated between 1870 and 1940. The diversion of surface water has historically supported agriculture. Drought conditions and increasing competition for surface water have led to significant groundwater development for irrigation in many of the alluvial basins within the watershed. To date, these groundwater supplies are generally reliable in areas that have sufficient aquifer storage or where surface water replenishes supply throughout the year. In areas that depend on sustained runoff, water levels can be significantly depleted in drought years. For more in-depth and specific information about the region's groundwater basins, please see *California's Groundwater Bulletin 118, Update 2003*, available at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/california's_groundwater__bulletin_118_-_update_2003_/bulletin118_entire.pdf

[7] California Grange News. 2008. "Ostrum [sic] Point Dam Feasibility Study Passes First Assembly Hurdle." California Grange News, Issue 2. 2008.

The Upper Pit River watershed sits in one of the most unique volcanic regions in North America. The region consists primarily of Cenozoic-age (younger than 65 million years) volcanic rocks overlain by Quaternary volcanic, alluvial, and lacustrine deposits. The western portion of the region contains many Pliocene and recent Holocene volcanics. Central and eastern portions of the watershed consist of heavily faulted, late Cenozoic volcanics and more recent Tertiary volcanics of the Warner Mountains.

Volcanic-rock aquifers are located in the Modoc Plateau and the Cascade Mountains in volcanic terrains that extend into Oregon. In general, these aquifers are not distinct, readily identifiable aquifers because they contain water in fractures, volcanic pipes, tuff beds, rubble zones, and interbedded sand layers, primarily in basalts of Miocene age or younger. Areas in which permeable zones are sufficiently large and interconnected to provide a good source of water to wells are usually found only through exploratory drilling because surficial fracturing may not reflect fracturing in the subsurface. Because of the unpredictable distribution of the permeable zones, exploration is speculative and, in many cases, several dry holes are drilled for every productive well. Drilling near fault zones is usually a good strategy because the stress and shear forces generated in these zones can cause exceptional fracturing of the rock; thus, the probability of large groundwater yields is high. Numerous springs also occur where the contact between recent and older volcanic deposits are exposed.

A groundwater basin is an area underlain by permeable materials capable of storing or providing a significant supply of groundwater to wells. These basins include the surface extent and all of the subsurface freshwater-yielding materials. Groundwater basins are delineated for some areas of the state and designated into sub-basins to distinguish groundwater systems. These boundaries, however, are usually not precise, and little information is available about the hydrogeology and groundwater levels for most of the basins.

The watershed contains 20 groundwater basins as identified by the California Department of Water Resources.[8] The Alturas and Big Valley groundwater basins are the largest alluvial groundwater basins located within the Upper Pit River watershed. The principal water-bearing formations in the Alturas Basin, South Fork of the Pit River sub-basin, are Holocene sedimentary deposits (which include alluvial fan deposits, intermediate alluvium, and basin deposits), Pleistocene lava flows and near-shore deposits, and Plio-Pleistocene Alturas Formation and basalts. Upland recharge areas consist of permeable lava flows of Plio-Pleistocene and Pleistocene age. Precipitation falling on these areas infiltrates the lava flows and moves toward the valley floor for recharge. Recharge is limited by precipitation inches per year. Big Valley is a broad, flat plain extending about 13 miles north to south and 15 miles east to west, consisting of a series of depressed fault blocks surrounded by tilted fault block ridges. The primary water-bearing formations in Big Valley are Holocene sedimentary deposits, Pliocene and Pleistocene lava flows, and the Plio-Pleistocene Bieber Formation.

The DWR collects semi-annual groundwater-level data from 11 wells in the Alturas groundwater basins, 18 wells in the Big Valley groundwater basin, two wells in the Round Valley groundwater basins, and 19 wells in the Fall River Valley groundwater basins. In general, the results show declining water levels during the irrigation season, when the underlying groundwater is used for

[8] California Department of Water Resources. *Groundwater Information Center*. Sacramento, CA. 2011. 20 July 2011. Available from: http://www.water.ca.gov/groundwater

agricultural purposes, and increasing levels in the spring. These annual fluctuations are superimposed on longer-term fluctuations that reflect annual precipitation, declining during the 1987 to 1992 drought and more recent drought conditions. DWR does not collect groundwater-level data in the Burney Creek and Hat Creek sub-watersheds.[9]

California does not have a statewide management program or statutory permitting system for groundwater. Some local agencies have adopted groundwater ordinances under their police powers or have adopted groundwater management programs under a variety of statutory management schemes. Most of the body of law governing groundwater use in California today has evolved through a series of court decisions beginning in the early 20th century.

In August 2011, Lassen County Board of Supervisors adopted a Groundwater Management Plan (GWMP) for Lassen County that includes a specific section addressing Big Valley, drained primarily by the Pit River and Ash Creek. Preparation of the GWMP was driven by evolving demands for groundwater within and adjacent to Lassen County, by increasing complexity and scope of groundwater management, and by past and current projects to develop and export groundwater to Nevada from interstate basins. The GWMP presents groundwater information on use and monitoring, groundwater quality, subsidence information, and action levels for select wells. It articulates the county's expectations for groundwater management, presents groundwater-basin management objectives, and acknowledges stakeholder involvement. The GWMP states, "Lassen County developed a GWMP with the goal of maintaining or enhancing groundwater quantity and quality, thereby providing a sustainable, high-quality supply for agricultural, environmental, and urban use into the future that remains protective of the health, welfare, and safety of residents. The GWMP seeks to achieve this goal by identifying management objectives and supporting implementation items that help the County achieve the GWMP's goal."[10]

Groundwater data was obtained from DWR's groundwater semi-annual groundwater monitoring of 13 domestic and agricultural wells over a long period (at least 30 years) of record using quality-control methodology. According to these data, groundwater levels in the Big Valley management area are currently at or near historically low levels. If adopted by stakeholders, remedial action is recommended in five wells; no water-quality data was available from DWR for these wells. A groundwater quality surveillance plan is recommended to be developed for Big Valley.

The watershed is home to abundant geothermal resources. A massive reserve of 450-degree F water lies approximately 5,000 feet below Medicine Lake. The water, heated by a large body of cooling magma, is stored in the pore space of the surrounding volcanic rock. Isolated hot springs are common throughout the watershed and have been used for a variety of economic endeavors.

1.1.3 Water Supply and Demand

Please see **Chapter 5 Water and Land Use Planning** for a full discussion of water supply and demand. The Upper Pit water system is not dependent on Delta water supply.

[9] VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.

[10] Brown and Caldwell. Big Valley Management Area Basin Management Objective Development Guidance Document. Prepared for Lassen County, CA. Rancho Cordova, CA. August 2011. Available from: http://www.lassenbmos.org/index_htm_files/Big%20Valley%20BMO%20Guidance%20Document.pdf

1.1.4 Climate Effects on Water Supply

Based on the climate trends and climate vulnerability analysis contained later in this document, the overall Upper Pit watershed appears to have fared far better to date than many northern California watersheds in terms of both temperature increases and decreases in precipitation. Indeed, localized areas such as Alturas and Hat Creek have experienced either little or no change in these variables, or an increase in precipitation.

Overall, however, this climate region is 1.7 degrees F warmer on average than 100 years ago, which has reduced slow-releasing spring snowmelt feeding upper-elevation streams. While streamflows are anticipated to be stable for the foreseeable future within the lower reaches of the Upper Pit River due to contributions from spring-fed rivers and streams, extended drought could eventually affect those flows. Lowered flows would likely affect availability for irrigation, industrial use, domestic supply, habitat needs, and recreational uses.

Combining knowledge of historic weather records, climate trends, projected climate scenarios, and current water management practices and concerns, as discussed in **Chapter 8 Climate Vulnerability**, will help watershed stakeholders and decision-makers determine how best to withstand climate variability within the region and its effect on water supplies into the future.

1.1.5 Weather Modification

Since December 2005, PG&E placed about 20 cloud-seeding units in Shasta and Siskiyou Counties, in the McCloud and Pit River areas. Units were proposed to be run about 20 days maximum per year, using silver iodide generators. According to DWR staff, no permits were needed from the county air quality districts because silver iodide is not classified as a hazardous or toxic air pollutant. Public notification requirements for such projects consist of a Notice of Intent to be filed with DWR, and a notice in the newspaper.

According to PG&E calculations, "the silver concentrations measured in snow, water, soils, and lake sediments are far below thresholds of concern for humans, animals, fish, insects, and plants. Also, emission rates of primary pollutants (NOx, Co, etc.) from the seeding generators' chimneys are far below regulated rates." (Email from Wayne E. Yeager, Sr. Environmental Engineer, PG&E, to Siskiyou County, December 7, 2005.)

PG&E also proposed a cloud-seeding project in the Upper Pit watershed in the 2009 Update of the State Water Plan, where the company acknowledged several cloud-seeding projects in the state. According to the Regional Water Quality Control Board (RWQCB) records, PG&E withdrew that most recent cloud-seeding proposal.

1.1.6 Vegetation

Vegetation characterizing the watershed is highly varied, ranging from conifer forests, sagebrush, juniper, and chaparral to open grassland, irrigated and dryland pasture, wet meadows, riparian vegetation, and aspen stands. At large scale, vegetation patterns are shaped by the ecological forces at work in the Pit River watershed. Hydrology, soils, topography, climate, frequency of natural disturbance, and various human activities have modified the landscape from its original form.

Where favorable topography is present, agricultural uses are more common. Available moisture is a key determinant in vegetative community composition, with drier sites supporting more drought-tolerant species mixes. Higher elevations and areas with cooler aspects support species, such as red fir, not found at lower elevations. Meadows are common along drainages and in low-gradient areas. Drier areas tend to support juniper and sage species. Fire suppression has significantly altered the composition and biodiversity of vegetation across the landscape.

Historically, much of the low- and mid-elevation ecosystems were maintained with relatively frequent lightning-caused wildfires (20- to 50-year intervals). In the sage-steppe ecosystem, wildfires killed young juniper trees and stimulated growth in aspen stands and meadows. Old growth juniper trees have bark that withstood these natural wildfires and, along with isolated juniper stands, provided important habitat for birds and other wildlife within the sage-steppe ecosystem. In the historic pine and mixed conifer ecosystems, the grassy understories would carry wildfires that would kill young trees, particularly young white fir trees, maintaining more open fire-resilient forests.

In the early part of the 20th century, intensive season-long domestic livestock grazing eliminated the fine fuels (grasses) that would carry these natural wildfires. This reduction in wildfire in the early 20th century allowed young juniper trees to become established across the sage-steppe ecosystem, and young white fir trees to become established as understory in the pine and mixed conifer forests. In the latter half of the 20th century, fire management agencies actively suppressed natural wildfire, continuing to favor juniper growth and expansion, and the densification of pine and mixed conifer forests. A cooler-wetter weather pattern in the first part of the 20th century contributed to more rapid growth of the young trees. Then, when industrial-scale logging by private and federal agencies accelerated from about 1960-1990, often the mature and old growth, high-value pine trees were removed, leaving behind the denser, less valuable trees, particularly white fir. Also, the second half of the 20th century experienced repeated periods of drought. These warmer-drier conditions caused extreme moisture competition in the pine and mixed conifer forests (that lack biodiversity and herbaceous understory species composition), with the resulting tree mortality that is now evident throughout the landscape. Due to the current juniper density in the sage-steppe ecosystem, and the density and tree mortality in the pine and mixed conifer forests, these ecosystems are now very susceptible to large-landscape wildfires that can result in major impacts to the watershed from soil erosion and accelerated surface runoff.

Figure 5 shows the common vegetation types found throughout the watershed. Acreages for these vegetation types are shown in **Table 3-2**.

Figure 5
CWHR Existing Vegetation Types
Upper Pit River IRWMP

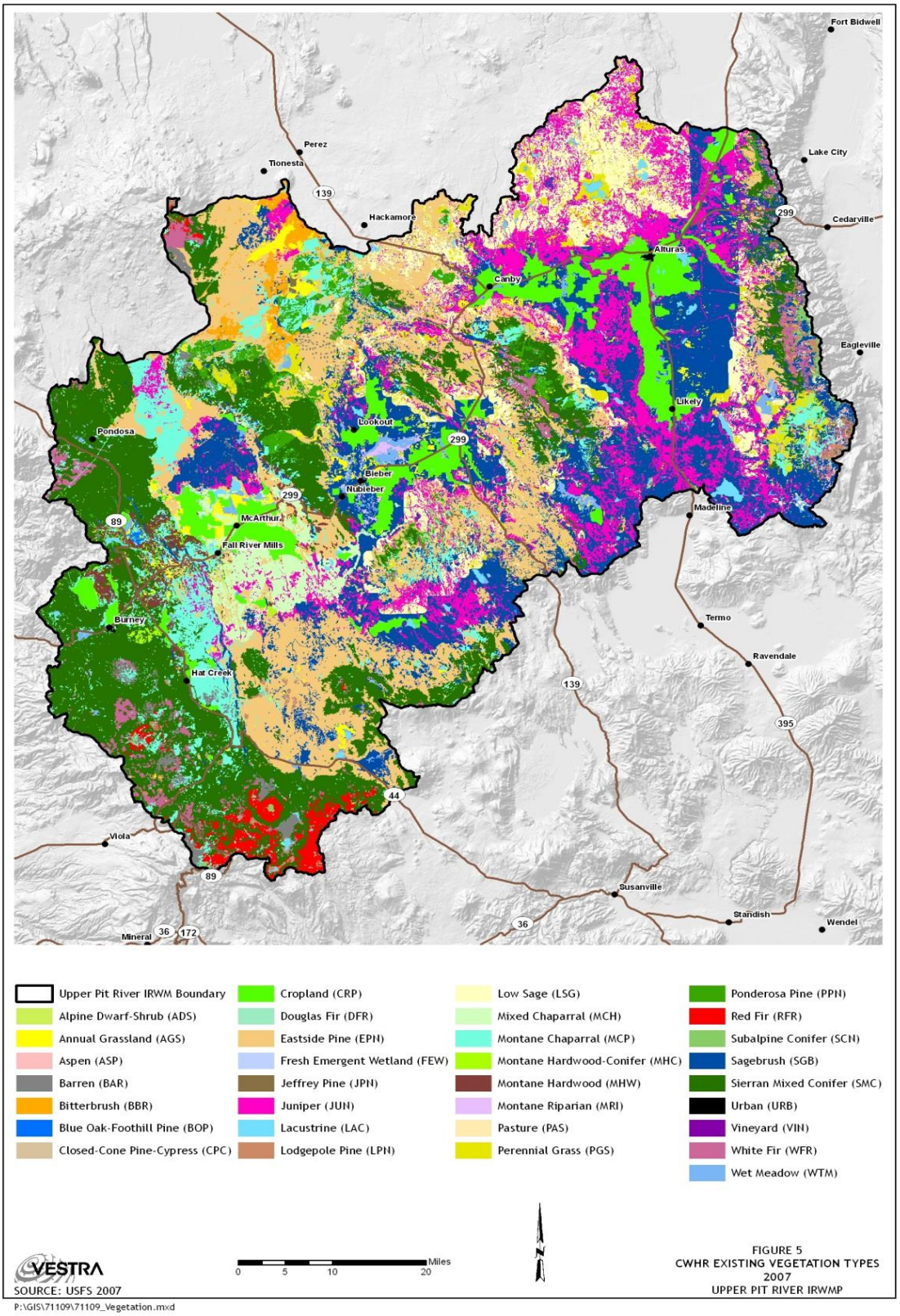


Table 3-2. Vegetation Communities		
Vegetation Type	**Acreage**	**Percent of Watershed**
Grass		
Annual Grass	38,421	1.3%
Cropland	179,604	6.2%
Pasture	2,529	0.1%
Perennial Grass	69,347	2.4%
Total Grass	*289,901*	*10%*
Brush		
Bitterbrush	28,686	1.0%
Blue Oak-Foothill Pine	1,808	0.1%
Low Sage	208,275	7.2%
Mixed Chaparral	65,004	2.2%
Montane Chaparral	166,130	5.7%
Montane Hardwood-Conifer	8,971	0.3%
Montane Hardwood	31,048	1.1%
Montane Riparian	6,221	0.2%
Sagebrush	475,495	16.4%
Alpine Dwarf-Shrub	59	<0.1%
Total Brush	*991,697*	*34.2%*
Timber		
Eastside Pine	479,602	16.6%
Jeffrey Pine	4,737	0.2%
Lodgepole Pine	16,952	0.6%
Ponderosa Pine	50,167	1.7%
Red Fir	36,653	1.3%
Subalpine Conifer	5,221	0.2%
Sierran Mixed Conifer	535,498	18.5%
White Fir	55,308	1.9%
Douglas Fir	514	<0.1%

Table 3-2. *continued* Vegetation Communities		
Total Timber	*1,184,652*	*41%*
Other Vegetation		
Aspen	4,235	0.1%
Barren	31,042	1.1%
Juniper	327,407	11.3%
Lacustrine	23,639	0.8%
Urban	1,608	0.1%
Wet Meadow	37,257	1.3%
Fresh Emergent Wetland	92	<0.1%
Vineyard	45	<0.1%
Total Other Vegetation	*425,325*	*14.8%*
TOTAL	**2,891,575**	
Source: U.S. Forest Service, Existing Vegetation Data (CALVEG), 2011		

1.1.7 Fisheries

Historical data show that seasonal runs of salmon may have migrated to the mouth of the Fall River.[11] Up to the 1920s, with the installation of dams by PG&E, the Pit River Tribe relied primarily on fish as a staple food. Wet-meadow marsh habitats and streams supported many traditional foods important to the Pit River Tribe, such as: salmon, rainbow trout, Pit sculpin, redband trout, and Modoc sucker. Many species of fish were introduced to various rivers, lakes, and streams in the watershed for a number of reasons. As a result, the fish assemblage in the watershed is a mix of native and introduced warm-water and cold-water fish species. Some spatial separation of species occurs where habitat or water conditions favor one group or another; however, many of the species can tolerate a variety of habitat conditions. The fisheries resources in the watershed are both ecologically and economically important, and over the past several decades much emphasis has been placed on maintaining and restoring the recreational fisheries and in protecting the unique aquatic species native to the system.

Aquatic biology plays a major role in the biodiversity and health of a watershed. Fish surveys of native species found that fish population percentages in the mainstem, North Fork, and South Fork of the Pit River are largely similar to historic surveys. To augment natural fish populations for sport

[11] Southwest Regional Office, Marine Fisheries Service. Central Valley Chinook Salmon Historic Stream Habitat Distribution. http://swr.nmfs.noaa.gov/hcd/cvschshd.htm

fishing, agencies use fingerlings raised in hatcheries. Over the years, various species of trout have been the most popular for planting.[12]

Four distinct fish assemblages appear in the Upper Pit River watershed, including the rainbow trout, Pit sculpin-dace-sucker, pike minnow-hardhead-sucker, and the introduced warm-water fish assemblages. The fishes in each assemblage are specifically adapted for definable sets of environmental conditions; however, the boundaries between these assemblages are not sharply defined, and other fishes can dominate small stream sections. The warm-water assemblages dominate the mainstem of the Pit River.

The health and vigor of fisheries and other aquatic resources are impacted by water-quality parameters, including temperature, dissolved oxygen, pH, turbidity and total solids, and nutrients. Other potential impacts on fish include altered temperature regimes, low water levels, entrapment, physical barriers, channelization, loss of riparian zones, degradation of spawning habitat, fish-eradication practices, and hatchery planting practices.

Native fish species currently found in the watershed include:

Pit Klamath brook lamprey
Sacramento pike minnow
Sacramento sucker
Tule perch
Pit River tui chub
Speckled dace
Rainbow trout
Redband trout
Rough sculpin

Several native fish species in the watershed are being threatened by non-native species. For example, largemouth bass and brown trout are aggressive predators that feed extensively on native fishes and crayfish, and can significantly suppress or extirpate native populations. Non-native species include:

Signal crayfish
Brown trout
Carp
Green sunfish
Largemouth bass
Smallmouth bass
Black bullhead catfish
Sacramento perch
Striped bass
Channel catfish

Cold Water Indigenous Species

Rainbow Trout *(Oncorhynchus mykiss)* are native to the watershed, but their distribution has increased dramatically due to fish planting above natural barriers. Rainbow trout use most

[12] VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.

habitats but are most abundant in cool, clear, swifter-flowing stream sections with adequate shade and riffles and predominately rocky bottoms. The highest abundance of rainbow trout occurs in habitats where they coexist with Pit sculpin, brown trout, and speckled dace.

Redband Trout (*Oncorhynchus mykiss* subspecies) are native to northeastern California and are known to be in only three tributaries of the North Fork of the Pit River: Joseph Creek, Parker Creek, and East Creek. Redband trout streams *may* also include: Shields, Gleason, Franklin, Thomas, and Spring Canyon Creeks of the North Fork Pit; Mill, East, Cedar, Parsnip, Fitzhugh, and Pine Creeks of the South Fork Pit; and Russell, Dairy, Indian, Rush, Johnson, Willow, Juniper, Halls Canyon, Butte, Beaver, Taylor, and Canyon Creeks of the mainstem Pit River (Paul Divine, pers. comm., December 2012).

These trout are genetically similar to the endemic Goose Lake redband trout, a currently unnamed subspecies of the rainbow trout. Redband trout are found in cold, clear, permanent streams with an abundance of riffles, some pools, and ample riparian vegetation cover. One possible reason for the decline in population is hybridization with hatchery rainbow trout, though this has not been verified. The redband trout is classified as a federal "species of concern" and by the State of California as a "species of special concern," even though it is not listed in the California Department of Fish and Game's Natural Diversity Database.[13]

Rough Sculpin (*Cottus asperrimus*) is a small (< 3.3 inches), bottom-dwelling fish with extremely restricted range, limited to the lower reaches of the Pit River and its spring-fed tributaries from the Fall River downstream to about Big Bend. Within this range, its actual distribution is fragmented and generally restricted to cool, clear, spring-fed habitat, primarily in the Fall River drainage, lower Hat Creek (at and below Crystal Lake), Sucker Springs, Clark Creek, and patchy mainstem or reservoir habitat with suitable conditions. Unlike many sculpin that occupy rocky or cobbley habitat, the rough sculpin is generally found over finer substrates (silt, sand, and gravels), often in association with native aquatic vegetation. The rough sculpin is classified as "fully protected" by the State of California and is also protected as "threatened" under the Endangered Species Act. Therefore, rough sculpin are both a conservation and regulatory priority. Conservation concerns for the rough sculpin include habitat loss due to changes in substrate or availability of spawning sites caused by downstream sediment influxes or bank erosion; smothering of habitat by detritus caused by reduced flows and increased vegetative decay associated with extensive beds of invasive vegetation (e.g., Eurasian watermilfoil); changes in water quality caused by warm, nutrient-rich agricultural runoff or water withdrawals for agriculture and hydroelectric projects; reduced spring-flow caused by excessive groundwater withdrawal; and predation by non-native fishes.

Shasta Crayfish (*Pacifastacus fortis)* is one of only three crayfish species native to California and only five species native west of the Continental Divide (all in the genus *Pacifastacus*). The Shasta crayfish has an extremely restricted range, limited to the lower reaches of the Pit River and its spring-fed tributaries. Within this range, actual distribution is quite fragmented and limited to only a few areas. Most populations of Shasta crayfish occur in pristine headwater spring pools and streams where there are abundant lava cobbles and boulders on clean gravel or sand. Shasta crayfish prefer stable, unembedded cobble substrate in systems with minimal sediment transport.

[13] California Department of Fish and Game, Biogeographic Data Branch. *California Natural Diversity Database*. Sacramento, CA. July 2011. Available from: http://www.dfg.ca.gov/biogeodata/cnddb/

This type of habitat is found primarily in the Fall River and Hat Creek sub-watersheds and Sucker Springs Creek in the lower reaches of the Upper Pit River watershed. Because of the spring-fed nature of these waters, the habitat in the spring areas is generally pristine and constant, with almost no seasonal or annual change in water temperature, flow, or clarity. The principal reasons for the decline in Shasta crayfish populations are competition with non-native crayfish and habitat fragmentation.

1.1.8 Species and Habitats of Special Concern

The Upper Pit River watershed is home to 170 species and habitats of special concern. Many of these species were historically, and continue to be, of great importance to the subsistence and culture of the Pit River Tribe.

An endangered species is defined as a native species or subspecies of a bird, mammal, fish, amphibian, reptile, invertebrate, or plant that is in serious danger of becoming extinct throughout all, or a significant portion, of its range (because of loss of habitat, change in habitat, over-exploitation, predation, competition, or disease). Rare species are either limited in geographic distribution or occur in small, isolated populations. The reasons for rarity can be natural or human-caused. Some species may be adversely affected by the destruction of habitat or the introduction of exotic, invasive weeds; other species may be naturally rare because of unique biological or genetic features; while still others may be abundant, but extensive surveys determining species extent are lacking.

Species of special concern are protected under the California and federal Endangered Species Acts or other regulations. Special-status species are also considered sufficiently rare by the scientific community that they qualify for consideration and/or protection pursuant to the California Environmental Quality Act. A complete list of these species and habitats that exist within the watershed, as well as their state and federal status, are listed in **Table 3-3**.

The U.S. Fish and Wildlife Service has designated areas in the watershed as critical habitat for several species.[14] These species include: slender orcutt grass (*Orcuttia tenuis*), Greene's tuctoria (*Tuctoria greenei*), northern spotted owl (*Strix occidentalis caurina*), and Modoc sucker (*Catostomus microps*). Other federal agencies and stakeholders also have concerns about redband trout, vernal pools, and fens.

[14] U.S. Fish and Wildlife Service. Critical Habitat Portal. Washington, D.C. 4 August 2011. Available from: http://criticalhabitat.fws.gov/crithab/

Table 3-3. State of California Natural Diversity Database Species and Habitats of Special Concern				
Life Form	**Common Name**	**Scientific Name**	**FEDLIST**	**CALLIST**
Habitat	Big Lake	*Big Lake*	7	5
Habitat	Lower Pit River/Canyon River (Hardhead/Tule Perch River)	*Lower Pit River/Canyon River (Hardhead/Tule Perch River)*	7	5
Habitat	Northern Basalt Flow Vernal Pool	*Northern Basalt Flow Vernal Pool*	7	5
Habitat	Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	7	5
Habitat	Pit River Drainage Rough Sculpin/Shasta Crayfish Spring Stream	*Pit River Drainage Rough Sculpin/Shasta Crayfish Spring Stream*	7	5
Habitat	Pit River Drainage Modoc Sucker Stream	*Pit River Drainage Modoc Sucker Stream*	7	5
Habitat	Pit River Drainage Speckled Dace/Pit Sculpin Stream	*Pit River Drainage Speckled Dace/Pit Sculpin Stream*	7	5
Habitat	Pit River Drainage Squawfish/Sucker Valley Stream	*Pit River Drainage Squawfish/Sucker Valley Stream*	7	5
Bird	American peregrine falcon	*Falco peregrinus anatum*	8	6
Bird	Bald eagle	*Haliaeetus leucocephalus*	8	1
Bird	Bank swallow	*Riparia riparia*	7	2
Bird	Black swift	*Cypseloides niger*	7	5
Bird	Black tern	*Chlidonias niger*	7	5
Bird	Golden eagle	*Aquila chrysaetos*	7	5
Bird	Great blue heron	*Ardea herodias*	7	5
Bird	Great gray owl	*Strix nebulosa*	7	1
Bird	Greater sage-grouse	*Centrocercus urophasianus*	5	5
Bird	Greater sandhill crane	*Grus canadensis tabida*	7	2
Bird	Northern goshawk	*Accipiter gentilis*	7	5
Bird	Northern spotted owl	*Strix occidentalis caurina*	2	5
Bird	Osprey	*Pandion haliaetus*	7	5
Bird	Prairie falcon	*Falco mexicanus*	7	5
Bird	Purple martin	*Progne subis*	7	5
Bird	Swainson's hawk	*Buteo swainsoni*	7	2
Bird	Tricolored blackbird	*Agelaius tricolor*	7	5
Bird	White-faced ibis	*Plegadis chihi*	7	5
Bird	Willow flycatcher	*Empidonax traillii*	7	1
Fish	Bigeye marbled sculpin	*Cottus klamathensis macrops*	7	5
Fish	Hardhead	*Mylopharodon conocephalus*	7	5
Fish	Modoc sucker	*Catostomus microps*	1	1
Fish	Pit roach	*Lavinia symmetricus mitrulus*	7	5
Fish	Rough sculpin	*Cottus asperrimus*	7	2
Invertebrate	Archimedes pyrg	*Pyrgulopsis archimedis*	7	5
Invertebrate	Ash Valley pyrg	*Pyrgulopsis cinerana*	7	5
Invertebrate	Canary duskysnail	*Colligyrus convexus*	7	5
Invertebrate	Great Basin rams-horn	*Helisoma newberryi*	7	5
Invertebrate	Kneecap lanx	*Lanx patelloides*	7	5

Table 3-3. *continued* State of California Natural Diversity Database Species and Habitats of Special Concern				
Invertebrate	Leech's skyline diving beetle	*Hydroporus leechi*	7	5
Invertebrate	Likely pyrg	*Pyrgulopsis falciglans*	7	5
Invertebrate	Nugget pebblesnail	*Fluminicola seminalis*	7	5
Invertebrate	Scalloped juga	*Juga occata*	7	5
Invertebrate	Shasta crayfish	*Pacifastacus fortis*	1	1
Invertebrate	Shasta Hesperian	*Vespericola shasta*	7	5
Invertebrate	Smoke Creek pyrg	*Pyrgulopsis eremica*	7	5
Invertebrate	Sucker Springs pyrg	*Pyrgulopsis rupinicola*	7	5
Invertebrate	Topaz juga	*Juga acutifilosa*	7	5
Invertebrate	Western ridged mussel	*Gonidea angulata*	7	5
Invertebrate	Willow Creek pyrg	*Pyrgulopsis lasseni*	7	5
Mammal	American badger	*Taxidea taxus*	7	5
Mammal	California wolverine	*Gulo gulo*	5	2
Mammal	Fringed myotis	*Myotis thysanodes*	7	5
Mammal	Gray-headed pika	*Ochotona princeps schisticeps*	7	5
Mammal	Hoary bat	*Lasiurus cinereus*	7	5
Mammal	Long-eared myotis	*Myotis evotis*	7	5
Mammal	Long-legged myotis	*Myotis volans*	7	5
Mammal	Oregon snowshoe hare	*Lepus americanus klamathensis*	7	5
Mammal	Pacific fisher	*Martes pennanti (pacifica) DPS*	5	5
Mammal	Pallid bat	*Antrozous pallidus*	7	5
Mammal	Sierra marten	*Martes americana sierrae*	7	5
Mammal	Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*	1	1
Mammal	Sierra Nevada red fox	*Vulpes vulpes necator*	7	2
Mammal	Silver-haired bat	*Lasionycteris noctivagans*	7	5
Mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	7	5
Mammal	Western white-tailed jackrabbit	*Lepus townsendii townsendii*	7	5
Mammal	Yuma myotis	*Myotis yumanensis*	7	5
Plant	Adobe lomatium	*Lomatium roseanum*	7	5
Plant	Aleppo avens	*Geum aleppicum*	7	5
Plant	American riella	*Riella americana*	7	5
Plant	Ash Creek ivesia	*Ivesia paniculata*	7	5
Plant	Ash Valley milk-vetch	*Astragalus anxius*	7	5
Plant	Baker's globe mallow	*Iliamna bakeri*	7	5
Plant	Bearded lupine	*Lupinus latifolius var. barbatus*	7	5
Plant	Beautiful sagebrush bluebells	*Mertensia oblongifolia var. amoena*	7	5
Plant	Bellinger's meadowfoam	*Limnanthes floccosa ssp. bellingeriana*	7	5
Plant	Black Rock potentilla	*Potentilla basaltica*	5	5
Plant	Blue alpine phacelia	*Phacelia sericea var. ciliosa*	7	5
Plant	Blunt-fruited sweet-cicely	*Osmorhiza depauperata*	7	5
Plant	Boggs Lake hedge-hyssop	*Gratiola heterosepala*	7	1
Plant	Bristly sedge	*Carex comosa*	7	5
Plant	Buxbaumia moss	*Buxbaumia viridis*	7	5

Table 3-3. *continued* State of California Natural Diversity Database Species and Habitats of Special Concern				
Plant	Cascade alpine campion	*Silene suksdorfii*	7	5
Plant	Cocks-comb cat's-eye	*Cryptantha celosioides*	7	5
Plant	Cream-flowered bladderwort	*Utricularia ochroleuca*	7	5
Plant	Cusick's monkeyflower	*Mimulus cusickii*	7	5
Plant	Doublet	*Dimeresia howellii*	7	5
Plant	Dwarf resin birch	*Betula glandulosa*	7	5
Plant	Eel-grass pondweed	*Potamogeton zosteriformis*	7	5
Plant	Egg Lake monkeyflower	*Mimulus pygmaeus*	7	5
Plant	Engelmann spruce	*Picea engelmannii*	7	5
Plant	English Peak greenbrier	*Smilax jamesii*	7	5
Plant	English sundew	*Drosera anglica*	7	5
Plant	Ephemeral monkeyflower	*Mimulus evanescens*	7	5
Plant	Falcate saltbush	*Atriplex gardneri var. falcata*	7	5
Plant	Fell-fields claytonia	*Claytonia megarhiza*	7	5
Plant	Flat-leaved bladderwort	*Utricularia intermedia*	7	5
Plant	Golden alpine draba	*Draba aureola*	7	5
Plant	Grass alisma	*Alisma gramineum*	7	5
Plant	Great Basin downingia	*Downingia laeta*	7	5
Plant	Great Basin nemophila	*Nemophila breviflora*	7	5
Plant	Greene's tuctoria	*Tuctoria greenei*	1	3
Plant	Hairy marsh hedge-nettle	*Stachys palustris ssp. pilosa*	7	5
Plant	Henderson's lomatium	*Lomatium hendersonii*	7	5
Plant	Hillside arnica	*Arnica fulgens*	7	5
Plant	Howell's thelypodium	*Thelypodium howellii ssp. howellii*	7	5
Plant	Howell's triteleia	*Triteleia grandiflora*	7	5
Plant	Intermontane lupine	*Lupinus pusillus var. intermontanus*	7	5
Plant	Janish's beardtongue	*Penstemon janishiae*	7	5
Plant	Kitten-tails	*Synthyris missurica ssp. missurica*	7	5
Plant	Klamath fawn lily	*Erythronium klamathense*	7	5
Plant	Lassen Peak copper moss	*Mielichhoferia tehamensis*	7	5
Plant	Lassen Peak smelowskia	*Smelowskia ovalis*	7	5
Plant	Lemmon's milk-vetch	*Astragalus lemmonii*	7	5
Plant	Liddon's sedge	*Carex petasata*	7	5
Plant	Lilliput lupine	*Lupinus uncialis*	7	5
Plant	Little hulsea	*Hulsea nana*	7	5
Plant	Little ricegrass	*Oryzopsis exigua*	7	5
Plant	Long bluebells	*Mertensia longiflora*	7	5
Plant	Long-haired star-tulip	*Calochortus longebarbatus var. longebarbatus*	7	5
Plant	Long-leaved starwort	*Stellaria longifolia*	7	5
Plant	Long-stiped campion	*Silene occidentalis ssp. longistipitata*	7	5
Plant	Macdougal's lomatium	*Lomatium foeniculaceum var. macdougalii*	7	5

Table 3-3. *continued* State of California Natural Diversity Database Species and Habitats of Special Concern				
Plant	Macoun's buttercup	*Ranunculus macounii*	7	5
Plant	Marsh skullcap	*Scutellaria galericulata*	7	5
Plant	Mingan moonwort	*Botrychium minganense*	7	5
Plant	Modoc bedstraw	*Galium glabrescens ssp. modocense*	7	5
Plant	Modoc County knotweed	*Polygonum polygaloides ssp. esotericum*	7	5
Plant	Mud sedge	*Carex limosa*	7	5
Plant	Newberry's cinquefoil	*Potentilla newberryi*	7	5
Plant	Nodding vanilla-grass	*Hierochloe odorata*	7	5
Plant	Northern spleenwort	*Asplenium septentrionale*	7	5
Plant	Nuttall's ribbon-leaved pondweed	*Potamogeton epihydrus*	7	5
Plant	Obtuse starwort	*Stellaria obtusa*	7	5
Plant	Oregon campion	*Silene oregana*	7	5
Plant	Owyhee ivesia	*Ivesia baileyi var. beneolens*	7	5
Plant	Pacific fuzzwort	*Ptilidium californicum*	7	5
Plant	Profuse-flowered pogogyne	*Pogogyne floribunda*	7	5
Plant	Prostrate buckwheat	*Eriogonum prociduum*	7	5
Plant	Pyrola-leaved buckwheat	*Eriogonum pyrolifolium var. pyrolifolium*	7	5
Plant	Raven's lomatium	*Lomatium ravenii*	7	5
Plant	Rayless mountain ragwort	*Packera indecora*	7	5
Plant	Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	7	5
Plant	Rigid pea	*Lathyrus rigidus*	7	5
Plant	Sagebrush bluebells	*Mertensia oblongifolia var. oblongifolia*	7	5
Plant	Santa Lucia dwarf rush	*Juncus luciensis*	7	5
Plant	Scalloped moonwort	*Botrychium crenulatum*	7	5
Plant	Sheldon's sedge	*Carex sheldonii*	7	5
Plant	Slender collomia	*Collomia tenella*	7	5
Plant	Slender Orcutt grass	*Orcuttia tenuis*	2	1
Plant	Slender-leaved pondweed	*Stuckenia filiformis*	7	5
Plant	Snow fleabane daisy	*Erigeron nivalis*	7	5
Plant	Spiked larkspur	*Delphinium stachydeum*	7	5
Plant	Squarestem phlox	*Phlox muscoides*	7	5
Plant	Stoloniferous pussy-toes	*Antennaria flagellaris*	7	5
Plant	Suksdorf's milk-vetch	*Astragalus pulsiferae var. suksdorfii*	7	5
Plant	Susanville beardtongue	*Penstemon sudans*	7	5
Plant	Talus collomia	*Collomia larsenii*	7	5
Plant	Three-ranked hump moss	*Meesia triquetra*	7	5
Plant	Toiyabe bluebells	*Mertensia cusickii*	7	5
Plant	Tracy's eriastrum	*Eriastrum tracyi*	7	3

Table 3-3. *continued* State of California Natural Diversity Database Species and Habitats of Special Concern				
Plant	Tufted loosestrife	*Lysimachia thyrsiflora*	7	5
Plant	Tufted saxifrage	*Saxifraga cespitosa*	7	5
Plant	Watershield	*Brasenia schreberi*	7	5
Plant	Western black currant	*Ribes hudsonianum var. petiolare*	7	5
Plant	Wheat sedge	*Carex atherodes*	7	5
Plant	Woolly meadowfoam	*Limnanthes floccosa ssp. floccosa*	7	5
Plant	Woolly stenotus	*Stenotus lanuginosus*	7	5
Plant	Yakima bird's-beak	*Cordylanthus capitatus*	7	5
Reptile	Cascades frog	*Rana cascadae*	7	5
Reptile	Northern leopard frog	*Lithobates pipiens*	7	5
Reptile	Oregon spotted frog	*Rana pretiosa*	5	5
Reptile	Western pond turtle	*Emys marmorata*	7	5

Notes:

FEDCODE: 1: Federally listed as Endangered 2: Federally listed as Threatened 3: Proposed for federal listing as Endangered 4: Proposed for federal listing as Threatened 5: Candidate for federal listing 6: Species of concern 7: No federal status 8: Delisted

CALCODE: 1: State listed as Endangered 2: State listed as Threatened 3: State listed as Rare 4: Candidate for state listing 5: No state status 6: Delisted

Source: California Department of Fish and Game, Biogeographic Data Branch. California Natural Diversity Database. July 2011; U.S. Fish and Wildlife Service, 2011

1.1.9 Species of Tribal Importance

The Achumawi had an intimate knowledge of the plants and animals located within their ecosystem. Their subsistence strategies revolved around hunting, fishing, and the gathering of wild plants, which they did in seasonal rounds. During the summer months, they traveled throughout their territory in a preset pattern, setting up temporary camps in order to acquire and store sufficient provisions for the upcoming winter (Angulo, *Achumawi Sketches* 82). It is important to be aware that the various Tribelets lived in different ecological zones and, as a result, had differing access to resources. The following is a compilation of subsistence practices, and is not intended to suggest that all Achumawi groups utilized exactly the same resources. The Achumawi consumed a wide variety of birds, fish, mammals, and insects.

Table 3.4. Animals Used as Food				
Birds	**Fish**	**Mammals**	**Insects**	**Reptiles**
Ducks Geese Swans Coot Cranes Grebe Blackbirds Eagles Magpies Crows Hawks Meadowlarks Grouses Pelicans Cranes	Salmon Bass Suckers Minnows Lamprey Pike Catfish Trout Crawfish Mussels	Deer Elk Antelope Bear Mountain Sheep Badgers Beavers Foxes Wolf Coyote Chipmunk Gopher Mink Mole Mountain Lion Otter Porcupine Raccoon Skunk Rats Squirrel Wildcat Weasel	Grasshoppers Caterpillars Crickets Angleworms Wasp larvae Hornet larvae Ant larvae Bee larvae	Snakes Turtles

(Olmstead and Stewart, 225-228)

Gathering of plant materials was also an essential activity; the Achumawi made use of an assortment of plant materials for food and medicines.

Table 3.5. Plants Used as Food		
Swamps	**Grasslands**	**Forests & Sage Brush**
Tule Sprouts	Camas bulbs Brodiaea bulbs Tiger-lily bulbs Wild onions Sunflower seeds	Piñon pine nuts Sugar pine nuts Acorns Wild berries Oregon grape Plum

(Olmstead and Stewart, 227-230)

The Achumawi people used a wide variety of plants for medicinal purposes. Some of these plants included tiger and water lily, oak, chokecherry, hazel bark, wild parsley, manzanita berries, bear berries, juniper berries, Oregon grape, angelica root, and pine sap (Olmstead and Stewart, 230).

1.1.10 Important Bird Areas

The Pacific Flyway runs through the Upper Pit River watershed, classifying it as essential habitat for migrating bird species. Many native bird species were relied upon by local Pit River Tribes for sustenance. Also, of utmost importance to the material culture of Pit River Indians are the feathers of many native bird species. Bird feathers are the elements of ritual culture and traditional belief.

Moreover, the National Audubon Society has designated four Important Bird Areas (IBAs) within the Upper Pit River watershed, based on their outstanding habitat for a wide variety of migratory and resident birds as well as species of special concern. All four IBAs offer wetland and/or riparian habitat.[15]

Big Valley – Ash Creek

This site harbors up to 300,000 migrating Ross's and snow geese annually as well as almost the entire California population (near 5,800) of sandhill cranes. The upland portion of the IBA supports one of the last consistently producing greater sage-grouse leks remaining in California. Land managers of the area recommend community-supported riparian and wetland restoration projects.

Modoc Plateau

The Modoc Plateau encompasses dozens of marshy wetlands with sage-steppe uplands and coniferous forests. Some of the more important breeding areas for wetland birds on the plateau include Big Sage Reservoir, Taylor Creek wetlands, and Egg Lake. The wetlands of the Modoc Plateau boast the highest diversity of breeding waterfowl in the state. The area has a network of small, marsh-edged ponds that are productive for some of the largest concentrations of breeding black tern in the state. The sage-steppe habitat between Clear Lake and Big Sage Lake is one of the last greater sage-grouse strongholds.

Modoc National Wildlife Refuge

Modoc National Wildlife Refuge is located just south of the town of Alturas and protects 7,000 acres of marsh, wet-meadow, and grassland/sagebrush habitat along the Upper Pit River. This IBA has consistently supported some of the highest numbers of breeding sandhill cranes in California. More recently, small numbers of least bittern have been found summering in the area, a species little known in northeastern California.

Fall River Valley

The Fall River Valley IBA supports a high diversity and number of breeding ducks and shorebirds, including long-billed curlew, willet, Wilson's phalarope, and sandhill cranes, as well as numerous species of both breeding and wintering raptors. The Rat Farm Road area is home to breeding long-billed curlews and Swainson's hawks. Burrowing owls intermittently breed in the area, and bank swallows nest locally along the Pit River. More than 20 pair of black swift, by far the largest colony in the state, breed at McArthur-Burney State Park. The oak woodland in the area supports one of the few regular purple martin colonies in northeastern California.

[15] Audubon Society. 2012. Important Bird Areas Program: A Global Currency for Bird Conservation. November 2011. Available from web4.audubon.org/bird/iba/

1.1.11 Management Issues

Several invasive species and noxious weeds are found throughout the watershed. These populations affect native communities and are pests to agricultural resources. Control and eradication of non-native and invasive species has become a top priority to governing districts and local stakeholders. Please see **Appendix 3-1** for a list of noxious weeds found within the watershed.

A number of non-native, introduced, or invasive wildlife species occur within the watershed. From an ecological perspective, introduced species are often considered invasive because they can negatively affect native species, either directly (through predation) or indirectly (through competition). Some species have intentionally been introduced by humans and can be desirable in some circumstances; however, even desirable non-native species may impact natural ecosystem function and be considered invasive or encroaching. Some common invasive/encroaching/ introduced non-native wildlife species found in the watershed include:

Bullfrog
Muskrat
Sunfish
Feral dogs and cats
Wild turkey
European starling
Wild horses
Signal crayfish
Brown trout
Ring-neck pheasant

Invasive weeds are considered a major problem in the watershed for their potential to adversely affect the economy and natural environment of a given area. In the watershed, a number of invasive species have had significant negative impacts on the economy and environment by outcompeting native plant and animal species, altering the natural fire frequency and severity, lowering crop production, decreasing available water supplies, reducing rangeland productivity, hindering recreational opportunities, and increasing the potential for erosion. Of these, the most recent and damaging invasive species is Eurasian watermilfoil. Common noxious weeds found throughout the watershed include:

Eurasian watermilfoil
Purple loosestrife
Cheat grass
Yellow starthistle
Spotted knapweed
Medusa head
Scotch thistle
Leafy spurge
Spanish broom

Please see **Chapter 4 Issues and Conflicts** for a broader discussion of regional issues, and **Chapter 7 Goals and Objectives** for a discussion of water-related objectives to address those issues.

Eurasian watermilfoil (*Myriophyllum spicatum*)

The potential negative environmental and economic impacts caused by Eurasian watermilfoil deserve special mention due to its widespread occurrence in the Fall River sub-watershed. Native to Europe, Asia, and northern Africa, the plant is now known to inhabit water bodies along both the east and west coasts of the United States. In August 2003, Eurasian watermilfoil was believed responsible for flooding 300 acres of ranchlands in the Fall River sub-watershed by slowing the flow of the Fall River when one of the levees collapsed. By forming vast mats of vegetation up to depths of 15 feet in areas it inhabits, the plant can restrict access to recreational opportunities such as boating, swimming, and fishing. Furthermore, these mats slow the rate of flow and cause sediment to settle out in the areas inhabited by the plant, leading to higher sedimentation rates. The enormous underwater coverage of the plant restricts the wind from mixing the water column, which reduces the amount of dissolved oxygen available at greater depths. The resulting change in sedimentation rates and oxygen content disrupts the natural ecosystem by favoring some plant species over others, which can have profound effects on native fish habitat. Indeed, in the Fall River sub-watershed, Eurasian watermilfoil has outcompeted many native plants, thereby reducing the amount of native aquatic plant species available for fish habitat. Research efforts have been undertaken in recent years to determine the best means of controlling this invasive weed and prevent worsening of its impacts in the watershed.[16]

Several methods have been identified to control Eurasian watermilfoil. These include mechanical, chemical, and biological control.

Mechanical Control. Because this plant spreads readily through fragmentation, mechanical controls, such as cutting, harvesting, and rotovation (underwater rototilling) should be used only when the extent of the infestation is such that all available niches have been filled. Using mechanical controls while the plant is still invading will tend to enhance its rate of spread. Mechanical cutters and harvesters are the most common method for controlling Eurasian watermilfoil. While harvesting may clear out beaches and boat landings by breaking up the milfoil canopy, the method is not selective, removing beneficial aquatic vegetation as well. These machines also create shoot fragments, which contribute to milfoil dispersal. Harvesting should be used only after colonies have become widespread, and harvesters should be used offshore where there is room to turn around. Hand-cutters work best inshore where they complement hand-pulling and bottom-screening. Bottom-screening can be used for severe infestations but will kill native vegetation as well. A diver-operated suction dredge can be used to vacuum weeds, but this technique can destroy nearby native plants and temporarily raise water turbidity. Hand-pulling is the preferred control method for smaller colonies. The process is both thorough and selective; however, special care must be taken to collect all roots and plant fragments during removal.

Eurasian watermilfoil

Milfoil canopy

Milfoil harvester

Courtesy Fall River Valley RCD

[16] VESTRA Resources, Inc. *Fall River Watershed Assessment and Watershed Management Plan*. 2010.

***Chemical Control*.** Control of watermilfoil has been reported using 2,4-D, diquat, diquat and complexed copper, endothall dipotassium salt, endothall and complexed copper, and fluridone. To be effective, fluridone concentrations of 10 to 15 parts per billion (ppb) must be maintained in the water column for 10 to 12 weeks. Follow-up diver surveillance and hand-pulling of surviving plants is essential to the success of this technique. Some eradication attempts with fluridone have had mixed success due to factors such as surface and groundwater inflows and development of landforms of Eurasian watermilfoil. The selective herbicides triclopyr and 2,4-D are excellent for Eurasian watermilfoil control. Unlike fluridone, both of these herbicides require a short contact time (18 to 48 hours) and will selectively control Eurasian watermilfoil while leaving many native aquatic plants relatively unaffected. Herbicide treatment is not recommended by some groups because it is typically disruptive to aquatic ecosystems and not selective in the vegetation it affects, thus threatening native plants.

***Biological Control*.** The U.S. Department of Agriculture (USDA), in conjunction with the U.S. Army Corps of Engineers, has searched for Eurasian watermilfoil biological control agents in Pakistan, Bangladesh, China, Korea, and Yugoslavia. Several insects have been evaluated, including a number of pyralid moths and several stem-boring weevils; however, many of these insects were found to be nonspecific to Eurasian watermilfoil or to offer little potential as effective biological control agents. *Eurhychiopsis lecontei*, an herbivorous weevil native to North America, has been found to feed on Eurasian watermilfoil. Adult weevils feed on the stems and leaves, and females lay their eggs on the apical meristem (top-growing tip). Larvae bore into stems and cause extensive damage to plant tissue before pupating and emerging from the stem. These insects are believed to be causing a substantial decline in some milfoil populations. Because this weevil prefers Eurasian watermilfoil, other native aquatic plant species are not at risk from the weevil's introduction.

1.2 Internal Boundaries

The Upper Pit River watershed contains several internal boundaries related to the Pit River Tribe, counties, cities, and special districts.

1.2.1 Jurisdictional Boundaries

Tribal Jurisdictions

The jurisdiction of the Tribe extends throughout its territory (see **Figure 2**).

The Upper Pit River watershed sites are located on separate Tribal lands: XL Reservation and Rattlesnake Creek located near Alturas, Lookout Rancheria in Lookout, and Likely Rancheria near Likely.

Headwaters to the North Fork include several tributaries originating on the Warner Mountains and on rare occasions Goose Lake, an enclosed basin north of the Upper Pit River. When Goose Lake overflows, it discharges into the North Fork Pit River. The North Fork Pit River flows through the XL Reservation until the confluence with the South Fork Pit River in Alturas, California. XL Reservation is the Pit River Tribe's jurisdictional Reservation and consists of approximately 9,200 acres on different parcels. Five major tributaries to the North Fork Pit River flow here: Gleason, Parker, Spring Canyon, Stoney, and Thomas Creeks. The Bull Allotment is downstream of the XL Reservation, a property held in trust, consisting of 160 acres.

Rattlesnake Creek flows through the allotment and into Pit River downstream of the confluence of the North and South Forks.

Surface water resources within the XL Reservation are located within the Joseph Creek, Parker/Gleason, North Fork Pit River/Lauer Reservoir, and the McGuinty (Goose Lake) ecological units.

Joseph Creek Ecological Unit. This area occupies 478 acres in an agricultural area on the XL Reservation. It is part of the Joseph Creek watershed. The site or sampling area is bordered on the north by a private ranch and Joseph Creek, on the west by Highway 395, on the south by Highway 299, and on the east by a private ranch and Thomas Creek. The Tribe has water rights on Joseph Creek which is ultimately diverted into an agricultural drain which discharges into Thomas Creek.

Parker/Gleason Ecological Units. This area occupies 2,612 acres in an agricultural area on the XL Reservation. The site or sampling area is bordered on the north by a private ranch and Highway 395; on the west by Highway 299; on the south by private land, a gravel mine, and County Road 56; and on the east by a private ranch. This is the part of the Parker Creek watershed.

North Fork Pit River/Lauer Reservoir Ecological Unit. This area occupies 2,235 acres in an agricultural and residential area on the XL Reservation. In this ecological unit, a significant tributary originates from Spring Canyon, and then discharges into the North Fork Pit River.

Fall River. Several Tribal lands are scattered on the Fall River, and all lands have various levels of development. The Thomas Ryan allotment is located on the Fall River in Dana, California. The property is split by the river. The Tribe participated in a 2006 study that examined physical and biological characteristics of the channel meandering through the Thomas Ryan allotment.

Burney Creek. Burney Creek flows through the Rancheria located in Burney, California. The property is bordered by homes and private timber. The entire property is southeast of Highway 299 on the western edge of the town of Burney. The Burney Rancheria is considered Tribal Headquarters for Tribal programs. Burney Creek ultimately drains into the Pit River at Lake Britton. The creek originates from natural springs on Burney Mountain. Burney Creek flows southwest to northeast through the property and is redirected by a small diversion dam visible from the northeast corner.

Burney Rancheria is also known as "79," referring to the amount of acres that was given to the Tribe for this land base. A significant portion of the Burney Rancheria is located in the floodplain. Several rills, gullies, and ditches discharge sediment and other pollutants into the creek. Burney Creek water-quality monitoring data is limited to a monitoring study funded by the Central Valley RWQCB; however, the sample site is several miles downstream from the Rancheria, after it passes through the town of Burney.

Hat Creek. Hat Creek is a major tributary to the Pit River. Water contributed to Hat Creek is derived from spring-fed sources and snow runoff from the Mount Lassen range. Hat Creek flows south to north, with portions along Highway 89, until it discharges into Lake Britton. Several Pit River Tribe 'fee' and 'trust' allotments reside along Hat Creek. Residents along Hat Creek still utilize this resource for drinking water, fishing, irrigation, and recreation.

***Rattlesnake Creek*.** This stream flows through the Bull Allotment and is a significant tributary to the Pit River. Rattlesnake Creek is north of Highway 299 which traverses in an east/west direction.

Municipalities

The City of Alturas, located in Modoc County, is the only incorporated municipality in the watershed and is responsible for services including water and wastewater, street and traffic maintenance, and land-use planning within the city limits. **Figure 6** shows the Alturas city limits as well as the locations of several smaller communities found throughout the watershed.

Counties

The Upper Pit River watershed encompasses portions of Siskiyou, Shasta, Lassen, and Modoc Counties as shown on **Figure 6**. The jurisdictions of these counties generally include land-use planning, tax assessment, elections, development, health and human services, and water and wastewater services in some unincorporated areas outside of the city boundaries. Shasta County manages the sewage disposal program in Fall River Mills.

Special Districts

Numerous special districts exist within the Upper Pit River watershed. Districts that assist with water management are discussed below.

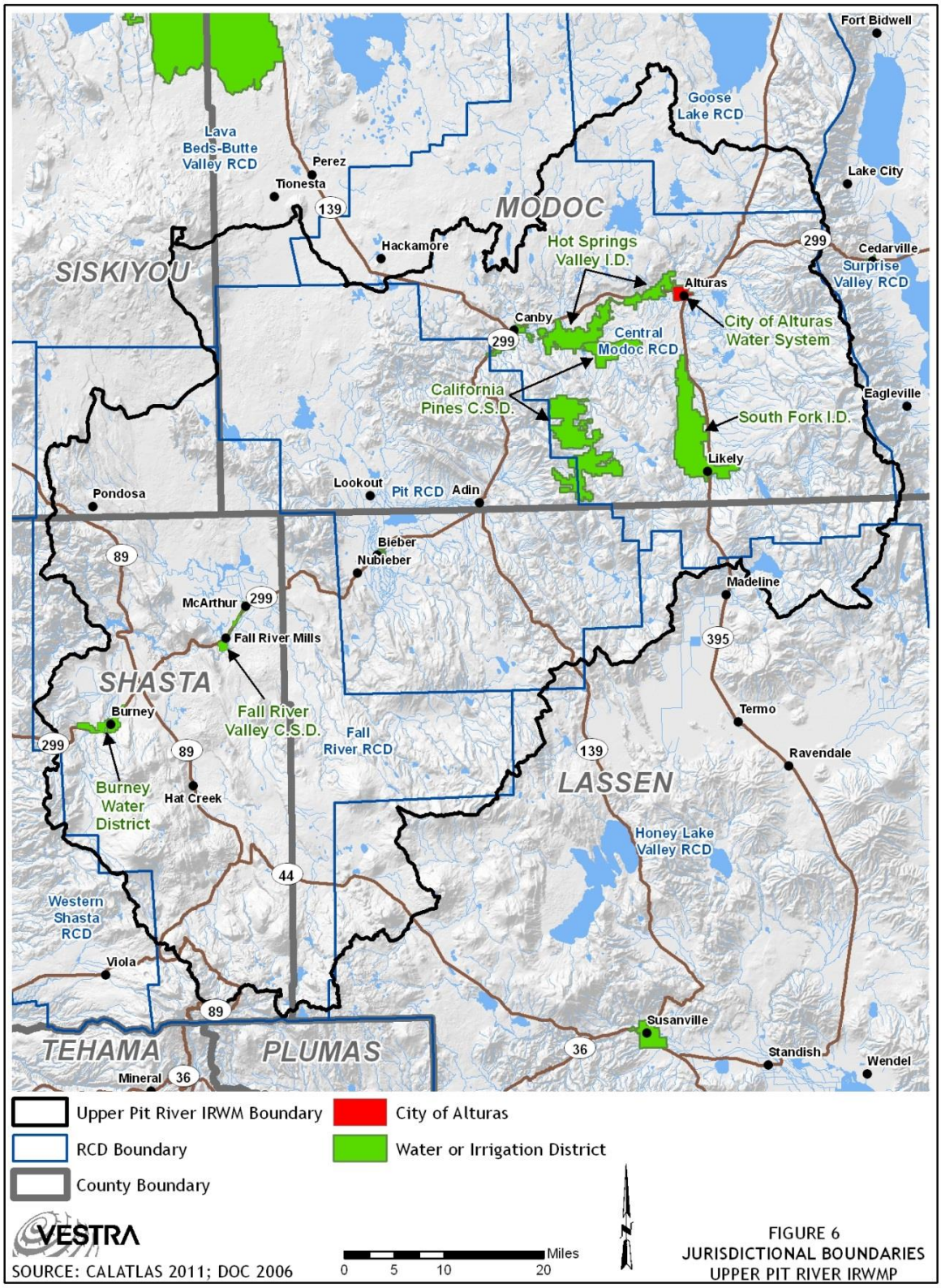
Resource Conservation Districts. Resource conservation districts (RCDs) are "special districts" of the State of California established to be locally governed agencies with independent, locally appointed boards of directors. Although RCDs are established by the rules of a county's Local Agency Formation Committee (LAFCO) and often have close ties to county government, they are not county government entities.

The watershed encompasses portions of six RCDs, including Lava Beds-Butte Valley RCD, Western Shasta RCD, Fall River RCD, Pit RCD, Central Modoc RCD, and Honey Lake RCD. The RCDs manage a diversity of resource conservation projects addressing soil and water conservation, wildlife habitat enhancement and restoration, control of exotic plant species, watershed restoration, conservation planning, and community education.

Beginning in 2012, the Pit River Tribe is in the process of designing a Tribal Conservation District to: manage ancestral lands, address land management through stewardship contracts, offer cultural and environmental education, and implement wildlife and watershed enhancement and protection programs that involve Traditional Environmental Knowledge (TEK).

Water Districts. Several water purveyors serve the watershed, including: Burney Water District, Fall River Valley Community Services District, Lassen County Waterworks District #1, California Pines Community Services District, Hot Springs Valley Irrigation District, Del Oro Water Company, City of Alturas, and South Fork Irrigation District. These entities are shown on **Figure 6**.

Figure 6
Jurisdictional Boundaries
Upper Pit River IRWMP



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1.2.2 Physical Boundaries

Groundwater Basins

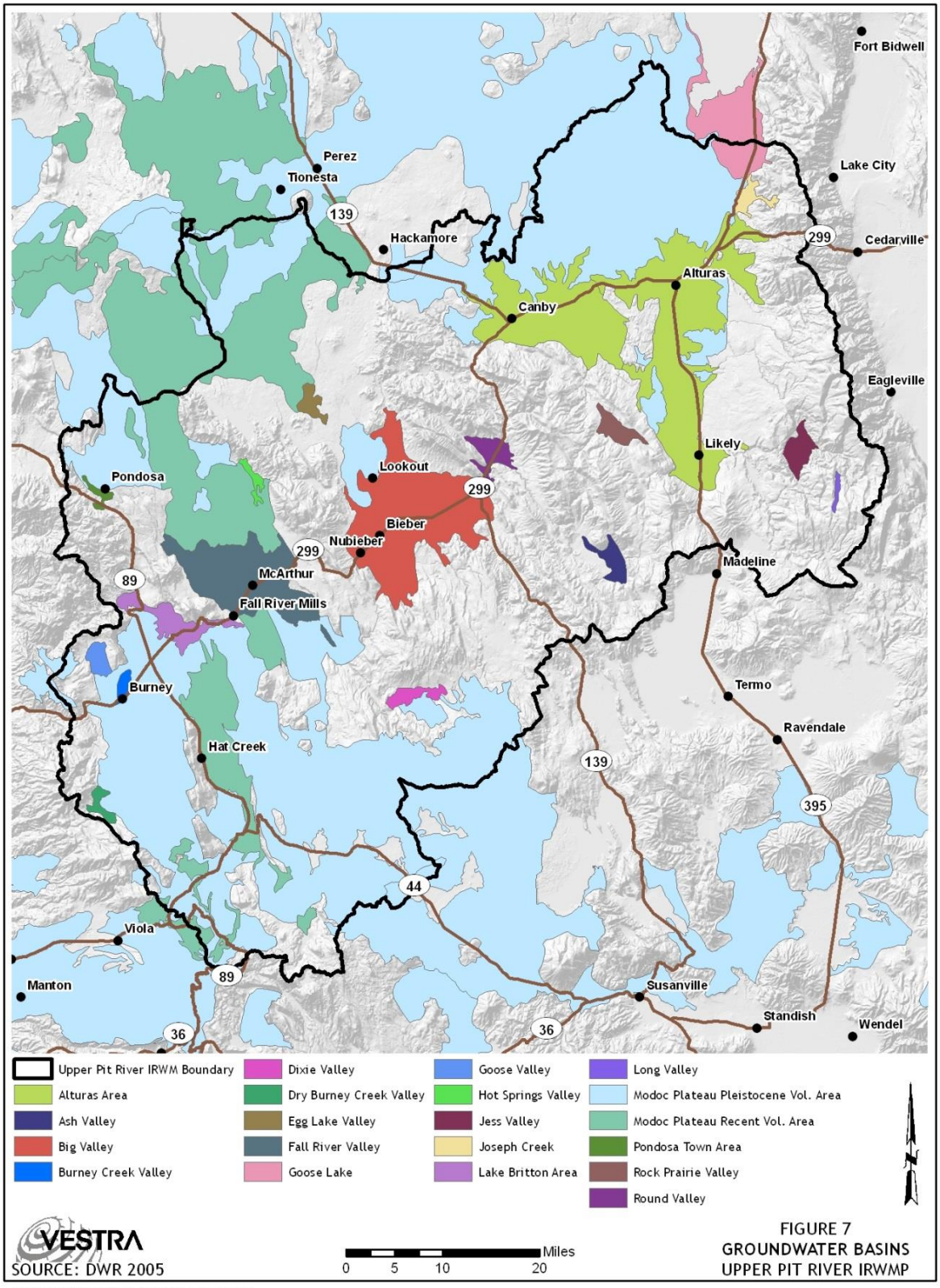
The watershed contains 20 groundwater basins as identified by the Department of Water Resources (DWR). These basins are listed in **Table 3-6** and are shown on **Figure 7**.

Table 3-6.
Groundwater Basins

Alturas Area	Fall River Valley	Long Valley
Ash Valley	Goose Lake	Modoc Plateau Pleistocene Volcanic Area
Big Valley	Goose Valley	Modoc Plateau Recent Volcanic Area
Burney Creek Valley	Hot Springs Valley	Pondosa Town Area
Dixie Valley	Jess Valley	Rock Prairie Valley
Dry Burney Creek Valley	Joseph Creek	Round Valley
Egg Lake Valley	Lake Britton Area	

Source: California Department of Water Resources, 2005

Figure 7
Groundwater Basins
Upper Pit River IRWMP



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Watershed Boundaries

The headwaters of four sub-watersheds (see **Figure 1**) are found within the Upper Pit River watershed. These sub-watersheds are described below.

Upper Pit River. The Upper Pit River sub-watershed is located in northeastern California at the eastern edge of the Great Basin Province. The North and South Forks of the Pit River drain into the northern portion of the sub-watershed. The North Fork Pit River originates at Goose Lake, an enclosed basin, except during rare events when it spills over into the Pit River. The North and South Forks headwaters include a significant number of tributaries originating in the Warner Mountains. The North and South Forks of the Pit River converge at Alturas and flow in a southwesterly direction into Shasta Lake in Shasta County, and eventually into the Sacramento River. The southern limit of the Upper Pit River sub-watershed is marked by the confluence of the Pit River and Hat Creek in eastern Shasta County, excluding the area that encompasses the Fall River sub-watershed. The Upper Pit River sub-watershed includes approximately 3,632 square miles (or 2,324,663 acres), perennial tributaries totaling over 1,000 stream miles, and approximately 6,000 river miles.

Fall River. The Fall River sub-watershed overlaps into Lassen, Modoc, Siskiyou, and Shasta Counties. Fall River flows west through the sub-watershed and drains into the Pit River and eventually into Lake Shasta. The Fall River sub-watershed includes approximately 203,000 acres and 340 stream/river miles. Elevation in the sub-watershed varies from 6,321 feet above mean sea level (MSL) at the Widow Mountain summit in the eastern portion of the sub-watershed to 3,200 feet above MSL in the Fall River Valley. The largely volcanic history of the region has done much to shape the topography and landforms present today. The Fall River is unusual in that it is generally spring-fed with minimal dependence on snowmelt for flow. Because of this, flow at the source is generally consistent year-round. The Fall River Valley is home to valuable agricultural lands and important waterfowl areas.

Burney Creek. The Burney Creek sub-watershed is located in eastern Shasta County. Burney Creek flows northward and ultimately drains into Lake Britton, a human-made impoundment. The lake is drained by the Pit River, which flows into Shasta Lake, making it part of the Sacramento River watershed system. The Burney Creek sub-watershed includes approximately 120,800 acres and 240 stream/river miles. Elevation in the sub-watershed varies from 8,630 feet above MSL at Crater Peak summit in the southeastern portion of the sub-watershed to 2,700 feet above MSL at Lake Britton.

Hat Creek. The Hat Creek sub-watershed, known for its cool, clear water and blue-ribbon wild trout, is located in northeastern California in Shasta County. Hat Creek flows north through the sub-watershed and drains into the Pit River. The Hat Creek sub-watershed includes approximately 243,000 acres with 250 stream/river miles. Elevation in the sub-watershed varies from 10,457 feet above MSL at Lassen Peak summit in the southern portion of the sub-watershed to 2,800 feet above MSL at Hat Creek's confluence with the Pit River. As with Fall River, Hat Creek gains much of its flow from springs.

1.3 Water Quality

IRWM Guidelines require that the Plan discusses water quality for groundwater, surface water, imported water, and water from storage facilities, both within and outside the region. An extensive discussion of surface water quality is discussed below. The availability of groundwater-quality data is limited and has been discussed as a data gap later in this document. No water is imported into the

region, and the only identified problem within storage facilities/lakes has been elevated levels of naturally occurring mercury from geologic sources and atmospheric deposition (see **Chapter 4 Issues and Conflicts**.)

Section 13240 of the Porter-Cologne Water Quality Control Act requires each regional board to formulate and adopt water-quality control plans, or basin plans. The Upper Pit region falls under the *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* (1998), administered by the Central Valley Regional Water Quality Control Board.[17] Regarding surface water, several water-quality constituents are considered stressful or limiting for aquatic life in the Pit River and some reaches of tributary streams, under standards and objectives set by the Basin Plan, and as discussed below. Those constituents are temperature, dissolved oxygen, sediment concentrations, and nutrients. In addition, recreational use and general aesthetics are adversely impacted by high turbidity levels in the watershed. Under the federal Clean Water Act (CWA), states are required to list those water bodies that do not meet adopted water-quality standards for beneficial use protection. Current beneficial uses designated for the Pit River include support for cold and warm freshwater habitats and spawning; contact and non-contact recreational use; and municipal, industrial, and agricultural supply use. Also of importance are Safe Drinking Water Act standards.

IRWM Guidelines also wish to make stakeholders aware of the *Watershed Management Initiative (WMI) for the Sacramento Hydrologic Region,*[18] established in 2003 by the Central Valley RWQCB. The WMI was designed to integrate various surface and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed. The WMI used a strategy to draw solutions from all interested parties within a watershed, and to more effectively coordinate and implement measures to control both point and non-point sources. For initial implementation of the WMI, each regional board identified the watersheds in their region, prioritized the water-quality issues, and developed watershed management strategies. These watershed management areas corresponded with the three basins (Sacramento River Basin, San Joaquin River Basin, and Tulare Lake Basin) that are described in the respective region's Basin Plan, and were then broken down into smaller watersheds or sub-watersheds in order to work on specific problems or to focus on a specific area, in this case the Upper Pit River watershed.

In an effort to initiate improvement in identified watershed conditions, the regional board staff established the Upper Pit River Watershed Enhancement and Protection Project (Project). The specific activities and objectives developed under the Project were as follows:

- Compile inter-agency database referencing existing, watershed-related reports, defining existing monitoring programs, and identifying additional monitoring needs.
- Begin implementation of enhancement efforts such as bank stabilization, fisheries improvement (such as establishing shade and augmenting spawning gravels), and developing and implementing resource management plans for private landowners.

[17] Central Valley Regional Water Quality Control Board. 1998. *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins*.

[18] California Department of Department of Water Resources. *State of the Watershed Report, Upper Pit Sub-Watershed Report, Watershed Management Initiative.* Central Valley Regional Water Quality Control Board.

- Integrate watershed studies, and restoration efforts into the local community education programs. Utilize enhancement projects (such as planting riparian vegetation and improving spawning gravels).
- Sponsor demonstration projects and a holistic watershed management approach for local ranchers in order to encourage practices that will enhance and protect the watershed.

This list identifies closely with several of the resource management strategies, objectives, and projects for implementation identified during the Upper Pit River IRWMP process.

While the WMI has not been substantially updated since 2003, the agency priorities still do apply in watersheds where not much has changed in terms of water quality over the past ten years. The budget support for this program has also dramatically decreased since 2003. Although there is no formal nexus between WMI and IRWMP, and they are an initiative and a program from two different agencies – RWQCB and DWR – they clearly have compatible focus.

1.3.1 Water Quality Concerns

Temperature

Water temperature is a key parameter of water quality and an integral component of aquatic habitat. Geography, climate, stream-channel characteristics, riparian vegetation, and water source are all major factors contributing to water temperature. Elevated temperatures can impact aquatic biota and influence other water-quality parameters, such as dissolved oxygen.

Physical conditions along the mainstem Upper Pit River impacting water temperatures include low flows, shallow slow-moving water, and largely unvegetated streambanks. With an elevation drop of less than ten feet per mile between Alturas and Canby, slope is insufficient to keep the mainstem flowing rapidly. As a result, the Upper Pit River meanders through several open valleys, often in shallow, braided stream segments, and is subject to warming by solar radiation. Seasonal discharge from storage reservoirs, discharge from numerous hot springs located between Alturas and Canby, and discharge from irrigation activity may also contribute to elevated temperatures along the mainstem.

Data from water-quality studies done from 2001 through 2005 show that, for the Pit River, summer water temperatures at times do not support cold-water species. For tributaries, most high-elevation stream reaches have temperatures that support cold-water species. These tributaries receive snow melt from higher elevations during spring and early summer. Some low-elevation streams are marginally supportive; and, in some streams, temperatures are too warm for cold-water species to survive (typically in the lower reaches). Controversy surrounds the initial Pit River listing with a beneficial use as a cold-water system as most of the mainstem does not support the environmental conditions required for a cold-water habitat and did not when the CWA was passed in 1972.

Temperature data for Fall River, Hat Creek, and Burney Creek is limited. Fall River and Hat Creek have temperatures capable of supporting trout and other cold-water fish species and are widely known for their value as a trout fishery. The small amount of data able to be obtained indicates that water temperature in Burney Creek is generally good.

Dissolved Oxygen

Dissolved oxygen levels in water are influenced by temperature, flow velocity, and respiration by plants and algae. During nighttime hours, plants and algae take up oxygen from the water column

and release CO_2 in the process (this is reversed in daytime hours). For this reason, actions that stimulate growth of weeds and algae has the effect of decreasing dissolved oxygen concentrations. Past studies have shown that summertime dissolved oxygen in the Pit River and the lower reaches of some tributaries exhibit significant daily fluctuations, falling to 2 to 4 mg/L in the early morning hours and increasing to 10 to 12 mg/L in the afternoon. The Basin Plan water-quality standard for dissolved oxygen in cold-water habitat is above 7 mg/L; therefore, the Pit River is 303(d) listed as "impaired" for dissolved oxygen.

Data for Fall River, Hat Creek, and Burney Creek is limited but is generally good for dissolved oxygen.

Sediment

The low-gradient nature of the watershed makes sediment transport a very slow process. The Pit River is relatively high in turbidity and, during high runoff and flow conditions, carries particularly high levels of suspended sediment. Some sediment transport is retained by impoundments in the upper river reaches, some settles out in the slower reaches of the river, and some is carried downstream and deposited in the lower river, in PG&E reservoirs, and in Lake Shasta. The principal source of sediment in the Upper Pit River watershed is believed to be bank channel erosion, from both the main channel of the river and from the large network of tributary channels, and down-cutting of the channel system.

The Basin Plan water-quality standard for sediment is a narrative standard, referencing a limited increase over "background" levels and no increase that adversely impacts beneficial uses. Compliance with this standard is difficult to assess. The Pit River is currently not listed as sediment impaired; however, the continued high levels of turbidity adversely impact recreation use and aesthetics, and macro-invertebrate studies indicate that higher levels of turbidity and suspended solids result in a less healthy aquatic insect population in the Pit River and its tributaries.

Fall River is listed as an impaired water body for sediment under Section 303(d) of the federal Clean Water Act. The increased sedimentation in the Fall River in recent years is based on several natural and artificial factors. The clear, predominantly spring-fed waters that feed the river cause high rates of channel scour, leading to locally incised channels and higher rates of sedimentation. Channel incision in turn disconnects stream channels from their floodplains. Sedimentation has increased due to fire occurrences, overgrazing, and channelization in the Upper Fall River sub-watershed. The higher rates of sedimentation have increased erosion and sediment deposition during high runoff periods and in the headwaters area, which has led to increased erosion and sedimentation downstream. Furthermore, degradation of meadows and wetlands in the upper sub-watershed has reduced the sediment retention capacity of these areas, again resulting in increased sedimentation downstream. Muskrats compound the problem of sedimentation in the sub-watershed by creating burrows in riverbanks for habitat. The burrows deteriorate levees and lead to bank erosion, increasing sedimentation in many parts of the Fall River.

The northern portion of the Hat Creek sub-watershed is also susceptible to increased sediment loading. Corral Creek has been found to be a point source of sediment to the Hat Creek Wild Trout Area. Corral Creek is located on the west side of Hat Creek, near the Carbon Bridge fishing access. Check dams were placed to catch some of the sediment from migrating further downstream, but bank-cutting during high flows have put the dams at risk for washouts. In addition, Cinder Flats Creek was found to have active headcuts working up through the drainage and an extremely degraded floodplain and channel due to historic overgrazing. It is unknown how much recovery has taken place in the creek. Muskrat, cattle, and anglers have been identified as contributors to the

sedimentation problem. Burrowing by muskrat in streambanks is particularly prevalent in lower Hat Creek in low-elevation banks due to easier access for the animal, and these types of banks are common along Hat Creek. Muskrat burrowing has reduced the integrity of streambanks locally, causing the banks to be more prone to erosion during high flows or runoff events. Vegetation trampling along the creek caused by cattle grazing and fishing use has further reduced channel integrity, ultimately increasing channel width and decreasing sediment transport capacity of the creek, causing sediment deposition to increase locally. Furthermore, the cumulative impact from these factors has resulted in a loss of shaded undercut areas that offer prime habitat for fish and aquatic insects. Data is limited for Burney Creek; however, there are concerns regarding elevated sediment loads in the creek.

Bacteria

Swimming is an important beneficial use of the Pit River to the Pit River Tribe, while fishing and boating are important throughout the watershed. *Escherichia coli* (E. coli) levels in the Pit River and tributaries have exceeded criteria established for protection of water-contact recreation in the past. However, though E. coli was found to exceed the water-quality standards in 2005 and 2006, in July 2010 the RWQCB waived the E. coli management plan requirements for the Pit River sub-watershed because:

1) No exceedances observed in samples taken from Canby Bridge site since summer 2006;
2) No exceedances observed in 28 samples taken at the Pittville site; and
3) The Alturas Wastewater Treatment facility was upgraded in 2008 to address effluent limits for parameters including coliform bacteria.

Principal sources of E. coli in the watershed have most likely been from a variety of sources, including livestock, point-source pollution, failed water-treatment systems, and wildlife. In an effort to match water quality to use, the City of Alturas is considering recycling municipal wastewater for regional wildlife refuges, to enhance wildlife habitat, and supplement agricultural use. Local sponsors may develop projects for this purpose in the future.

Limited data for fecal coliform bacteria and E. coli is available for Fall River, Hat Creek, and Burney Creek. Data for Fall River show that levels generally tend to be higher in the summer and lower in the winter.

Nutrients

Nutrients are addressed in the narrative Basin Plan objectives. The Basin Plan requires that bio-stimulatory substances not be present in such quantity that they promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses. There is no numeric standard for these constituents.[ii] Nutrients on the Upper Pit River have been monitored through the Irrigated Lands Regulatory Program (ILRP) administered by the Central Valley Regional Water Quality Control Board on the Upper Pit River by the Northeastern California Water Association since 2005. Nutrients measured include Nitrogen (ammonia, nitrate, and Kjeldahl) and phosphorus (phosphate and orthophosphate). Data collected between 2005 and 2010 has been in compliance with ILRP. The detailed results can be found on file with the RWQCB.

Water-quality control plan objectives state that nutrient concentrations shall not promote growth of weeds and algae to nuisance levels that adversely impact beneficial uses. As previously discussed, nutrient levels in the river do promote plant growth which seasonally causes dissolved

oxygen depletion. There also have been complaints regarding weeds and algae clogging irrigation devices.

Principal sources of nutrients in the watershed are believed to be fertilizers, fecal matter from livestock, decaying vegetation, and wildlife.

Total phosphorus levels in the watershed are high relative to most other north state rivers and streams. Nitrate-nitrogen levels in the water are relatively low; however, these low levels may indicate that nitrogen, and not phosphorus, is the principal nutrient controlling plant growth in the river (e.g., dissolved nitrate is rapidly taken out of the water column and converted to plant growth). Currently, it is not known which specific nutrients are causing accelerated plant and algae growth in the Pit River. Further analyses are needed to better understand the principal sources of nutrients and their roles in promoting weed and algae growth in the watershed.

Nutrient concentrations are not an issue in Fall River, Hat Creek, or Burney Creek due to lower water temperatures and spring-fed nature.

pH

The source of elevated pH levels in the Upper Pit River watershed is unknown. Historical data, although limited, shows that elevated pH has been documented in the system for 50-plus years. The Goose Lake Basin, which is hydrologically connected to the Pit River system and shares the same underlying geology, has been designated with a natural pH range of 7.0 to 9.0 in the Basin Plan compared to the range of 6.5 to 8.5 established in the Basin Plan for the rest of the Sacramento River basin.

pH data collected from 2003 to 2005 for Fall River was slightly alkaline, which is typical for similar surface waters in the region. pH data for Burney Creek and Hat Creek are within the regulatory standards.

2010 303(d) List

The adopted 2010 303(d) list includes ten water body segments within the Upper Pit River watershed. These segments are identified as "impaired water bodies" under Section 303(d) of the federal Clean Water Act. The 303(d) listing means that the Regional Water Quality Control Board has determined on a preliminary basis that the concentrations or levels of the listed parameters exceed the numeric or narrative standards that apply to existing or potential beneficial uses assigned to the Pit River[19] (California Environmental Protection Agency, Central Valley Regional Water Quality Control Board, 2011). The segments identified in the Upper Pit River watershed are shown in **Table 3-7** with the reason for each listing, the source, and the beneficial use.

[19] California Environmental Protection Agency, Central Valley Regional Water Quality Control Board. The Integrated Report – 303(d) List of Water Quality Limited Segments and 305(b) Surface Water Quality Assessment. Sacramento, CA. State of California. 2011. Available from: http://www.swrcb.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/index.shtml

Table 3-7. 2010 303(d) LIST			
Water body Segment	**Reason for Listing**	**Source**	**Beneficial Use**
Beaver Creek	E. coli	Source Unknown	Water Contact Recreation Non-Contact Recreation
Canyon Creek	E. coli	Source Unknown	Water Contact Recreation Non-Contact Recreation
Eastman Lake	pH	Source Unknown	Warm Freshwater Habitat
Fall River	Sediment	Historic Land Management Activities	Cold Freshwater Habitat
Pit River Main Stem	Nutrients	Agriculture Agriculture-grazing	Cold Freshwater Habitat
	Organic Enrichment/Low Dissolved Oxygen	Agriculture Agriculture-grazing	Cold Freshwater Habitat
	Temperature	Agriculture Agriculture-grazing	Cold Freshwater Habitat
Pit River North Fork	pH	Source Unknown	Cold Freshwater Habitat
Pit River South Fork	pH	Source Unknown	Cold Freshwater Habitat
	Salinity	Source Unknown	Municipal & Domestic Supply
Rush Creek	pH	Source Unknown	Cold Freshwater Habitat
Upper Ash Creek	E. coli	Source Unknown	Water Contact Recreation Non-Contact Recreation
	pH	Source Unknown	Cold Freshwater Habitat
Willow Creek	E. coli	Source Unknown	Water Contact Recreation Non-Contact Recreation
	pH	Source Unknown	Cold Freshwater Habitat

The RWQCB has designated beneficial uses for the Pit River and tributaries. These uses include Cold Freshwater Habitat as an existing beneficial use on the North and South Forks of the Pit River and along the mainstem between Alturas and the confluence with Shasta Lake. It has been argued that the stretch of the Pit River between Alturas and the confluence with Fall River was improperly designated as cold freshwater habitat. Historical data and fish assemblages suggest this stretch is potentially warm-water habitat.

1.4 Description of the Social and Cultural Makeup of the Regional Community

1.4.1 Cultural Resources

To the Pit River Indians, distinctions between natural resources and cultural resources are meaningless. They are all part of the same harmonious system which makes up the Pit River world. Salmon, which once sustained the people, are seen as inseparable from water, and water, salmon, and people inseparable from one another. The natural-versus-cultural dichotomy is a very different worldview from that held by Native peoples.

The Upper Pit River watershed is Ancestral Territory belonging to six bands of the Pit River Tribe: Ahjumawi, Atswamsini, Astarawi, Hammawi, Kosealektewi, and Hewisedawi. Today, members of the Pit River Tribe still reside within their ancestral homelands. Pit River Tribal Trust lands located within the watershed include: Lookout Rancheria in Lookout, Likely Rancheria near Likely, and the XL Reservation and Rattlesnake Creek lands near Alturas. The Upper Pit River watershed has an abundance of cultural resources; the natural environment is considered to be a cultural resource.

Irreplaceable foods utilized by the Pit River people included: multiple varieties of manzanita berries, wild plums, wild carrots, fish (suckers, salmon, pike), mussels, oysters, mule and other deer, four kinds of acorn (black, tan, two kinds of white oak), sweet anise root, varieties of clover, pinnola, sugar pine and yellow pine nuts, strawberries, blackberries, and cherries, also hazelnuts and peppernuts.[20] Archaeological investigations have determined at least a 12,000-year span of human occupation in the watershed.

Human settlements, recognized now via scatters of stone tools and chipping debris, tended to concentrate along the shores of current and historic streams, lakes, and marshes. The people of the Early Holocene (10,000 to 5,000 B.C.) relied on hunting and gathering for subsistence. Stone tools found at these sites are often fashioned from obsidian obtained from a wide range of source locations. Throughout the watershed, small hunting camps dating back to the Early Archaic (5,000 to 1,500 B.C.) often contain a distinctive dart-point type known as Northern Side-notched. These dart points are one of the most common items found in archaeological sites in the watershed and throughout California. Within the Upper Pit River watershed, obsidian was generally the preferred material for the manufacture of stone tools. Fishing was an important activity throughout the past. In periods where fish runs were abundant and stable, large villages could assemble. These are first noted in the archaeological record during the Archaic Period. By the Late Archaic (A.D. 700 to 1,350), archaeological evidence suggests the elaborate villages and residential sites characteristic of the Middle Archaic (1,500 B.C. to A.D. 700) were mostly abandoned. Climate change, increasing population, or scarcity of resources may have been some of the reasons native peoples' diet base placed a higher reliance on gathering. Evidence of this is a profusion of millstones and plant-processing tools found at numerous sites on the valley floor.

Artifacts other than spear points are found throughout the watershed in the form of animal bone and tooth fragments. Thousands of individual animal bones and tooth fragments have been recovered from housing structures and campsites. Most of these bones are the discarded remains of food items, such as mule deer, jackrabbits, and bobcats. Animal bone was often used to fashion a

[20] The Pit River Native History in the Federal Archives, 1850 to 1940. March 2004. Jason C. Newman. PhD Thesis. U.C. Davis

variety of tools and ornaments. Rabbit and bird bone made good beads and other adornments. Also common are bone awls, which were used for piercing rawhide and weaving baskets.

At several locations in the watershed, ancient artisans etched designs into the basalt rock near caves or mudstone lining the ancient lakes. Chipping the weathered surface of the basalt with a rock hammer or chiseling into the softer mudstone material made these designs. Most of the petroglyph panels contain abstract designs, such as meandering lines, circles, dots, and line sequences. Their meaning is difficult to interpret, although many archaeologists believe they may have been associated with the rituals and spirit world surrounding the hunting of large game. Some petroglyphs are thought to be very old, perhaps dating back to the Middle Archaic period.

Recent archaeological resources consist of houses, camps, and villages occupied within the last 500 to 600 years, many of them within the last few centuries. A large number of artifacts found are from the period when items of Euro-American origin begin to be seen in the Pit River watershed. Items found at archaeological sites include glass trade beads from Italy, bottle glass, buttons, bullet-shell casings, nails, and wire. Hunting strategies include bow and arrow, clubs, fire, atlatl, straps, and snares. Deadfall pits, used to hunt larger game, such as deer, were placed along deer trails leading to watering holes. The many pits dug in the area of the river gave the Pit River its name. By the late 1800s, European goods had largely supplemented many native foods, hunting, food-processing tools, apparel, and household items. Several fragments of cow and sheep bone attest to the rising importance of introduced Euro-American animal foods in the historic period. Native American archaeological sites reflect this transition.

From the Tribal perspective, the coming of the Europeans completely and permanently changed the Pit River region, forever altering the historic lifestyle and livelihoods of its Native people. Introduced Old-World diseases decimated its people. Invasive, exotic plant and animal species, which for them included cows, goats, sheep, and a host of plants, permanently altered the local ecology by changing and or locally destroying native plant associations. Mining, forest removal, and wholesale refashioning of the water systems forever changed the way the Pit River had previously functioned. Extreme acts of violence against the Pit River people, and subsequent forced assimilation were meant to devastate the Native culture. Despite decades of such treatment, the Pit River Indians have survived. Many of the Pit River Tribe's ancestral claims were recognized by the Indian Land Claims Commission in 1959 under Docket 347. The modern Pit River Indians struggle to balance economic development with their ancestral beliefs. The prevailing culture and the Tribe still often struggle to find common ground.

1.4.2 Disadvantaged Communities

A "disadvantaged community" (DAC) is defined by the State of California as a community with an annual median household income (MHI) less than 80 percent of the statewide MHI. Census data from 2000 and 2010 were collected and reviewed to identify disadvantaged communities in the watershed. The 2009 State MHI was $58,925; therefore, communities with an average MHI of $47,140 are considered DACs. **Table 3-8** shows the MHI for the four counties located in the watershed.

Table 3-8. Median Household Income* (2009)	
County	**Median Household Income**
Lassen	$46,377
Modoc	$34,290
Shasta	$42,552
Siskiyou	$39,218
Upper Pit River Watershed	$40,609
California	$58,925
California Poverty Line	$47,140
Source: U.S. Census Bureau, 2010 *California Median Household Income $61,833 in 2010	

The evaluation in **Table 3-9** indicates that a high percentage of the communities within the watershed are disadvantaged, and nine of the DACs in the watershed meet the requirements for designation as severely disadvantaged (SDAC), less than or equal to 60 percent of the statewide MHI).

Table 3-9. DAC Status of Communities in the Upper Pit River Watershed IRWMP					
Zip Code	**City**	**County**	**Median Household Income (MHI)***	**Population estimate**	**DAC Status**
96006	Adin	Modoc	$31,500	599	SDAC
96101	Alturas	Modoc	$32,385	2,827	SDAC
96009	Bieber **	Lassen	$61,250	312	---
96013	Burney	Shasta	$44.632	3,154	DAC
96015	Canby	Modoc	$19,615	403	SDAC
96016	Cassel	Shasta	$55,976	326	---
96108	Davis Creek	Modoc	$44,722	91	---
96028	Fall River Mills	Shasta	$41.296	1,901	DAC
96040	Hat Creek	Shasta	$39,489	392	DAC
96116	Likely	Modoc	$17,283	257	SDAC
96056	Little Valley	Lassen	No data	No data	
96054	Lookout	Modoc	$18,036	367	SDAC
96119	Madeline	Lassen	$14,583	70	SDAC
96056	McArthur	Lassen	$19,600	1,546	SDAC
97635	New Pine Creek	Modoc	$22,500	348	SDAC
96068	Nubieber	Lassen	$28,428	220	SDAC
96071	Old Station	Shasta	$38,000	169	DAC
TOTAL	**---**	**---**	**---**	**14,000+*** **	**---**

Source: U.S. Census Bureau, 2010

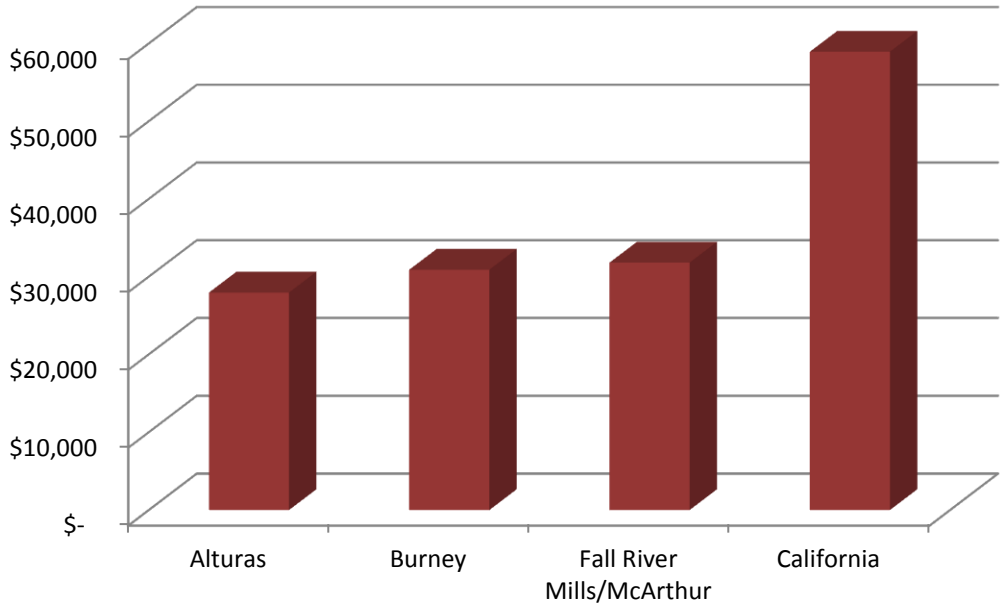
*California Median Household Income $61,833 in 2010

**Of note is that the community of Bieber is not identified as a DAC under the MHI analysis presented. However, it appears that the MHI data calculated for the Bieber zip code area is skewed by the tax information filed by a small percentage of wealthy residents, and a large population of disadvantaged residents who may not file tax information. Substantiating this view is that 70% of the students in the Big Valley Joint Unified School District are on the Free and Reduced Federal Lunch Program. Therefore, the RWMG views Bieber as a DAC.

***No data for Little Valley and other remote areas, so population is estimated slightly higher than total.

Graph 3-1 shows the MHI for Alturas, Burney, and Fall River Mills/McArthur in comparison to the California MHI. Stakeholders want to recognize Big Valley as a cultural center in the region; however, individual data for the area is not widely available.

Graph 3-1: Median Household Income (2000)



1.4.3 Tribal Demographics

Statistical data from the 2000 and 2010 U.S. Census were analyzed for the Pit River Tribe. Data pertaining to population, economics, and education were compared between the two census results and are presented in this section.

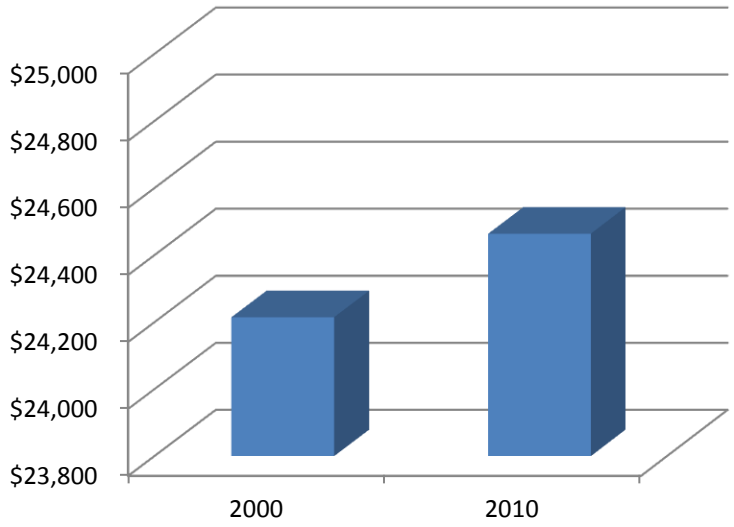
According to the 2010 U.S. Census, the Pit River Tribe has a total population of 2,027, up from 1,765 members in 2000. The number of households is also up from 499 in 2000 to 697 in 2010. **Table 3-10** shows the population trends of the Tribe over the past decade.

Table 3-10.
Population Trends

Pit River Tribe	2000 Population	2010 Population	Numeric Change Over Decade	Percent Change Over Decade
Total Population	1,765	2,027	262	12.9
Total Households	499	697	198	28.4
Notes: Based on 2000 and 2010 Census data.				

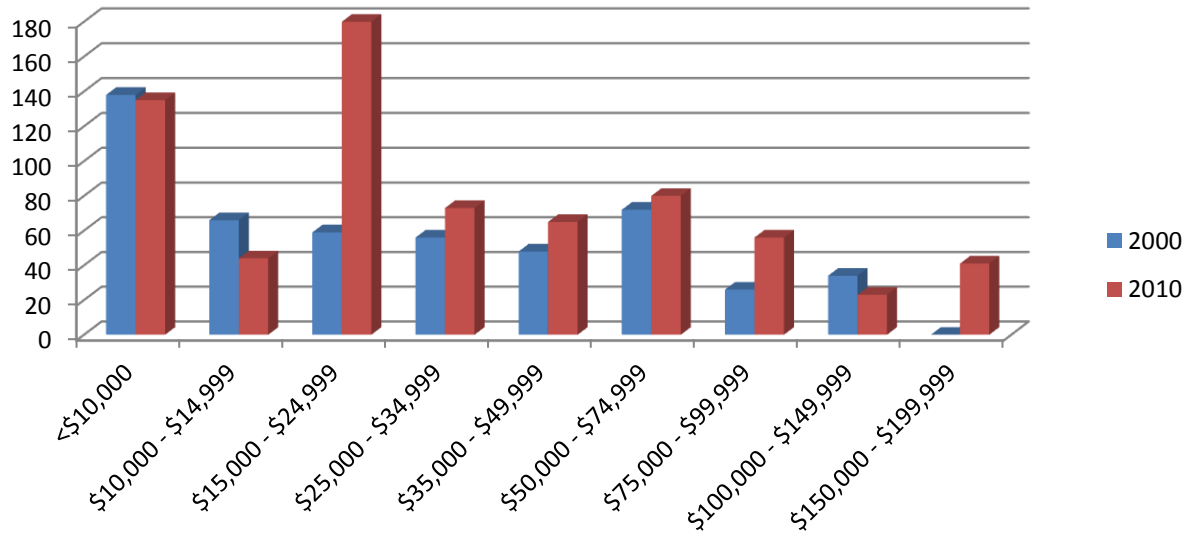
Management, business, service occupations, sales and office occupations, natural resources, construction, maintenance, production, transportation, and metal moving are the primary occupations for the members of the Pit River Tribe. The median household income in 2010 was $24,464, up slightly from the MHI of $24,215 in 2000. **Graph 3-2** shows the median household income for the Pit River Tribe in 2000 and 2010.

Graph 3-2: Median Household Income (2000 and 2010)



A comparison of annual income for 2000 and 2010 is shown in **Graph 3-3**.

Graph 3-3: Annual Household Income

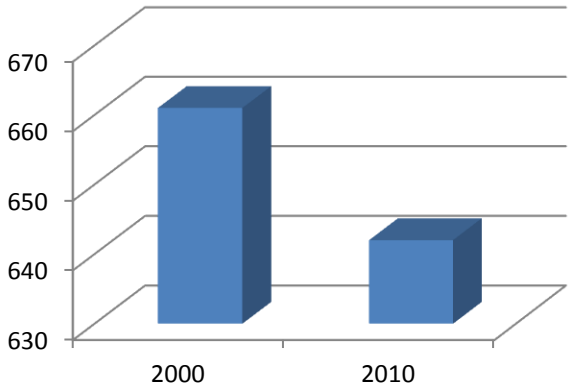


The poverty level of the members of the Pit River Tribe appears to be on a decline from 2000. In 2000, the percent of the population below poverty level was 37 percent. In 2010, it was down to 32 percent. **Table 3-11** and **Graph 3-4** show the poverty levels from the 2000 and 2010 Census.

Table 3-11.
Poverty Levels

	2000	2010
Below Poverty Level	661	642
Population	1,765	2,027
Percent of Population Below Poverty Level	37%	32%
Notes: Based on 2000 and 2010 U.S. Census data.		

Graph 3-4: Poverty Levels - 2010



1.4.4 Local Economy

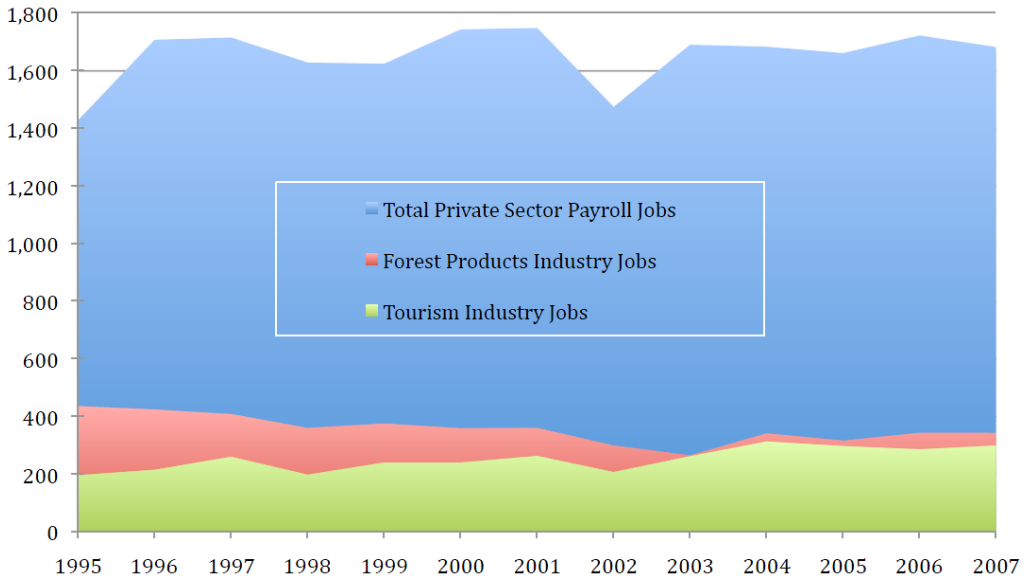
Ranching, farming, forest products (including fuel for electricity-producing plants), and recreation are the primary economic drivers in the watershed (see **Graph 3-5**). The decline in the forestry product industry has encouraged many to look into the prospect of boosting revenue from tourism. However, many of the visitors to the watershed arrive during the warmer months and often do not remain in local communities to the benefit of the tourism revenue. As a result, not enough revenue is generated to sustain tourist and recreation businesses throughout the year. Efforts are underway to create more economically sustainable, year-round industries.[21]

Availability of water is highly important to the economic stability of the region. Recreational use relies upon water to attract anglers, hunters, wildlife watchers, and others who in turn support

[21] Sierra Institute for Community and Environment. *Burney Creek-Hat Creek Community Forestry Project*. May 2010. Available from: http://www.sierrainstitute.us/index.php/forests-and-watersheds/burney-hat-creek

local businesses. The main economic benefit to the region's economy is from agricultural production, which in turn shapes the communities and residents. Over 70,000 acres are under agricultural crop production. The value of livestock production in 2011 totaled over $44 million and crop production was nearly $71 million.[22] [23] [24] Aside from direct job benefits, spinoff from agricultural production supports local businesses as well. Another major contributor to the region is forest products, which accounted for over $51 million to the local region's economy in 2011.

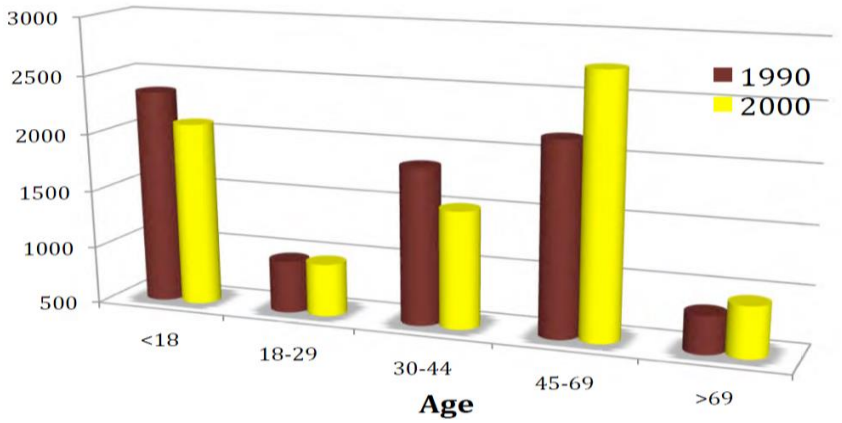
Graph 3-5: Total Private Sector, Forest Products, and Tourism Industry Payroll Jobs in Burney



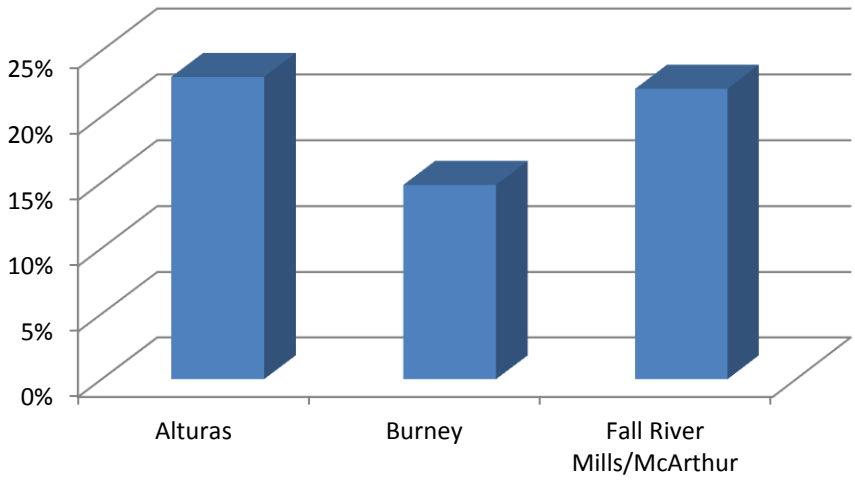
Two major trends in the change of demographics in the watershed have been present since the early 1990s. A large group of retirees and second-home owners has moved to the watershed (see **Graph 3-6**). This has helped to create new jobs associated with home building and renovation. However, with the current socioeconomic condition, many younger families with children have moved from the watershed. The 2008 recession is pushing some families to leave and deepening the impoverishment of the less well-off families that remain (see **Graph 3-7**). A decline in family-wage jobs has caused an increase in poverty rates, unemployment (see **Graph 3-8**), and enrollment in school lunch programs. The declining student population in the watershed has had a significant impact on the viability of schools in the watershed, particularly the high schools (see **Graph 3-9**).[25]

[22] Shasta County Department of Agriculture/Weights & Measures. 2011. 2011 Crop and Livestock Report.
[23] Lassen County Department of Agriculture. 2010. 2010 Annual Crop and Livestock Report.
[24] California Farm Bureau Federation. 2010. Modoc County Crop Information. U.S. Census. 2010.
[25] Sierra Institute for Community and Environment. *Burney Creek-Hat Creek Community Forestry Project*. May 2010. Available from: http://www.sierrainstitute.us/index.php/forests-and-watersheds/burney-hat-creek

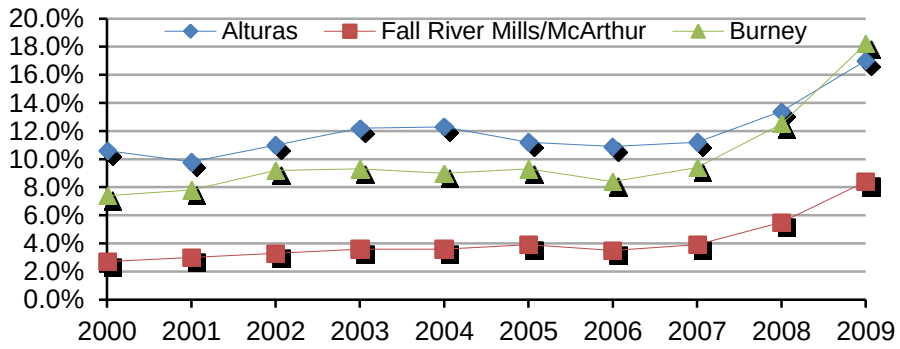
Graph 3-6: Changing Demographics



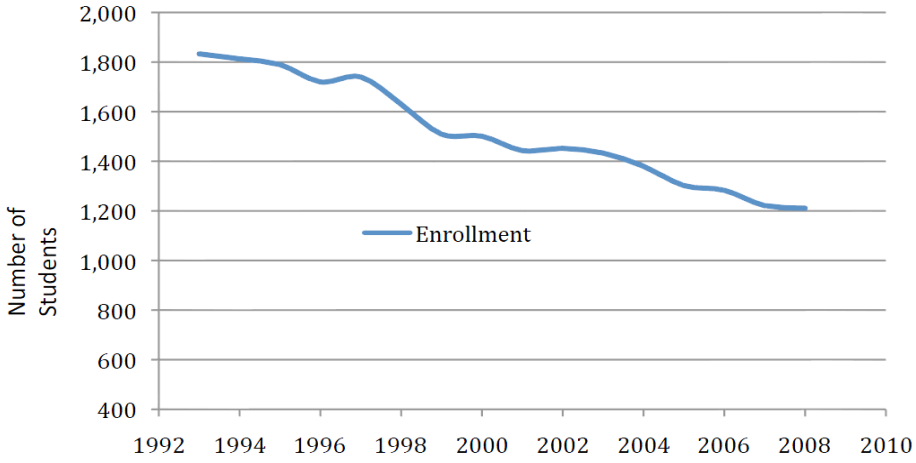
Graph 3-7: Families below the Poverty Line (2000)



Graph 3-8: Unemployment Rates for Burney and Fall River Mills (1999-2009)



Graph 3-9: Fall River Joint Unified School District Enrollment



Population by zip code totaled about 14,000 in the Upper Pit River watershed in 2010 as shown in **Table 3-9**. In contrast, the four-county regional population was 266,710, demonstrating that the vast majority of regional/county population is accounted for outside the watershed.

Population growth trends over the past decade appear modest, with the exception of Shasta County, both by numbers and percentages. **Table 3-12** shows the population trends by county from 2000 to 2010. Since 2010, both Burney and Alturas have declined in population.

Table 3-12. Population Trends by County				
County	**2000 Population**	**2010 Population**	**Numeric Change Over Decade**	**Percent Change Over Decade**
Lassen	33,828	34,895	1,067	3.1
Modoc[A]	9,449	9,686	237	2.5
Shasta[B]	163,256	177,223	13,967	7.9
Siskiyou	44,301	44,906	605	1.4
TOTAL	250,834	266,710	15,876	6.0

Notes: Based on 2000 and 2010 U.S. Census data.
[A] Towns lying in Modoc County in the watershed include Alturas, Canby, Davis Creek, Likely, Lookout, and New Pine Creek. Population totals 4,892 (by zip code) from these communities.
[B] Towns lying in Shasta County in the watershed are Fall River Mills, McArthur, Hat Creek, Burney, Cassel, and Old Station whose populations (by zip code) total 5,942.

The California Department of Finance has compiled a series of population projections by county for each decade through 2050.[26] Population projections for the four-county region are included in **Table 3-13**. These projections show that the greatest population growth in the four-county region is anticipated during the decade between 2010 and 2020 with a projected growth rate of nearly 25 percent. Growth rates in the four-county region for 2030s, 2040s, and 2050s are expected to drop to approximately 15 percent, which is consistent with the average growth rate that was seen in the region between 1950 and 2010.

Table 3-13. Population Projections By County				
County	**2020**	**2030**	**2040**	**2050**
Lassen	42,394	47,240	51,596	55,989
Modoc	13,134	16,250	20,064	24,085
Shasta	224,386	260,179	295,281	331,724
Siskiyou	51,283	55,727	60,656	66,588
Source: California Department of Finance				

[26] California Department of Finance. *Population Projections by Race/Ethnicity for California and Its Counties 2000-2050*. Sacramento, CA. May 2012. Available from: http://www.dof.ca.gov/research/demographic/reports/projections/p-1

Based on the figures in **Table 3-12**, it is clear that the watershed's overall population and growth rates are substantially below the four-county regional population growth rates, predominantly taking place in urban areas located outside of the watershed boundary. In the near term, without a strong economic incentive, the population could either stabilize as people look for work outside of the area, or increase from the addition of, primarily, retirees from out of the area. In any case, growth rates are likely to be well below overall county averages.

1.5 Explanation of the Regional IRWM Boundary

The Upper Pit River watershed IRWM boundary was identified by the Pit River Watershed Alliance with assistance from Northeastern California Water Association (NECWA) board members during a series of meetings. The Upper Pit River watershed is a contiguous geographic area encompassing the watersheds of the Upper Pit River. The watershed has shared resources across the span of the area. Many of the water supply, water quality, flood management, and environmental enhancement challenges within the watershed are best addressed through cooperation of the agencies and stakeholders found within its boundaries.

1.5.1 Goose Lake Addition

At the latter stages of the IRWM planning process, the Goose Lake RCD held a meeting and determined that on behalf of those it represented, it would explore joining the Upper Pit IRWM planning region. The RCD requested and was approved by the Regional Watershed Management Group (RWMG) to join the Upper Pit planning area, if the DWR approved the boundary change. Subsequently, the two groups requested and received approval in March 2013 from DWR for a boundary adjustment of the Upper Pit IRWMP region to include the California portion of the Goose Lake area. Please see **Figure 8** for the approved Goose Lake addition to the IRWMP region.

In the year following Plan adoption, the Goose Lake RCD will explore with its constituents/ stakeholders its financial ability and broader willingness to meet Plan specifications for public involvement and information to supplement the Plan, reserving the right to withdraw from the planning area should financial hardship and/or local opposition arise. If the Goose Lake area, under the leadership of the RCD, chooses to remain in the Upper Pit IRWM planning area, additional information generated could be evaluated during annual Plan reviews.

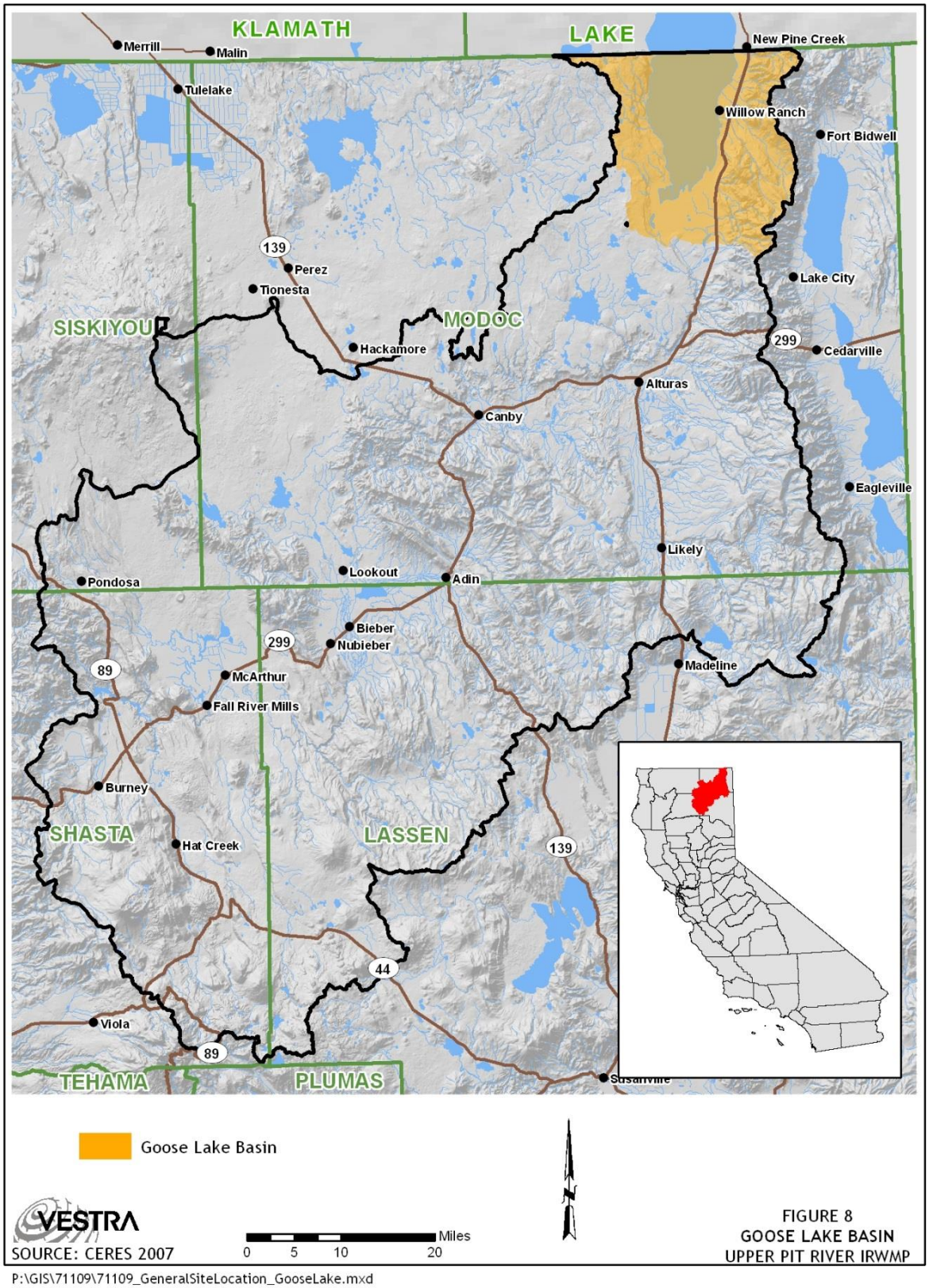
Activities anticipated by the RCD to be conducted over the next year include:

1) Joining the RWMG and Project Review Committee and attending meetings regularly;
2) Holding a public meeting(s) and other public outreach to determine if Goose Lake constituents wish to join the IRWMP region, and to identify local issues;
3) Developing additional issues statements and objectives relevant to Goose Lake, if needed;
4) Seeking funds to pay for outreach and information gathering to supplement the Plan; and
5) Reviewing Plan sections with the RWMG to determine where additional information may be needed relevant to the Goose Lake area.

The Watershed

The Goose Lake Basin watershed stretches across the border between northeastern California and south-central Oregon. Please see **Figure 8**. While this high-desert watershed encompasses 1,140 square miles, only the 232,370 acres that lie in California are proposed to be included in the Upper Pit IRWM planning area.

Figure 8
Goose Lake Basin
Upper Pit River IRWMP



P:\GIS\71109\71109_GeneralSiteLocation_GooseLake.mxd

Land drains from both the west and the east into Goose Lake, a closed-basin lake system that no longer has a surface outlet to the nearby Pit River. The last recorded lake overflow occurred in 1868 when, after a series of extremely wet years, the lake did contribute some surface flow into the Pit River system.

Elevations within the watershed range from 8,000 feet in the Warner Mountains on the east side of the basin down to 4,693 feet at average lake level.

Population

New Pine Creek is the only community in the Goose Lake Basin with Census information available for analysis. Population in the 2010 U.S. Census was 98 with a total of 53 households. The median age of the residents is 55.5.

Tribal Information

Goose Lake Basin is part of the Pit River Tribe territory.

Major Towns, Counties

Goose Lake Basin is located at the northeast end of Modoc County. Communities in the basin include Willow Ranch, New Pine Creek, Davis Creek, and Fairport.

Income

One community found in the basin is identified as being a SDAC. **Table 3-14** shows the DAC status of two communities in the basin.

Table 3-14.
DAC Status of Communities in Goose Lake Basin

Zip Code	City	County	Median Household Income (MHI)	Population	DAC Status
96108	Davis Creek	Modoc	$44,722	91	---
---	New Pine Creek	Modoc	$28,472	98	SDAC

Source: U.S. Census Bureau, 2010

Almost 35 percent of the residents of New Pine Creek live below the poverty level. The primary occupations of residents are construction, transportation, warehousing, and utilities, with the majority of the workforce earning less than $35,000 per year.

Climate

The climate of Goose Lake Basin is typical of a high-elevation desert region, with warm dry summers and cold wet winters. The annual precipitation throughout the basin typically ranges between 15 and 20 inches, much of it occurring as snow. The area usually experiences four distinct seasons. These weather conditions are similar to the upper-elevation sites within the existing Pit River region.

Vegetation

Vegetation is diverse and ranges from mixed conifer forests in the Warner Mountains to sagebrush-dominated shrublands, grasslands, and marshes descending from the mountains toward the lake.

Hydrology

Most of the significant perennial tributary creeks within the California portion of the basin flow westward out of the Warner Mountains toward Goose Lake, which itself covers 13 percent of the entire area of the basin. Within California, Lassen and Willow Creeks are the major water bodies that flow into Goose Lake. Though much of Pine Creek flows on the California side of the state line, the creek actually enters Goose Lake on the Oregon side of the basin.

Six additional creeks (Cottonwood, Barnes, Davis, Roberts, Linnville, and Franklin) rarely reach the lake but instead usually end in terminal pastures. These creeks and their tributaries are important for aquatic habitat benefits and aesthetic quality, in addition to contributing to local supplies for agricultural uses.

Groundwater

The sub-watershed contains two groundwater basins as identified by the California Department of Water Resources. These basins are Goose Lake and Modoc Plateau Pleistocene Volcanic Area. Goose Lake Basin is bounded on the north by Goose Lake, on the east by Pliocene and Tertiary basalt and Tertiary intrusive rocks of the Warner Mountains, and on the west by Pliocene basalt of the Modoc Plateau. The surface area of Goose Lake is variable given that the lake is an intermittent lake and has been completely dry several times since the early 1900s. Several tributary streams flow into the sub-basin from the Warner Mountains. At the southern end of the sub-basin, tributary streams flow south to the North Fork Pit River. Annual precipitation ranges from 15 to 17 inches. The primary water-bearing formations are Holocene sedimentary deposits (which include lake deposits, intermediate alluvium, and alluvial fan deposits), Pleistocene near-shore deposits, Pliocene to Pleistocene lava flows, and to a lesser extent, the Plio-Pleistocene Alturas Formation. Upland recharge areas consist of permeable basalt flows of Pliocene to Pleistocene age. Precipitation and surface runoff infiltrates the basalt flows and percolates toward the valley, recharging valley sediments. Most of the recharge to deeper aquifers along the east side of the California portion of Goose Lake Valley is derived from infiltration of surface water, generally along the foothill portions of stream channels. A relatively large portion of precipitation occurring along the west side of the valley infiltrates upland recharge areas. Groundwater storage to a depth of 500 feet is estimated to be 1,000,000 acre-feet (DWR 1963).

DWR collects semi-annual groundwater-level data from three wells in Goose Lake Basin. In general, the results show declining water levels during the irrigation season, when the underlying groundwater is used for agricultural purposes, and increasing levels in the spring. These annual fluctuations are superimposed on longer-term fluctuations that reflect annual precipitation, declining during the 1987 to 1993 drought and more recent drought conditions.

Water Supply and Demand

Six jurisdictional, directional dams are located within the basin. Jurisdictional dams are defined as artificial barriers, together with appurtenant works, which are 25 feet or more in height or have an impounding capacity of 50 acre-feet or more. Any artificial barrier under six feet, regardless of storage capacity, or that has a storage capacity less than 15 acre-feet, regardless of height, are not considered jurisdictional.

A detailed water budget has not been conducted for Goose Lake Basin.

Streams in the basin include Barnes Creek, Buck Creek, Corrall Creek, Cottonwood Creek, Lassen Creek, Long Branch, Mason Creek, Pine Creek, Roberts Creek, Russell Slough, and Willow Creek. Reservoirs in the basin include Black Reservoir, Briles Reservoir, Davis Creek Orchards Reservoir, Enquist Reservoir, Everly Reservoir, Mcginity Reservoir, and Poindexter Reservoir.

Water Quality

Currently, the State Water Resources Control Board has not identified any of the water bodies within the California portion of Goose Lake Basin as impaired under Section 303(d) of the federal Clean Water Act.

The Central Valley Regional Water Quality Control Board (CVRWQCB) Basin Plan for the Sacramento River Basin has, however, set some waterbody-specific limits for Goose Lake itself. According to that plan, the pH of Goose Lake must be in the range of 7.5-9.5 units at all times, and total dissolved solids cannot exceed 1,300,000 tons.

Goose Lake itself has been deemed to have several beneficial uses, which include irrigation, stock watering, contact recreation, noncontact recreation (other than canoeing and rafting), warm freshwater habitat, cold freshwater habitat, and wildlife habitat.

After the desiccation of Goose Lake in 1992, the Goose Lake Fishes Working Group formed to protect and establish native fishes in the Goose Lake Basin. The group includes Oregonians, Californians, local ranchers, representatives of government agencies, and others. The group produced a Conservation Strategy in 1996 that called for the conservation of all native fishes in the basin by reducing threats, stabilizing populations numbers, and maintaining the ecosystem through the cooperation and coordination of the different land management agencies, resource agencies, private landowners, and other interested parties.

One of the group's main emphases is on improving and maintaining optimal riparian and stream habitat. There is a large number of habitat improvement projects in the watershed that have been a collaboration of individuals and agencies involved with the Goose Lake Fishes Working Group. There have been a number of diversion replacements, fish passage improvements, and installations of fish screens throughout the basin. Private landowners have completed many miles of riparian fencing, grazing management projects, and have planted thousands of willows along creeks.

Goose Lake Coalition and the Irrigated Lands Regulatory Program (ILRP)

In January 2003, California's water quality regulations addressing agriculture changed: The 20-year-old waiver that previously eliminated the requirement for irrigators to obtain individual waste discharge permits had expired. Out of the changes, the ILRP was developed, providing landowners with three options to comply with state water-quality regulations:

- Obtain coverage under the conditional waiver by participation in a watershed coalition group;
- Obtain coverage under the conditional waiver by individual effort; or
- Be regulated under the state's Waste Discharge Requirements instead of receiving coverage through the waiver.

In May 2003, the Goose Lake RCD sponsored a meeting to ask whether landowners would like the RCD to facilitate a coalition group for Goose Lake Basin to provide coverage for those irrigators choosing to join. The meeting attendants responded affirmatively, and the Goose Lake Coalition began.

Since 2003, the Goose Lake Coalition has been working hard to meet the requirements of the waiver on behalf of its members. In 2005, the Goose Lake RCD applied for and was awarded a state grant funded through Proposition 50 to help cover the significant monitoring and analysis costs involved with meeting the requirements of the ILRP for the Coalition. In 2007, all necessary planning documents were submitted to the CVRWQCB and initiated the Coalition's ILRP monitoring program during the 2007 irrigation season. Since then, the Coalition has continued to perform required ILRP monitoring each year and has submitted all reports and related management plans to the CVRWQCB on behalf of grower members.

The Coalition currently serves approximately 30 members representing over 9,000 acres of irrigated land within the California portion of Goose Lake Basin. The northern boundary of the Coalition's area is at the town of New Pine Creek on the Oregon-California border, with the southern boundary falling approximately seven miles south of the town of Davis Creek (a total distance of approximately 23 miles, north to south). All of the irrigated lands on the California side of the basin occur on the east side of Goose Lake, occupying the area that lies between the lake and the Warner Mountains.

Best Management Practices (BMP)

One of the Goose Lake RCD's major efforts in 2011 was to distribute BMP information to growers via copies of the University of California Cooperative Extension's (UCCE) DVD entitled "Management Options to Reduce Pollutants in Runoff from Grazed Irrigated Pastures." The DVD covers many of the potential pollutants that can affect water quality in similar watersheds, based on the types of agricultural operations and the crops grown.

In addition to the DVD, the RCD provides helpful articles, fact sheets, and other printed BMP information to growers. Below are some links to this additional information. UCCE's article on management practices to reduce *E. coli*: Management reduces E. coli in runoff.pdf

Agriculture/Watershed Database

Part of the Goose Lake RCD's efforts in administering the Goose Lake Coalition for ILRP compliance was to improve the information sources of existing agricultural practices and ongoing programs directed at water-quality protection and enhancement in Goose Lake Basin.

An important component of accomplishing this task was the development of a database to collect and record information regarding agricultural operations, management practices, and watershed characteristics. In order to create a meaningful and comprehensive database, the Goose Lake RCD compiled information from member growers, UCCE studies, Goose Lake Fishes Working Group materials, and any other relevant sources. Links to the database are provided below in both Microsoft Excel and PDF formats.

Database in Microsoft Excel: Goose Lake Coalition Ag and Watershed Database.xls
Database in PDF format: Goose Lake Coalition Ag and Watershed Database.pdf

Goose Lake Watershed Groups and Agencies in California

Goose Lake Fishes Working Group and Watershed Council
Goose Lake Resource Conservation District
Natural Resources Conservation District (Alturas Office)
U.C. Cooperative Extension – Modoc County (Alturas Office)
U.C. Davis – Dr. Ken Tate, Rangeland Watershed Specialist

Species and Habitats of Concern

Goose Lake Basin is home to 42 species and habitats of special concern. A complete list of these species and habitats that exist within the basin, as well as their state and federal status, are listed in **Table 3-15.**

Table 3-15. State of California Natural Diversity Database Species and Habitats of Special Concern				
Life Form	**Common Name**	**Scientific Name**	**FEDLIST**	**CALLIST**
Habitat	Goose Lake	*Goose Lake*	7	5
Habitat	Goose Lake Drainage Redband Trout/Lamprey Spawning Stream	*Goose Lake Drainage Redband Trout/Lamprey Spawning Stream*	7	5
Habitat	Goose Lake Drainage Resident Redband Trout Stream	*Goose Lake Drainage Resident Redband Trout Stream*	7	5
Habitat	Goose Lake Drainage Speckled Dace/Goose Lake Sucker Stream	*Goose Lake Drainage Speckled Dace/Goose Lake Sucker Stream*	7	5
Habitat	Goose Lake Drainage Valley Tui Chub Stream	*Goose Lake Drainage Valley Tui Chub Stream*	7	5
Bird	Bald eagle	*Haliaeetus leucocephalus*	8	1
Bird	California gull	*Larus californicus*	7	5
Bird	Greater sage-grouse	*Centrocercus urophasianus*	5	5
Bird	Greater sandhill crane	*Grus canadensis tabida*	7	2
Bird	Northern goshawk	*Accipiter gentilis*	7	5
Bird	Osprey	*Pandion haliaetus*	7	5
Bird	Prairie falcon	*Falco mexicanus*	7	5
Bird	White-faced ibis	*Plegadis chihi*	7	5
Fish	Goose Lake lamprey	*Entosphenus tridentatus ssp. 1*	7	5
Fish	Goose Lake redband trout	*Oncorhynchus mykiss ssp. 1*	7	5
Fish	Goose Lake sucker	*Catostomus occidentalis lacusanserinus*	7	5
Fish	Goose Lake tui chub	*Siphateles bicolor thalassina*	7	5
Mammal	Gray-headed pika	*Ochotona princeps schisticeps*	7	5
Mammal	Western white-tailed jackrabbit	*Lepus townsendii townsendii*	7	5
Plant	Baker's globe mallow	*Iliamna bakeri*	7	5
Plant	Beautiful sagebrush bluebells	*Mertensia oblongifolia var. amoena*	7	5
Plant	Bolander's bruchia	*Bruchia bolanderi*	7	5
Plant	Buxbaumia moss	*Buxbaumia viridis*	7	5
Plant	Common moonwort	*Botrychium lunaria*	7	5

Table 3-15. *continued*
State of California Natural Diversity Database
Species and Habitats of Special Concern

Life Form	Common Name	Scientific Name	FEDLIST	CALLIST
Plant	Doublet	*Dimeresia howellii*	7	5
Plant	Dwarf resin birch	*Betula glandulosa*	7	5
Plant	Ephemeral monkeyflower	*Mimulus evanescens*	7	5
Plant	Grass alisma	*Alisma gramineum*	7	5
Plant	Hillside arnica	*Arnica fulgens*	7	5
Plant	Kitten-tails	*Synthyris missurica ssp. missurica*	7	5
Plant	Modoc County knotweed	*Polygonum polygaloides ssp. esotericum*	7	5
Plant	Northwestern moonwort	*Botrychium pinnatum*	7	5
Plant	Oregon campion	*Silene oregana*	7	5
Plant	Profuse-flowered pogogyne	*Pogogyne floribunda*	7	5
Plant	Prostrate buckwheat	*Eriogonum prociduum*	7	5
Plant	Rayless mountain ragwort	*Packera indecora*	7	5
Plant	Rigid pea	*Lathyrus rigidus*	7	5
Plant	Serrated balsamroot	*Balsamorhiza serrata*	7	5
Plant	Warner Mountains bedstraw	*Galium serpenticum ssp. warnerense*	7	5
Plant	Western valerian	*Valeriana occidentalis*	7	5
Plant	Western valley sedge	*Carex vallicola*	7	5
Plant	Yakima bird's-beak	*Cordylanthus capitatus*	7	5

Notes:
FEDCODE: 1: Federally listed as Endangered 2: Federally listed as Threatened 3: Proposed for federal listing as Endangered 4: Proposed for federal listing as Threatened 5: Candidate for federal listing 6: Species of concern 7: No federal status 8: Delisted
CALCODE: 1: State listed as Endangered 2: State listed as Threatened 3: State listed as Rare 4: Candidate for state listing 5: No state status 6: Delisted
Source: California Department of Fish and Game, Biogeographic Data Branch. California Natural Diversity Database. March 2013

Eight native fish species populations inhabit the basin. Four of the species – Goose Lake redband trout, Goose Lake sucker, Goose Lake tui chub, and Goose Lake lamprey – are considered endemic to the area and are known to spend at least part of their lives in the lake. The other four native

species are primarily stream dwelling; they are the Pit-Klamath brook lamprey, speckled dace, Pit roach, and Pit sculpin.

Pit roach and all endemic fishes, except Goose Lake tui chub, are listed as ‘‘species of concern’’ by the U.S. Fish and Wildlife Service, a designation that implies there is concern about species viability; but not enough information is known to initiate a listing review for threatened or endangered status.

1.6 Identification of and Integration of Water Management with Neighboring or Overlapping IRWM Regions

1.6.1 Identification

The Upper Pit River watershed IRWMP region shares boundaries with five adjacent regions identified by DWR that are currently participating in the IRWM planning process. These regions include the Upper Sacramento-McCloud region to the west, North Coast region to the north, Lahontan Basin region to the southeast, Upper Feather River watershed region to the south, and North Sacramento Valley Group region to the southwest. No regions have been identified for the areas to the northeast or east of the Upper Pit River watershed.

Two minor overlapping areas within the Upper Sacramento-McCloud region are known to exist in eastern Siskiyou County. The first is a lava plain area with extremely flat topography and with little to no surface flow. The second is in the southeastern corner of Siskiyou County in the area around Bear Creek.

During the Regional Acceptance Process (RAP) in 2009, the various regions had already discussed their boundaries and to date no additional issues surrounding these boundaries have been identified, despite specific conversations aimed at considerations of boundary adjustment.

1.6.2 Opportunities for Integration of Water Management

Preliminary interviews were conducted with the Upper Sacramento-McCloud, Upper Feather, and North Sacramento Valley IRWM regions during the grant application process. During these discussions, many common issues were identified including groundwater resources, Tribal outreach, consequences of a potential increase in the height of Shasta Dam, consequences of introduction of anadromous fish above Lake Shasta, intentional coordination with the North Sacramento-McCloud IRWM to address Medicine Lake, and the State Water Resources Control Board’s Irrigated Lands Regulatory Program.

In November 2012, a conference was convened by the Sacramento River Watershed Program that involved all adjacent IRWM regions. Upper Pit Project Team representatives met with regional representative in spring 2013 to confirm they would be willing to attend an early-2013 meeting, and to confirm agenda topics. Agenda topics included: sharing issues and conflicts lists, opportunities for joint inter-IRWMP development of projects, early warning of emerging issues in the headwater or receiving water areas, management of natural resources (e.g., the reintroduction of salmon above Shasta Dam), co-sponsorship of a cost-benefit workshop in summer 2013 and final confirmation of boundaries.

A representative of the RWMG attended a meeting in early 2013 to formalize the efficient and cost-effective way to communicate and collaborate in the post-IRWMP preparation period, when funding to support outreach will be constrained.

The Upper Pit region is represented in three other IRWM-focused venues: the Round Table of Regions (RTOR), the Sacramento Region Funding Area (SRFA), and the Sacramento Valley Coalition (via NECWA). The RTOR, an ad hoc group, including representatives of each of the IRWM regions in the state, has been meeting since 2007. The group meetings are generally via phone, roughly once a quarter, and have proven to be a valuable venue for IRWM regions to discuss issues of both statewide and regional concern. This venue will continue to be available to all the IRWMs as an informal venue for discussion and problem solving, as well as early warning for emerging issues or problems.

The SRFA group, convened by the Cosumnes American Bear Yuba (CABY) IRWM region, has met several times a year since 2008. This group is a forum for discussion that serves all eight IRWM areas within the Sacramento Region Funding Area. This group offers opportunities for joint fact-finding, collaboration on projects, development of interregional projects, early identification of emerging issues, and problem solving on issues of mutual concern but differing perspectives. CABY will continue to convene these meetings into the future as part of its organizational program. The Sacramento Valley Water Quality Coalition is made up of irrigated lands groups in the Sacramento River watershed and was formed to provide a venue to discuss and advance landowner/operator issues associated with DWR's irrigated lands program.

Public agencies have been and are represented in PRWA and the RWMG, and have participated in the activities of the Project Review Committee. This collaboration is expected to continue and includes not only project development, but also regular exchange of data and identification of any changes to listed issues or conflicts.

[i] Indian Claims Commission in its July 29, 1959, findings of fact and opinion in Docket No. 347, i.e., the 100-mile square. "The jurisdiction of the Tribe under this Constitution shall extend throughout its territory. Nothing in this Article shall be construed to limit the ability of the Pit River Nation to exercise its jurisdiction to the fullest extent permitted by Federal law, including but not limited to lands, waters, properties, air space, fish, wildlife, and other resources."

[ii] While the data collected through 2010 to assure irrigated agriculture is in compliance with the ILRP, there have been complaints regarding weeds and algae clogging irrigation devices. This plant growth can result in lowered dissolved oxygen levels. (Larry Foreoro, UCCE Shasta County, pers. comm., 11/15/12).

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CHAPTER 4. REGIONAL WATER ISSUES AND CONFLICTS

1.0 IDENTIFICATION OF ISSUES

The following issues and conflicts were identified throughout the Integrated Regional Water Management Plan (IRWMP) development process by stakeholders at regional meetings, sub-watershed meetings, Northeastern California Water Association (NECWA) board meetings, during personal interviews and discussion with stakeholders, from review of local and regional planning documents, and through intensive project identification and development. This list of issues and conflicts served as the basis for developing resource management strategies, goals and objectives, and, ultimately, defining and refining implementation projects that help resolve these issues.

For purposes of clarity, issues are defined as problems facing the watershed that have been brought up by stakeholders or the Project Team preparing this Plan; conflicts are diverging viewpoints over what ought to be done to resolve an issue.

1.1 Tribal Sovereignty

The Pit River Tribe is recognized under federal law as a sovereign nation. At the time of this writing, the California Department of Water Resources was unable to provide the Project Team with guidance on how or when the issue of Tribal sovereignty might affect the planning process**.** The Tribe believes that federal Consultation between the Tribe and federal agencies is not taking place to an adequate degree, and that the State of California should be in formal Consultation with the Tribe over natural resource issues, water quality, and allocation issues that affect Tribal rights and interests.

For purposes of this planning process:

1) The Pit River Tribe is participating as a member of the Regional Water Management Group (RWMG) and by sending a Tribal representative to the Project Review Committee meetings.
2) The Tribe has designated two individuals to formally represent its interests at the RWMG and the PRC.
3) It is assumed that federal agencies involved in this planning process will work with the Tribe to follow all federal Consultation requirements triggered by this Plan.
4) As guidance on Tribal sovereignty vis-à-vis the IRWM program becomes available, it will be incorporated into the planning process.

2.0 ISSUES

2.1 Issue Statement: Water Quality

Various water-quality studies and concerns expressed by stakeholders reveal that water quality is one of the paramount concerns in the watershed, and has been for some time. Numerous studies and projects in the watershed have been directed at this issue to date.[i]

Elevated water temperature, increased turbidity and dissolved oxygen, sedimentation, bacteria, nutrients, and nuisance algae have all been identified as water-quality issues. These topics are discussed in greater detail in **Chapter 3 Region Description**. A combination of natural and human-

caused, management-related phenomena are likely causes. Natural phenomena include rainfall and fire, while management activities that contribute to, or historically contributed to, water-quality concerns include livestock grazing, discharge of warm water and nutrients from irrigated pastures, irrigation agriculture, logging, road construction and maintenance, stream channel modifications, rural residential development, and failed water treatment systems. Some problems are legacy issues related to practices no longer in use.

Improved management practices have been implemented including livestock fencing, off-stream watering sites, road crossing and drainage improvements, irrigation tailwater control, and re-vegetation of streambanks. Within the past 15 to 20 years, practices have significantly changed. On Bureau of Land Management (BLM) and U.S. Forest Service (USFS) allotments, standards and guidelines are in place for permittees, although lack of agency enforcement can result in inconsistent compliance. On private lands, many ranchers have participated in the UC Rangeland Water Quality Shortcourse that offers techniques for grazing management to reduce negative impact, as well as to improve conditions for waterways and pastures. Agencies, local watershed programs, and individual landowners continue to seek opportunities to implement projects that provide water-quality and habitat-improvement benefits. While these issues apply in general, each sub-watershed has its own set of water-quality issues, as discussed below.

One of the conditions that affects water quality on the mainstem Pit River is the seasonal removal of flashboard dams and related water level decline that exposes raw dirt banks, subjecting them to erosion and sediment. This system of irrigation is widespread and difficult to replace cost-effectively. Some landowners have used canals (e.g., Rattlesnake Creek) as the water delivery system, while the Central Modoc and Pit Resource Conservation Districts (RCDs) have studied and addressed these with monitored bank stabilization projects to determine what is most effective. Several miles of bank stabilization have taken place to date within the Central Modoc and Pit RCDs that should inform solutions for the future.

2.1.1 Upper Pit River and Tributaries

Within this section, the Upper Pit River and tributaries refers to all watersheds that flow into the Pit River upstream of its confluence with the Fall River. Ten water-body segments within the Upper Pit River watershed have been identified as "impaired water bodies" under Section 303(d) of the federal Clean Water Act in 2010. The 303(d) listing means that the Regional Water Quality Control Board (RWQCB) has determined on a preliminary basis that the concentration or level of certain water-quality parameters exceed the numeric or narrative standards that apply to existing or potential beneficial uses assigned to the Pit River. The mainstem Pit River (from the confluence of the North and South Forks to Shasta Lake) is listed as impaired for nutrients, organic enrichment, low dissolved oxygen, and temperature. Several of the Pit River's tributaries are listed for pH and/or *E. coli*, while one – the South Fork – is listed for salinity as well.

The Upper Pit River is not currently listed as sediment impaired; however, persistent high levels of turbidity and suspended and settleable solids adversely impact recreation use and aesthetics. Moreover, macro-invertebrate studies have shown that higher levels of turbidity and suspended solids correlate with less healthy aquatic insect populations in the Pit River and its tributaries. A variety of factors are responsible for higher sediment levels (i.e., historic channelization, poor bridge and culvert design, historic overgrazing) and many enhancement and restoration projects have been implemented and/or are planned to improve water quality related to this parameter.

Many of the tributaries and both the North and South Forks of the Pit River originate in the Warner Mountains. Early settlers brought large numbers of sheep and cattle to this area and impacts from this era are still present on the land. The streams are generally perennial within the Warners, and those such as Parker Creek, Mill Creek, and East Creek are important tributaries for native fish. Tributaries of the Pit River located to the south and west are generally ephemeral and quit flowing during the summer. A few exceptions, such as Ash Creek, are perennial and provide important water for fish and agriculture. Many of the meadow systems in the Upper Pit River suffer from entrenchment which results in poor water quality and reduced quality of habitat for aquatic species. The lack of consistent water-quality flow data upstream of and within the XL Reservation inhibits management.

2.1.2 Lower Pit River and Tributaries (below the confluence with Fall River)

The Lower Pit River and tributaries refers to watersheds that contribute to the Pit River below Fall River, including the Fall River sub-watershed. The Lower Pit River is much different than its upper reaches because the Fall River and other tributaries provide a large and consistent flow of cold water on a yearly basis. Fall River is 303(d) listed in its entirety as an impaired waterway from sedimentation. Sediment sources that affect waterways are principally due to erosion from entrenched channels and erosion in upland areas caused by logging, widespread intense wildfire (e.g., the Pondosa Fire that was followed by a large storm event), post-fire logging and road construction, grazing, and boat wake from recreational users. Pacific Gas & Electric Company (PG&E) data studies completed for Federal Energy Relicensing Commission relicensing set the stage for the natural background levels of pH, dissolved oxygen, and nutrients.

Erosion and degradation of wet meadows has hindered the meadows' sediment-retention capacity. Additionally, muskrats (an invasive species) burrow into and weaken streambanks, adding to potential erosion. Because Fall River is a low-gradient, low-velocity system, excessive sediment within this system is transported very slowly, thus adversely affecting fish, aquatic insects, and vegetation. This sedimentation is of paramount concern to anglers as Fall River is regarded as a premier trout fishing stream, and for the Tribe, as historic habitat for the Sacramento sucker.[ii]

While there is concern that elevated nutrient levels exist in the Fall River and may contribute to increased algal and nuisance plant growth, monitoring studies have not shown any increasing trends in either nutrient concentrations or temperature conditions.

Lower Hat Creek watershed has experienced sediment loading that has resulted in impacts to fish habitat. Like Fall River, it is a premier wild trout fishery. Muskrats, livestock grazing, hydroelectric facilities, and angler use have been identified as contributors to the sedimentation problem. Muskrat burrowing has reduced the integrity of streambanks, causing the banks to be more prone to erosion during high flows or runoff events. Vegetation trampling along the creek caused by cattle grazing and fishing use has further reduced channel integrity, ultimately increasing channel width and decreasing sediment-transport capacity of the creek, causing increased sediment deposition. The cumulative impact from these factors has resulted in a loss of shaded undercut areas that offer prime habitat for fish and aquatic insects. Local landowners have cooperated with angler groups and other interests to try to address these problems in Hat Creek.

Limited data indicate that water quality in Burney Creek is generally good and there are currently no exceedances of regulatory standards. Monitoring from 2003 to 2005 showed a decline in water

quality as Burney Creek flowed through irrigated pasture and wild rice operations in the lower watershed. Subsequent monitoring in 2006-2007 contracted by NECWA did not reveal water-quality problems in the creek (Rod McArthur, pers. comm., January 6, 2013). The Pit River Tribe, Burney 79 Acres property lies along Burney Creek. The Tribe expresses concerns about sediment deposition and water quality from upstream activities.

While the Pit River below the confluence of Fall River is generally considered to be in good condition, it is 303(d) listed for the parameters listed above. Stakeholders consider this an administrative error that needs correction.

2.1.3 Mercury

Concerns about natural and atmospheric mercury contamination were expressed by Native American stakeholders during public outreach. The state has just completed environmental scoping for a statewide Total Maximum Daily Load (TMDL) for mercury in reservoirs. Discussions with RWQCB staff confirm that elevated levels of mercury have been documented in some species of fish in four regional reservoirs: Moon Lake, West Valley Reservoir, Big Lake, and Lake Britton. However, there are no federal or state listings or advisories for mercury content in water bodies of the Upper Pit region. Further, there are no known sources of contamination in the watershed aside from atmospheric deposition and natural contributions from hydrothermal springs into the Pit River. An example would be the Warm Springs area between Alturas and Canby. Of importance to Tribal interests is the posting of advisories for water bodies within the Upper Pit River region known by the RWQCB to show evidence of elevated mercury.

2.1.4 Tribal Water Quality Perspectives

The Pit River Tribe is concerned about what effects that present land use both on and off the Reservation (e.g., faulty and primitive septic systems; livestock grazing; certain management practices by federal agencies, such as pine beetle control treatments, aggressive fuels management and fire suppression projects, and silviculture; and hydromodification) may have on Tribal water resources, local ecology, and, most important, human health.

Several members of the Tribal Council expressed concern about irrigation ditches on their property being deepened and enlarged without their permission. They did not know whether this was a trespass issue, and/or who they should contact to address their concerns. Some residents also suspect illegal water diversions. **Note:** Suspected illegal water diversions are beyond the scope of this IRWMP, but should be referred to the State Water Resources Control Board, Division of Water Rights, for investigation and follow-up action.

Also, as a result of current and historical grazing and management techniques, invasive weeds proliferate. The use of pesticides for management of invasive species also contributes to the degraded water quality on and off Reservation lands and intermittent algae blooms indicate poor water quality. Algae can result from warm-water nutrient drainage from irrigated pastures, and pesticides and herbicides. Other on- and off-Reservation areas of concern are non-point-source pollutants from roads and the railroad which runs through XL Reservation. The Tribe reports that railway accidents have frequently occurred, spilling rail car contents into the North Fork of the Pit River. When this occurs there has been no notification or mitigation by the responsible railroad, and spill clean-up has not occurred.

The Pit River Tribe has identified the following beneficial uses for surface waters within Reservation lands: drinking water, COLD freshwater habitat, cultural and ceremonial, swimming, wildlife habitat, and agriculture/irrigation.

Other Tribal Water-Quality Issues and Conflicts

- Access to quality safe-drinking water from undeveloped or inadequate water systems infrastructure for safe-water delivery.
- Water-quality assessments related to water contamination in surface waters and wells used as sources for drinking water, swimming, traditional cultural practice.
- Acknowledgement/maintenance of Tribal Water Rights.
- Adequate water flows and quality water for sustainable fisheries and access to traditional fishing practices.
- Agricultural water diversions and storage.
- Water contamination resulting from pesticides, herbicides, and runoff from agricultural farming and grazing activities.
- Water contamination associated with weather modification activities.
- Dams and access to traditional subsistence foods and fisheries.

2.1.5 Groundwater Quality

Many residents rely on groundwater as a source for safe drinking water. There are no specific, documented groundwater-quality problems; however, a lack of groundwater-quality data, and therefore the inability to address related issues, has been widely expressed at stakeholder meetings. Lassen County has developed a management plan for the Big Valley Basin that also acknowledges the lack of groundwater-quality data.

Geothermal energy developments have being proposed for the Medicine Lake Highlands. This proposal has been controversial, with local support and opposition for both sides of the issue. Studies conducted have linked Medicine Lake Highlands and subsurface aquifer flows to the Fall River and adjoining watersheds. The project is currently undergoing federal environmental review. The use of hydraulic fracturing or "fracking" associated with energy extraction has the potential for groundwater contamination in the region.

2.2 Issue Statement: Water Quantity

Major sections of the Pit River were adjudicated during a wet climate cycle (1870-1950). In recent decades there is often insufficient water to meet demand and need. Late-season low flows are common in the watershed, exacerbated by cases of inefficient transport of irrigation water and down-cut river and stream channels that result in floodplain disconnection, and subsequent dewatering of shallow aquifers/wet meadow systems. Dense juniper cover in upland areas and changes from perennial to annual grasses, both brought on by early 1900s grazing practices and aggressive management of fire over the past half century, may also contribute to a reduction in overall supply, but this has not been proven.

From the Tribal perspective, a lack of core scientific data exists for sustainable management of juniper and should be considered before large-scale removal. Tribal interests believe the drive for biomass should be weighted relative to the important ecological role juniper trees fill for key wildlife species as well.

Recent local weather records for the region as well as simulated climate projections discussed in **Chapter 8 Climate Vulnerability** of this document suggest that the Upper Pit region has been warming over the past century and will continue to do so. Coincident increases in precipitation are not projected, indicating that conservation and efficient use of water could become ever more important over time.

2.2.1 Low-Flow Impacts to Aquatic and Terrestrial Species

Water quantity is essential to all forms of aquatic and terrestrial wildlife, but in particular to aquatic and wetland-dependent species and species of concern, such as redband trout, rough sculpin, Shasta crayfish, and Modoc sucker. Reduced flows can severely shrink critical occupied fish habitat and put isolated populations at risk, especially Modoc sucker (Paul Divine, Department of Fish and Game, pers. comm., July 12, 2012).

Many species of wetland-dependent birds and wet meadow-associated terrestrial species are also impacted by low flows. Additionally, water quantity affects the trout fishery within the watershed and waterfowl numbers that draw in hunters, both of which help bolster the local economy.

2.2.2 Water Reliability for Tribal Interests

Tribal interests wish to assure water reliability for "cultural beneficial uses," and to support sustained fisheries for redband trout, and a native species hatchery.

2.2.3 Water Supply Reliability for Agriculture

Late-season low flows are a source of concern for irrigators wishing to maximize crop production and/or water livestock. By far, the most common irrigation practices in the region are flood irrigation and wheel lines. The Natural Resources Conservation Service has funded transitions to pivot systems in many places around the planning region, improving irrigation efficiency on those particular tracts. Flood irrigation is still widespread along the Pit River floodplain and some landowners are concerned changes in practice may invoke additional regulatory action and/or increased costs. Pivot irrigation is not viable in many locations in the region, so alternative systems or technology that modify and improve on current systems may hold the answer. Agricultural producers that farm irrigated crops within the region have done extensive land leveling which has led to increased water efficiencies. Water reliability over the long-run can be increased with agricultural conservation practices and riparian restoration.

Tribal interests also include the establishment of Tribal greenhouses to propagate and grow native plants, trees, and shrubs for restoration and educational purposes; and to contribute to local and Tribal economic vitality.

2.2.4 Need for Additional Surface Storage and Release

Stakeholders recognize the need and potential for additional storage capacity and ability to enhance timed releases of water in the region, especially to supplement late-season flow. Aside from discussion of raising West Valley Dam, and historic proposals for Allen Camp and Ostrom Point Dams (see **Chapter 3 Region Description**), there are currently no formal proposals for additional human-made, surface-water storage capacity.

2.2.5 Groundwater Supply

Knowledge of groundwater hydrology in the region is uneven at best, and the source of available data is often unknown by stakeholders. This data gap handicaps planning and managing efforts, and could become more problematic if groundwater use continues to increase at its current rate, if population grows significantly, and/or if drying of the climate continues. Groundwater usage in the Upper Pit Watershed has increased approximately tenfold in the last 40 years (see **Chapter 3 Region Description**). Since the watershed is subject to drought and late-season low flows, is fully adjudicated in some areas, and is experiencing an increased use of groundwater already, getting a handle on regional groundwater quantity will be a means of strengthening water supply management options for the future.

Formal and non-regulated (groundwater) interregional water transfers have the potential to impact groundwater supplies.[1] Also, potential groundwater contamination can diminish quality and quantity groundwater supplies. Geothermal energy development over significant hydrological regions and recharge zones presents potential threats to groundwater supply and reliability and subsurface aquifer pressure.

2.3 Issue Statement: Invasive Species

Both terrestrial and aquatic non-native species have been introduced into the watershed over time, often at the expense of native species. The species included in this section are either encroaching on native species, and/or are listed on states' noxious weeds lists.

2.3.1 Terrestrial Invasives

Stakeholders have expressed concern about several noxious weed species, including knapweeds, Dalmatian toadflax, yellow starthistle, Canada and Scotch thistle, several species of hoary cress, cheat grass, and medusahead, as well as other invasive species that rob natural systems of native diversity and decrease agricultural yield. Please see **Appendix 3-1** for a list of noxious weeds.

© Todd Sloat

Scotch thistle infestation

Stakeholders have specifically identified infestations in need of management along the Fall River near Fall River Mills, wet meadows adjacent to the Pit River and tributaries in the upper half of the planning area, and along roadways. Extensive infestations have been mapped by cooperative public/private efforts, and the RCDs, BLM, and the Modoc County Ag Advisors office conduct outreach and education about all invasive species.

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1 http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_transfers/docs/watertransferguide.pdf

Invasive animal species include muskrats that dig into streambanks and increase erosion and attendant sedimentation, as mentioned previously.

2.3.2 Aquatic Invasives

While the aquatic invasive purple loosestrife has been identified in the watershed, the priority species identified is Eurasian watermilfoil, a weed that has caused disruption to the natural function of Fall River, as well as posing a management problem for PG&E and maintenance of county infrastructure. The problems associated with these invasive plants range from the inconvenience of having weeds clog waterways to competition with beneficial native plants and habitat degradation. As mentioned previously, several native fish species in the watershed are being threatened by non-native species. For example, largemouth bass and brown trout are aggressive predators that feed extensively on native fishes and crayfish, and can significantly suppress or extirpate native populations.

Stakeholders anticipate it is only a matter of time before the arrival of invasive quagga and zebra mussels. While invasive mussels have not yet made it farther north than San Benito County in California (approximately 400 miles away), and Carson City, Nevada (approximately 200 miles away), the issue is of high enough risk for stakeholders to consider preventative action.

Other potential aquatic invasive species not yet identified could pose a significant threat to water quality and aquatic and terrestrial organisms.

2.3.3 Genetically Modified Organisms (GMOs)

Concerns have been expressed about the use of GMO crops in the watershed, both now and in the future, and their potential effect both on interbreeding with non-GMO crops and on potential pesticide resistance.

2.4 Issue Statement: Economy

2.4.1 Disadvantaged Communities

The Upper Pit region has a high percentage of disadvantaged communities; a major portion of the region is considered disadvantaged, with a large percentage of that considered severely disadvantaged. This situation leads to a lessened ability of local governments to provide for desired services and infrastructure.[iii]

The XL Reservation will be considered a Public Water System in 2013. The XL Reservation's small water system will need a full-time water systems operator to maintain and ensure the integrity of the water supply for the community, but lacks the funds to hire this position.

2.4.2 Local Economic Drivers

The watershed's traditional natural resource-based and resource extraction-based economy has included: timber harvest and milling; hunting and fishing; hydroelectric, geothermal, and wind power generation; and agriculture. The lack of economic diversification, and vulnerability of these industries to the combined forces of natural phenomena as well as market forces, has been a contributing factor to the low-income status of many local communities.

From the Tribal perspective, a sustainable extraction-based economy that supports Tribal jobs is a focus for the region. A paradigm shift is supported that focuses on best management practices and environmental outcomes monitoring that would contribute greatly to the stability of the watershed. They express the need to enhance and support industries that add value and encourage cultural awareness, environmental health, and integrity of the region through: local resources preservation, eco-tourism, year-round organic greenhouse foods production, watershed restoration, improved agriculture practices, recreation, and small biomass development.

2.4.3 Hydropower Generation

PG&E has conducted an extensive study on changes in timing and type of precipitation to better predict the effect that these climate variations would have on hydroelectric generation from the Pit River watershed's runoff into the future. Continued change from snowfall to rainfall is anticipated to begin having a cumulative effect on such production by 2025, and possibly prior to 2020. While the Pit River's flows are largely influenced by steady aquifer outflows (primarily from Fall River) rather than low-elevation snow loss, previous multi-decadal droughts that decreased this abundant subsurface flow are cause for concern to PG&E. Reduced snowmelt from other sub-basins that cumulatively feed its northern and central California generation system cause PG&E to anticipate that, *"…if climate change impacts on the diminishing snowpack continue, associated impacts of climate change to hydroelectric operations are likely to eventually occur and must be planned for in terms of developing additional adaptation alternatives."*[iv]

From the perspective of many stakeholders, hydropower generation has significantly altered river systems, caused the demise of salmon species endemic to the region, and threatens the stability of the watershed given increased water temperatures from water storage.

2.5 Issue Statement: Communities

2.5.1 Community Infrastructure

Several communities, the Pit River Tribe, and service or irrigation districts identified concerns about old, outdated, and/or poor-quality water infrastructure. This includes pipes, tanks, wells, diversion structures, wastewater service lines, wastewater treatment facilities, and underground mainlines. Poor or failing water infrastructure results in substantial water loss, increased annual maintenance costs, and inadequate fire-fighting capabilities.

By way of example, Fall River Valley Community Services District has documented a 31 to 48 percent loss of water between the well and the consumer within its antiquated water system, making it vulnerable to reduction of water supply due to drought, overuse, and climate variability. Some of its supply lines are so brittle and some valves so old they require replacement rather than repair. Potential contamination of supply is also of concern due to compromised lines.

Burney Water District staff has identified the need for water-use efficiency measures to assure adequate water supply into the future, especially in times of drought and anticipating future demand. While some of the water supply system has been replaced by newer PVC pipes, much of the system has older, rusting, and crumbling iron pipes. Further, several large water meters serving the system are in need of calibration, which the District lacks the equipment to conduct. Infrastructure of inadequate capacity is also a concern. Monitoring has detected past wastewater treatment plant spills in the Alturas area, although more recent monitoring no longer demonstrates

that is a problem. The city wastewater treatment plant discharge into the Pit River is in interim compliance with state water-quality regulations, but needs to find an out-of-river, long-term solution, potentially in conjunction with the nearby wildlife refuge. County general plans identify Burney and Alturas as communities where future development should be focused. These communities will likely require a greater investment in infrastructure expansion to make them suitable for increased development.

In the Upper Pit planning area, drinking water access is an important issue for Tribal communities. A significant portion of the Pit River Tribal community is without access to safe drinking water. Many Pit River communities have undeveloped drinking water sources and community members rely on untreated surface waters; a lack of wells and water systems exists to supply water to households on Tribal lands and allotments.

Septic issues are an often-referenced challenge in the region, with failing systems requiring replacement and/or sewer installation, and user issues expressed about septic installation regulations. Discussions with county staff reveal that septic tanks fail relatively frequently in the region for a couple of reasons: legacy subdivision approvals in areas not lending themselves to septic systems and not having sewer systems available (either shallow hardpan barriers or soil with insufficient assimilative capacity); and the cost to keep septic systems working and/or repair them when they fail is beyond the capacity of some members of this largely disadvantaged region.

There are a variety of ways people deal with this. Planners encourage parcel joins rather than splits (they'd much rather have a septic/water-well parcel on three acres than one), but this is a limited strategy based on the desire and capability to acquire more land, which has up-front acquisition costs and long-term tax burdens.

A recent reconstruction on Main Street in Alturas by Caltrans resulted in urban runoff being directly diverted into the Pit River. Numerous attempts by Modoc County to have Caltrans correct the issue have been unsuccessful.

2.5.2 Flood Management

Federal Emergency Management Administration maps (FEMA 2005)[v] for the watershed designate areas around Alturas, Canby, Adin, Lookout, Bieber, Nubieber, Fall River Mills, and Burney as within the Zone A – Subject to Inundation from Flooding. Historic flooding has occurred in these areas, although a bridge reconstruction project has prevented recent flooding in Burney, to the extent that local residents are actively trying to remove the flood designation there. Flooding has not been identified as an issue by stakeholders in the region, with three exceptions: 1) in the Parker Creek drainage (Modoc County), 2) in the Bieber area as historic high flows threaten bridges and homes, and 3) in Alturas in the event there is levee failure, since many emergency services are in the floodplain.

Most of the rural flooding within the watershed has been exacerbated by stream channel modifications that increase the capacity to transport water and sediment. The enlarged channel capacity allows storm water to remain within the channel rather than spilling onto the floodplain.

As individual streams join from enlarged channel reaches and flow continues downstream, more flow is generated, creating greater energy, subsequently increasing the flood risk to areas lower in the flood control system or watershed. Rising streams can then threaten bridge and culvert stability, homes and other structures, as well as irrigation infrastructure (i.e., pumps, buried pipe). The stream can also erode valuable cropland. The underlying problem is that the streams/ rivers have become disconnected from their floodplains because of the enlarged channel capacities. Restoration of depositional stream reaches, often referred to as meadows, is known to attenuate flood flows, thereby reducing flood risk. Weather records over the last century document a greater variability in storm events with a shift in precipitation from snow to rain. When combined with earlier snowmelt and compromised geomorphology, the resulting runoff events may exacerbate flooding in the region.

© Todd Sloat

Pit River flooding, 2005

2.5.3 Illegal Dumping

Illegal dumping, both on the vast public lands, private forestlands, and in agricultural areas, is a chronic issue in the region. Effects of this issue on water resources include pollution from toxic waste (e.g., batteries, paint) and corroding materials, as well as habitat alteration for aquatic and wildlife species.

2.5.4 Local Culture

While it is difficult for some non-Native residents to understand, an historic foundation of violence against Native people, coupled with what is perceived as taking and/or diminishing of traditional land, cultural resources, and water has caused an atmosphere of concern and mistrust among Tribal residents. A strong Native American presence persists within the region today and much of the region remains in historic condition.

The Pit River Tribal Territory spans five counties (four in California and one in Oregon) and the Upper Pit River IRWM planning area lies within the ancestral territory boundary of the Pit River Tribe. There will be need for project work to be in compliance with National Historic Preservation Act Laws, American Indian Religious Freedom Act, Senate Bill 18 executive orders related to sacred sites, and Native American Consultation in addition to other federal laws.

Pit River Tribal members see this IRWMP process as an opportunity to demonstrate where there are acute water-related problems that need to be addressed on and off Reservation lands, and to demonstrate a common concern for resource issues within the watershed.

Watershed-wide, there also exists a culture of rugged independence, amply demonstrated during the IRWM planning process. There is a mistrust of public agencies, compounded by what is seen as inconsistency between regulatory processes (see **Agency Policy and Regulation**, below), especially because a generous percentage of the region is administered by federal agencies such as USFS, BLM, USFWS, BIA, and NPS.

Non-Native and the Native American populations alike feel strong recognition and a sense of pride in the natural beauty and abundance the region offers.
During this planning process, the Project Team found it difficult to recruit conservation interests to participate in committees and during public outreach. When team members probed further, they found that members of the conservation community had been "shouted down" during previous processes and felt wary of participating.

2.5.5 Recreation

The Upper Pit watershed is a beautiful and highly valued mecca of streams, mountains, and meadows, attracting visitors from far outside the region. Recreational use is on the increase and causes significant impact to culturally sensitive areas and many botanical species along streams in both developed and undeveloped recreational areas on public lands. Inappropriate use of motorized and off-highway vehicle (OHV) use on public lands, specifically around Fall River Lake, is causing habitat degradation (rogue trails) in the region. Also, increased use by recreational kayakers and illegal access points to waterways has caused trampled streambanks and degradation from human waste and garbage in some areas. Because of the noise and other by-products of OHV use, and the expectations of hikers of a quiet, natural habitat in which to walk, it is difficult to resolve these two forest uses. Specifically, OHV recreation is an issue for the Hat Creek Ranger District, as they are going through a process to identify and manage an OHV area near Old Station. Also of concern are water-quality impacts to recreation caused by cattle access to and overgrazing in riparian corridors.

Fishing guide Art Teter on Fall River

© Lisa Bay

Anglers and angling outfitters have expressed concerns about impacts to fisheries from Eurasian watermilfoil and sedimentation from muskrats and upstream management on Fall River. Access for angling is also perceived as limited in the region.

Some stakeholders express concern that sensitive wildlife and game species that provide valued recreation opportunities within the watershed have been adversely affected by human activities, including poor seasonal water quality, channel alterations and dewatering, and upland vegetation management/fire suppression. These challenges affect recreational interests.

2.6 Issue Statement: Habitat and the Environment

Region-wide concern has been expressed for the conservation of the natural attributes of the watershed. Several regional documents portray publicly developed objectives for improving natural resources and habitat, and a cadre of volunteers has pursued a balanced future for habitat and the environment via restoration, improved agricultural practices, and watershed stewardship and education.

Education on native species and Tribal Environmental Knowledge provides environmental and cultural awareness. Indigenous interpretation provides education on traditional food sources, gathering methods, and the use of fire to maintain a thriving landscape. Beautification and cultural awareness are vital to re-establishing: native species, environmental education, interpretive site tourism, marketing, and the economic vitality of the region. The Tribe expresses the importance of incorporating ethnographic information related to historical conditions of the landscape into restoration project design.

2.6.1 Stream Channel Down-cutting and Wet Meadows

As mentioned in earlier sedimentation discussions and in several earlier resource documents, channel erosion is a major issue in the watershed. As channels down-cut and widen, they become entrenched and eventually become disconnected from their floodplain and capture more water in the channel instead of allowing water to spread over a wider area and recharge shallow groundwater.

Among the most-often cited needs for habitat improvement has been restoration of wet meadow and riparian systems. According to local biologists, few local stakeholders understand that the low-gradient valleys in the watershed function as huge wet-meadow systems that can aid in shallow groundwater storage and, thus, when in fully functioning condition, offer a more consistent water supply downstream. While watershed stakeholders have undertaken numerous restoration and wet meadow and channel improvement/enhancement projects, many more await implementation. Tribal interests are concerned that projects affecting wet meadows, fens, and vernal pools, in particular, have the potential to affect cultural and environmental resources.

Reasons for stream channel alteration have been previously discussed; they have led to moderate-to-severe entrenchment of streams and rivers throughout the watershed. Poor bedform morphology often has the secondary effect of decreasing the amount of habitat suitable for spawning (i.e., gravels become covered with silt/sand).

2.6.2 Habitat Needs

Adequate natural flows are needed throughout stream systems and below dams and diversions to sustain aquatic ecosystems, allow for fish passage, transport sediment and complete natural geofluvial processes, and develop and maintain riparian habitat and other wetlands. Seasonal low flows, habitat conversion, extreme water events, poor water quality, invasive species competition

for habitat and food and interbreeding, and disrupted connectivity of habitat have negatively affected iconic species in the watershed such as Shasta crayfish, greater sage-grouse, wetland-dependent birds, vernal pool-associated species, rough sculpin, and area fisheries.

Courtesy Pit River Tribe

Water quality monitoring on Tribal lands

Of major concern to Tribal members is the decline of the Modoc sucker; the U.S. Fish and Wildlife Service states the following reason for its ESA listing and decline: 1) habitat loss, 2) possible hybridization with the Sacramento sucker, 3) limited distribution in two sub-drainages of the Upper Pit drainage, and 4) exotic fish predation. A lack of fisheries and flow data has made it more difficult to craft solutions to address aquatic concerns. Native American stakeholders expressed their desire to restore salmon, redband trout, Modoc sucker, and other native species to the watershed.

2.6.3 Wetlands, Fens, and Vernal Pools

Widespread drainage of land has substantively reduced wetland, fen, vernal pool, and vernal swale habitats available for waterfowl, wading birds, aquatic invertebrates, and other wetland-dependent species. Restoring river- and wetland-associated acreage while maintaining agricultural opportunities can be challenging, so projects need to be chosen carefully to address both needs.

2.6.4 Sage-Steppe Restoration

A sage-steppe restoration strategy has been developed[2] that would improve habitat and watershed function over a 6.5-million-acre area, including much of the watershed. The impetus behind this plan is to improve habitat for greater sage-grouse and other sage-steppe species, and hydrologic function. Speculation exists that removal of invasive juniper may improve water supply, but hard data on this topic is not yet available. (See **Fire and Fuels**, below.)

An additional restoration focus is the removal and/or reduction of invasive and/or encroaching species. For example, invasive annual grass species such as cheat grass have replaced native bunchgrasses that had inhibited surface runoff and soil erosion in the sage-steppe ecosystem. Moreover, cheat grass offers much less seasonal forage value than bunchgrasses for domestic livestock and native wildlife species.

[2] Modoc National Forest-Alturas Field Office, Bureau of Land Management, Modoc County. *Sage Steppe Ecosystem Restoration Strategy Final EIS.* April 2008. RS-MB-161. Available from: http://www. blm.gov/ca

2.6.5 Weather Modification

Some stakeholders have significant concerns about PG&E's current cloud-seeding projects (see **Chapter 3 Region Description**) as well as proposals mentioned in the *State Water Plan Update 2009* to potentially conduct cloud-seeding in the watershed as it has pursued in other watersheds in California. While PG&E withdrew its most recent cloud-seeding proposal in the Upper Pit watershed, some stakeholders express wariness or outright opposition to this weather modification because of concerns about the lack of scientific data regarding impacts from the process of injecting substances into clouds (primarily silver iodide, but also liquid propane and dry ice) that causes raindrops to form, and the unknown effects of how cloud-seeding affects weather and precipitation over neighboring regions.

Local interests are concerned about Geo-engineering or Stratospheric Aerosol Geo-engineering (SAG), a form of weather modification. While there is no evidence that SAG is being practiced in the watershed, it is of great concern to some stakeholders. SAG is a "global dimming" product to try to limit the effect and impact of climate change due to greenhouse gases.[3] Scientific data exists on the use of barium, aluminum, and strontium particulates and their effect on human health, water quality, wildlife, and plant species.

Also of concern is the disclosure of weather modification activities to the public. Permitting and public notification for these activities is unclear, raising concern about whether weather modification activities are currently taking place without adequate evaluation of impacts and public disclosure.

2.7 Issue Statement: Forest and Range Health

2.7.1 Fire and Fuels

Much of the uplands in the watershed are within what was a healthy, functioning sage-steppe ecosystem, maintained by a frequent natural fire regime. During the early 20th century, intensive livestock grazing removed fine fuels that would have carried natural fires, and then in the past 50 years, fire has been aggressively suppressed, which has allowed century-old juniper to become dominant in a system that was a diverse mosaic of sagebrush, grasslands, aspens, old growth juniper, and scattered juniper woodlands. The result is habitat condition that is now at greater risk of large-landscape wildfire, especially if localized climate trends continue to dry and warm.

Some stakeholders expressed that mixed fire regimes are an integral component of healthy native plant recruitment and wildlife and that seasonal burning to achieve fire mosaics should be used as much as possible.

Public land managers cite the need for increased fuels reduction, fuel breaks, and the restoration of natural fire regimes. The emphasis is on developing landscape-scale treatments, and working with the forest products industry to implement treatments. But considerable divergence of opinion exists on fire management prescriptions between Tribal members and governmental agencies.

[3] http://en.wikipedia.org/wiki/Stratospheric_sulfate_aerosols_(geoengineering)

The wildland-urban interface is encroaching further into wildland areas. This increases the risk of potential losses within suburban and urban areas, including property, cost of replacement, and human life. Fire Safe Councils exist in most of the region; however, fee-for-service programs used in other areas are not widespread here because many residents cannot afford or choose not to participate in them.

2.7.2 Unhealthy Conifer Conditions

As discussed above, reduction in wildfire in the 20th century allowed young juniper trees to become established across the sage-steppe ecosystem and young white fir trees to become established as understory in the pine and mixed conifer forests. A wetter weather pattern in the first part of the 20th century contributed to more rapid growth of the young trees. Then, when industrial large-scale logging by private and federal agencies accelerated from about 1960-1990, often the mature and old-growth, high-value pine trees were removed, leaving behind the denser, less valuable trees, particularly white fir. Also, the second half of the 20th century experienced repeated periods of drought. These drier conditions caused extreme moisture competition in the pine and mixed conifer forests, with the resulting tree mortality that is now evident throughout the landscape. Due to the current juniper density in the sage-steppe ecosystem, and the density and tree mortality in the pine and mixed conifer forests, these ecosystems are now very susceptible to large-landscape wildfires, which can result in major impacts to the watershed from soil erosion and accelerated surface runoff.

May Hack prescriptive burn

From the Tribal perspective, fire management techniques could be incorporated to restore soils and deficit snag habitat. Old-growth and legacy trees could be protected instead of utilized for their commercial value. Much of the native landscape (herbaceous understory species) has been negatively affected by modern land management techniques. Differing perspectives exist on fire and fuels management and on the presence of the bark beetle in forests, both their causes and how or if to treat them.

2.7.3 Rangelands

Rangeland vegetation has suffered in some portions of the watershed from historic poor management practices, including overgrazing, disrupted fire regime from aggressive fire suppression, and invasive weeds. Historically there were many more cattle and sheep on the rangelands than today. Public rangelands, in particular, have been recognized as a benefit to the region, both ecologically and economically. Stakeholders identify the use of rangeland to be desirable, but hope to continue to see improving trends in good land management.

2.8 Issue Statement: Education

Extensive improvements have been made in the watershed, yet remain unheralded or unknown to any great degree. Many of the successful stewardship and restoration projects completed in the region and the other watershed data, such as groundwater and water-quality studies, remain unavailable or unknown. These data are vital to improving management practices, enhancing collaborative decision-making processes, securing funding, and improving stewardship. Stewardship and outreach entities in the region have difficulty securing sustainable funding. Funding opportunities could lie within collaborative efforts made among these entities. The Pit River Environmental and Tribal Historic Preservation Offices offer the region much in the way of education related to regional environment and culture. The departments work collaboratively with non-profits and conservation groups, in addition to state and federal agencies. Many educational resources are available within Tribal departments.

2.8.1 Role and Needs of Watershed Stewardship Education Organizations

The non-profit Central Modoc River Center in Alturas, Spring Rivers Foundation, Pit River Watershed Alliance, Fall River Conservancy, Fall River RCD, Pit RCD, Central Modoc, Pit North Cal-Neva Resource Conservation and Development, and NECWA were formed in recognition that good stewardship leads to a healthy watershed, often helping avoid the need for further regulation, and in response to stakeholders' desire for more watershed education at all levels. These organizations and the Pit River Tribe offer stewardship learning opportunities for K-12 education, perform public outreach about the watershed, conduct stewardship projects, and house exhibits and displays that foster an understanding of the watershed's natural systems. Sustainable funding is needed by these organizations.

2.8.2 Need for a Watershed Improvement Project Directory

Lead agencies and funding sources are often diverse, with varying reporting processes. Often, the benefits, outcomes, and learning associated with watershed improvement and enhancement projects remain unknown because there is no central repository or database for such projects. Without data sharing, educational and adaptive management opportunities can often be lost. Part of the planning grant awarded to the Upper Pit IRWM region includes the development of a data repository in the Sacramento River Watershed Information Module database. This repository will serve the function of both storing regional data and allowing users to geo-locate that data throughout the region. While it may not fully address this regional need, it is a starting place. Geographic Information Systems and mapping should be added to this repository.

3.0 CONFLICTS

3.1 Differing Perspectives on Watershed Management and Restoration

Differing perspectives exist between various interests concerning appropriate management strategies and practices of some watershed resource managers and agricultural interests. From the perspective of various stakeholders, the types of restoration techniques that benefit the ecosystem, wildlife, and enhance the watershed are in question. What is being restored? To what point in time? Forest management practices that focus on economics and value associated with timber yields and other resource use should instead put priority on the intrinsic values of watershed health. From the

Tribal perspective, this Plan has been largely written to display resource management from the viewpoint of current federal, state, and local resource management agency plans and programs.

3.2 Consultation with the Tribe

While many federal and local stakeholders believe they have conducted formal Consultation with the Tribe prior to project work, the Tribe feels adequate Consultation has not taken place. As mentioned in the introduction to this chapter, this issue likely will not be resolved during this planning process, but eventually will be decided during the process conducted via the update to the state water plan, currently taking place.
The Tribal Advisory Committee was established to involve the Tribes with the current water plan update. The Upper Pit River IRWMP process has moved forward simultaneously. While the Pit River Tribe has requested it, the state has not addressed sovereignty issues associated with governance and decision-making in the IRWMP process, nor provided a guidance platform for government-to-government Consultation with Tribes participating in the IRWMP processes. This has made it difficult to smoothly move forward with the planning effort while still assuring that Tribal interests are properly incorporated into the Plan.

3.3 Agency Policy and Regulation

During the course of gathering stakeholder concerns for this IRWMP process, agency policies and regulations related to water management have been identified. Generally, they are related to conflicts over three topics: the 303(d) listing of the Pit River and tributaries, the Irrigated Lands Regulatory Program (ILRP), and a deep distrust and dislike of regulations, in their varying interpretations, and lack of communication between regulators. Stakeholders also suggest that sometimes public agencies do not follow their own stewardship policies, and hope to help with that by encouraging partnerships through this planning process.

3.3.1 The 303(d) Listings

In part, the impetus for this planning effort was spurred by the local desire to address water-quality concerns that promulgated the listing of the Pit River and many of its tributaries as an impaired waterway under Section 303(d) of the federal Clean Water Act, and its attendant, requisite TMDL program. The Pit River, from Alturas to Lake Shasta, is listed as impaired for nutrient enrichment, dissolved oxygen, and temperature. The RWQCB administers these requirements and programs.

At issue is whether the Basin Plan should be amended to reflect real and historic conditions in the Pit River and tributary reaches. Many stakeholders believe that natural conditions rather than human activities are contributing to the listing and need to be accounted for. Stakeholders cite frustration with the numerous regulations and qualitative water-quality objectives, as well as the considerable expense associated with monitoring and water-quality improvement.

The RWQCB has designated beneficial uses for the Pit River and tributaries. These uses include Cold Freshwater Habitat as an existing beneficial use on the North and South Forks of the Pit River and along the mainstem between Alturas and Hat Creek. One of the more controversial water-quality issues in the planning area is whether the Upper Pit should be classified under warm- or cold-water beneficial uses, partially because several naturally occurring geothermal sources contribute water of elevated temperature to the river.

3.3.2 Irrigated Lands Regulatory Program

Anyone within the watershed with commercial irrigated lands must comply with the ILRP, administered by the RWQCB. Most agricultural operators have chosen to join NECWA because it provides a means for them to comply with a conditional waiver of waste discharge as long as NECWA conducts monitoring at selected sites along the Pit River and implements other required actions. Recently, fees associated with the ILRP have been raised by 248 percent, considered a substantial economic impact, especially since little perceived progress has been made in addressing the underlying concerns of the program. The conflict is twofold: 1) fees are seen as excessive, and 2) the program as designed appears ineffective in solving water-quality issues. Stakeholders have expressed that the RWQCB needs to get away from a "one-size-fits-all" program design and, instead, tailor a program to the attributes and problems of upper watersheds, as opposed to Sacramento valley floor watersheds.

3.4 Local Opposition to the Plan

A vocal faction has come to meetings in the watershed, both IRWMP and County Board of Supervisors meetings, to express opposition to this planning process. This faction and others believe that the planning effort represents an organized effort on the part of the state or other outside forces to take away local water rights and self-determination and/or impose further regulations in the watershed.

A summary of the opinions expressed in opposition to the Plan taken from sub-regional meetings held in October and November 2012 follow:

- The IRWMP process is in direct support of United Nations Agenda 21 and is part of an international conspiracy.
- The IRWMP will negatively affect both local property rights and water rights.
- The projects may be needed, but by using state funding, the local area will be obligated to greater regulation and control.
- Project decisions should be subject to a local vote.
- There is no accountability to elected officials for decisions about the Plan; elected officials should have jurisdiction over Plan development and implementation.
- The IRWMP process is not trustworthy and did not have enough public involvement.
- This process is extortion – you have to sell your soul to get a project funded.

4.0 CONFLICT RESOLUTION

This sub-section focuses on identifying conflict resolution strategies that can help aid in resolving differences among stakeholders. The identified strategies might be used between RWMG members when trying to reach a decision, between groups with differing perspectives about how to approach a solution to an issue, or among project sponsors to improve the joint project design and integration process across the planning area.

While the various stakeholders in the region have a strong history of being able to resolve disputes, there is a pragmatic understanding that this may not always be the case. This is particularly true as staff is replaced or retires, as new people are elected to boards or commissions, as new stakeholders are recruited into the decision-making body of the IRWMP, and/or as new issues or regulations emerge.

The choice of consensus as a decision-making structure in the RWMG was based on over a decade of shared experience within the Pit River Watershed Alliance (PRWA) and its member groups. The provision of a 75 percent super majority process if consensus cannot be reached was based on the emergence of strong opinions and positions articulated by various RWMG members in the course of preparing the Plan.

Currently several entities help bridge the gap between stakeholders, interest groups, and government agencies in the region: PRWA, the Pit River Tribe, Resource Conservation Districts (state special districts), the Natural Resources Conservation Service (a federal agency), and NECWA. These organizations work directly with private landowners to complete best management practices on their property and better comply with regulations on a low-cost, collaborative basis. Stakeholders expect that the IRWMP process will complement the activities of these agencies and organizations, helping stakeholders to collaboratively plan for resource management from the ground up, thereby building trust between each other and with public agencies.

Generally, conflicts that have emerged during preparation of the IRWMP are of six distinct types:

- Disagreements over facts;
- Differences of opinion about particular resource management strategies or methodologies;
- Different perspectives on regional and project priorities;
- Opposition to individual projects (either in design or perceived outcomes);
- Differing opinions that result from ideological or deeply held values; and
- Opposition to the Plan.

Each of these conflict types stems from widely divergent factors. Therefore, devising an individual process to address any given source of conflict is simply not possible. Instead, the RWMG has elected to identify a variety of options, starting points, or strategies that are available to any conflict, depending on the desires and willingness of the participants.

In the past, PRWA has served as both an 'early warning' venue to identify emerging issues and as a venue to debate and resolve differences of opinion. A basic assumption of this Plan is that the RWMG will become a similar type of venue.

It is the experience of many RWMG members and stakeholders that getting conflicting entities out on the ground together to review projects and understand where there may be commonality of perspective can go a long way to resolving conflict. While discussion can help, the key venue for resolution of these issues may be offered through the cooperative step-by-step process of project design, implementation, and monitoring. The Project Review Committee has drafted conflict resolution criteria to help assist in resolution of conflicting viewpoints.

4.1 Techniques for Resolution of Differing Perspectives

Tactics and strategies identified by the RWMG members, including the Pit River Tribal Council through their representatives, to address differing perspectives on issues include:

- Gather conflicted parties at the RWMG venue, to let the group assist in identifying points of agreement – then use those ideas as a starting point for resolving differences.
- Schedule RWMG-sponsored field visits for individuals who have divergent opinions so that the source of their debate is at hand and problem-solving can be done at a location that best represents the divergent management options perceived by the participants.

- Cooperatively develop a set of best management practices for specific resource management issues throughout the watershed.
- Develop specific multi-party monitoring protocols that implement best practices for water and natural resource management.
- Develop mutually agreed upon pre- and post-tests for water-quality monitoring, as well as evaluation methods for long-term outcomes.
- Present a "How-To Workshop" regarding intergovernmental affairs coordination with Tribes.
- Convene a workshop in-region to address issues of Tribal Consultation and how to improve the process.
- Use conflict resolution documents referenced as part of the Implementation Guide (see **Chapter 15 IRWMP Management, Governance, and Implementation**) to support development of specific strategies or methods to address individual conflicts.
- Work with potential funders to provide conflict resolution training to RWMG members and stakeholders in the region to deepen the capability of stakeholders to facilitate process design and provide in-region mediation for individual disputes.

[i] Numerous studies and data sets informed this section including:

Brown and Caldwell. Big Valley Management Area Basin Management Objective Development Guidance Document. Prepared for Lassen County, CA. Rancho Cordova, CA. August 2011. Available from: http://www.lassenbmos.org/index_htm_files/Big%20Valley%20BMO%20Guidance%20Document.pdf.

California Department of Water Resources. 2012. Sacramento Watershed Coordinated Monitoring Program (SWCMP). March 2012.

Department of Water Resources, Northern District. 1982. Pit River Water Quality Study. December 1982.

NECWA. 2003 to present. Pit River monitoring of Upper Pit River sites. Unpublished data.

Pit River Watershed Alliance. 2010. *Upper Pit River Watershed Management Strategy*.
Regional Water Quality Control Board, Redding Office. *Pit River Watershed Alliance Water Quality Monitoring Program 2003-2005*. March 2007. Prepared by Todd Sloat Biological Consulting, Inc.

Regional Water Quality Control Board. 2003-2005. Fall River Water Quality Study. For: Fall River Resource Conservation and Development and Pit River Alliance. By Todd Sloat Biological Consulting, Inc. 2007.

State Water Resources Control Board. 2001-2002. Pit River Water Quality Study. For: Nor Cal-Neva Resource Conservation and Development.

VESTRA Resources, Inc. *Burney Creek Watershed Assessment and Watershed Management Plan*. 2010.

VESTRA Resources, Inc. *Fall River Watershed Assessment and Watershed Management Plan*. 2010.

VESTRA Resources, Inc. *Hat Creek Watershed Assessment and Watershed Management Plan*. 2010.

VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.

[ii] The Modoc sucker is currently under a 90-Day review by USFWS to down list from endangered to threatened. The historical range of the Modoc sucker is thought to have been limited to the Ash Creek and Turner Creek watersheds and Thomas Creek (Oregon tributary to Goose Lake) (Paul Divine, CDFG, January 2012).

"*The natural distribution of the Modoc sucker is highly restricted relative to the widespread Sacramento sucker, which is also native to the upper Pit Drainage. However, there is no evidence showing that the historical range of the Modoc sucker, or its distribution within that range, has been substantially reduced in the recent past* (Reid 2008c)." (USFWS 2009, Modoc Sucker 5 Year Review).

[iii] A "disadvantaged community" (DAC) is defined by the State of California as a community with an annual median household income (MHI) less than 80 percent of the statewide MHI. Census data from 2000 and 2010 were collected and reviewed to identify disadvantaged communities in the region. The 2009 State MHI was $58,925; therefore, communities with an average MHI of $47,140 are considered DACs.

[iv] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G._Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevation.pdf

[v] FEMA 2005. Zone A – Areas subject to inundation maps. Available from: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1

CHAPTER 5. WATER AND LAND USE PLANNING

1.0 INTRODUCTION

The purpose of this section is to demonstrate that local land use and water planning have been used to inform the preparation of this Integrated Regional Water Management Plan (IRWMP), and that opportunities for improving coordination among local water and land use planning have been explored and identified.

2.0 WATER SUPPLY AND DEMAND OVER THE 20-YEAR PLANNING HORIZON

With few exceptions, the low population density and rural nature of the Upper Pit IRWM region puts relatively little pressure on land use and domestic water resources. As mentioned in **Chapter 3 Region Description**, population for the entire watershed is estimated to be about 14,000, and population density per acre is very low. Population projections over the 20-year planning horizon indicate either little change or decreasing trends, with the exception of the Fall River Mills, McArthur, and greater Burney areas. Shasta County has identified Burney and Fall River Mills as appropriate for low-income housing development to meet California Department of Housing and Urban Development county-wide requirements. This type of concentrated development has met with local opposition, but if it were to occur, significant challenges could arise for the communities' small water and wastewater providers in water supply, delivery, wastewater management, and/or groundwater infiltration and management.

Population outside these areas appears to be stable or declining, as indicated by Census data and decreasing high school enrollment. Changes in land and water use on a regional level are generally thought to be minimal unless an economic driver, such as a new major industry, locates in the region, or urban refugees accelerate their relocation to the area.

As mentioned in **Chapter 3**, the preliminary water balance indicates that 33 percent of the total watershed's available surface water and 13 percent of the available groundwater is used annually. In both cases, irrigation is the primary water use, with the forest products industry and domestic use following. Based on irrigation well drilling, reliance on groundwater usage is increasing significantly; groundwater usage in the Upper Pit River watershed appears to have increased approximately tenfold in the last 40 years (see **Chapter 3 Region Description, Section 1.1.1 Hydrology**).

For now, water supply is adequate for current and immediate future needs. Due to the low development and population pressures discussed above, it is unlikely that the region will be dealing with un- or under-served demand in the next decade; beyond that, it is difficult to predict. One of the outcomes of the interviews process in subsequent sections is a need to fill this gap in knowledge about water supply availability per projected customers. This would include consideration of conservation measures (supply- and demand-side), future availability, and future development patterns**. Appendix 5-1** contains a water supply assessment template developed for local water managers/planners.

Climate change projections indicate a potential for decrease in the amount, and increase in the seasonal variability of future water supply (see **Chapter 8 Climate Vulnerability**). Streamflows are anticipated to be stable for the foreseeable future within the lower reaches of the Upper Pit River due to contributions from spring-fed rivers and streams, but extended drought could eventually affect those flows. The nature of the groundwater and surface water interaction in the region is not yet fully understood, so responding to supply challenges brought on by drying climate trends will be difficult for planners until that data gap is resolved. The residence time of the groundwater[i] in the southwestern portion of the region ranges between five and ten years (information shared by stakeholders in the region). Residence times in other portions of the region have not been measured. The IRWMP, and therefore its climate discussion and projections, will be made available to land use and water planners throughout the region (via the Website and as members of the Project Review Committee and/or RWMG) to incorporate into future planning considerations.

The economic tie between water availability and land use planning is evident in the region through agricultural and forest industry sectors. For example, forest products businesses have the capacity to use up to 100,000 gallons (about one-third of an acre-foot) of water per hour. These businesses represent a high percentage of overall water use within the region and land use (timber harvest, fuels reduction). Much of the southern part of the region has experienced surface water supply shortages in the past, especially for irrigation. In response, several streams have been adjudicated. Even with adjudication, water rights holders are not assured of receiving their full complement of water in frequent late-season, low-flow conditions. In the northern portion of the watershed, surface water adjudication has not taken place to the same degree, but reliance on groundwater there has increased significantly. In the case of extended drought, it is possible that these regional economic engines will be pressured to change their use patterns either through increased conservation measures, or through curtailing operations. Both of these outcomes would have an immediate effect on the community.

Meanwhile, potential exists at the local level to make a difference in coordination and cooperation efforts between water managers and land use planners, especially in their efforts to assure water for all beneficial uses. Water managers serving unincorporated communities in the Upper Pit planning area often find out about land use planning efforts with the rest of the public; they are not always included in the planning and decision-making process. Also, due to the small size of the water agencies throughout the region, there are no Urban Water Management Plans (UWMPs) looking at current and future supply needs or making demand projections (the UWMP threshold is 3,000 connections or 3,000 acre-feet distributed). The absence of this information can further complicate the water-land use relationship. This chapter offers suggestions for improving coordination when planning for supply and demand.

2.1 Environmental Water Demand

The supply of environmental water demand has changed somewhat in the last decade. Historically, the identification of environmental flows was based on the concept of a minimum flow level, which considered all river health issues to be related to low flows; as long as the flow was kept at or above a critical minimum level, the river ecosystem was thought to be maintained. However, it is increasingly recognized that all elements of a flow regime, including floods, medium and low flows are important. Thus, any changes in flow regime will influence the river ecosystem. PG&E's 2003 and 2007 Federal Energy Relicensing Commission (FERC) relicensing on the Upper Pit River raised the level of required flow for environmental purposes. While this was identified as a better situation for fish and other aquatic organisms, it is not an ideal situation for the anglers in the region. The challenge for scientists and managers is to help decision makers predict the consequences of varying degrees of alteration of the flow regime so that the implications to society are understood; in return, the goals for river management must be clarified so that scientists can determine appropriate flow recommendations. The move to restore flow regimes that mimic natural variability marks an evolution in river management.

Rush Creek

The instream flow requirements established during the FERC licensing renewal process are the only defined environmental flows in the region. Higher flows were identified as necessary for fish and aquatic biota in the reaches below powerhouses 3, 4, and 5 to control high summer water temperatures, sub-optimal flows for habitat, and the lack of periodic purging (freshet) flows. Anglers and outfitters express unhappiness with this regime because it increases flow in certain coveted wade-fishing reaches to the degree that they are now much more difficult to access. They express that this has also had a deleterious effect on local outfitting business. In any case, the license represents the current compromise between stakeholders.

The final relicensing agreement flows are as follows:

Pit 3:
- Summer – 300cfs (4/21-8/31)
- Fall – 280cfs (9/1-11/1)
- Winter [prior to spill] – 300cfs (12/1-4/20)
- Winter [after spill] – 350cfs (11/1-4/20)

Pit 4:
- Summer – 375cfs (5/16-8/31)
- Fall – 350cfs (9/1-11/1)
- Winter [prior to spill] – 375cfs (12/1-6/15)
- Winter [after spill] – 450cfs (11/1-6/15)

Pit 5:
- Summer – 400cfs (4/21-8/31)
- Fall – 350cfs (9/1-11/1)
- Winter [prior to spill] – 400cfs (12/1-4/20)
- Winter [after spill]) – 450cfs (11/1-4/20)

Freshet flows of 1,500 cfs will be provided every other year, if natural freshet flow does not occur in a project reach in the late winter and early spring. A freshet flow release is a 21-day flow release with a two-day average flow of 1,500 cfs, after which the flow decreases in approximately five equal steps.

Recreational flows will include one weekend in August (minimum flows of 1,500 cfs from 10:00 a.m. to 4:00 p.m.) and one weekend in September (minimum flows of 1,200 cfs from 10:00 a.m. to 4:00 p.m. in the Pit 5 reach). These flows will not begin until 2013 at the earliest. Over the next two years, baseline data for fish, insects, and others creatures will be collected at the new base flow. This data will allow for a review of the impacts of recreation flows on the fishery.

3.0 LOCAL WATER AND LAND USE PLANNING

Regionally, there are uneven efforts in water management and land use planning. Each of the planning efforts listed below is relevant to the IRWM process, and was considered in the development of the IRWMP and the implementation projects proposed within it. Successful coordination efforts will be identified and analyzed for the potential to use them as a template for other parts of the region. A prompt to consider any updates to local water and land use plans has been added to the Implementation Guide in **Chapter 15** to maintain the link between the IRWMP and local planning efforts.

3.1 Local Water Planning

Alongside the priorities of local water management and planning documents participation was solicited of local agencies' staff in the development of issues, goals, and objectives. Agencies in the region have completed planning documents to be better prepared for future change and development, some of which are listed below.

3.1.1 Groundwater

There are three basic methods available for managing groundwater resources in California: 1) management by local agencies under authority granted in the California Water Code or other applicable state statutes, 2) local government groundwater ordinances or joint powers agreements, and 3) court adjudications. Of the four counties involved in the IRWMP region, both Lassen County and Shasta County have addressed the state mandate to counties regarding groundwater monitoring. Lassen County has completed groundwater management plans (GWMPs) for all of the basins in the county; the only one affecting the Upper Pit planning area is Big Valley. In addition to the Alternative Monitoring Plan[ii] that Shasta County has put into place, Shasta County Water Agency has identified groundwater basins needing additional study for future monitoring efforts.

Lassen County: Lassen County's GWMP for Big Valley states, "*Lassen County developed a GWMP with the goal of maintaining or enhancing groundwater quantity and quality, thereby providing a sustainable, high-quality supply for agricultural, environmental, and urban use into the future that remains protective of the health, welfare, and safety of residents. The GWMP seeks to achieve this goal by identifying management objectives and supporting implementation items that help the County achieve the GWMP's goal.*"[iii] The GWMP identifies actions to be taken when the monitoring wells reach a specific point: Tier 1 actions include technical and water user meetings and press releases and are implemented by the groundwater committee; and Tier 2 actions include establishing a recharge program and implementing a well-spacing ordinance and are implemented by the Lassen County Board of Supervisors. The unincorporated community of Bieber is within the Big Valley Basin, but is 100 percent dependent upon surface water for its supply. It is likely that the successful method used by Lassen County in developing their GWMPs will be used by other counties as they initiate GWMPs.

Shasta County: In May 2007, Shasta County Water Agency adopted a coordinated Groundwater Management Plan for the Redding Basin. While this is outside the Upper Pit planning area, the county is currently designing a program for groundwater management of basins within the region and has proposed a project under this IRWMP to implement it. The project is found in **Chapter 9 Project Development and Implementation**. Shasta County Water Agency estimates recharge rates to the Redding Basin as part of its GWMP.

Seven groundwater basins underlie both the Upper Pit planning area and Shasta County. The Department of Water Resources (DWR) monitors the largest one outside of the Redding Basin. The Burney Basin is monitored in collaboration with the Burney Water District, through its well records.

The County has an ordinance that protects groundwater resources from transfer outside the county without an extensive public process and policy consideration by an appointed committee.

While a significant data gap exists for groundwater volumes, recharge, and quality in the region, many local residents are wary of government monitoring their wells, potentially leading to groundwater use regulation. This situation has contributed to the difficulty of long-term management of groundwater.

Alturas Ground Water Basin Water Quality Study: In 1986, the state published a study on the quality of the water in the Alturas Basin. The principal objective for the study was to update the knowledge of water quality in the basin, which contains approximately 7.5 million acre-feet in

storage – a major supply source for many agricultural users. The study found that the groundwater in the region is of generally good mineral quality, with some constituents concentrating toward the center of the basin, indicating a relation to the prehistoric lake deposits of the Alturas Formation. The study indicated some localized problems that could limit the water's beneficial uses for residential and/or agricultural use, though most of these poorer quality waters are from wells drawing from confined portions of the formation or from water migrating along faults.

Because it is likely that further water resource development in the Alturas area will be dependent upon groundwater, it is important that the water quality be tracked. The issue of inadequate groundwater quantity and quality information was identified in this IRWM process and is expected that monitoring will continue in this basin as well as others in the region.

3.1.2 Urban Water Management

Water purveyors serving the Upper Pit region are not qualified as "urban water suppliers" under California Water Code, Section 10617; no agency, public or private, in the Upper Pit IRWM region delivers over 3,000 acre-feet in a year or has more than 3,000 connections. Because of this, Urban Water Management Plans are not mandatory for these agencies, nor is compliance with particular state planning and conservation mandates (see below). However, domestic supply is offered by the following entities that have prepared plans

Fall River Valley Conservation Service District (CSD) Capital Improvement Plan: The Fall River Valley CSD provides not only water and sewer service to the towns of McArthur, Fall River Mills, and surrounding areas, but also community services including parks management, weed abatement, and animal control. The capital improvement plan (CIP) for the CSD includes updates and new projects addressing all of the services provided by the CSD. The projects particular to water and sewer include:

- Main Line Replacement and Knoch Well Refurbishing
- Water Tanks in McArthur *(a project submitted to the IRWMP)*
- Main Line Replacement in Fall River Mills *(a project submitted to the IRWMP)*
- Sewers to McArthur and Sierra Center *(a project submitted to the IRWMP)*
- Sewers Safety Equipment

Burney Master Plan: Burney Water District completed a master water plan in 1976 that described the service area and water system at the time, developed and evaluated alternatives addressing Burney's pressure issues, and assessed next steps. The recommended project included: 1) a variable-speed booster pump, 2) a 1,000 gpm fire flow pump, 3) a new 3,000 gpm well on the east side of town, and 4) distribution system improvements to increase the carrying capacity of the existing distribution system. The cost for these improvements was estimated at more than $1.2 million in 1976. These recommendations were made based on the assumption that the district would be serving approximately 4,400 people in 1990. The 1990 population of Burney was 3,400, with the water connections likely coming in around 1,500; it is likely that the need for the system expansion was overestimated, though pressure throughout the system remains a challenge.

3.1.3 Tribal Water Management

The Pit River Tribe manages water rights for both domestic and irrigation purposes on Tribal lands. Its Pit River Tribe Housing Department also raises funds for and facilitates and manages domestic water and wastewater treatment and supply projects.

3.1.4 Water Supply Assessments

Aside from the groundwater management planning completed by Lassen County and the Burney Master Plan noted above, there are no completed water supply assessments for any service area in the region. This has been noted by several water managers as an important tool to be added for planning purposes. **Appendix 5-1** contains a water supply assessment template developed for local water managers/planners.

3.1.5 Agricultural Water Management

The agricultural activities in the Upper Pit region are primarily supplied by individual water rights taken directly off of a stream (riparian rights), from water impoundments via a water conveyance, or using groundwater. In some cases, a system is monitored by a water master to assure respective allocations of water. There are no adjudicated groundwater basins in the region, and it is not uncommon for agricultural surface water users to suffer a lack of late-season supply. Lassen County's General Plan specifically addresses agricultural water management (see below).

3.2 Local Land Use Planning

Of the four counties represented in the Upper Pit River watershed, each have their own unique land use designations and general plans. The general plans' objectives and policies related to water and resource management are in **Table 5.1** at the end of this chapter. No inconsistencies between local and regional plans were noted during the preparation of this IRWMP.

Government Code, Article 6, Chapter 3, Section 65,103, mandates that every county shall adopt, amend, and revise a general plan when deemed necessary. A prompt to consider any updates to local land use plans has been added to the Implementation Guide in **Chapter 15** to maintain the link between the IRWMP and local planning efforts.

3.2.1 Lassen County General Plan Elements

Lassen County has strong groundwater protection policies put into place, likely due to the adjudication of one of their major groundwater basins in the last decade. The county also supports water conservation and cooperation by county entities with the state and federal governments; it specifically calls out the State Water Resources Control Board in "considering programs and actions to protect the quality of ground water and surface water resources" (Policy NR15).

The Lassen County housing element was last updated in 2000. Small, unincorporated communities include Pittville, Bieber, and Nubieber. The Lassen County General Plan acknowledges that the building intensity of these town centers is largely dependent upon the availability of community water and/or sewer services. Extensive growth is not planned for in these communities due both to any foreseeable economic driver and to the absence of services.

In addition to supporting the protection of water quality, Lassen County demonstrates support for the "sensible appropriation and utilization" of agricultural water, including development of water impoundments if necessary. In this policy (Policy NR20) the county indicates support for the identification of "areas within the county which have the foremost agricultural soils," indicating thoughtfulness behind the consideration of appropriate land uses on the varied watershed lands in the county. The demonstrated support for "new, well-planned reservoirs" emphasizes multiple benefits and the conservation of resources.

Forest management is a major component of land use throughout the Upper Pit watershed, and Lassen County addresses this issue in its Natural Resources Element. The timber industry continues to be a "major economic and social component of Lassen County" (Policy NR31), and the county likewise supports the industry through the zoning of all land with significant forest resources as timber production zones (TPZ).

With respect to flood dangers, Lassen County "supports interagency cooperation in developing programs and considering projects to protect people, property, and resources." The county identifies flood channels and reservoirs with flood control benefit to aid in this consideration.

3.2.2 Modoc County General Plan Elements

Modoc County identifies septic systems as a major water quality issue for potable water quality, and lists the assurance of domestic water supply as a requirement for all rural subdivisions. This is consistent with what the interview process uncovered (see section **4.0 Facilitating an Exchange of Knowledge – Coordinating Water Management and Land Use**).

The California Department of Housing and Community Development projects that the housing needs of Modoc County will grow only by 15 units between 2010 and 2019 (housing need in 2019 estimated at 4,096 units; with current housing stock, vacancy allowance, and absorption subtracted, that leaves a need of 15 units – citation from a Housing and Community Development [HCD] letter to Modoc County Planning Department dated June 30, 2012). This indicates a very low population growth rate and designates the majority of homes for above-moderate incomes and in unincorporated areas of Modoc County. It is not expected that Modoc County will experience significant development pressures in the next two decades.

The Plan's timber, vegetation, and fuels management discussion emphasizes the resource extraction history in the county and its continued importance to the economy. The county's Policy 2 under its Timber/Vegetation heading states the goal of ensuring the "compatibility of rural development with valuable timberland resources." This is similar to Lassen County's identification of good soils for farmland use, and shows thoughtfulness on the part of the county in terms of identifying appropriate land uses for appropriate lands.

Geothermal resources are a unique feature of Modoc County, and as such there are three policies addressing this issue. Policy 1 provides an overarching goal for the region: "[e]ncourage the wise use of geothermal resources in the county." County officials have identified geothermal power and heating as a desirable project in the IRWM process, and will be further developing this option in future years. The Pit River Tribe, an active participant in the IRWM process, is concerned about further geothermal development unless and until the Tribe is involved with determining potential effects on Tribal resources.

3.2.3 Shasta County General Plan Elements

Similar to Lassen County, Shasta County is interested in protecting water resources and preventing out-of-county export. This brings up the issues of area-of-origin water rights (California Water Code, Sections 1215-1222), county of origin water rights (Water Code, Sections 10500-10507), the Watershed Protection Act (Water Code, Sections 11460-11465) and their expression in State Water Resources Control Board water rights Decision 990. The extent to which counties and right-holders may rely on these laws has not yet been fully tested.
Groundwater and surface water quality as listed as important, with septic systems specifically mentioned (along with waste disposal sites and "other sources of hazardous or polluting materials," Policy W-b) as needing to be designed to prevent contamination to water bodies. Policy W-d identifies that there will be a periodic evaluation of the presence of septic systems in "poorly suited soils" to determine whether additional monitoring is needed, as well as potential changes to sewage disposal standards.

Water supply for development addresses and complies with state laws for water availability assurances when developments are proposed for over 500 units. Shasta County needs to accommodate 800 lower-income households as projected in its March 2011 updated housing element. The General Plan identifies the Burney and Fall River Mills areas as having parcels suitable for this type of development. In Burney, just shy of 60 acres is proposed for development, with a projected capacity of 1,198 units. All of the acreage is designated urban or suburban residential. In Fall River Mills, there are 14 acres zoned for commercial use with a projected capacity of 280 units. A development of this size could be significant for these towns and water/wastewater systems, and would necessitate a rezoning of the land. Some of these efforts have already begun. However, the likelihood of these developments is also uncertain because stakeholders express opposition to dense new developments of low-income housing within their largely low-density, rural communities. In addition, the California Department of Public Health's most recent annual inspection report of Burney Water District indicated that one of the biggest threats to their high-quality, potable groundwater includes high-density development and transportation corridors.

Burney-Hat Creek Forestry Project is proposed around the community of Burney, which possesses two sawmills and three co-generation plants that produce energy from wood biomass, a byproduct of the timber industry. When implemented, treatments associated with this project will help maintain a sustainable flow of materials including saw logs and wood biomass for bio-energy totaling 950,000 ccf over ten years.

Interagency planning efforts are called out in at least two policies in the Water section of the Natural Resources Element, indicating Shasta County's commitment to collaborative planning on a regional level.

3.2.4 Siskiyou County General Plan Elements

Portions of Siskiyou County included in the Upper Pit IRWM planning area are largely forested and sagebrush lands. Eighty-three percent of Siskiyou County is forested, making this one of the major economic activities in the county. This land includes both publicly and privately managed land, and also includes Lava Beds National Monument. As the area of Siskiyou County included in the Upper Pit IRWM planning region does not include any housing projections, a description of the development plans for the county is not included here.

Siskiyou County, likely because of the resources available throughout the county, has the most extensive conservation/natural resources element of all counties included in the Upper Pit IRWMP. The objectives and recommendations continually emphasize the natural values of the region and the need to preserve those values for human uses (recreational and economic) and for the innate significance of open space and native habitat.

The "Watershed and Water Recharge Lands" section of the conservation element includes several technologically advanced concepts (the conservation element date is 1973), including water recycling and siting new reservoirs for water supply and recreation. Flooding is not an issue in the section of Siskiyou County that is included in the Upper Pit River watershed.

3.3 Flood Protection

Federal Emergency Management Administration maps[1] for the watershed designate areas around Alturas, Canby, Adin, Lookout, Bieber, Nubieber, Fall River Mills, and Burney as within the Zone A – Subject to Inundation from Flooding. Historic flooding has occurred in these areas, although a bridge reconstruction project has prevented recent flooding in Burney, to the extent that local residents are actively trying to remove the flood designation there. Flooding has not been identified as an issue by stakeholders in the region, with three exceptions: 1) in the Parker Creek drainage (Modoc County), 2) in the Bieber area where historic high flows have threatened bridges and homes, and 3) in Alturas in the event there is levee failure, since many emergency services are in the floodplain.

Few planning documents and activities address flooding. One important exception to this is the City of Alturas. Flood protection is discussed in the Modoc County General Plan policies, and the Modoc County Planning Department, in partnership with the City of Alturas, has submitted a project to address flooding. These stakeholders are currently working with the local FEMA representative to identify an updated floodplain map and work from there to design the levees restoration project for coming years.

The community of Burney has a document identifying flood planning (through 2048) done by the U.S. Army Corps of Engineers in 1996. The document includes planning objectives in addition to technical, economic, social, and planning constraints and criteria by which to measure success in meeting the objectives. There are also alternatives included with discussion regarding the relative applicability and costs versus benefits of those alternatives. Because of the high cost of doing flood management for a small amount of people, and the social costs of some of the more technically and economically acceptable alternatives, the conclusion of the report was that "no flood protection plan investigated is feasible or has local support."

A similar plan was completed for Hat Creek in 1975. The conclusion was to go forward with a "detailed project report on the Hat Creek flood problem." Although the benefit-to-cost ratio was found to be positive, no further action was taken.

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[1]FEMA 2005. Zone A –Areas subject to inundation maps. Available from: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1

3.4 Watershed Management

Stormwater management, low-impact design, and recycled water are all important, current-day concepts that planners in the region are considering. Plans do not currently address these issues, due largely to the low development pressure in the region and scarcity of resources. However, as additional resources become available, it is likely these ideas will be addressed.

3.4.1 Pit River Watershed Alliance

The Pit River Watershed Alliance (PRWA) has been active throughout the region since 1999, and completed an assessment of the Upper Pit River in 2004 and the Upper Pit River Water Management Strategy in 2010. The North Cal-Neva RC&D sponsored these PRWA efforts. Active participants in the efforts included the Pit Resource Conservation District (RCD), the sponsor organization, the Central Modoc and Fall River RCDs, the U.S. Forest Service, the Central Valley Regional Water Quality Control Board, Sierra Pacific Industries, DWR, and many other diverse organizations. As stated in the document, the goal of the watershed assessment is to "prepare a balanced document that will serve as an educational tool; provide available information to stakeholders; build consensus within the watershed; and provide a baseline for future action." Watershed management was the focus, with goals and objectives to improve both water and land stewardship.

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Fish rescue before a meadow restoration project

3.4.2 Resource Conservation District Planning

The Pit Resource Conservation District put together a watershed management strategy in 2006, and the Fall River RCD published watershed management plans for Hat Creek, Fall River, and Burney in 2010. The purpose of these management documents is to identify principal issues and concerns and align interests in the planning areas to better reach consensus about appropriate watershed and land management actions. Emphasis is placed on opportunities to modify stream channel and landscape conditions to benefit water quality, aquatic habitat, wildlife habitat, and range and forest

health. Social and economic factors are also considered in the development of the management documents.

3.4.3 Disaster and Other Planning

The low population density of the region, the existence of only one incorporated city, the self-reliant nature of its citizens, wariness of government regulation, and the high percentage of disadvantaged communities has resulted in a minimum of localized planning, or the perceived need for it. Several areas in the watershed have Fire Safe Councils, while in others, residents have elected not to participate in such councils either because of the cost, or for other reasons. With the exception of storm water management in Alturas, there is no other specialized planning (nor any perceived need for it) for low-impact development, multipurpose program planning, nor salt and salinity management. However, Shasta County has also prepared a Regional Climate Action Plan (RACP), as pointed out by the Shasta County representative who attended several PRC and RWMG meetings over the planning period. Relevant climate information from that RCAP is reflected in **Chapter 8** of this Plan.

3.5 State Mandates and Plans

State mandates and plans, including Urban Water Management Planning, AB 1420 water conservation requirements, SBx7-7 water conservation goals and measurement requirements, and urban meter requirements do not apply to any urban agency in the region because of the small population centers. There is no water agency in the Upper Pit IRWM Region that serves more than 3,000 connections or more than 3,000 acre-feet per year.

Groundwater monitoring requirements do apply in this region. Lassen County is in full compliance with these requirements, and Shasta County has in place an interim Alternative Management Plan until they secure resources to complete a groundwater management plan for the many small basins in the county and the Upper Pit planning area. As groundwater monitoring is a required activity for counties, if they do not have these plans in place they are not eligible for most DWR and/or State Water Resources Control Board (SWRCB) funds.

3.5.1 California Water Plan

The Upper Pit IRWM region represents the northernmost portion of the Sacramento River Hydrologic Region, and a source water area for much of the state's water. The Sacramento River Regional Report doesn't identify anything specific about the planning area other than the presence of Tribal landholdings in the area and the activity of the U.S. Army Corps of Engineers' work on the Pit River as it runs through Alturas. Stakeholders in the region have been active in the Sierra Water Work Group, and hope to see the Mountain Counties overlay in the California Water Plan Update 2013 expand to include the watershed, as it shows in the Sierra Nevada Conservancy map of the region.

3.5.2 California DWR Floodplain Management

As mentioned in previous **Chapter 4 Issues and Conflicts**, flooding is an issue for only a few populated areas of the Upper Pit watershed. Specific portions of the Upper Pit watershed are

included in FEMA's flood maps, and these portions of the watershed have been identified by the affected stakeholders; measures are being taken to address the status.

3.6 Federal Plans

Federally managed land represents a significant portion of the Upper Pit watershed: nearly 60 percent of the watershed is managed by the U.S. Forest Service (USFS), Bureau of Land Management (BLM), and National Parks Service (NPS) alone.

3.6.1 U.S. Forest Service Plans

The USFS, which oversees the Modoc, Lassen, and Shasta-Trinity National Forests, is required by the Rangeland Renewable Resource Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA), to prepare individual forest plans. The plan summarizes demand and supply potential for a variety of natural resources, amplifies the preferred alternative, and applies its management direction to each management area. A detailed look at forest management plans can be found in the Upper Pit Watershed Assessment, pages 3-21.

Forest restoration on the Lassen National Forest

The USFS is entering into a new program called "Forests to Faucets" in which they're looking at managing forests specifically for water quality and quantity. The results of this assessment provide information that can identify areas of interest for protecting surface drinking water quality. This project also sets the groundwork for identifying watersheds where a payment for watershed services (PWS) project may be an option for financing conservation and management on forest lands – a concept that has been raised in the Upper Pit watershed. On a macro scale, Forests to Faucets data identifies areas that supply surface drinking water, have consumer demand for this water, and are facing significant development threats. Outcomes of this assessment could be incorporated into future IRWMP updates.

3.6.2 Bureau of Land Management Plans

The USDA Bureau of Land Management, is directed under Title II, Section 202 [43 U.S.C. 1712], of the Federal Land Policy and Management Act of 1976 to develop, maintain, and periodically update land use plans for all tracts or areas for the use by the public. The BLM updated their Alturas Resource Management Plan (RMP) in 2008. The approved management actions included in the Alturas RMP were selected by the BLM with input from Tribes, state and county governments, other federal agencies, the Northeast California Resource Advisory Council (RAC), interested organizations, and the public.

The BLM's RMP identifies the management of riparian zones to improve water quality, aquatic habitat, and reduce soil erosion. It also notes the potential effect of grazing management on water quality and quantity.

New recreation facilities proposed under the preferred alternative include 25 miles of new hiking trails and the enhancement of cold-water and warm-water fisheries. Off-highway vehicle (OHV) use in the region will be more closely managed, and any negative results of this change will be offset by establishing OHV management areas.

Fire and fuels management actions concerned with fuels reduction are expected to continue as previously, with moderate beneficial effects to fire risk in the managed areas. It is possible that excluding livestock from areas could result in the buildup of fire fuels in those exclosures, but because these actions would affect only a small area, it is likely that these effects will be negligible.

3.6.3 Lassen National Park Management Plans

Lassen Volcanic National Park, in the southern part of the Upper Pit watershed, has several plans applying to land use throughout the Park.

Fire Management Plan

Lassen Volcanic National Park developed and adopted a Fire Management Plan in spring of 2012. Generally, the policy recognizes the natural process of fire and dependence of many plant and animal communities on fire for propagation and/or balance. Exceptions to the burn policy occur where systems are not adapted to this regime or human life and/or property is in danger. The Park has a number of active agreements with local, county, state, and federal cooperators, which are essential in providing a collaborative effort in managing planned and unplanned incidents related to the protection of life, property, and natural or cultural resources. The plan also includes the provision of budget and staff time for research and monitoring, and it is expected that information will be available to regional stakeholders as it is developed.

Miscellaneous Planning

There are a variety of other plans developed by the Lassen Volcanic National Park staff, including trails and other interpretive projects, small vertebrate inventory, vegetation management plans for recreational areas, and a business plan. Perhaps the most relevant documents relate to roads rehab and terrestrial invasive species management. These documents identify management strategies the Park Service is and will be using to control activities and species that threaten water sources, the integrity of native habitat, and general recreational enjoyment.

General Management Plan

Lassen Volcanic National Park's most recent overall management strategy was finalized in 2003 for a ten-to-15-year period. The purpose of the plan is to provide long-term direction for resource preservation and visitor use, and it is likely that the document will be updated within five to ten years. This plan would increase wilderness areas by 25,000 acres, and increase monitoring and cultural baseline information gathering. The activities described in the plan will result in more effective control of invasive species and successful preservation and potential reintroduction of endangered and extirpated species, increased use of prescribed fire to restore natural fuel loads, and inventory and preservation of park archeological sites, among other outcomes. The successes in the National Park will be passed on through stakeholder interaction in the Upper Pit watershed, and successful projects will be replicated where appropriate. These outcomes could be added to future IRWMP updates.

4.0 FACILITATING AN EXCHANGE OF KNOWLEDGE – COORDINATING WATER MANAGEMENT AND LAND USE PLANNING

Current relationships between water managers and land use planners are varied. In Modoc County the planning relationship is quite close-knit because of the low population level; Alturas is the county seat, and the city and county share planning staff and, therefore, develop proposals easily. In Shasta County, some coordination challenges were identified; however, steps have been taken to address these challenges, as available below. An extensive process of interviews with water managers and land use planners was undertaken to support preparation of this section, and is discussed below.

Siskiyou County does not experience development pressure in the portion of that county included in the Upper Pit planning area. Lassen County development is focused more in the Susanville area than in the less-populated Upper Pit planning area, so coordination is not as much of an issue. However, the water manager for Lassen County Water Works District #1 (serving the town of Bieber) has said that while additional residential service may be possible, larger users (e.g., golf courses, cemeteries) could not be served with the current water supply and system, and coordination would be needed if such proposals arose.

Land use planners' participation in the IRWM process has been commensurate with their respective county's relative development pressure on the region. Modoc County (Alturas) planning has had an active voice in the process of document and project development, and has attended both Project Review Committee (PRC) and RWMG meetings throughout the course of the planning effort. A representative of the Shasta County Department of Public Works (Fall River Mills, Burney, McArthur) has taken an active role in PRC and RWMG meetings and in all stages of document review, as well. A free-flow of ideas on the state of groundwater planning, climate change planning,

municipal water supply concerns, illegal dumping, public safety, and flood management has taken place with these counties' representatives.

Lassen County has taken a more observational role, while Siskiyou County has been absent, due largely to the fact that most of those regional areas that are included in the Upper Pit watershed are publicly managed, forested, and unpopulated. It is expected that some of the findings on the topic of water and land use will improve the coordination with and between local agencies. The projects identified as Tier 1 in this process (see **Chapter 9 Project Development and Implementation**) have been completed in coordination with local planning agencies and satisfy zoning laws.

In light of the essential communication processes that ideally occur between water managers and land use planning staff, and to avoid misunderstanding and missed coordination opportunities, the Upper Pit RWMG identified an interview process as an essential first step in the process of coordination. These interviews occurred with water managers and land use planners throughout the region in summer of 2012. Six interviews occurred with: Fall River Valley CSD, Burney Water District, Lassen County Water Works District #1, a joint interview with Modoc County and City of Alturas, Lassen County, and Shasta County. Interviews with the Pit River Tribe occurred later in the planning process.

Generally, the land use and water management nexus interviews found that in the southwestern portion of the region (including Burney and Fall River Mills), where greater population growth is occurring, more agency interaction exists regarding development pressures and water availability. But more coordination is needed throughout the planning area about challenges from past land use decisions (often called "legacy developments") and some concerns regarding emergency water supplies.

One of the findings of the interviews was that adjudicated basins in the region (Hat Creek, Burney Creek, and the lower Upper Pit) are judged to be "safer" with regard to protecting local water rights than basins that are not adjudicated. However, it is for precisely this reason that many of the municipalities and purveyors in the region deliver groundwater rather than surface water – because of adjudication, there is no reliable surface water available.

Interview findings are described below, along with successes in the region and potential solutions to identified challenges.

4.1 Legacy Developments

A common challenge stated by land use planners and water managers interviewed was that of legacy developments and/or parcel splits. These are places where property splits were approved, mostly in the 1960s and 1970s, to create parcels under ten acres. In some cases, these parcels were developed with homes and mobile trailers. Water supply is generally available only by drilling a well, and wastewater treatment must be completed onsite through the creation of a septic system. Where these parcel splits were not developed, the county faces the challenge of uninformed, remote buyers purchasing the property sight unseen, and without researching the permitting requirements applicable to the parcel. It is often the case that well water is not reliable enough for the parcel due to its location outside of a reliable aquifer, or that there is not adequate space or the proper soils for a septic system.

Counties affected by this issue are looking at ways to deal with it, including reconstituting original, larger, parcels with the cooperation of willing landowners. As this issue is addressed further, information will be shared with and between IRWM members and participants.
From a Tribal perspective, there are small communities and individual residences throughout the region that were developed with inadequate, or even completely without, septic systems and/or water service. In cases where this infrastructure was installed, it was often inadequate and sometimes not maintained so that it is now in a state of disrepair, or inoperable. In cases where the infrastructure was never available or installed, members of the Tribe must draw water from streams, and there are cases of surface disposal of untreated sewage. This problem is addressed through several projects described in **Chapter 9 Project Development and Implementation**.

4.2 Urban Density and Water Quality

In places with high concentrations of water wells *and* onsite wastewater treatment (septic), conflicts between these activities occur. In one region, failing septic systems led residents to simply drill a hole through the hard clay pan just five-to-seven feet down to allow the wastewater to drain directly into the aquifer. This potentially leads to a groundwater source that is not to drinking-water standards. The community in question obtains its water resources exclusively from surface sources, and is nearing maximum capacity (it will no longer accept large-scale irrigation accounts such as sports fields, cemeteries, or golf courses). When that community's surface water runs out, the groundwater may require extensive (and expensive) treatment to serve potable needs.

Individual residences whose owners request a hook-up to community septic and/or potable water system can generally be accommodated on a fee basis. The more pipe that has be laid, the higher the fee. Beyond trucking water in, remote areas have few alternatives in the case that their water/ wastewater systems fail.

One of the projects developed through the IRWM process is to expand a sewer system, allowing residents to then abandon septic systems. This is extremely costly, especially for disadvantaged communities.

4.3 Water System Reliability and Redundancy

Providing water system redundancy is a challenge felt throughout the region. Surface water users do not have the capacity to pump groundwater (or the water is of questionable quality), and groundwater users' surface water options are either non-existent (much of the basin is adjudicated) or very expensive. In Burney, the two water wells (the city's entire supply source) are located not more than 100 yards from each other, utilizing the same basin; this situation would likely be disastrous should the groundwater elevation drop too much or become contaminated.

In addition, the age of most systems within the planning area is such that inefficiencies are widespread. Repairing older systems is costly, but results in lower maintenance fees. Several upgrades have been proposed as implementation projects within this IRWMP.

Some smaller communities in the region experience erratic and/or low-quality water from their well systems. A couple of communities are served by small systems that are failing due to age or lack of water availability. In both of these cases it would be best to hook up the system to a larger purveyor's; however, most communities are too remote to allow for this to be done with any cost

efficiency. These small systems must address their challenges together and with the help of county planning departments.

Most agencies in the region do not have the capacity to build or install supply redundancy. The expense of the activity and requirements for system retrofit can be too much for these small systems to afford. Supply redundancy is acknowledged as a need, but is a gap in regional water management and planning.

4.4 Regional Successes

The Fall River Valley CSD, in the last five years, has worked to develop a Municipal Advisory Council (MAC) with the purpose of allowing a forum for members of the public and affected agencies/entities to give input to planning processes from an early stage. The MAC structure was developed by the California legislature for this very purpose; though the Fall River MAC is not yet recognized by Shasta County (and so is called the Municipal Advisory *Committee*), it has been fairly successful in allowing residents' and smaller agencies' voices to be heard. Stakeholders hope that the process of recognizing this success through the IRWM process will encourage the county to take notice of this effective communication forum.

The success of Lassen County's groundwater management program is discussed above. These basin management documents represent a proactive strategy for protecting the groundwater basins on which so many residents rely, and present an excellent model for other counties' use.

5.0 LOOKING TO THE FUTURE

5.1 Developing the Relationship

The MAC, described above, represents a significant opportunity to further develop the relationship between water managers and land use planners. The Upper Pit RWMG hopes to encourage coordination efforts with others interested in the program, as well.

Land use planning entities and all regional water purveyors who have chosen to participate in the IRWM process have done so as members of the PRC and RWMG, or have been included via the interview process described above. It is expected that this relationship will continue into the future, especially as IRWMP implementation projects are developed and brought before required reviews. Strong continuity exists between the PRC and RWMG because many of the participants are members of each group and because most of the PRC's recommendations for projects and Plan elements must be approved by the RWMG.

In such a lightly populated region of 14,000, per capita representation by water interests in the IRWMP process is frankly extremely high, and constituents know one another by name, so transfer of information is generally more easily facilitated. In fact, the IRWM has become the regional forum to improve coordination between and among planners, and between planners and the RWMG for IRWMP implementation; holding timely meetings with these water interests (via the PRC and RWMG) will facilitate better communications among all water/land use planning interests. Coordination can also be improved by the RWMG taking the lead on contacting planners at least annually to determine if updates to local plans and policies have relevance to/potential to precipitate revision of the IRWMP.

5.2 Developing Regional Knowledge and Resources

5.2.1 Coordinated Planning

While many of the smaller agencies occasionally feel as though they do not have adequate input to the county planning process, the counties in the region do have an email contact list to which they send out planning-related announcements. These announcements include zoning requests, parcel split requests, and general plan-related actions and activities. While these do go out to each entity, it is not always assured that they will be read. Small utilities have challenges when it comes to staffing and budgets (they are often staffed by volunteers and may experience a high turnover), and people in these positions may not be aware of the options they have when viewing a planning notice, or may not have the time to read through them. They may not even understand what it is they have received. This limits the ability of local agencies and entities to respond adequately to issues requiring their input. One of the options identified in the IRWMP's interview process is that a page of information about the type of land use alert sent out, the appropriate responses, and a phone number to call with questions would be a good way to address the issue. This form is included in **Appendix 5-2**.

5.2.2 Water Supply and Drought Planning

Small water systems in the planning area have not developed water supply assessments or drought response plans. The dependence of municipal systems and agriculture on groundwater is vulnerable, as the groundwater basins are increasingly being tapped and show a direct, if delayed, response to arid conditions. One of the objectives in this Plan addresses additional drought planning.

5.2.3 Improving Water-Land Use Coordination Implements the IRWMP

Meeting multiple demands is always a complicated process of law, social priorities, public input, and history. Better coordination means fewer surprises and better preparation for the future – whether the future means additional development beyond what is projected, or includes extreme climate variability and changes in regional hydrology. If those adaptations can begin now, and with all players at the table, they can be completed with greater efficiency of time and money.

Table 5.1 General Plan Goals, Policies, Implementation Measures, and Objectives Relative to Integrated Regional Water Management Planning NOTE: Only those measures identified as relevant to and/or directly affecting the IRWMP are listed.	
Lassen County General Plan	
Natural Resources Element: Water	
GOAL N-3: Water supplies of sufficient quality and quantity to serve the needs of Lassen County, now and in the future.	
NR13 POLICY	The county recognizes the critical importance and future value of its water resources and shall support the conservation of water supplies and protection of water quality.
NR14 POLICY	The county supports efforts by state and federal agencies, including the California Department of Water Resources, to monitor the quantity and quality of the county's water supplies and to protect the water resources of the county when such efforts are demonstrated to be based on sound, scientific assessment of potentially adverse impacts to those resources.
NR15 POLICY	The county advocates the cooperation of state and federal agencies, including the State Water Resources Control Board and its regional boards, in considering programs and actions to protect the quality of groundwater and surface water resources.
NR16 POLICY	The county supports the continued use of appropriated and adjudicated surface water rights.
NR17 POLICY	The county supports measures to protect and insure the integrity of water supplies and is opposed to proposals for the exportation of groundwater and surface waters from ground-water basins and aquifers located in Lassen County (in whole or part) to areas outside those basins.
	Implementation Measure: NR-H: The county will maintain groundwater ordinances and other forms of regulatory authority to protect the integrity of water supplies in Lassen County and regulate the exportation of water from groundwater basins and aquifers in the county to areas outside those basins.
NR18 POLICY	The county may adopt specific resource policies and development restrictions to protect specified water resources (e.g., Eagle Lake, Honey Lake, special recharge areas, etc.) to support the protection of those resources from development or other damage which may diminish or destroy their resource value.
NR19 POLICY	The county supports control of water resources at the local level, including the formation of local groundwater management districts to appropriately manage and protect the long-term viability of groundwater resources in the interest of county residents and the county's resources.
GOAL N-4: Maintain a sensible appropriation and utilization of water for agricultural use in the county.	
NR20 POLICY	In order to insure adequate supplies of irrigation water to areas having the highest potential for agricultural productivity, the county supports analysis and, when warranted, development of water impoundments and aqueducts to transport water resources to areas within the county which have the foremost agricultural soils.
GOAL N-5: The development of new, well-planned reservoirs and other facilities and projects for water supply and/or flood control purposes which will benefit related resources and provide opportunities for multiple public benefits.	
NR21 POLICY	The county encourages feasibility studies for and, when appropriate, the development of new, well-planned reservoirs and the conservation and replenishment of water resources through means such as infiltration basins and reinjection when feasible.

Table 5.1 *continued* **General Plan Goals, Policies, Implementation Measures, and Objectives Relative to Integrated Regional Water Management Planning** **NOTE: Only those measures identified as relevant to and/or directly affecting the IRWMP are listed.**	
NR22 POLICY	Plans for reservoirs, flood control facilities, and other water-supply and flood-control programs and projects shall regard the related impacts and cost-benefit relationships to other resource values and land uses which may be affected, and shall consider opportunities and design elements to achieve multiple public benefits including recreation and enhancement of wildlife and fishery resources.
Natural Resources Element: Flooding	
GOAL N-6: Eliminate the threat of flood events which may result in the loss of lives and major damage to property and resources.	
NR23 POLICY	The county supports interagency cooperation in developing programs and considering projects to protect people, property, and resources from the threat of and damages from flood events.
NR24 POLICY	The county encourages feasibility studies, planning projects and, when appropriate, the development of new, well-planned reservoirs, flood channels and other facilities and programs which can serve to control flooding and help reduce flood-related damage.
Natural Resources Element: Forest Management	
GOAL N-11: Healthy forest environments which will continue to provide resources for multiple uses and timber production in sustainable quantities which will benefit the local economy.	
NR31 POLICY	It is recognized by the county that the timber industry has historically been and continues to be a major economic and social component of Lassen County and therefore represents a vital factor in the fundamental culture and customs of the community.
NR32 POLICY	The county supports the conservation and management of timber production areas for the production of timber and shall, within the county's authority, protect them from land uses (e.g., residential development) and factors which would significantly restrict their capacity for production.
	Implementation Measure: NR-M: The county will continue to support the use of timber production zones (TPZ) and related programs to promote the productive management of timber resource lands.
	Implementation Measure: NR-N: Land with significant forest resources, unless identified and designated for unique and specific development opportunities, should be zoned: TPZ, Timber Production Zone District; U-C, Upland Conservation District; or U-C-2, Upland Conservation Resource Management District.
NR33 POLICY	The county supports the balancing of policies for the conservation of natural resources (including wildlife management policies) in forested areas with the need to maintain production of timber at abundant, sustainable levels as an economic resource.
NR34 POLICY	The county recognizes the critical role that timber resources on federal lands have in the economy of Lassen County and shall continue to advocate and support federal resource management policies and practices which make plentiful, sustainable quantities of timber available for local lumber and timber-related industries.
NR35 POLICY	The county supports the efforts of the timber industry and local citizens to forge cooperative plans and agreements to achieve diverse objectives for protecting and managing forest resources while providing for the long-term economic stability of timber-reliant industries.
NR36 POLICY	In areas having significant forest and timber resources, the county supports the formulation of resource management goals and objectives which address the long-term health and diversity of resources in these areas as well as the sustained productivity of timber products.

Table 5.1 *continued* **General Plan Goals, Policies, Implementation Measures, and Objectives Relative to Integrated Regional Water Management Planning** **NOTE: Only those measures identified as relevant to and/or directly affecting the IRWMP are listed.**	
NR37 POLICY	The county supports management of endangered species and critical wildlife habitats in balance with other resource management needs, including the need for economic stability related to timber industries.
NR38 POLICY	The county supports successful reforestation of harvested and fire damaged areas on private and publicly owned timberlands.
Modoc County General Plan	
Conservation and Open Space: Water	
Policy 1	Encourage the increased development and use of surface water.
Policy 2	Cooperate with responsible agencies and organizations to solve water-quality problems, particularly septic system-related problems.
Policy 3	Work with the agricultural community to resolve any groundwater overdraft problems.
Policy 5	Require adequate domestic water supply for all rural subdivisions.
Conservation and Open Space: Timber/Vegetation	
Policy 1	Enhance the timber resources through a county-wide conservation program.
Policy 2	Ensure compatibility of rural development with valuable timberland resources.
Policy 3	Protect timber resources through a vegetation program.
Policy 4	Protect timber resources for its wildlife habitat and scenic resources.
Policy 5	Protect officially listed rare and endangered plants in Modoc County which contribute to the natural diversity of plant life.
Conservation and Open Space: Geothermal	
Policy 1	Encourage the wise use of geothermal resources in the county.
Policy 2	Continue efforts to use geothermal energy for public building space heating and water use.
Policy 3	Designate industrial land uses adjacent to appropriately located geothermal resources.
Modoc County Action Program for Conservation and Open Space	
1	Initiate a cooperative effort among state and local agencies and special districts to explore appropriate actions necessary to resolve the long-term water supply and quality problems in the county.
3	Require as part of the review of any subdivision approval a demonstration to the satisfaction of the county that the following conditions exist for every lot in the proposed development: An adequate domestic water supply; Suitable soil depth, slope, and surface acreage capable of supporting an approved sewage disposal system; and Suitable surface acreage less than 30 percent slope for constructing residences and appurtenant buildings.
4	Continue the timberland preserve zoning program. Review proposals for compatibility with maintenance of timber resources and impacts on officially listed rare or endangered plants.
6	Initiate appropriate follow-up efforts as recommended in the report: Assessment of Geothermal Resources in Modoc County, CA, January 1986.
Shasta County General Plan	
Natural Resources Element: Water	
Objective W-2	Take all reasonable actions to protect against the export of water resources from Shasta County which will be needed for ongoing and future beneficial uses within the county.
Objective W-5	Consider jointly-sponsored planning studies or capital improvement projects among purveyors with similar interests and needs.
Objective W-9	Institute effective measures to protect groundwater quality from potential adverse effects of increased pumping or potential sources of contamination.

Table 5.1 *continued* **General Plan Goals, Policies, Implementation Measures, and Objectives Relative to Integrated Regional Water Management Planning** **NOTE: Only those measures identified as relevant to and/or directly affecting the IRWMP are listed.**	
Policy W-a	Sedimentation and erosion from proposed developments shall be minimized through grading and hillside development ordinances and other similar safeguards as adopted and implemented by the county.
Policy W-b	Septic systems, waste disposal sites, and other sources of hazardous or polluting materials shall be designed to prevent contamination to streams, creeks, rivers, reservoirs, or groundwater basins in accordance with standards and water resource management plans adopted by the county.
Policy W-c	All proposed land divisions and developments in Shasta County shall have an adequate water supply of a quantity and a quality for the planned uses. Project proponents shall submit sufficient data and reports, when requested, which demonstrate that potential adverse impacts on the existing water users will not be significant. The reports for land divisions shall be submitted to the county for review and acceptance prior to a completeness determination of a tentative map. This policy will not apply to developments in special districts which have committed and documented, in writing, the ability to provide the needed water supply.
Policy W-d	The potential for cumulative water quality impacts resulting from widespread use of septic systems in poorly suited soil areas shall be periodically evaluated by the county for the need to provide greater monitoring and possible changes to applicable sewage disposal standards.
Policy W-e	The Shasta County Water Agency should encourage and promote interagency water planning efforts within the county, particularly in the Redding Basin.
Policy W-f	The county shall encourage and participate in interagency planning efforts, such as the Redding Area Water Council, to protect and enhance the quality of all groundwater and surface water resources.
Siskiyou County General Plan	
Forest Lands Objective: Preserve, protect, and manage the forest lands as both a natural wild habitat and a productive economic resource.	
Recommendation 1	Forest land, wherever possible, should be separated from other uses, and only those uses related to and compatible with sound forestry practices should be allowed within or located on forest land.
Rec. 2	Forest land should be encouraged as a means of providing open space and conserving other natural resources.
Rec. 3	Forest lands not considered as prime forest land should be improved as commercial timberland, preserved as open space and wildlife habitat.
Rec. 4	Forest lands must be recognized as a resource in its own right as well as a protector of many other resources and as such must be permanently and exclusively reserved.
Rec. 5	Forest lands not presently zoned should be zoned Agricultural/Forestry.
Rec. 6	Encourage private timber holders to engage in active timber management programs.
Wildlife Habitat Objective: To preserve and maintain streams, lakes, and forest open space as a means of providing natural habitat for species of wildlife.	
Rec. 1	To maintain all species of fish and wildlife for their intrinsic and ecological values as well as for their direct benefit to people.
Rec. 2	To provide for diversified recreational use of fish and wildlife.
Rec. 3	Provide for an economic contribution of fish and wildlife in the best interest of the present and future populations.
Rec. 4	Provide for scientific and educational use of fish and wildlife.
Rec. 5	When planning any alteration to the present environment or habitat, consideration should be given to the effects on fish and wildlife.

Table 5.1 *continued* **General Plan Goals, Policies, Implementation Measures, and Objectives Relative to Integrated Regional Water Management Planning** **NOTE: Only those measures identified as relevant to and/or directly affecting the IRWMP are listed.**	
Rec. 6	Present land uses which result in siltation or pollution of inland waters should be carefully monitored and, if necessary, corrected to assure clean and productive habitat.
Rec. 7	Outstanding wildlife habitats and sites what have unusually high value for fish and wildlife should be carefully considered before any development altering this environment is permitted.
Rec. 8	Encourage development and enhancement of wildlife habitat through careful use of methods such as controlled burning, planting, judicious livestock grazing, mechanical land manipulation, and creation of ponds in water courses.
Rec. 9	Recognize and encourage the various appropriate and inappropriate uses of wildlife. This includes such activities as scientific studies, educational purposes, and hunting and fishing.
Rec. 10	Retain and develop access to public areas through riding (non-motorized) and hiking trails.
Natural Resource Lands Objective: Protect the scenic natural resources of Siskiyou County and preserve areas which are important as commercial natural resources for future generations.	
Rec. 1	To preserve areas of natural scenic beauty as areas of active and passive recreation.
Rec. 2	Continue to promote a program of agricultural land preservation to assure adequate food supply for the future.
Rec. 3	Maintain prime forest lands in timber production under multiple-use concept. Recreation and subdivision development of forest lands should be carried out in an orderly manner with high standards for environmental protection.
Watershed and Water Recharge Lands Objective: To preserve the quality of the existing water supply in Siskiyou County and adequately plan for the expansion and retention of valuable water supplies for future generations and to provide for a comprehensive program for sustained multiple use of watershed lands though reduction of fire hazards, erosion control, and type conversion of vegetation where desirable and feasible.	
Rec. 1	Provide for the safety and welfare of the residents of the county by flood control efforts on a regional scale.
Rec. 2	Continue to assure the high quality of water within the county with management programs for agricultural waters and emphasizing programs which stop intrusion of agricultural waste into the water supply.
Rec. 3	Every precaution must be maintained to eliminate the danger of any pollution to the streams and lakes as well as recharge areas through human and industrial waste and agricultural runoff.
Rec. 4	Continue a program research into the future water demands of Siskiyou County to establish the need for any future facilities.
Rec. 5	Promote a plan for future expansion of water storage reservoirs to be utilized as water supply as well as recreation.
Rec. 6	Utilize latest scientific techniques toward reclamation and recycling of wastewater.
Rec. 7	Use of watershed or recharge lands for urban or second home purposes should be permitted only under rigid controls.

[i] Groundwater residence time means the amount of time a drop of water spends in the aquifer before continuing through the hydrologic cycle. This is significant because, when combined with use patterns, it indicates the recharge rate of groundwater sources. A higher residence time (50-100 years) generally indicates a slower recharge rate (it takes the water a long time to build up), whereas a shorter residence time (5-15 years) generally indicates a faster recharge rate (the runoff reaches the aquifer more quickly).

[ii] Allowed through AB1152 (Chesbro and Cook, 2011), which extended the deadline for formal groundwater monitoring plan implementation, in addition to other considerations.

[iii] The California Water Code Section 10617 defines an urban water agency as "supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers."

CHAPTER 7. GOALS AND OBJECTIVES

1.0 INTRODUCTION

The following goals and objectives were developed by assessing and responding to the Basin Plan objectives discussed at length in **Chapter 3 - 1.3 Water Quality** and **1.3.1 Water Quality Concerns**; the issues and conflicts, and resource management strategies identified within the watershed; and subsequently formulating actions to address them. The Project Team gleaned and updated goals and objectives from previous recent water management strategy documents and provided wording, where necessary, for new objectives. The objectives then went through a rigorous review and approval process by the Regional Watershed Management Group (RWMG) and the Pit River Tribe. As noted previously in **Chapter 4 Issues and Conflicts**, there may be a divergence of opinion on how to carry out meaningful restoration or management, depending on one's perspective. It is assumed that such differences will be negotiated and further resolved during the project review process and as the IRWMP is revised over time.

The RWMG Plan Review Committee formulated these goals and objectives with qualitative or quantitative metrics to meet the IRWMP Guidelines. Measures included in the objectives to evaluate progress are implicitly conservative because it is recognized that funding is difficult to secure, permitting and environmental review can have uncertain outcomes, and/or willing landowners may not emerge for a specific project. Regardless of uncertainties, it is the intent of the RWMG and the region's stakeholders to be strategic and cooperative in project development, and especially in seeking funding – by using match opportunities, collaborations, and shared resources to leverage funding to the maximum extent.

Stakeholders expressed their dilemma – that of balancing vision with realism. On the one hand, they wanted to portray a blueprint via these goals, objectives, and metrics that would advance restoration, infrastructure solutions, and stewardship within the current reality that funding and financing are difficult to come by. Stakeholders remain concerned that by offering these measurable objectives as required, they will be judged to have failed if they cannot find the resources, or meet other requirements, to accomplish the activities and measurements as set forth below.

This IRWMP is an attempt at holistically assessing the Upper Pit region's water-related management; there is currently no catalog of all the restoration or infrastructure needs. But a picture of the depth and scope of need begins to emerge from the numerous projects that stakeholders advanced during Plan preparation.

It was partially by examining this "opportunity pool" of water management-related projects that the RWMG began to develop metrics – comparing what could reasonably be accomplished over five years, given the capacity and potential funding – not only from the IRWMP, but from leveraged and match sources. The Project Team also determined appropriate metrics by talking with Natural Resources Conservation Service staff, University Extension staff, and stakeholders. The final test was not only to determine what was conservatively reasonable, but what was desirable on the part of regional stakeholders. The appropriate unit of measure or qualitative comparison was then finalized for each objective. Monitoring for projects is essential to determine the success of any project implemented. Given the above considerations of cost and capacity, the RWMG felt it was unrealistic to develop an objective for every issue identified.

The Pit River Tribe requests that stakeholders familiarize themselves with Traditional Environmental Knowledge (TEK) information and consider using appropriate techniques from TEK when considering natural resource planning and restoration projects.

The RWMG considered the following when developing objectives:

- Basin plans and strategies to meet applicable water-quality standards;
- Actions that will reduce per capita water use by the year 2020 in California, including both urban water use and improvement of agricultural water use efficiency;
- Protection and improvement of water-supply reliability, including identification of feasible agricultural and urban water-use efficiency strategies;
- Identification and consideration of the drinking water quality of communities within the area of the Plan;
- Protection and improvement of water quality within the area of the Plan consistent with relevant basin plan;
- Identification of any significant threats to groundwater resources from over-drafting;
- Protection, restoration, and improvements of stewardship of aquatic, riparian, and watershed resources;
- Protection of groundwater resources from contamination; and
- Identification and consideration of water-related needs of disadvantaged communities in the area within the boundaries of the Plan.

For purposes of clarification, a goal is defined as a general statement of purpose; an objective is the measureable action(s) by which the goal will be carried out.

1.1 Prioritization of Objectives

The Department of Water Resources Guidelines require that the Plan contain an explanation of how objectives were prioritized, or why they were not prioritized. The RWMG decided not to prioritize objectives, as discussed below.

As identified in **Chapter 6 Resource Management Strategies**, collaboration and integration are critical to maximizing benefits to the watershed through strategically aligning opportunities, particularly in the face of limited financial resources. Integration reduces conflict and actively demonstrates the benefits of a multi-strategy approach.

With integration and collaboration overriding principles for long-term stewardship of the Upper Pit River watershed, it would be counterproductive to parse apart the numerous objectives in an attempt at prioritization. These objectives are interrelated and often interdependent.

Bottom line, in the Upper Pit River watershed it is desirable, *at every opportunity,* to emphasize collaboration, and not competition, for limited resources, both in financial and human capital. This approach provides the maximum benefit to the watershed now and into the future. Therefore, the RWMG has decided not to prioritize objectives.

1.2 Goals and Objectives

Goal 1. Maintain or Improve Water Quality

Elevated water temperature, dissolved oxygen, sediment, bacteria, and nutrients – all identified as water-quality issues in the region – are discussed in greater detail in **Chapter 3 Region Description** and **Chapter 4 Issues and Conflicts**. In most cases, specific causes of these conditions have not been conclusively demonstrated, although a combination of natural and management-related phenomena are likely. Management activities that contribute to water-quality concerns include livestock grazing, irrigation agriculture, logging, road construction and maintenance, stream channel modifications, and rural residential development. Some problems are legacy issues related to practices no longer in use. Improved management practices have been implemented, including livestock fencing, off-stream watering sites, vegetative buffer strips, road crossing and drainage improvements, irrigation tailwater control, and revegetation of streambanks. Agencies, local watershed programs, and individual landowners continue to implement projects that provide water-quality and habitat-improvement benefits.

Groundwater quality is unknown in much of the region, and was frequently mentioned as a data gap. This Plan addresses this issue with an objective to document groundwater quality problems in the watershed's sub-basins and solve them through basin management objective plans and implementation. Please see **Goal 2, Objective D**.

Please note: All metrics, either quantitative or qualitative, are bolded within each objective.

Courtesy of Pit River Tribe

Off-stream water source – an agricultural best management practice

Objectives

- **A.** Implement **two new projects** that **measurably improve water quality** from tailwater management.
- **B.** Assist landowners in implementing **five additional projects to improve livestock management** in riparian areas (e.g., off-site watering facilities, relocation of feedlots and corrals, riparian and stream-zone fencing).
- **C.** Implement **five miles of bank stabilization** projects to **reduce erosion and siltation**.
- **D. Conduct a feasibility analysis** of alternative methods of irrigation water delivery (e.g., piping or canals) that **benefits both agricultural users and riparian/aquatic health**.
- **E. Research and improve** the Main Street urban runoff problem in Alturas.
- **F. Establish a Pit River Tribe Resource Conservation District** to help address water-quality issues.

(See **Goal 3** for restoration projects affecting water quality.)

Goal 2. Maintain and Improve the Quantity and Availability of Water for Irrigation Demands

Major sections of the Pit River were adjudicated during a wet climate cycle (1870-1950). In recent decades there is often insufficient water to meet demand and need. Late-season low flows are common in the watershed, exacerbated by cases of inefficient transport of irrigation water and down-cut river and stream channels that result in floodplain disconnection, and subsequent dewatering of shallow aquifers/wet-meadow systems.

Knowledge of groundwater hydrology in the region is uneven at best, and the source of available data is often unknown by stakeholders. This data gap handicaps planning and managing efforts, and could become more problematic if groundwater use continues to increase at its current rate, if population grows significantly, and/or if drying of the climate continues. Groundwater usage in the Upper Pit watershed has increased approximately tenfold in the last 40 years (see **Chapter 3 Region Description**). Since the watershed is subject to drought and late-season low flows, is largely adjudicated, and is experiencing an increased use of groundwater already, getting a handle on regional groundwater quantity will be a means of strengthening water-supply management options for the future.

Recent local weather records for the region as well as simulated climate projections discussed in **Chapter 8 Climate Vulnerability** suggest that the Upper Pit region has been warming over the past century and will continue to do so. Coincident, region-wide increases in precipitation are not projected (although some areas may experience increases in precipitation) indicating that conservation and efficient use of water could become ever more important over time.

Objectives

- **A.** Work with local Resource Conservation Districts (RCDs) to secure funding for **completing additional sprinkler irrigation system efficiency evaluations**.
- **B.** Support voluntary drought management plans in sub-basins; **complete at least one by 2015**.
- **C.** Implement **at least one project** to demonstrate improved flashboard dam operations.
- **D.** Develop groundwater basin management objective plans for **at least one more groundwater sub-basin** of the watershed.
- **E.** **Conduct feasibility analysis** of additional water storage **by 2017**.
- **F.** Implement piping and/or lining to replace **at least five miles of open ditch systems** to reduce water losses **by at least 50 percent**.

Goal 3. Sustain/Improve Aquatic and Terrestrial Communities and Habitat and Ecological Function

Region-wide concern has been expressed for the conservation of the natural attributes of the watershed. A cadre of federal, state, and local resource agencies, local non-profit groups, the Pit River Tribe, and individual landowners has pursued a balanced future for habitat and the environment via restoration, improved agricultural practices, and watershed stewardship and education.

Sandhill Cranes

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A major issue in the region is channel erosion, with the related problem of disconnection of streams from their floodplains. Among the most-often cited needs for habitat improvement has been restoration of wet-meadow and riparian systems. Low-gradient valleys in the watershed function as huge wet-meadow systems that can aid in groundwater storage, and thus, when in fully functioning condition, offer a more consistent water supply downstream as well as slow and absorb storm water during flood events, thus assisting in protecting downstream communities.

Stream channel alteration by development of roads, railroads, channel straightening, logging, irrigation diversion, riparian vegetation removal, and mismanaged livestock grazing has led to moderate-to-severe entrenchment of streams and rivers throughout the watershed.

Bank stabilization project

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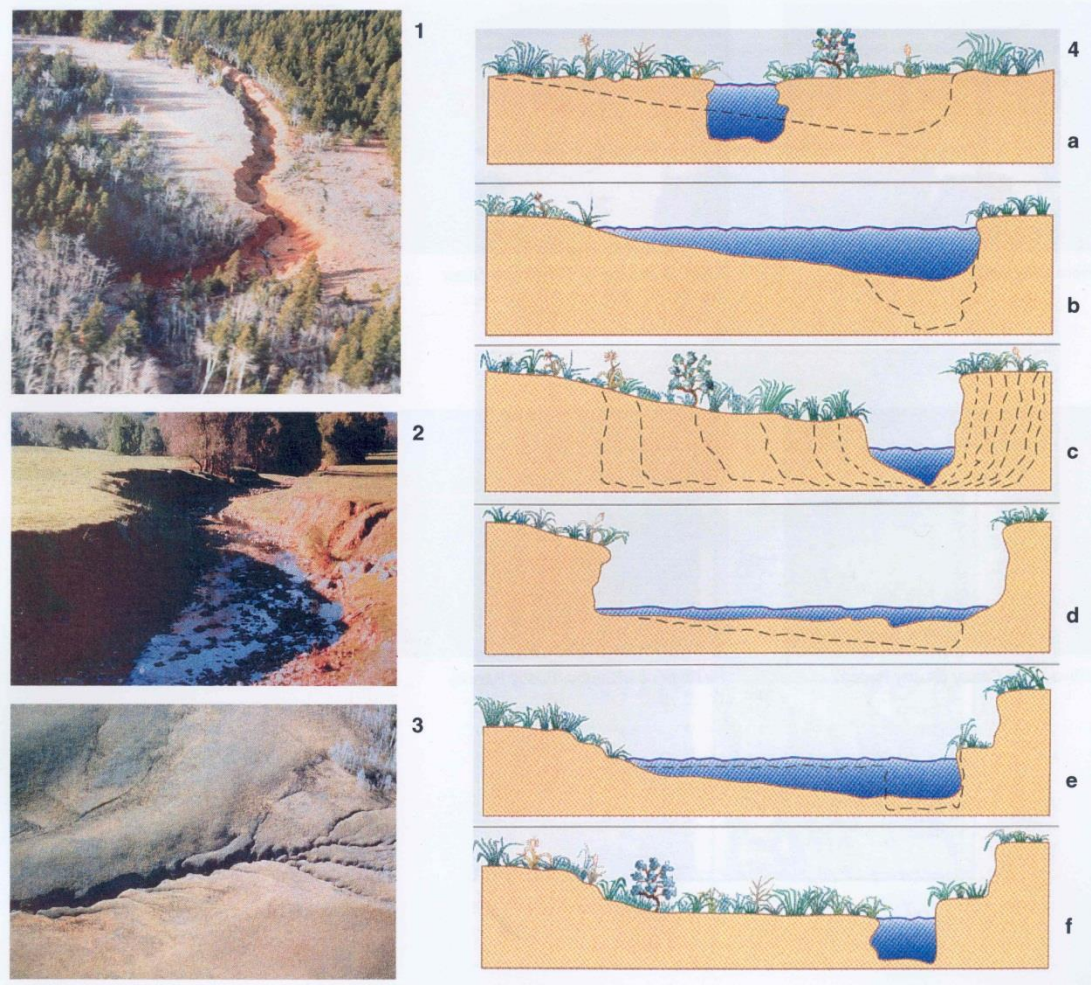
Poor bedform morphology, for example, often has the secondary effect of decreasing the amount of habitat suitable for spawning (e.g., gravels are eroded and transported downstream and/or become covered with silt/sand). **Figure 7-1**, below, represents one of the many forms of down-cutting, or entrenchment.

Figure 7-1.
Illustration of Channel Geomorphology and Change over Time Due to Watershed Degradation[1]



Seasonal low flows and altered flows, extreme water events, poor water quality, invasive species, and disrupted connectivity of habitat have negatively affected iconic species in the watershed such as sandhill cranes and other wetland-dependent birds, vernal pool-associated species, Shasta crayfish, redband trout, rough sculpin, Modoc sucker, and other native fish. A lack of fisheries and flow data has made it more difficult to craft solutions to address concerns.

Modification of wetlands from widespread drainage and conversion of land, and some agricultural practices, has substantively reduced wetland, fen, and vernal pool habitat available for waterfowl, wading birds, aquatic invertebrates, and other wetland-dependent species. Restoring river- and wetland-associated acreage while maintaining the agricultural economy can be challenging, so projects need to be chosen carefully to address both needs.

Rangeland vegetation has suffered in some portions of the watershed from poor management practices including overgrazing, disrupted fire regime from aggressive fire suppression, and

[1] Rosgen, D.L. (1996). Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology.

invasive weeds. On the uplands, a sage-steppe restoration strategy has been developed that would improve habitat and watershed function over a 6.5-million-acre area, including much of the watershed. The impetus behind this Plan is to improve habitat for greater sage-grouse and other sage-steppe species, and improve hydrologic function.

Due to a combination of natural and human-induced conditions, the current juniper density in the sage-steppe ecosystem, and the density and tree mortality in the pine and mixed-conifer forests ecosystems are now very susceptible to widespread and intense wildfires that can result in major impacts to the watershed from soil erosion and accelerated surface runoff.

Public land managers cite the need for increased fuels reduction, fuel breaks, and the restoration of natural fire regimes. The emphasis is on developing landscape-scale treatments, and working with the forest products industry to implement the treatments.

Moreover, the wildland-urban interface is encroaching further into wildland areas. This increases the risk of potential losses within suburban and urban areas, including property, cost of replacement, and human life.

Objectives

- **A.** Conduct meadow, spring, fen, and vernal pool restoration projects affecting **at least 1,000 acres. Stabilize and/or restore 25 miles of streams** within the watershed **to natural ecological function** to increase shade canopy, improve summer base flows, decrease peak flows, improve bank and channel stability, and improve habitat conditions.
- **B.** Restore and reconnect streams with historic floodplains, affecting **at least 1,000 acres of floodplain**.
- **C.** **Increase the number of stream miles** that support native fisheries in some tributaries to the Pit River.
- **D.** Enhance fish populations by **implementing projects that reduce entrainment** (unintentional trapping) of fish in irrigation diversions and blockage of migration at diversion dams.
- **E.** Reduce the potential for large, uncontrolled fires, and thus subsequent erosion and runoff and property loss by **conducting forest health and small fuels reduction projects on at least 20,000 acres**. Implement the Burney-Hat Creek Basins Collaborative Forest Landscape Restoration Program (CFLRP) forest restoration project. (Each element has its own project metrics.)
- **F.** Implement the Sage-Steppe Ecosystem Restoration Strategy. (**Each element has its own project metrics**.)

Goal 4. Control and Prevent the Spread of Invasive Species

A variety of both terrestrial and aquatic invasive species has been introduced into the watershed over time. Stakeholders have expressed concern about several noxious weed species, including knapweed, Dalmatian toadflax, yellow starthistle, Canada and Scotch thistle, several species of hoary cress, cheat grass, and medusahead, as well as other invasive species that rob natural systems of native diversity and decrease agricultural yield.

Stakeholders have specifically identified infestations in need of management along the Fall River near Fall River Mills, wet meadows adjacent to the Pit River, tributaries in the upper half of the Plan area, and along roadways. Extensive infestations have been mapped by cooperative public/private efforts, and the RCDs, Bureau of Land Management, Modoc National Forest, and Agricultural Extension staffs conduct outreach and education about all invasive species.

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Community meeting to discuss Eurasian watermilfoil

The priority aquatic invasive species identified is Eurasian watermilfoil, a weed that has caused disruption to the natural function of Fall River as well as posing a management problem for PG&E and maintenance of county infrastructure. The problems associated with aquatic invasive plants range from the inconvenience of having weeds clog waterways to competition with beneficial native plants and habitat degradation.

Invasive animal species can also degrade stream habitat. Animals such as muskrats increase erosion and related sedimentation by burrowing into streambanks. Several native aquatic animal species in the watershed have been negatively impacted by introduced non-native species, such as: largemouth bass, signal crayfish, and brook and brown trout. For example, largemouth bass, an aggressive predator that feeds extensively on fish, has been shown to prey on Modoc sucker in the Turner Creek drainage, threatening population numbers. Competition and predation of non-native signal crayfish has been determined to be the primary reason for extirpations of Shasta crayfish. Past introductions of brook and brown trout, although not thought to be significant threats to any one species, may have suppressed native redband trout and Modoc sucker through competition, predation, and spatial displacement.

Opinion is deeply divided between biologists and anglers about the benefits and impacts of these introduced fish. Non-native fish introductions have been done by California Department of Fish and Game (CDFG) as well as an extensive amount of unauthorized illegal introductions in the watershed. CDFG no longer stocks warm-water species such as bass, and stocking of trout is thoroughly evaluated for potential impacts to sensitive native species prior to stocking.

Objectives

A. **Promote and expand collaborative strategic weed management plans** and then **implement treatments on at least 500 acres** of noxious weeds annually. Include a noxious weed treatment element in all restoration projects implemented under this Plan.

B. Increase aquatic health and resiliency of the Fall River by implementing Eurasian watermilfoil pilot projects. **Measures include establishing four monitored locations for the pilot project, 30,000 weevils cultured and stocked, and five randomly selected sites sampled with fully assessed results**.

C. **Develop two action plans and/or implement projects** to prevent introduction and/or expansion or reduction of non-native animal species (e.g., muskrat, non-native bass, quagga mussels, and/or address genetic mixing

Goal 5. Improve Efficiency and Reliability of Community Water Supply and Other Water-Related Infrastructure

In keeping with California's 20x2020 water efficiency goals, stakeholders identified means of improving water supply efficiency. Old, outdated, and/or poor-quality water infrastructure in the region includes pipes, tanks, wells, diversion structures, wastewater service lines, wastewater treatment facilities, and underground mainlines. Poor or failing water infrastructure results in substantial water loss, increased annual maintenance costs, and inadequate fire-fighting capabilities.

By way of example, Fall River Valley Community Services District has documented a 31 to 48 percent loss of water between the well and the consumer within its antiquated water system, making it vulnerable to reduction of water supply due to drought, overuse, and climate variability. Potential contamination of supply is also of concern.

County general plans identify Burney and Alturas as communities where future development should be focused. These communities will likely require a greater investment in infrastructure expansion to make them suitable for increased development.

Septic issues are one of the challenges in the region, with failing systems requiring replacement and/or sewer installation, and user issues expressed about septic installation regulations. This Plan addresses solving groundwater-quality problems in the watershed's sub-basins through basin management objective plans and implementation.

Flooding has not been identified as a major threat by stakeholders in the region, with three exceptions: 1) in the Parker Creek drainage (Modoc County), 2) in the Bieber area as historic high flows threaten bridges and homes, and 3) in Alturas in the event there is levee failure, since many emergency services are in the floodplain. Problematic flooding has been exacerbated by upstream channel modifications that have resulted in enlarging capacity to transport water and sediment. The enlarged channel capacity allows storm water to remain within the channel rather than spilling onto the floodplain. As individual streams join from enlarged channel reaches and flow continues downstream, more flow is generated, creating greater energy, and subsequently increasing the flood risk of the area. The rising stream can then threaten bridge and culvert stability, homes and other structures, as well as irrigation infrastructure (i.e., pumps, buried pipe). The stream can also erode valuable cropland.

The underlying problem is that the streams/rivers have become disconnected to floodplains because of the enlarged channel capacities. Restoration of depositional stream reaches, often referred to as meadows, is known to attenuate flood flows, thereby reducing flood risk. Weather records over the last century document a greater variability in storm events with a shift in precipitation from snow to rain. When combined with earlier snowmelt, the resulting runoff events may exacerbate flooding in the region.

Objectives

A. Conduct **at least two water-supply infrastructure projects** that could include: leak detection and repair; distributions system pipeline replacement; creation of supply redundancy; water tank storage repair/replacement; and meter calibration, repair, and replacement that help improve the integrity of local water supply.

B. To reduce per capita water use, create incentives for efficient appliances and fixtures, help plant drought-resistant landscaping, and publicize available audits, rebates, and incentives as a **pilot program in at least one jurisdiction**.

C. Implement at **least one wastewater treatment improvement project to increase the quality of discharged waters**.

D. **Increase conservation education** via water bills and other outreach throughout the watershed by designing a series of outreach materials that can be used by all water purveyors.

E. To gain an understanding of long-term system reliability and to aid in capital improvement and planning decisions, **undertake at least one water-supply assessment** for a community service provider.

F. Work with county agencies and Caltrans to **reduce artificial constrictions of flood flows, prioritize projects, and promote proper design**.

G. **Implement three projects to address flood attenuation** and secondary effects: 1) in the Parker Creek drainage (Modoc County), 2) in the Bieber area, and 3) in the Alturas area.

H. **Implement the City of Alturas' project** to construct wetlands (green infrastructure) for wastewater disposal and treatment, and **make progress toward** (could include completed design, securing funding for, and/or implementing) **measures to address wastewater-treatment issues** identified in Fall River Mills and Burney.

Goal 6. Strengthen Community Watershed Stewardship and Encourage Better Coordination of Data Collection, Sharing, and Reporting

Extensive improvements have been made in the watershed, yet remain unheralded or unknown to any great degree. Many of the successful stewardship and restoration projects completed in the region and the other watershed data, such as groundwater and water quality studies, remain unavailable or unknown. These data are vital to improving management practices, enhancing collaborative decision-making processes, securing funding, and improving stewardship.

The non-profit Central Modoc River Center in Alturas, Spring Rivers Foundation, Pit River Watershed Alliance, Fall River Conservancy, Fall River RCD, Pit RCD, Central Modoc, Pit North Cal-Neva RC&D, and Northeastern California Water Association were formed in recognition that good stewardship leads to a healthy watershed, often helping avoid the need for further regulation, and in response to stakeholders' desire for more watershed education at all levels. These organizations and the Pit River Tribe offer stewardship learning opportunities for K-12 education, perform public outreach about the watershed, conduct stewardship projects, and house exhibits and displays that foster an understanding of the watershed's natural systems. Sustainable funding is needed by these organizations.

Additional stewardship outreach could address a chronic issue – illegal dumping – on public lands, private forestlands, and in agricultural areas. Effects of illegal dumping on water resources include pollution from toxic waste (e.g., batteries, paint) and corroding materials, as well as habitat alteration for aquatic and wildlife species. Another stewardship issue is misuse of off-highway vehicles that destroy vegetation and add to erosion and sedimentation issues.

Lead agencies and funding sources are often diverse, with varying reporting processes. Often, the benefits, outcomes, and learning associated with watershed improvement and enhancement

projects remain unknown because there is no central repository or database for such projects. Without data sharing, educational and adaptive management opportunities are lost.

Objectives

- **A.** Pit River Watershed Alliance (PRWA) to create a Pit River Steward of the Year award **by 2013**.
- **B.** Continue to hold annual watershed stewardship, cooperative public/private demonstration days/field tours by RCDs, but showcase all projects planned and completed under this Plan **annually**.
- **C.** **Assist in place-based learning during at least one event annually** for K-12 students to learn about the watershed system and needs by PRWA and the RWMG coordinating/sharing IRWMP project outcomes and volunteer opportunities with the Pit River Tribe, the River Center's Pit River Adoption Project, and Spring Rivers Foundation.
- **D.** **Finalize and publicize a watershed improvement directory** that documents local restoration and enhancement projects and shares successes that improve adaptive management within the watershed.
- **E.** **Identify river and stream segments in need of restoration** to include: prioritized reaches, restoration opportunities, funding sources, partnership opportunities, and a design/implementation plan.
- **F.** Support counties or appropriate groundwater basins to collect existing groundwater data for all sub-basins and **conduct a groundwater inventory to determine data gaps**, including the relationship between ground and surface water.
- **G.** **Add watershed data** to the Sacramento River Watershed Information Module (SWIM) database as a part of this planning effort.
- **H.** Encourage California SB 18 (2005) conservation easements for willing landowners to permanently protect Tribal lands, as well as cultural and environmental resources on Tribal lands. Explore implementation of Tribal conflict resolution suggestions, including:
    - Cooperatively **developing a set of best management practices** for various resource management issues throughout the watershed;
    - **Multi-party monitoring protocols** that implement best practices for forest health and management;
    - **Mutually agreed upon pre and post tests for water-quality monitoring** and evaluation methods for long-term outcomes;
    - Partnerships and projects in the spirit of collaboration with the Tribal Government; and
    - **Conduct a "How-To Workshop"** regarding intergovernmental affairs coordination with Tribe for all local water-management entities.

Goal 7. Support Community Sustainability by Strengthening Natural Resource-Based Economies

The Upper Pit region has a high percentage of disadvantaged communities; a major portion of the region is considered disadvantaged, with a large percentage of that considered severely disadvantaged. This situation leads to a lessened ability of local governments to provide for desired services and infrastructure.[i]

Further, the watershed's traditional natural resource-based and resource extraction-based economy has included: timber harvest and milling; hunting and fishing; hydroelectric, geothermal and wind power generation; and agriculture.

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Shasta Green Mill and Burney Forest Power co-generation plant

The need for economic diversification, and the vulnerability of these industries to the combined forces of natural phenomena as well as market forces, has been a contributing factor to the low-income status of many local communities. Stakeholders express the need to enhance and support industries that add value to or derive from local resources, such as wood products, tourism, agriculture, and recreation.

Objectives

- **A.** Support **two restoration/enhancement projects** that benefit the local economy.
- **B.** Explore **at least two solar, wind, geothermal, and/or biomass projects**.
- **C.** Encourage projects conducted under this Plan to **hire a local workforce**.
- **D.** Seek Stewardship Contracts from the U.S. Forest Service to **conduct at least one** ecological restoration project.

Goal 8. Improve Agency Programs and Policies by Increasing Accuracy, Accountability, and Effectiveness

A strong culture of independence is evident in the planning region along with a mistrust of public agencies, compounded by what is seen as inconsistency between regulatory processes. Generally, concern is expressed over three topics: the 303(d) listing of the Pit River and tributaries, the

Irrigated Lands Regulatory Program (ILRP), and a deep distrust and dislike of regulations in general.

In part, the impetus for this planning effort was spurred by the local desire to address water-quality concerns that promulgated the listing of the Pit River and many of its tributaries as an impaired waterway under Section 303(d) of the federal Clean Water Act, and its attendant, requisite Total Maximum Daily Load program. The Pit River, from Alturas to Lake Shasta, is listed as impaired for nutrient enrichment, dissolved oxygen, and temperature. Further, the South Fork Pit River was listed as impaired for salinity; however, subsequent monitoring has not upheld high salinity readings for this water body. The North Fork is listed for pH, which is naturally occurring in the underlying, young volcanic deposits.

At issue is whether the Basin Plan should be amended to reflect real and historic conditions in the Pit River and tributary reaches. Many stakeholders believe that natural conditions rather than human activities are contributing to the listing and need to be accounted for. Stakeholders cite frustration with the numerous regulations and qualitative water-quality objectives, as well as the considerable expense associated with monitoring and water-quality improvement.

The Regional Water Quality Control Board (RWQCB) administers these water-quality requirements and programs. The RWQCB has designated beneficial uses for the Pit River and tributaries. These uses include Cold Freshwater Habitat as an existing beneficial use on the North and South Forks of the Pit River and along the mainstem between Alturas and Hat Creek. One of the more controversial water-quality issues in the planning area is whether the Upper Pit should be classified under warm- or cold-water beneficial uses, partially because several naturally occurring geothermal sources contribute water of elevated temperature to the river.

The RWQCB's Irrigated Lands Regulatory Program is likewise of concern to many stakeholders because anyone within the watershed with commercial irrigated land must comply with the ILRP, administered by the RWQCB. The conflict is twofold: 1) fees are seen as excessive, and 2) the program as designed appears ineffective in solving water-quality issues.

Objectives

- **A.** Apply for a **salinity delisting of the South Fork Pit River, a pH delisting in the North Fork, and complete delisting of the Pit River downstream of Fall River** as soon as feasible.
- **B.** **Evaluate the credibility of 303(d) listings** for the Pit River and tributaries and, if appropriate, **request that the State and Regional Board modify the Basin Plan** beneficial-use designations.
- **C.** Work with RWQCB to **re-design the ILRP** to better suit the conditions of upper (as opposed to Sacramento Valley floor) watersheds.
- **D.** **Improve the permitting and public notification required for weather modification** by working with RWQCB and local air quality districts. Recommend that appropriate agencies request full disclosure statements that include: the chemical composition of agents used in weather modification, monitoring protocols for water and soils sampling to determine adverse effects associated with weather modification activities, and a determination of weather modification effects on nearby and/or adjacent regions.
- **E.** Work with state and local agencies to **post water-quality advisories in both English and Spanish** at impaired water bodies with public access.

Goal 9: Provide Adaptive Management Strategies for Conserving Energy and Reducing Greenhouse Gas Emissions

Stakeholders did not identify this as an issue during Plan preparation, but the state IRWMP guidelines suggest providing adaptive strategies for energy conservation as a way to address climate impacts. Reductions in energy consumption have the added benefit of reducing costs, which in turn can help the economic bottom line of all water users. Objectives may be added when projects offering the greatest savings in energy use are developed and proposed.

Objectives

- **A.** Improve energy conservation and economic stability through irrigation/water-pumping efficiencies that **reduce the amount of electricity used over the same number of acres**.
- **B.** Support **three alternative energy projects** on agricultural lands in partnership with existing federal agricultural programs, such as Environmental Quality Incentives Program (EQIP).
- **C.** Include solar-supported pumping **at a minimum of two remote well sites** in conjunction with water-supply infrastructure projects.

[i] A "disadvantaged community" (DAC) is defined by the State of California as a community with an annual median household income (MHI) less than 80 percent of the statewide MHI. Census data from 2000 and 2010 were collected and reviewed to identify disadvantaged communities in the region.

CHAPTER 8. CLIMATE VULNERABILITY

1.0 INTRODUCTION

This climate vulnerability assessment acknowledges that, for some, climate change is a contentious issue. While some watershed residents believe the climate is altering in more recent decades and is being influenced by human activities, such as the addition of greenhouse gases to the atmosphere from burning fossil fuels, others are skeptical that documented changes are anything more than the normal vagaries of weather, and/or that humans have much to do with these variations. At the extreme, climate change is viewed as a political agenda rather than a natural resource or scientific issue.

This debate is not addressed in the following analysis. Rather, as the Integrated Regional Water Management (IRWM) Guidelines require, an overview of weather trends for the watershed is reviewed and includes analysis regarding how trends might affect the daily lives and livelihoods of watershed residents and the future management of the watershed's natural resources. Climate is defined as the long-term record of weather phenomena, and the analysis relies upon scientific data and local and regional weather records and trends. Further, the information has been ground-truthed where possible with local and regional experts familiar with the watershed and people who live and work here.

2.0 CURRENT CLIMATE TRENDS

The current climate of the Upper Pit watershed is characterized by hot, dry summers and cold winters. Temperature and precipitation ranges differ from the lower elevations to the higher elevations. The Warner Mountains receive an average of 20 to 30 inches of precipitation (mainly in the form of snowfall) per year, while the lower-elevation valley floors receive less than ten inches of annual precipitation. The watershed is within a semi-arid region characterized by low-elevation intermountain valleys.[1]

2.1 Temperature

The Upper Pit River is considered to be in the Northeast climate region of the Sierra Cascade Climate Province, an area that experiences similar weather and climate patterns. An analysis was made[2] of eight individual weather stations across the Province (two of which are within the Northeast region) from 1895 to present, data compiled from the Western Regional Climate Center (WRCC) from 1949-2005, and from the PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate data set (1931-2010) that tracks long-term climate trends across a broad spatial area.

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[1] Miles, Scott and Charles Goudey. 1997. Ecological Subregions of California, Section and Subsection Descriptions. USDA Forest Service Pacific Southwest Region, San Francisco, CA. Prepared in cooperation with USDA Natural Resources Conservation Service, USDI Bureau of Land Management. Available from: http//fssgeodata.fs.fed.us/otherresources/ecosubregions.html

[2] Merriam, K.E. and H. D. Safford. 2011. A summary of current trends and probable future trends in climate and climate-driven processes in the Sierra Cascade Province, including the Plumas, Lassen and Modoc National Forests. 31 pp. USDA Forest Service, Pacific Southwest Region internal report. Available at: http://fsweb.r5.fs.fed.us/program/ecology/

While the authors found that temperatures had increased across the Province, these increases varied by location, with the Northeast climate region's mean annual temperatures rising the least, or by 1.7 degrees F since 1895. By comparison, mean minimum (nighttime) temperatures have risen by 2.5 degrees F across the Sierra region of the Province during the same period. Further inquiry into individual weather station data (five weather stations within the Upper Pit region) showed even greater localized variation: no significant change in mean temperature was evident at the Alturas station, while at the Hat Creek station, temperatures had declined over the period by 1.9 degrees F. Of note, the Hat Creek station also reported a significant increase in the number of months below freezing, from 5.5 months in 1920 to 6.5 months in 2010.

In summarizing the above discussion, although the Upper Pit watershed has experienced an average rise in temperature over the last century, overall it has not experienced increases equivalent to other higher-elevation regions within the same weather province. And in some portions of the watershed, temperatures have actually remained stable or declined over the last century.

2.2 Precipitation

Merriam and Safford's analysis indicates that the Northeast region experienced a modest increase in precipitation from 1895-1995 according to WRCC data, and almost a three-inch increase across the region in the last 80 years, according to PRISM data. In contrast, Susanville's weather station (just outside the watershed) reported annual precipitation has decreased by almost nine inches since 1893. Mai et al.[3] note that precipitation *variability* has significantly increased at all gauges in the Sacramento River Basin (Southern Cascade Province) on the east side of the [Shasta Trinity] forest.

The significant shift during this period is *the form* in which precipitation arrives. For instance at Hat Creek, while *precipitation* increased, annual snowfall has decreased from 41 inches in 1934 to seven inches in 2009. In contrast, Alturas records show no significant change in snowfall for the period.

2.3 Runoff

Similar to conditions in the northeastern Sierra Cascade Province, the Sierra Nevada is considered one of the most vulnerable regions to climate variability in the continental U.S. due to its relatively warm snowpack. The Sierra snowpack acts as an enormous natural water storage system, accumulating precipitation over the winter and slowly releasing it in spring and early summer. The 1,000-plus dams in the Sierra were designed to take advantage of this predictable and manageable inflow of water to ultimately provide over 60 percent of California's water supply.[4] However, several observers have documented that the Sierra precipitation is arriving ever more often as rain rather than snow, especially at lower elevations, and that the snowpack is melting sooner.

[3] Mai, Christine, F. Levitan, S. Bachman, and W. Brock. Watershed vulnerability to Climate Change, Shasta Trinity National Forest Pilot Project. November 2011. Unpublished paper.

[4] Rothert, S. 2008. Sierra Meadows and Climate Change. Tree Rings, Journal of the Yuba Watershed Institute. 21:18-19. Available from: http://www.yubawatershedinstitute.org/documents/treerings21.pdf

Moser et al.[5] documented a 23 percent decrease in the April-July annual runoff within the Sacramento basin within the recent past.

Perhaps the best and most in-depth analyses on runoff within the region and the watershed come from PG&E, a utility with a significant stake in analyzing and predicting flow inputs to its hydroelectric generating system. PG&E's water management team has documented a "…*significant reduction in the low- to mid-elevation April 1 snowpack during the second half of the 20th century. This appears to be most noticeable within the PG&E headwater drainage from the Yuba River in the central Sierra north into the McCloud and Pit Rivers in the southern Cascades. This downward shift appears balanced among increased frequency of both precipitation occurring as rainfall and earlier snowmelt. The effect has been an overall shift in runoff timing and quantity from the spring into the winter period."*[6]

Freeman points out that the lower-elevation snow zone (below 6,000 feet[7]) is the most sensitive to early melt and lack of seasonal accumulation in recent years. Along with the early melt, the increased rainfall produces runoff at a much faster rate than snowmelt, and has increased the frequency and amount of winter (as opposed to spring) runoff periods.

The shift from spring to winter (November through February) runoff periods has implications for water use and management both within the watershed and for those downstream. In a later analysis on spring snowmelt and sub-basin runoff, Freeman discusses current planning by PG&E to incorporate adaptive water management strategies with the assumption that climate impacts on snowpack and early melt will "…*likely accelerate change in annual snowpack* [into the future]."[8]

2.4 Streamflow

The Upper Pit River watershed has two basic hydrologic systems, each of which suggests different management systems and levels of vulnerability. The watershed's volcanic basalt geology sets it apart from other less-porous Sierra watersheds. These volcanic deposits feature high infiltration capacity that sustains the largest spring-fed river in California, Fall River, as well as its spring-fed tributaries, Hat Creek and Rising River. During an average water year, between 80 and 90 percent of river flow is water that emerges as spring water from an aquifer that may contain as much as

[5] Moser, S., G. Franco, S. Pittiglio, W. Chou, D. Cayan. 2009. The future is now: An update on climate change science impacts and response options for California. California Climate Change Center Report CEC-500-2008-071, May 2009. California Energy Commission, Sacramento, CA.

[6] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G.Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf

[7] Freeman, G. J. 2008. Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation-a mountain hydroelectric system perspective. Western Snow Conference 76:23-34. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2008/Freeman.RunoffImpactsOfClimateChangeOnNorthernCalifornia'sWatersheds.pdf

[8] Freeman, G. J. 2010. Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff. Western Snow Conference 78:107:118. Available from: http://www.sierrainstitute.us/ALMANOR/Freeman_Climate_Change_and_Snowmelt.pdf

16 million acre-feet.[9] For streams and rivers that overlay volcanic aquifers, an increase in winter rainfall is expected to have little effect on flow. Sustained drought appears to be this hydrologic system's primary vulnerability.

Short-term drought seems to have little effect on Fall River baseflow; during two consecutive extremely dry years (1976-1977), little drop in flow was noted. In contrast, the relatively dry period between 1923 and 1964 produced a protracted period of reduced underground storage and subsequent reduction of baseflow in Fall River. In contrast, the period from 1965 through 2006 produced a nine percent increase in precipitation, and a 19 percent increase in Fall River's baseflow.[10]

The other hydrogeological system at work in the watershed involves localized sedimentary and alluvial lake deposits over older metamorphosed volcanic rock. These systems function as shallow-groundwater, shallow-gradient wet meadows, and may be more susceptible to levels of precipitation and timing of runoff, particularly in the dry summer months.

2.5 Flooding

Peak natural flows have increased on many of the state's rivers during the past 50 years. For instance, the five highest floods of record on the American River have occurred since 1950.[11] While the spring-fed systems of the Upper Pit watershed have been documented to sustain relatively consistent seasonal flows, annual-precipitation-dependent streams may experience increased flooding.

Federal Emergency Management Administration maps[12] for the watershed designate areas around Alturas, Canby, Adin, Lookout, Bieber, Nubieber, Fall River Mills, and Burney as within the Zone A – Subject to Inundation from Flooding. Historic flooding has occurred in these areas, although a bridge reconstruction project has prevented recent flooding in Burney, to the extent that local residents are actively trying to remove the flood designation there. Flooding has not been identified as an issue by stakeholders in the region, with three exceptions: 1) in the Parker Creek drainage (Modoc County), 2) in the Bieber area where historic high flows have threatened bridges and homes, and 3) in Alturas in the event there is levee failure, since many emergency services are in the floodplain (see **Potentially Affected Communities and Economic Interests**, below).

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[9] Freeman, G. J. 2008. Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation – a mountain hydroelectric system perspective. Western Snow Conference 76:23-34. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2008/Freeman.RunoffImpactsOfClimateChangeOnNorthernCalifornia'sWatersheds.pdf

[10] Ibid.

[11] California Department of Water Resources. *Managing An Uncertain Future: Climate change adaptation strategies for California's water.* Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[12] FEMA 2005. Zone A – Areas subject to inundation maps. Available from: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1

2.6 Storm Intensity

Along with reductions in snowpack and accelerated snowmelt, greater storm intensity and weather extremes have been documented elsewhere in California.[13] However, climate projections conducted by UCSD staff do not suggest greater *storm intensities* for the Upper Pit watershed for the foreseeable future.[14]

2.7 Groundwater

Establishing an *annual* tie between groundwater elevations and climate in the Upper Pit watershed is difficult because of localized factors of drawdown, geology/recharge, and tapping into groundwater sub-basins by others beyond the watershed. However, as described previously, PG&E's long-term studies of streamflow fed by underground aquifers have indicated a correlation between long-term drought and decreased groundwater elevations (see section **2.4 Streamflow**, above).

2.8 Water Quality

Section 3.3 of the Region Description addresses specific water-quality concerns within the watershed; this section addresses only those concerns that may be exacerbated by climate variability.

Earlier snowmelt coupled with rain-on-snow events that accelerate runoff may increase erosion and higher turbidity, as documented elsewhere in California.[15] Higher water temperatures also have accelerated some biological and chemical processes, increasing growth of algae and microorganisms, the depletion of dissolved oxygen, and produced impacts to water treatment processes. If projected drying of the climate manifests, the period of seasonal low flows may be extended, negatively affecting water quality.

3.0 CLIMATE VULNERABILITIES

The primary objective of this section is to increase awareness of projected climate variation and existing or potential needs related to predicted changes so that local stakeholders can be prepared for and make sound decisions about water management and related infrastructure. Adaptive strategies are offered at the end of each vulnerability discussion, based on solutions offered by stakeholders in the region (please see **Table 8-1**).

It is anticipated that additional information and data and, potentially, additional localized effects of climate variability will manifest in coming decades. While new studies and technologies may emerge for this relatively new science, localized climate information will unlikely need annual revisions as climate is the record of weather phenomena over the *long-term*. Therefore, the

[13] California Department of Water Resources. *Managing An Uncertain Future: Climate change adaptation strategies for California's water.* Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[14] April 2012. Climate projections from Mary Tyree, California Nevada Applications Program, Scripps Institution of Oceanography, UCSD

[15] California Department of Water Resources. *Managing An Uncertain Future: Climate change adaptation strategies for California's water.* Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

Regional Water Management Group (RWMG) may wish to search and review new climate studies annually, but revisit climate projections at longer intervals.

3.1 Climate Vulnerability Working Group

A Climate Variability Working Group (Group) was convened to assist in developing technical information and providing local review and approval of climate data into the climate analyses used in this Plan. (**Chapter 2 Table 2-3** shows the membership of this group.)

The Group met five times between October 2011 and May 2012 to: 1) review and refine data and information used for the climate analyses in the Plan, 2) help direct the approach used by the Project Team and UCSD staff who produced the climate projections, and 3) review drafts and prioritize vulnerabilities as required in the 2012 IRWM Guidelines.

October 28, 2011, meeting: The Group met to determine the level of available climate data for the Upper Pit watershed and available methodology for determining climate vulnerability for both natural and human resources. An overview of the 2010 IRWM Guidelines for climate analysis was presented, as well as a PowerPoint presentation of Variable Infiltration Capacity (VIC) modeling results for the watershed, conducted in summer 2010 by the Project Team.

The Group determined it did not feel comfortable with the veracity of historical flow data upon which the VIC model was based. Mary Tyree, Programmer/Analyst at the California Nevada Applications Program/CASPO, Scripps Institution of Oceanography at UCSD, joined the meeting by conference call and suggested she would work on behalf of the Group to conduct correlation between historic weather data and climate scenario output, interpreting trend data, and produce synthesized graphics that meaningfully displayed historic trends, climate projections over time, and answers to specific questions.

On the parallel track, the Project Team was charged at this point with preparing a draft write-up of existing climate studies and reports generated for the region.

November 27, 2011, meeting: The Project Team gave a more thorough overview of the literature search to date, approach used by the U.S. Forest Service in preparing vulnerability analyses, and the draft handbook the Department of Water Resources (DWR) was preparing to give further guidance on climate analyses.

Group members offered information about sage-steppe restoration analyses, geothermal and flood mapping and issues, fire management, snowpack and precipitation data, and groundwater use. The vulnerability of community infrastructure was discussed, such as culverts and water supply, as well as potential climate impacts on species, particularly redband trout.

The Group then delved into the relative uncertainty of modeled data. It wanted to make sure that projections were conservative and, to the degree possible, defensible. They questioned the veracity of precipitation data from the Canby weather station that they suspected might be compromised. The Group was concerned that the longer the timeframe of analysis, the greater the uncertainty involved. At that point, it determined to examine a 40-year timeframe. The Group acknowledged that climate modeling introduces a level of uncertainty into any analysis, and agreed that simulated and modeled data should not only be treated cautiously, but revisited as this Plan is revised.

The public process for Plan review was discussed and various group members were tasked with gathering localized information to supplement technical analyses.

January 19, 2012, Meeting: Discussion began with how the climate data would fit into and influence the overall Plan. It was explained that several sections of the Plan had been initiated, and that project development was at the initial stage, parallel with climate analyses.

At this meeting, the Group approved pursuing a vegetation modeling exercise based on the MC-1 modeled data interpreted by public foresters. A lengthy discussion followed on the uneven availability of groundwater data and that it should be used cautiously.

The Project Team provided feedback from interim work with the UCSD climate projections staff, correlating local weather data with projection analyses; high correlation was exhibited between actual weather records from the region and projections made by feeding data points into the analyses. The Group felt comfortable with moving ahead with projections, based on these initial results. It came back with specific questions to be answered by the projections, such as frost-free season and precipitation projections.

The Group went through an initial vulnerability analysis based on a checklist provided by DWR's climate handbook. It was explained that the outcome of the Group's climate work was simply to prepare the watershed against climate variabilities, especially when contemplating extremes.

April 6, 2012, meeting: An overview of the process used to produce climate projections was presented. The group decided they wanted to be comfortable with the correlation between locally observed and modeled data, and that they felt comfortable looking at two parameters: temperature and precipitation. Mary Tyree at UCSD then produced slides to examine the correlation between observed data and modeling and saw good correlation. The group directed the Project Team to go forward with modeling for 40-year projections, with a focus on variability, seasonal extensions of growing season, and frost-free days.

Mary Tyree joined the call to explain the latest set of slides being presented. The Group offered extensive feedback on imagery, questioned usability of various slides, and asked for additional slides and analyses on parameters they felt would be useful to, in particular, the agricultural producers, such as frost-free-day projections.

May 17, 2012, meeting: Modeled trends in vegetation covered over time were available for discussion. The Group took a closer look at the future vegetation projections covering the IRWMP region under two of the climate scenarios. The technical methodology for producing these two regional vegetation projections was based upon future climate models with different temperature and moisture assumptions, but the same socioeconomic assumptions. The Group asked for clarifications of several items, with the results being displayed in a technical appendix.

The Group then shifted focus to addressing edits and amendments to the vulnerability analysis and to a technical appendix that included projections and methodology. DWR staff noted that the analyses fully met the 2010 DWR guidelines for climate vulnerability assessment. The Project Team's next steps were to bring the draft analysis to the Northeastern California Water Association (NECWA) and the RWMG for comments and input.

May through November 2012: Review and input from NECWA and the RWMG on the climate analyses followed over subsequent months. To bring the climate analysis into compliance

with the 2012 IRWM Guidelines, climate vulnerabilities were prioritized by email and telephone conversations with committee members in November 2012. These conversations were based on guidance from the *Climate Change Handbook for Regional Water Planning* and information furnished by, and recommendations made by, the Project Team.

3.2 Regional Climate Projections

Based on the existing climate trends analysis directed by the Group, the overall Upper Pit watershed appears to have fared far better to date than many northern California watersheds in terms of both temperature increases and decreases in precipitation. Indeed, localized areas such as Alturas and Hat Creek have either experienced little to no change in these variables, or an increase in precipitation.

Overall, however, this climate region is 1.7 degrees F warmer on average than 100 years ago, and is losing its ability to count on slow-releasing spring snowmelt to feed its upper elevation streams. And while streamflows are anticipated to be stable for the foreseeable future within the lower reaches of the Upper Pit River due to contributions from spring-fed rivers and streams, extended drought could eventually affect those flows.

Combining a knowledge of historic weather records, climate trends, projected climate scenarios, and current water management practices and concerns, as discussed below, will help watershed stakeholders and decision-makers determine how best to manage for climate variability in the future.

3.2.1 Modeled and Simulated Climate Projections

To explore possible future scenarios for climate variables, the Climate Variability Working Group (Group)[i] turned to climate simulations as a tool for examining possible water management challenges in the future. Statistical analyses used for this section were provided by California Nevada Applications Program, Scripps Institution of Oceanography, UCSD. The analysis was informed by four global climate models and data from the local weather stations at Adin, Alturas, Canby (temp only), Burney, and Hat Creek.

The Group acknowledged that climate modeling introduces a level of uncertainty into any analysis, and agrees that simulated and modeled data should not only be treated cautiously, but revisited as this Plan is revised. Please see **Appendix 8-1** for a more complete discussion of how climate projections were made for the Upper Pit region.

***Modeled Findings*:** Simulated projections showed that average summer temperatures are expected to rise by as much as 5°F by 2040 and as much as 10°F by 2099 under the A2 (high GHG) scenario. Under a lower emissions (B1) scenario, temperatures are projected to rise by about half that, or 4-6°F by the end of the century.

A corollary rise in precipitation is not projected; while precipitation will likely vary across the region, it is not expected to increase overall. Growing-degree days[ii] are projected to increase by 25 percent for March and April by 2040, and double under the B1 scenario and triple under the A2 scenario. Growing-degree days are projected to increase in both the spring (March-April) and fall (October). Under both emissions scenarios the number of fall through spring (September through May) days with the minimum temperature below freezing drop from about 200-220 (from

observations and the historical model simulation) to about 170 by mid-century, and to 120-160 days by late century, with some years having below 100 freeze days. This warming and net drying trend could have significant implications, both positive and negative, throughout the region.

3.3 Potentially Affected Natural Resources

3.3.1 Forest and Rangeland Vegetation Vulnerabilities

Attributing potential climate-related trends in forest and rangeland vegetation over time has been made more complicated by management practices, including fire management, grazing, and logging, especially at lower elevations where management has been more widespread and persistent. However, in comparison studies of thousands of forest plots by the U.S. Forest Service of Sierra vegetation during the 1930s with those same plots in 1999,[16] [17] Bouldin and others concluded principal trends that appeared to be related to climate rather than human management pointed to an increase in hardwood-dominated forests, a loss of subalpine and alpine vegetation, and an expansion of subalpine trees into previous permanent snowfields.

It is beyond the scope of the IRWMP to fully explore and assess downscaled climate vegetation projections; however, to better understand how vegetation might change in the watershed under differing climate scenarios, the Group looked at two examples from a set of mapped simulations generated for a project called "Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy."[18] The project relied on the highest resolution for which a dynamic model has been applied in California to project climate effects on vegetation. According to the overall results of the project, "under all climate change scenarios, forests and other types of vegetation will migrate to higher elevations as warmer temperatures make those areas more suitable for survival. For example, with higher temperatures, the area of alpine and subalpine forests will be reduced as evergreen forests and shrublands migrate to higher altitudes. They estimated that if it gets wetter, forests would expand in northern California and grasslands would expand in southern California. If it gets drier, areas of grasslands would increase across the state. Both wetter and drier scenarios resulted in increases in carbon storage (biomass) in California vegetation of between three percent and six percent. Wetter conditions generally allow for more biomass. Under drier conditions, grasslands, which store a relatively high amount of carbon below ground, expand."

The Group took a closer look at the future vegetation projections covering the IRWMP region under two of the climate scenarios used in the Project. These two regional vegetation projections are presented in more detail in **Appendix 8-2** and were based upon future climate models with different temperature and moisture assumptions, but the same socioeconomic assumptions.[19] It is interesting to note that under both projections, conifer forests in the watershed expand. This is due

[16] Wieslander, A.E. 1935. A vegetation type map of California. Madroño 3**:** 140-144.

[17] Bouldin. J. 1999. Twentieth-century changes in forests of the Sierra Nevada, California. Ph.D. dissertation, University of California, Davis, CA, USA.

[18] Lenihan, J.M., et al. 2008. The response of vegetation distribution, ecosystem productivity, and fire in California to future climate scenarios simulated by the MC1 dynamic vegetation model. Climate Change 87 (Suppl 1): S215-S230. Output of potential natural vegetation for California. (model simulations) Available from: http://www.enerty.ca.gov/pier/project_reports/500-03-58cf.html

[19] Nakicenovic, et al. 2000

to MC1 modeling assumptions about the effects of increased atmospheric CO_2 under the two projections.[20]

Again, there is much uncertainty inherent in these modeling efforts. "Rather than a misguided attempt to identify the 'most accurate' climate scenario, managers are strongly encouraged to explore variability through the use of multiple climate scenarios."[21]

***Adaptive Strategies – Forest and Rangeland*:** Prioritize the numerous projects and methodologies being developed to address sage-steppe restoration including thinning and burning of juniper, replanting native grasses, grazing realignment, strategic water development, and noxious weeds/invasive species management.

[20] Dr. Dominique Bachelet, pers. comm., October 2012
[21] RMRS-GTR-227WWW, April 2012

Table 8-1. Climate Vulnerabilities and Strategies to Increase Climate Resiliency					
		Summary of Modeling Results and Relevant Studies	**Vulnerabilities Identified by Stakeholder Group**	**New and Future Strategies to Address Vulnerabilities**	**Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency**
Potentially Affected Natural Resources	**Forest and Rangeland Vegetation**	Under all climate scenarios, forest ecosystems and vegetation **are** projected to migrate to higher elevations as a result of increasing temperatures and little increase in region-wide precipitation (e.g., with higher temperatures, the area of alpine and subalpine forests will be reduced as evergreen forests and shrublands migrate to higher elevations).	Poor habitat condition of sage-steppe communities, some forest habitat, and areas of rangeland in the watershed make them more susceptible to increased fire risk under potentially hotter and drier climate conditions, and make habitat less resilient in supporting native wildlife species.	Thinning and burning of juniper, replanting native grasses, grazing realignment, strategic water development, noxious weeds/invasive species management, and establishing and maintaining robust Fire Safe Councils throughout the watershed.	• Implement the Sage-Steppe Ecosystem Restoration Strategy to re-establish a healthy vegetative condition in the sage-steppe ecosystem. • Restore historic vegetative conditions on and near Ash Creek by removing encroaching juniper, re-establishing streamside cover and removing ladder fuels and pine and oak stands adjacent to Ash Creek on about 3,000 acres.
	Fire	Increased fire severity and intensity is predicted by the latter part of the century, more frequent fires and more area consumed by fires. Some vegetation-growth models predict an expansion of woody vegetation, such as juniper, on many western landscapes.	Studies link increased fire activity to increasing temperatures, earlier snowmelt, and fire suppression, all of which have occurred here. Increased fire severity and intensity is projected, especially for the latter part of the century.	Prioritize areas within the watershed most in need of treatments to reduce the risk of catastrophic fire and to maintain fire-resistance and resilience. Treatments could include mechanical tree and brush removal aimed at thinning and patch treatment, piling of fuels, prescribed burning, and planning and implementing strategic access for fire management.	• The Homestead Forest Health Project on the MNF would contribute to improved water quality and forest health from treatments to overcrowded stands susceptible to insect infestation and severe/ widespread fire. This 2,100-acre project would shift vegetative cover to a mixed conifer forest with a mosaic of species, and once again favoring production of Ponderosa and whitebark

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentially Affected Natural Resources	**Fire**, *cont'd*				pine. • Restore fire-resistant and fire-resilient ecosystems in a 35,000-acre area extending from Highway 44 on the north to Lassen Volcanic National Park to the south, overlapping both the Hat Creek and Lost Creek watersheds and on the 5,500-acre Whittington Project about five miles south of Burney. • Create a Fire Safe Council for Burney.
	Invasive Species	Future regional climate is likely to favor certain invasive species, such as knapweed and cheat grass. Additional invasive species identified in the watershed, such as Eurasian watermilfoil and signal crayfish, act as stressors on native species that, when combined with lower flows, or erratic flow regimes more likely with greater climate variability, can cause decreased species viability for desired species, such as native Shasta crayfish and redband trout.	Decreased species variability within natural systems could result in degraded habitat for native species and economic losses for agricultural producers.	Use integrated pest management on terrestrial noxious weed species, including: prioritization of most effective strategies; mechanical, chemical, and grazing treatments; revegetation; and monitoring to improve water quality and habitat condition. Continue implementing the collaborative Eurasian watermilfoil pilot project that uses integrated pest management, experimental treatments and monitoring, and provides additional data on this invasive species.	• Fall River Valley Community Services District has identified an area along the east side of the Fall River infested with Mediterranean sage, Scotch thistle, and knapweed that needs weed management. • The Fall River RCD and local partners have been working on a multi-year project to eradicate Eurasian watermilfoil on the Fall River system that displaces desirable vegetation, impedes flow, contributes to flooding, and degrades habitat and water quality.

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentiallv Affeted Natural Resources	**Species and Habitat**	The watershed is host to myriad species of special concern that may be climate-sensitive (e.g., are wetland-dependent, or occupy elevational niches projected to be affected).	Prioritize needs for aquatic habitat connectivity; provide in-steam barriers to signal crayfish to protect Shasta crayfish; prioritize wetland, vernal pool, and riparian restoration; maintain healthy aquatic systems or create water developments to support key species; promote activities that increase stream shading and flow attenuation, such as meadow restoration; adopt best management practices that reduce channel alteration and sedimentation; and determine where infrastructure replacements can be most meaningful (e.g., culvert and bridge projects that increase connectivity, reduce barriers).		• Restore specific wet meadow and/or spring habitats already identified by stakeholders to improve shallow groundwater storage, increase summer base flows, improve in-stream-habitat diversity, and create a vegetation community within the meadow that is dominated by species adapted to moist soil conditions. • Reconnect about a mile stretch of Egg Lake Slough with its floodplain, restoration of five to ten acres of wetland habitat, and the restoration and protection of two miles of riparian habitat to improve water quality and slower release of water supply by minimizing bank erosion and facilitating natural hydrologic function.

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentially Affected Communities	**Flooding**	The risk of flooding could be exacerbated by early snowmelt and increased winter, as opposed to spring, runoff.	The City of Alturas has experienced significant flooding on numerous occasions in the 20th century. Currently, the entire city and Modoc County emergency response system sits within the 75-year floodplain. Parker Creek, the major tributary to the North Fork of the Pit River, has been identified as an area of focus for water management issues. Previous restoration projects conducted in the watershed were largely washed out in the floods of 1997 and 2005. In the Bieber area, historic high flows have threatened bridges and homes, due primarily to the disconnection of stream channels from their floodplains.	Design (potentially to greater flood flows) and install a series of upgrades to the city levee. Carry out assessments and designs of habitat restoration and infrastructure needed to reduce flooding in Parker Creek and Bieber.	• Implement proposed projects to address flood attenuation in Alturas to prevent levee failure. • Implement proposed habitat restoration and infrastructure projects to reduce impacts of flooding in Parker Creek.
	Ground Water	Lassen County Board of Supervisors and residents in Big Valley have identified groundwater availability concerns in both domestic and agricultural wells. Decreases in precipitation coupled with warmer and drier conditions are projected that could affect groundwater supply.	Drying climate coupled with population growth and other human-caused factors could threaten local groundwater supplies.	Designate a single entity to gather all known sources of groundwater data for the region and make this compendium known to all water managers in the region. Implement more extensive groundwater monitoring to fill data gaps on groundwater trends and quality.	• Implement the Lassen County Groundwater Basin Management Objectives.

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
	Water Supply	Warming temperatures along with projected earlier snowmelt and little projected increase in regional precipitation could affect water supply.	Antiquated, leaking water supply infrastructure coupled with drying conditions could negatively impact water availability.	Conduct leak detection, pipeline repair/replacement and meter calibration. Subsequently consider providing fee incentives for customers who meet conservation objectives per household.	• Implement the proposed Fall River Mills water main replacement. • Adopt Basin Management Objectives and implement corrective actions for all watershed sub-basins.
Potentially Affected Economic Interests	**Hydrologic Power Generation**	Continued change from snowfall to rainfall is anticipated to begin having a cumulative effect on hydroelectric production by about 2020 to 2025.	With less predictable runoff periods and potentially more intensive storm events, hydroelectric generation management will be more challenging and may involve competing with other storage needs, such as flood control and natural system needs.	Managers may increase storage in the winter in anticipation of critical summer needs and subsequently with the need to spill in order to accommodate wet winter or intensive storm flows.	• Increased cloud seeding has been considered by PG&E.
	Wood Products Industry	Potential climatic changes are expected to shift forest types and species mixtures within the watershed.	The changing conditions may continue to render forests susceptible to insect invasion and fire, which may in turn create a greater need for thinning.	Opportunities may increase for thinning and subsequently processing dead and dying trees for biomass production.	• See adaptive strategies for **Fire**, above.

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentially Affected Economic Interests	**Agriculture**	More frequent drought, the drying effects at upper elevations from earlier snowmelt, potential variation in storm events, greater variability in temperatures and more intense storm events could potentially affect agriculture. Ditch losses of up to 80 percent have been identified in the watershed.	Non-irrigated agriculture – grazing and dryland hay – may be the most vulnerable to projected climate changes. If temperature increases continue, evapotranspiration rates will also likely increase water demand for irrigated agriculture. Projected longer growing seasons (more frost-free and growing-degree days) could benefit crop production and local agricultural profits, and could affect the current crop mix. Late-season low flows and potentially increased climate variability, including longer droughts interspersed with more intense storms, are two existing and potentially growing climate trends that could make local agriculture vulnerable. Irrigation inefficiencies also reduce overall water supply, both for agriculture and other beneficial uses, increasing agricultural vulnerability.	Prioritize agricultural irrigation efficiency improvements, potentially giving priority to 303(d) listed streams, projects having multiple benefits (i.e., habitat improvement, water quality and water supply enhancement, multiple partners) and implement these.	• The Pit River and Fall River Valley RCDs have identified opportunities to capture and reuse irrigation tailwater to prevent this from re-entering the rivers, and thus promote irrigation efficiency and improving water quality. • A diversion on Rattlesnake Ditch below Big Sage Reservoir that is badly leaking and at risk of failure. High flow events could cause failure of this diversion. • Open ditches could be replaced by underground piping along the Pit River, Burney Creek, Hat Creek, and several tributary streams and ditches.

		Summary of Modeling Results and Relevant Studies	Vulnerabilities Identified by Stakeholder Group	New and Future Strategies to Address Vulnerabilities	Examples Of Existing and Proposed Projects That Can Help the Watershed Increase Climate Resiliency
Potentially Affected Economic Interests	**Recreation**	Climate projections of potential greater storm intensity and variability may impact recreational infrastructure and fish and game species.	Forest infrastructure such as bridges, culverts, campgrounds, and roads may be damaged by increased variation in flows, while recreational fish species may be negatively affected by diminished water quality. Forage for big game species may be affected by increased invasive species, but these species may benefit from milder winter temperatures as well.	Assess public and private forestry road inventories for hot spots of sediment delivery and correct; conduct bridge and culvert inventory to replace undersized or failing infrastructure; reassess flood risk and establish recreational facilities out of potentially elevated peak flows. Update and maintain baseline data on trout populations that identify threats, including weather events, and help prioritize restorative actions. Reduce identified human-induced stressors, such as invasive species and sediment delivery.	

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- The Sage-Steppe Ecosystem Restoration Strategy[22] is designed for sage-steppe management across 6.5 million acres of predominantly public land, including portions of the Upper Pit watershed. The purpose of the project is to restore natural processes of the sage-steppe ecosystem prior to its current domination by encroaching juniper. Part of this project is aimed at restoring hydrologic function. This project would also restore habitat for the Greater Sage-grouse, a species of special concern, as well as other sage-steppe-dependent-species. (See also Record of Decision for the Strategy.[23])
- Restoring historic vegetative conditions on and near Ash Creek by removing encroaching juniper, re-establishing streamside cover, and removing ladder fuels and pine and oak stands adjacent to Ash Creek on about 3,000 acres. The treatments are meant to enhance fire resiliency, reduce transpiration from invasive juniper, and improve streamside condition.

3.3.2 Fire

The Pit watershed is included in one of two geographic regions in Northern California that has experienced especially increased fire frequency, size, and severity in the last two to three decades (Westerling et al. 2006).[24] The Westerling study strongly links increased fire activity to increasing temperatures, earlier snowmelt, and fire suppression, all of which have been documented for the watershed. Most wildfires in the Sierra Cascade Province were documented in years with early springs.

In another study by Miller et al. (2009), fire's effect on forest vegetation was documented, with fires of stand-replacing severity increasing from 17 percent to 30 percent between 1984 and 2007. Again, a combination of climate variables and increasing forest fuels explained these results.

Increased fire severity and intensity is predicted, both from direct extrapolation of trends and from modeling projections specific to California. Lenihan et al. found that the frequency and the size of fires would increase under most scenarios; however, the change is not projected to be significant until the latter part of the century. The drier scenarios result in more frequent fires and more area consumed by fires. The wetter scenarios result in fires of greater intensity than those in the dry scenarios because more fuel (vegetation) would grow when it is wet to be consumed by fire during occasional dry periods. Some vegetation-growth models predict an expansion of woody vegetation, such as juniper, on many western landscapes, which could produce greater fuel loads and thus more severe fires.

***Adaptive Strategies – Fire*:** Prioritize areas within the watershed most in need of treatments to reduce the risk of widespread and intense wildfires and to maintain fire resistance and resilience. Treatments could include mechanical tree and brush removal aimed at thinning and

[22] Modoc National Forest-Alturas Field Office, Bureau of Land Management, Modoc County. *Sage Steppe Ecosystem Restoration Strategy Final EIS.* April 2008. RS-MB-161. Available from: http:// www. blm.gov/ca

[23] http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/alturas.Par.67107.File.dat/sage%20steppe%20rod.pdf

[24] Westerling, A.L., and B. Bryant. 2006. Climate change and wildfire in and around California: fire modeling and loss modeling. Report from the California Climate Change Center to the California Energy Commission. CEC-500-2006-190-SF.

patch treatment, piling of fuels, prescribed burning, and planning and implementing strategic access for fire management.

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- Restore fire-resistant and fire-resilient ecosystems in a 35,000-acre area extending from Highway 44 on the north to Lassen Volcanic National Park to the south, overlapping both the Hat Creek and Lost Creek watersheds and on the 5,500-acre Whittington Project about five miles south of Burney.
- The Homestead Forest Health Project on the MNF would contribute improved water quality and forest health from treatments to overcrowded stands susceptible to insect infestation and severe/widespread fire. This 2,100-acre project at the south end of the Warner Mountains would shift vegetative cover from dense stands of lodgepole pine and white fir to a mixed conifer forest with a mosaic of species, and once again favoring production of Ponderosa and whitebark pine.
- Create a Fire Safe Council for Burney.

3.3.3 Vulnerabilities Exacerbated by Invasive Species

Future regional climate is likely to favor certain invasive species, such as knapweed and cheat grass. In a study that examined the main driving factors on cheat grass invasion under potential climate change scenarios in a high-elevation, sagebrush-dominated ecosystem, Rivera found that wetter and warmer climatic conditions favor cheat grass establishment, confirming the findings of previous studies.[25] Rivera also notes that, "*The combined effect of fire and grazing, which implies the reduction in of native species, has been identified as significant factors for the growth and reproduction of cheat grass*. . ." Similar climate future conditions and management in some areas may favor cheat grass and rob the watershed of future forage values.

Additional invasive species identified in the watershed, such as Eurasian watermilfoil and signal crayfish, act as stressors on native species that, when combined with lower flows, or erratic flow regimes more likely with greater climate variability, can cause decreased species viability for desired species, such as native Shasta crayfish and redband trout.

***Adaptive Strategies – Invasive Species*:** Use integrated pest management on terrestrial noxious weed species, including: prioritization of most effective strategies; mechanical, chemical, and grazing treatments; revegetation; and monitoring to improve water quality and habitat condition. Continue implementing the collaborative Eurasian watermilfoil pilot project that uses integrated pest management, experimental treatments and monitoring, and provides additional data on this invasive species.

[25] Rivera, S. 2011. Predicting the impact of climate change on cheat grass (bromus tectorum) invasibility for northern Utah: A GIS and remote sensing approach. From: http://digitalcommons.usu.edu/nrei/

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- Fall River Valley Community Services District has identified an area along the east side of the Fall River infested with Mediterranean sage, Scotch thistle, and knapweed that needs weed management.
- The Fall River RCD and local partners have been working on a multi-year project to eradicate Eurasian watermilfoil on the Fall River system that displaces desirable vegetation, impedes flow, contributes to flooding, and degrades habitat and water quality.

3.3.4 Species and Habitat Vulnerabilities

Please see **Chapter 3 Region Description, Fisheries and Habitats and Species of Special Concern** for an in-depth discussion of these topics. The Upper Pit watershed is host to an extensive list of species of special concern, partially because so many of these species have evolved locally (are endemic to the region) and are therefore limited in number and range. In this section, discussion has been confined to challenges facing riparian, aquatic, and shallow-groundwater-dependent species and habitat, as well as those species that appear to be affected by elevational habitat niches, or other climate-sensitive habitat. Further, they only include specific species for which recovery efforts are being made in the watershed, or for which concern has been expressed by stakeholders.

Local biologists have identified those species likely susceptible to alteration of habitat by climate, including severe and prolonged drought, drying of shallow groundwater that could affect wet mountain meadow and vernal pools, and to deterioration of water quality from a variety of factors mentioned in section 3.3 of the Region Description. Warming of water temperatures and shifts from spring to winter runoff could interrupt breeding and rearing of aquatic species as well as the insects and prey species they depend upon. These stressors could potentially result in loss of species.

Recovery efforts directed at the Shasta crayfish have been ongoing. According to information on the Spring Rivers Foundation website, by the early 1990s there were only four isolated subpopulations of Shasta crayfish remaining in the mainstem Fall River downstream of Thousand Springs. Shasta crayfish populations have been hard hit by two factors: increased sediment contributed from upstream erosion and competition for habitat by the non-native signal crayfish. If sediment delivery were to increase from accelerated runoff from increased storm intensity, the endemic Shasta crayfish could be adversely affected.

Redband trout are another species of concern in the upper watershed tributaries, mostly on public lands. Climate variations coupled with management on both public and private lands could affect this species. Several tributaries to the Pit River, as well as the Pit River itself, are known to support or may support redband trout and other endemic fish species (see **Chapter 3 Region Description, 1.1.7 Fisheries**). Bank erosion, that could be increased by greater storm intensity, has been identified as destroying riparian habitat and nesting gravels.

The Merriam and Safford (2011)[26] analysis of climate trends cites a study by the Museum of Vertebrate Zoology that compared surveys of terrestrial vertebrates at 41 sites along a transect in the southern Sierra, one completed between 1914 and 1920, and the other completed in the last decade. The comparisons revealed that many of these high-elevation species are shifting or expanding their geographic ranges upwards in elevation. Most upward shifts are consistent with climate warming for high-elevation species, while lower- to mid-elevation species shift are likely the result of vegetation changes related to fire history.

Other studies indicate that mobile species, such as birds and butterflies, are moving and adapting either to higher elevations, or more northerly in latitude to maintain habitat conditions to which they are adapted. Species with less ability to move, either because of habitat specialization or limited physical mobility, don't necessarily fare as well. Frogs and toads, for instance, are exhibiting widespread declines from a variety of factors, one of which appears to be the stressor effects of climate variability. By way of example, six lakes studies in California and Nevada have warmed by 0.2^0F per year since 1992. "A comparison with air temperature observations suggests that the lake surface temperature is warming approximately twice as fast as the average minimum surface air temperature" (Schneider et al. 2009).[27]

Vernal pools: Greene's tuctoria is a tufted annual in the grass family. One known occurrence exists on high-elevation private lands within the administrative boundary of the Lassen National Forest, and is the only site in Shasta County. This species was listed as endangered by the State of California in September 1979; subsequently, critical habitat was designated for all of the listed vernal pool species in August 2003 (68FR46683). As with the other vernal pool species, the primary threat to Greene's tuctoria is habitat alteration, which could include a diminishment of water contributions to the pools from climate variation.

Wet meadows, fens, and springs: Wet meadow, fen, and spring degradation in the watershed has been identified as a primary issue (addressed by three goals) in the *Upper Pit Watershed Management Strategy*[28] that if corrected, could help address water quality, late-summer low flows, *and* habitat quality for wetland-dependent species.

The four Important Bird Areas identified by the National Audubon Society in the Upper Pit watershed support wetland-dependent bird species, many of which are rare in California, or unique to the area. These include: Sandhill Crane, Willow Flycatcher, Swainson's Hawk, Long-billed Curlew, and White-faced Ibis. Drying of wet meadow habitat due to a reduction in localized precipitation and/or changes in local management could adversely affect these species.

***Adaptive Strategies – Species and Habitats*:** Prioritize needs for aquatic habitat connectivity; provide in-steam barriers to signal crayfish to protect Shasta crayfish; prioritize wetland, vernal pool, and riparian restoration; maintain healthy aquatic systems or create water developments to support key species; promote activities that increase stream shading and flow

[26] Merriam, K.E. and H. D. Safford. 2011. A summary of current trends and probable future trends in climate and climate-driven processes in the Sierra Cascade Province, including the Plumas, Lassen, and Modoc National Forests. 31 pp. USDA Forest Service, Pacific Southwest Region internal report. Available at: http://fsweb.r5.fs.fed.us/program/ecology/

[27] Schneider, P., S. J. Hook, R. G. Radocinski, G. K. Corlett, G. C. Hulley, S. G. Schladow, and T. E. Steissberg (2009), Satellite observations indicate rapid warming trend for lakes in California and Nevada, *Geophys. Res. Lett.*, 36, L22402, doi:10.1029/2009GL040846.

[28] Pit River Watershed Alliance. *Upper Pit River Watershed Management Strategy*. 2010.

attenuation, such as meadow restoration; adopt best management practices that reduce channel alteration and sedimentation; and determine where infrastructure replacements can be most meaningful (e.g., culvert and bridge projects that increase connectivity, reduce barriers).

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- Specific wet meadow, fen, or spring habitats identified by stakeholders as in need of restoration are located at/within: Lower and Upper Ash Creek Wildlife Areas, Burney Gardens, Butte Creek Meadow, Hunsinger Draw, Beaver Creek, Parker Creek, Canyon Creek, Fitzhugh Creek, and Egg Lake Slough. Addressing these needs would improve shallow groundwater storage, increase summer base flows, improve in-stream habitat diversity, and create a vegetation community within the meadow that is dominated by species adapted to moist soil conditions.
- U.S. Fish and Wildlife Service has identified the need to reconnect about a mile stretch of Egg Lake Slough with its floodplain, restoration of five to ten acres of wetland habitat, and the restoration and protection of two miles of riparian habitat to improve water quality and slower release of water supply by minimizing bank erosion and facilitating natural hydrologic function.
- At Hat Creek, about 6.3 miles of river corridor and 1.5 miles of in-stream habitat restoration would be aimed at improving conditions for native trout. The need is seen to protect with shading one of the state's largest spring-fed streams from the effects of climate warming.
- Erosion below the North and South Forks of the Pit River, caused by a re-channelization project in the 1950s to prevent flooding in Alturas, is causing extensive damage to streambanks and contributing to habitat degradation and water quality problems. Extreme flow events could greatly exacerbate this erosion/sedimentation.
- The Central Modoc Resource Conservation District, along with Ducks Unlimited and Natural Resources Conservation Service (NRCS), has been repairing a series of dams downstream of the confluence of the North and South Forks of the Pit River. These dams create waterfowl habitat as well as water for irrigation diversion. High flow events in the last 20 years have eroded the levees on either side of the dams and are in need of repair.

3.4 Vulnerabilities of Communities and Economic Interests

Population growth trends over the past decade appear modest within the watershed. No major economic driver that would attract a significant influx of population is foreseen in the near future (**see Chapter 3 Region Description**). Therefore, significant cumulative effects of population growth when combined with climate vulnerabilities do not appear imminent.

Aside from issues related to population trends, the following climate-related vulnerability issues have been identified during public meetings and outreach with stakeholders in the watershed.

3.4.1 Communities

Flooding: The City of Alturas has experienced significant flooding on numerous occasions in the 20th century; risk of flooding could be exacerbated by early snowmelt and increased winter, as opposed to spring, runoff. Currently, the entire city and Modoc County emergency response system sits within the 75-year floodplain, including the emergency services dispatch center, the

hospital and ambulances, the police department, the sheriff office, the fire department, and the veterans hall. The levee system was originally engineered for a 75-year event, and is unfortunately designed such that once breached, water is prevented from draining back to the river. The cement walls of the levees are crumbling and need to be replaced. During high-water events, significant amounts of woody and plant debris accumulates on the bridge pilings the entire length through the city. If enough accumulates, the material creates a dam, holding back water and increasing the risk of flooding and/or failure of the bridge structure. There is also sediment accumulation at the bottom of the channel which may reduce its effectiveness and flow capacity.

Parker Creek, the major tributary to the North Fork of the Pit River has been identified as an area of focus for water management issues by NRCS, Central Modoc RCD, the Pit River Tribe, and the U.S. Forest Service. Previous restoration projects conducted in the watershed were largely washed out in the floods of 1997 and 2005. Some of the irrigation infrastructure such as diversions, control dams, and culverts were also damaged or completely destroyed, leaving debris in the channel that is now causing further bank erosion. The significant amount of sediment that comes down Parker Creek from erosion later collects in the City of Alturas' sediment traps. These are close to full, and the city does not have the funds to clean out the traps regularly. Sediment and debris is also collecting on the structural supports for overpasses, which could plug up the stream channel and cause extensive flooding in the city.

In the Bieber area, historic high flows have threatened bridges and homes, due primarily to the disconnection of stream channels from their floodplains.

***Adaptive Strategies – Flooding*:** Design (potentially to greater flood flows) and install a series of upgrades to the City of Alturas levee system to meet U.S. Army Corps of Engineers requirements and to protect the city and county infrastructure from catastrophic flooding due to levee failure. Realize opportunity to re-design the channel to improve the aesthetics and hydrology of the streamflow. Carry out an assessment, design, and implementation of habitat restoration and infrastructure needed to reduce impacts of flooding in Parker Creek and Bieber.

Groundwater: Lassen County Board of Supervisors and residents in **Big Valley** have identified groundwater availability concerns in both domestic and agricultural wells. Decreases in precipitation coupled with warmer and drier conditions in the watershed and population growth could combine with other human-caused factors to threaten local groundwater supplies. Sustainable use of groundwater will not be possible without a landscape-level approach to understand if current withdrawals are outstripping recharge.

***Adaptive Strategies – Groundwater*:** Designate a single entity to gather all known sources of groundwater data for the region and make this compendium known to all water managers in the region. Implement more extensive groundwater monitoring to fill data gaps on groundwater trends and quality by the following documentation:

- Assess declining well levels in Fall River and Big Valley.
- Quantify water need for the community service districts now and into the future; past, current, and projected need.
- Analyze the number of times major reservoirs in the region have been dry in recent years. Determine total volumes and the percent of the volumes of irrigated agriculture use they represent versus runoff in the Pit River system.

Water Supply: Fall River Valley Community Services District has documented a 31 percent loss of water between the well and the consumer within its antiquated water system, making it vulnerable to reduction of water supply due to climate variability. Some of its supply lines are so brittle and some valves so old they will require replacement rather than repair. Contamination of supply is also of concern due to compromised lines and major drawdowns during fire-fighting events that may suck contaminated water within faulty water lines into the domestic water supply.

Burney Water District staff has identified the need for water-use efficiency measures to assure adequate water supply into the future, especially in times of drought and anticipating future demand. While some of the water supply system has been replaced by newer PVC pipes, much of the system has older, rusting and crumbling iron pipes. Further, several large water meters serving the system are in need of calibration, for which the city lacks the equipment to conduct.

***Adaptive Strategies – Water Supply*:** Conduct leak detection, pipeline repair/replacement and meter calibration. Subsequently consider providing fee incentives for customers who meet conservation objectives per household.

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- Implement Fall River Mills water main replacement that would prevent contamination from entering the public water supply through leaks and breaks in the line, conserve water by plugging leaks, and conserve energy by alleviating the need to pump extra water necessitated by leaks.
- Construct water tanks in Bieber and McArthur to provide backup supply for local communities. By having more storage capacity, slow-regenerating wells can be used to provide more reliable domestic water supply.
- Adopt Basin Management Objectives and implement corrective actions as recommended in a groundwater management plan for Lassen County.[29]

3.4.2 Vulnerabilities of Economic Interests

Hydroelectric Power Generation: PG&E has conducted an extensive study on changes in timing and type of precipitation to better predict the effect that these climate variations would have on hydroelectric generation from the Pit watershed's runoff into the future. Continued change from snowfall to rainfall is anticipated to begin having a cumulative effect on such production by about 2020 to 2025.[30] While the Pit River's flows are largely influenced by steady aquifer outflows (primarily from Fall River) rather than low-elevation snow loss, previous multi-decadal droughts that decreased this abundant subsurface flow are cause for concern to PG&E. Reduced snowmelt from other sub-basins that cumulatively feed its northern and central California generation system cause PG&E to anticipate that, "*…if climate change impacts on the diminishing snowpack continue, associated impacts of climate change to hydroelectric operations are likely to eventually occur and*

[29] Brown & Caldwell. 2011. Big Valley Management Area Basin Management Objective Development Guidance Document. Prepared for Lassen County, CA. August 5, 2011.

[30] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G.Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf

must be planned for in terms of developing additional adaptation alternatives."[31] In other analyses, PG&E has suggested this could include cloud seeding.
The shift to rainfall versus snowfall increases the chances of sediment movement, in turn filling water storage facilities. With less predictable runoff periods and potentially more intensive storm events, hydroelectric generation management will be more challenging and may involve competing with other storage needs, such as flood control and natural system needs.

***Adaptive Strategies – Hydroelectric Generation*:** Managers may increase storage in the winter in anticipation of critical summer needs and subsequently with the need to spill in order to accommodate wet winter or intensive storm flows.

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

Fall River Valley CSD has received preliminary permitting and financing for the construction of a small hydroelectric generating plant to take advantage of PG&E's seasonal releases of Fall River water into the Pit River, currently spilled to cool flows for benefit of imperiled Shasta crayfish.

Wood Products Industry: As discussed in previous sections, potential climatic changes are expected to shift forest types and species mixtures within the watershed. The changing conditions may continue to render forests susceptible to insect invasion and fire, which may in turn create a greater need for thinning. This could signal the need for a shift in the wood products industry to accommodate the processing of smaller-diameter trees.

***Adaptive Strategies – Wood Products Industry*:** Opportunities may increase for thinning and subsequently processing dead and dying trees for biomass production.

Agriculture: Non-irrigated agriculture – grazing and dryland hay – may be the most vulnerable to more frequent drought, the drying effects at upper elevations from earlier snowmelt, and potential variation in storm events. Greater variability in temperatures and more intense storm events could potentially result in crop loss, but could also expand the number and type of crops grown. If temperature increases continue, evapotranspiration rates will also likely increase, further affecting dryland agriculture and increasing water demand for irrigated agriculture. Projected longer growing seasons (more frost-free and growing-degree days) could benefit crop production and local agricultural profits.

Late-season low flows and potentially increased climate variability, including longer droughts interspersed with more intense storms, are two existing and potentially growing climate trends that could make local agriculture vulnerable in certain areas of the watershed. Irrigation inefficiencies also reduce overall water supply, both for agriculture and other beneficial uses, increasing agricultural vulnerability. Ditch losses of up to 80 percent have been identified in the watershed.

***Adaptive Strategies – Agriculture*:** Prioritize agricultural irrigation efficiency improvements, potentially giving priority to 303(d) listed streams, projects having multiple

[31] Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G._Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf

benefits (i.e., habitat improvement, water quality and water supply enhancement, multiple partners) and implement these.

Examples of Proposed or Existing Projects That Could Reduce Vulnerability

- The Pit River and Fall River Valley Resource Conservation Districts have identified opportunities to capture and re-use irrigation tailwater to prevent this from re-entering the rivers, and thus promote irrigation efficiency and improving water quality.
- A diversion on Rattlesnake Ditch below Big Sage Reservoir that is badly leaking and at risk of failure. High-flow events could cause failure of this diversion.
- Open ditches could be replaced by underground piping along the Pit River, Burney Creek, Hat Creek, and several tributary streams and ditches.

Recreation: Regarding public lands, the Shasta Trinity National Forest[32] conducted a climate vulnerability assessment that identified an increased risk of damage to public infrastructure, such as roads, campgrounds, water diversions, bridges, and culverts from predicted climate factors such as rain-on-snow events and increasing peak winter flows, as previously projected for this watershed by Freeman and others.

Local fly-fishing outfitters, who depend on a healthy trout population for their livelihood, as well as anglers and the Fall River Conservancy, have identified sedimentation and Eurasian watermilfoil in Fall River as two primary threats to the local trout fishery. Despite extensive studies, "two to four feet of fine sediment (275,000 cubic yards) still blankets much of the upper river while invasive aquatic plants continue to spread throughout the lower portion of the river."[33] The long-term impacts of these threats remain unknown, but anecdotal evidence from local observers suggest that the fishery value is deteriorating. Climate factors that could add to the stress to the fishery include increased sedimentation from accelerated or high-intensity runoff events and rising temperatures.

***Adaptive Strategies – Recreation*:** Assess National Forest and private forestry road inventories for hot spots of sediment delivery and correct, conduct bridge and culvert inventory to replace undersized or failing infrastructure, reassess flood risk and establish recreational facilities out of potentially elevated peak flows.

Update and maintain baseline data on trout populations that identify threats, including weather events, and help prioritize restorative actions. Reduce identified human-induced stressors, such as invasive species and sediment delivery.

3.5 Prioritizing Climate Vulnerabilities for the Region

After the Climate Variability Working Group considered the guidance of DWR's *Climate Change Handbook for Regional Water Planning* (see **3.1 Climate Vulnerability Working Group, May through November 2012**) and in light of the region's unique characteristics, it determined that four issues are co-equal as high priority vulnerabilities: water supply and quality for disadvantaged communities, water supply for agriculture, habitat quality, and groundwater supply and quality. Objectives and projects that address these prioritized vulnerabilities are included, respectively, in **Chapter 7 Goals and Objectives** and **Chapter 9 Project Development and Implementation**.

[32] Mai, Christine, F. Levitan, S. Bachman, and W. Brock. Watershed vulnerability to Climate Change, Shasta Trinity National Forest Pilot Project. November 2011. Unpublished paper.

[33] http://fallriverconservancy.org/issue/

Water supply and quality for disadvantaged communities is subject to multiple stressors, both from the potential drying and warming of the region and from the limited ability of local constituents to address domestic water-supply security. With the region's high percentage of disadvantaged communities, furnishing safe domestic supply for the first time, securing redundant supply in areas of unknown recharge, or replacing old, outdated systems emerged as a priority.

While nearly 60 percent of land in the region is publicly owned, the majority of private land in the region is largely agricultural. This industry is a primary economic engine for the region, and its irrigated agriculture relies on both ground and surface water. As identified in the vulnerability analysis, dry cycles manifest in both surface and groundwater regimes in the region, and groundwater use is increasing significantly in recent decades. So, enhancing irrigation efficiencies and reducing pumping costs are two means of reducing agricultural vulnerabilities.

The region prizes its fisheries and wildlife habitat in recognition of its intrinsic value to watershed health, for its beauty, and for the economic draw that healthy habitat produces for recreational tourism. Projected changes in temperature and water supply for fisheries and wildlife will subject such resources to multiple stressors. Habitat connections for fisheries may be reduced due to low flows. Therefore, objectives and projects to address critical habitat and restoration issues are paramount.

Groundwater resources are not only critical to both domestic and agricultural supply in the region, but present a conundrum for water managers. Little comprehensive data are available to regional water managers, and that problem is exacerbated by local wariness that groundwater monitoring will bring about additional regulation. Without progress forward on this issue, the region is vulnerable to using its groundwater at an unsustainable rate, made even more so by potential heat and drying.

4.0 CLIMATE CHANGE MITIGATION/GREENHOUSE GAS REDUCTION

4.1 Mitigation Strategies

Climate mitigation strategies and greenhouse gas (GHG) reduction methods are required as part of an IRWMP. The Project Team looked for guidance from the *Climate Change Scoping Plan* 2008, prepared by the California Air Resources Board (CARB), to evaluate identified climate mitigation strategies that might be applicable to the Upper Pit region. Because this region supports a largely dispersed population of only around 14,000, has little industrial infrastructure aside from forest-products processing, and does not, to any great degree, support GHG-intensive agricultural operations, such as dairying and row cropping, many of the suggested strategies are not locally applicable.

The CARB "recommended actions" relating to sustainable forests, water, and agriculture may hold the most promise locally and are embodied in the objectives and projects proposed in this Plan. CARB's proposed sustainable forest actions that offer the most promise in the region are carbon sequestration through sustainable forestry practices and prevention of widespread and intense forest fires. The sage-steppe restoration project, several forestry and fuels management projects, and restoration that stabilizes grasslands and forest ecosystems help address maintenance of California as a "carbon sink," in other words, more carbon is removed from the atmosphere in California at present than is generated from processes, such as wildfires and forest land conversion. Carefully calibrated fuels reduction projects also help assure that frequent widespread fires do not

shift this carbon sink balance. Biomass processing from forest residue also has been a potential project suggested under this Plan, although economic conditions will need to become favorable for this strategy to see local manifestation.

Improvements in water delivery, treatment, and use are another area of regional relevance addressed under the CARB strategies. IRWM Guidelines state that GHG emissions are associated with all aspects of water management, including: habitat management; recreation; domestic, municipal, industrial, and agricultural water supply; hydroelectric power production; and flood control. Since activities related to water management result in significant amounts of GHG emissions (19 percent of the electricity and 30 percent of the non-power-plant natural gas of the state's energy consumption are spent on water-related activities), several state mandates and strategies are aimed at reducing GHG contributions from this sector of energy use.

Two of the six CARB water-related strategies are most applicable for this region: improvements in water-use efficiency and water system energy efficiency. Objectives and projects to implement those objectives in this Plan address improved delivery, reduced water loss, and improvements in pumping efficiency. Pumping water over long distances, from the ground or over significant elevations, is one of the primary contributors to agricultural water-related energy use. Therefore, the strategy of improving groundwater pumping efficiency may yield the best GHG reductions under this Plan.

CARB strategies associated with agriculture typical of this region include improving fuel efficiency of on-farm equipment, water-use efficiency as mentioned above, and carbon sequestration from restoration of riparian, grassland, and forested areas. Objectives and projects in this Plan address the latter two actions; the IRWMP can address improving on-farm fuel efficiency via an objective to develop and share BMPs and through stewardship outreach with local watershed groups.

4.2 Greenhouse Gas Reduction

In keeping with the integrated, regional approach embodied in this Plan, the Project Team reviewed and has incorporated the relevant findings of the *Shasta Regional Climate Action Plan* 2012, prepared by Shasta County – the only Regional Climate Action Plan (RCAP) prepared to date in the four-county region. While there is no adopted requirement for local jurisdictions to establish emissions reduction targets, Shasta County chose to draft the plan to allow for project streamlining under the California Environmental Quality Act (CEQA) and in anticipation of future mandatory state requirements to fulfill state emission reduction goals. The plan states:

"*While the jurisdictions [in Shasta County] are serious about supporting statewide emissions reduction targets, local efforts need to be compatible with supporting a strong local economy and protecting the personal freedom of Shasta County residents and businesses. The plan's measures were also written to reflect the character of the development in the county. Traditional climate action planning measures that have been developed for urban communities do not make sense in these jurisdictions, nor would ambitious programs that require expensive local funding commitments. The RCAP measures were written to rely heavily on voluntary, market-based programs that can be implemented economically, and on existing utility- and jurisdictionally-sponsored programs.*"

Lands in Shasta County account for only about a quarter of the watershed, but these lands support about half the region's population. Further, the above statement aptly captures the independent and economically conservative sentiments of local stakeholders. Since the Shasta County RCAP is

the best locally generated information generated to date, it has been referenced below to create a context for the GHG regional discussion.

According to the Shasta RCAP 2008 inventory of total GHG emissions, the unincorporated areas of Shasta County generated an estimated 3,131,054 metric tons of CO_2. Of that, stationary sources (buildings and development) accounted for 73 percent of total emissions. Agriculture generated four percent of total emissions at 132,234 metric tons and forestry generated 156,538 metric tons, or five percent of GHG emissions. This is not to downplay the importance of energy efficiency and GHG reduction; it is only to put it in perspective. Stakeholders in the Upper Pit region are concerned that so much emphasis has been put on this issue, and skeptical that their efforts to meet GHG project review requirements will contribute in a meaningful way to state goals. They believe that for capacity-strapped, rural, low-population regions such as this, the state might consider different standards and expectations for project review vis-à-vis GHG reduction.

Additionally, many of the construction equipment-related and transportation-related emissions calculated for currently proposed projects will potentially become outdated as emission reductions from state- and federal-mandated actions related to transportation take effect. These include: passenger vehicle and light truck fuel-efficiency standards, low-carbon fuel standard, non-Pavley passenger vehicle efficiency programs, medium- and heavy-duty vehicle efficiency improvements, SB 375, 2008 and 2013 California Title-24 standards, and the renewable portfolio standard.[iii]

There exists a small potential (because of the low population base and lack of local resources for project implementation) to reduce GHG emissions through incentives and/or education provided by local water purveyors associated with rate reductions for conservation, low-water-use appliances and fixtures, future metering, and programs that encourage drought-resistant residential landscaping. These ideas are also captured in the Plan.

As well, some small amount of GHG mitigation could result from the recycling of construction waste, such as brick, concrete, lumber, metal, and dry wall through project design and/or Shasta County's proposed Lumber Waste Diversion Ordinance. The use of alternative energy systems to run pumps and other equipment, particularly related to remote community infrastructure, also offer some potential for GHG emission reductions.

4.2.1 GHG Reduction Considerations for Project Design

The Project Team conducted GHG emissions calculations for Tier 1 ready-to-proceed projects recommended in this Plan. (Please see **Chapter 13 Technical Analysis** for the methodology used to undertake these emissions calculations and **Appendix 8-3** for these individual analyses.) These calculations are a requirement for projects seeking DWR funding and offer a means of considering mitigations to reduce projected emissions among project alternatives.

IRWM Guidelines suggest that common emissions sources from projects are related to:

- Operations of construction equipment
- Passenger vehicle trips during construction and operation
- Transportation of construction materials and equipment
- Transportation of material inputs for O&M
- Transportation of material outputs or production
- Generation of electricity used for operation of projects
- Waste generation and disposal of materials during construction and operation

Reduction strategies during project design and project mitigations under CEQA/NEPA review could include any of the applicable measures listed below:

Project construction-related transportation

- Offer local contractor preference and local purchase of construction materials where possible to reduce transportation-related emissions
- Encourage or require carpooling within construction contracts
- Encourage use of B20 fuels in construction equipment and other diesel machinery
- Restrict inappropriate OHV use, particularly in sensitive or restored areas where project investments have been made

Project construction-related emissions

- Encourage or require recycling of construction waste, such as brick, concrete, lumber, metal, and dry wall, as may be required within Shasta County from the proposed Lumber Waste Diversion Ordinance
- Pursue projects in this Plan that would use biomass from fuels reduction projects
- Capture sequestration opportunities with forest, sage-steppe, riparian, and grassland revegetation, stabilization, and restoration projects

Water supply and water efficiency improvements

- Select project components and upgrades, such as pumps, based on energy efficiency
- Schedule pumping to reduce peak hour (12:00 to 5:00, highest carbon output) energy use
- Select projects that offer the best water conservation options among project choices (e.g., greatest reuse/recycling, greatest reduction in leakage or evaporation per mile)
- Install solar generation equipment for pumping and other energy-generation needs to reduce both emissions and long-term O&M costs
- Increase conservation/reduce water use (and thus the energy and emissions related to its delivery) with increased metering, favorable rate incentives for conservation, and education within utility bills

4.2.2 Environmental Compliance

The PRC will need to document through its project review process that: 1) emissions from a proposed project have been determined, 2) GHG mitigations have been incorporated into the project, 3) the project may help in adapting to climate change over the 20-year planning horizon, and 4) a determination of significance has been made.

The CEQA lead agency will need to develop significance criteria for its CEQA reviews. It may be a qualitative, quantitative, or performance level of a particular environmental effect above which impacts will normally be considered significant. Three basic strategies have been formulated to date: 1) a net-zero threshold, 2) a non-zero significance threshold based in compliance with AB32 (falls beneath a reporting requirement for 25,000 metric tons of $C0_2$ per year), or 3) other established GHG reduction strategies. IRWM Guidelines suggest considering the following questions in developing non-zero threshold significance criteria:

1) Does the project implement or fund its fair share of a climate mitigation strategy (perhaps as suggested from the list above, under GHG reduction strategies)?

2) A brief description of how and in what ways the project moves California toward a lower carbon future.
3) How closely does the project's overall GHG emissions balance approach net zero?
4) Are there process improvements or efficiencies gained by implementing the project?

5.0 FUTURE DATA GATHERING FOR CLIMATE VULNERABILITIES

The RWMG will determine during its annual review if updates that materially affect the Plan need to be appended, and whether climate vulnerabilities continue to be relevant and appropriate. New strategies and adaptations or mitigation may also emerge that warrant a change in objective or its metric.

It is anticipated that additional information and data and, potentially, additional localized effects of climate variability will manifest in coming decades. While new studies and technologies may emerge for this relatively new science, localized climate information will unlikely need annual updates as climate is the record of weather phenomena over the *long-term*. Therefore, the RWMG may wish to search and review new climate studies annually, but revisit climate projections at longer intervals. Revisions to the Plan will accommodate these updated data and studies accordingly. IRWM Guidelines encourage RWMGs to stay involved with the California Natural Resource Agency's California Adaptation Strategy process and to consider joining the California Climate Action Registry at: http://www.climateregistsry.org.

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[i] The Climate Variability Group is made up of several professionals and other interested stakeholders wishing to inform this aspect of the Plan.

[ii] A growing-degree day is defined as the cumulative number of degrees above 50 degrees F for each day in a defined period of time. For any days not reaching 50 degrees F, no "bonus points" are added to total degree days.

[iii] From Shasta RCAP, page 2.5: The largest anticipated reductions are from state and federal fuel efficiency improvements to passenger vehicles and light-duty trucks. As residents and businesses replace older vehicles with newer, people will consume less fuel and generate fewer emissions per vehicle-mile traveled. California's low carbon fuel standard will also reduce transportation-related emissions in the community by requiring a transition away from fossil fuels (i.e., gasoline and diesel) toward lower-carbon bio-fuels (e.g., ethanol). Implementation of the regional SB 375 Sustainable Communities Strategy will reduce vehicle emissions through development of effective transit and other alternative transportation systems and encouragement of low-carbon development. California law also requires all utilities to obtain 33% of their electricity from renewable energy sources by 2020. In 2008, 12% of PG&E's portfolio was generated from renewable sources. The medium- and heavy-duty vehicle efficiency improvements program and California Energy Code (Title 24) requirements for new construction will create smaller, but still important, community-wide emission reductions.

CHAPTER 9. PROJECT DEVELOPMENT AND IMPLEMENTATION

1.0 INTRODUCTION

This chapter is intended to ensure the process used for submitting, reviewing, and selecting projects is documented and understandable for regional stakeholders and the public. It is also to assure that projects that implement the Plan are identified and their status clearly presented.

Projects are the implementation aspect of the Plan, and as such will benefit from cooperative and collaborative development to eliminate redundancy; optimize resources of time, staff, and money; reduce conflict over approach; and improve project design. This chapter discusses the process for project development, the concept of "guideline compliance" and how to accomplish it, the Project Review Committee's (PRC) approach to scoring projects; and how projects can be developed and submitted to the Integrated Regional Water Management Plan (IRWMP) process into the future. State IRWM Guidelines encourage regional stakeholders to develop a tailored regional process by which projects are developed, evaluated, and integrated, and how project 'gaps' are to be addressed. The following sections set forth this process. Future projects will be considered for addition to the Plan on at least an annual basis during Plan revisions and updates, as discussed in **Chapter 11 Plan Performance and Monitoring**.

2.0 PROCESS OF PROJECT DEVELOPMENT

The development of projects for inclusion in the Plan began in October 2011 with a region-wide call for projects. The initial outreach strategy to identify and involve possible project sponsors was informed by Regional Water Management Group (RWMG) members who had knowledge about previous and ongoing project development and implementation activities in the region. This initial outreach specifically included local entities with a history of successfully developing projects to address issues identified by the various watershed assessments and the watershed management strategy. Ongoing outreach activities were also informed by the preliminary issues list developed after the sub-regional work groups met in September and October 2011, as well as input by RWMG meetings in March and October 2011.

Direct outreach to potential project sponsors was accomplished using email, personal conversations, targeted meetings, and informal dialog. Following this outreach effort, an exploratory meeting was held on January 19, 2012, in Bieber where all invited stakeholders attended. During that initial meeting the attendees were: given an overview of the suggested project development process, given a thorough briefing on the IRWMP guidelines pertaining to the development and review of projects for inclusion in the IRWMP, presented a list of projects that had been submitted to date; broken up into a variety of topical and geographic work groups to consider the options for project integration; and presented an opportunity to refine the project development process.

The outcomes of that initial January meeting included several important points of agreement: initially the projects would be integrated on a watershed basis (rather than by topic type – such as infrastructure, natural resource restoration, or agricultural water efficiency), that the various project sponsors wanted to convene an ongoing committee to focus specifically on developing and integrating projects, and that the PRC should request approval by the RWMG.

Issues identified by the RWMG (based on public comment, PRC input, and its own deliberations) are listed below. These issues have and will continue to inform project development:

- Water Quality Concerns: temperature, dissolved oxygen, sediment, bacteria, nutrients, potential sources of mercury
- 303(d) Listing/warm- versus cold-water fishery
- Groundwater quality and quantity
- Seasonal low flows
- Water supply reliability
- Need for additional water storage
- Stream channel alteration
- Alteration of aquatic, riparian, and wetland habitat
- Non-native (invasive) species
- Needs of Disadvantaged Communities (DAC)
- Decline in forest products industry, fluctuation in resource-based economy/lack of job opportunity
- Impacts of hydropower generation
- Outdated community infrastructure and access to sewer and water systems for DACs
- Flood management
- Tribal perspectives on issues
- Illegal garbage dumping
- Impacts to recreation, and from recreational uses
- Stream-channel downcutting
- Impacts on wet meadows, fens, springs, and vernal pools
- Need for sage-steppe restoration
- Weather modification
- Widespread drainage of land
- Fire suppression
- Need for fuels management
- Unhealthy conifer and rangeland conditions
- Sensitive wildlife species and game species
- Needs of watershed stewardship education groups
- Need for a watershed improvement project directory
- Distrust of public agencies
- Cost of mandatory water monitoring related to 303(d) listing and the Irrigated Lands Regulatory Program
- Perceived abundance of and inconsistency among regulations
- Opposition to this Plan

2.1 Formation and Activities of the Project Review Committee

Subsequently, the RWMG affirmed both the PRC and the objective of having all project development, scoring, evaluation, and funding recommendations for projects occur within that committee. The RWMG retained the ability to review materials generated by the PRC, assist in resolving any disputes arising from project development, and have final approval of all projects recommended for inclusion in the Plan. The PRC had a total of seven meetings over the planning period through January 2013.

At the initial PRC meeting in January 2012, the Project Team described the process of having projects included in the IRWMP. The Department of Water Resources (DWR) funding-cycle

schedules and projected funding amounts were discussed at length, as were the concepts of project tiering, project integration for funding applications, and ranking/scoring of projects. Previous to this meeting, the Project Team had worked with potential sponsors to complete project applications; 73 initial projects were submitted as of that meeting and shared among participants.

Integration was discussed at length and project sponsors agreed to try to integrate by geographic location as they were concerned about questions of equity when considering prioritization. Subsequent to this meeting, all applications were made available on a password-protected Website and additional information on process and guidelines was requested.

Over the next several months, the PRC took up the refinement of project applications and discussion about potential ranking/prioritization/scoring of projects. A timeline was set for project submission, tiering, developing scoring criteria, project refinement, and integration. The relationship between issues, resource management strategies, objectives, and projects was discussed. During this period, the PRC determined to expand its notion of integration to include: project geography, bundling to address a particular objective, and project-type groupings.

As the PRC matured, it agreed that membership should include all who attended and a request was made in May 2012 by the PRC to have this recommendation approved by the RWMG at its following meeting. It also decided to tackle the decision about whether to rank projects within the IRWMP. It used scoring criteria developed by another IRWMP with Upper Pit projects and priorities in mind, as well as how these criteria met DWR's revised 2012 Guidelines. The Project Team was directed to collate comments and bring the amended criteria back to the PRC at its next meeting. It also recommended to the RWMG that the PRC-developed scoring criteria be included in the Plan for the long term.

By fall 2012, the PRC agreed to designate 11 projects as Tier 1, discussed below, with three of those projects on conditional status depending on whether they could complete required information for their respective applications in a timely manner. The group agreed that Guideline-compliance evaluations would only take place on Tier 1 projects (see **2.5.2 Guideline Compliance**).

Further discussion of the scoring criteria was discussed and it was decided by the PRC not to rank projects for the Plan, but rather to score projects when funding sources applicable for multiple projects became available. Draft scoring criteria were discussed with amendments to be forwarded to the Project Team for consideration at the next meeting. The group also determined it needed to draft a conflict resolution process.

By December 2012, the project scoring criteria were finalized and it was agreed the criteria would be used at the discretion of the PRC to score projects when funding opportunities arose. The PRC decided not to break into subcommittees to score projects of similar types, but instead to require sponsors to provide technical justification and project feasibility assessments to the PRC to help determine project readiness. A determination was made that Tier 2 and 3 projects should not be able to claim support/endorsement by the Plan with prospective funders until they went through the PRC review process to become Tier 1, and that this should be clarified in the Plan. A PRC conflict resolution process was recommended for adoption to the RWMG along with voting procedures as outlined below.

2.2 Initial Call for Projects – Step 1 Applications

To recruit projects for potential inclusion in the Plan, the RWMG and PRC developed a simple, two-page form for project sponsors to submit their initial project ideas – from conceptual to fully developed projects. The form, known as a Step 1 Application, was distributed using an email list developed at the initial meeting of the PRC, with follow-up consultation/clarification with meeting attendees. The form asked the sponsors a series of questions about the project including: the project type (selected from a list), a brief description of the project, a simple project timeline, a list of any partners or collaborators, questions to determine project readiness to proceed (e.g., design, available match, environmental review), a preliminary budget, project outcomes, and issues the project addressed. This level of information assisted in determining whether a project was "shovel ready," nearly ready to go, or simply at a preliminary conceptual level. A copy of the Step 1 Application form is provided in **Appendix 9-1**.

The potential project sponsors were given several weeks to prepare and submit the application forms. The Project Team was made available to any sponsor needing assistance or advice about level of detail, types of "acceptable" projects, and other similar questions.

The Project Team reviewed each application for a variety of factors: location/watershed, project sponsor, project type, possibility for integrating each project (based initially on location, type of project, and regional significance), budget, and readiness to proceed. This initial review of projects enabled the Project Team to provide several aggregated lists of projects to the PRC (i.e., projects listed by watershed, by sponsor, and by type), as well as identification of possible programmatic areas based on submitted projects. As a direct result of the PRC discussion of submitted projects and continued project recruitment, an additional 20-plus projects were ultimately developed. (See **Appendix 9-2** for a list of all the projects received and their project tiering, and **section 2.5** below for a description of the tiering process and criteria.)

2.3 Targeted Communities Project Development Process

2.3.1 DAC

Addressing critical water supply needs of DACs and environmental justice issues was a primary objective of the project development process. Each DAC that had a community service district or municipal representative was personally contacted early in the process and was successfully recruited into the PRC. Within the venue of the PRC, water supply managers throughout the region helped each other design projects and craft potential funding packages (including needs assessments, work plans, and grant proposals) for projects that could address critical supply issues. An outcome of these efforts is a joint leak-detection project between communities, Tribal water supply, replacement of failing water tanks, and additional water storage. (Please see **Table 9-5** and **Chapter 12 Finance**.)

Additionally, considerable technical support was provided via workshops, trainings, and individual consultations by the Project Team to support project development (see **Chapter 2 Issues and Conflicts** for further discussion).

2.3.2 Tribal

The Tribal project development process followed a slightly different timeframe than that of other project sponsors. This was due to two factors: 1) changes in Tribal staffing that necessitated a delay while new staff was oriented and brought into the process, and 2) the passing of Tribal elders that necessitated a pause in the outreach effort. Tribal Council members were active partners in the development of potential projects and dedicated portions of five Council meetings to site visits, targeted discussions, presentations by staff, and deliberations about Tribal projects. Tribal staff members have extensive experience with successfully preparing projects for consideration by the Environmental Protection Agency (EPA), Bureau of Indian Affairs (BIA), and Indian Health Service. The Project Team met with Tribal staff members on numerous occasions to ensure that the relative delay in initiating project development did not preclude Tribal projects from due consideration by the PRC. Eight Step 1 Applications were ultimately developed and submitted to the PRC for consideration. A theme that emerged during discussions with the Tribe is development of essential assessments for critical water quantity and water quality needs of the dispersed and sometimes remote Tribal communities.

2.4 Integration Process

The DWR IRWMP guidelines specifically require that integration be considered during project review. The PRC interpreted integration to mean an intentional review of projects to determine opportunities for coordination to develop complementary projects that generate multiple benefits and/or meet multiple Plan objectives. This was not meant to preclude the inclusion of single "stand alone" projects, but rather to ensure that the importance of achieving multiple and quantifiable implementation objectives and benefits is held as a Plan standard.

Project integration included several specific and intentional considerations:

1. Geographic/Watershed: Under this standard the integrative principle is geographic location. Projects would be looked at based on their location within the watershed, for instance, a sub-watershed such as Hat Creek. This principle might result in the integration of multiple projects of different types, but all of which benefit a geographical area.
2. Project Type: Early on in the Step 1 process it became clear there were definite 'types' or categories of projects such as: community infrastructure, meadow restoration, fuel and fire reduction, and irrigation efficiency. Using this principle, all projects that address a particular issue would be looked at as a group and opportunities to aggregate, merge, or identify compatible projects would be evaluated. This option might generate a set of water tank installation or repair projects or a set of water distribution system improvement projects. The projects generate similar benefits in multiple locations. An example of this type of project is the Burney/Fall River Mills/McArthur/Bieber leak detection project – in which a single set of equipment is purchased, staff in each jurisdiction is trained in the use of the equipment, and the equipment is then shared between all four communities. This enables a definite economy of scale and also allows the jurisdictions to focus funds on repair rather than purchases of duplicative equipment.
3. Plan Goals/Objectives: Under this standard the integrative principle focuses on aggregating or organizing projects by the goal/objective they most closely align with. This offers an opportunity to identify projects that meet multiple goals or objectives, as well as multiple projects that address a specific goal/objective. At some point, project sponsors may wish to

aggregate projects that, for instance, address wet-meadow restoration to meet objectives on sediment reduction and habitat improvement.

After much deliberation, the PRC determined that all three types of integration should be considered by the committee throughout their efforts to develop a coherent and high-value set of projects for Plan inclusion, without any single principle having precedence. As a result of this, the additional decision was made to include projects in the Plan in two distinct ways: via a listing of individual projects and via creation of project "suites" or "bundles." In this way, project sponsors maintained their own distinct project descriptions and outcomes, but were also able to work with other sponsors to develop aggregations of projects that yielded multiple benefits and met multiple Plan objectives.

The integration process then advanced to the next stage. The Project Team evaluated all of the Step 1 Applications to identify options for integration. The options were submitted to the PRC. The PRC then debated, both in meetings and through outside conversations, the best integrative strategies. As a result of these deliberations, a conscious decision was made to pursue integration by project type as the initial filter for this Plan version: the group focused on infrastructure projects for critical water supply needs. This resulted in numerous conversations between water managers across the region and ultimately in the development of a variety of significant projects; for example: a four-community joint leak detection project, a four-community (including the Pit River Tribe) critical water supply well installation/repair or replacement, and the Pit River Tribe rural homesite water availability assessment and facility installation.

2.5 Project Tiering

The PRC and Project Team decided to use a tiering process because, while the IRWMP Guidelines clearly prefer projects to be ready-to-proceed prior to their endorsement by the Plan, the guidelines specifically provide for partially developed or conceptual projects as well:

> "*Remember that the product of the process is actions that will implement the IRWM Plan. Therefore, it may be wise to accept project concepts or ideas, as long as there is a process in place to take these concepts and ideas to fully developed implementation projects. . .*"
>
> *"The projects included in the IRWM Plan are the projects that will implement the Plan and achieve the Plan objectives. The projects should represent priorities of the planning effort and represent a wise investment for state grant funding. Hence, the process should not be designed to only select based on readiness to proceed.*"

Keeping in mind that it wanted to accommodate the full spectrum of projects to carry out Plan objectives, but distinguish which projects might be of the greatest readiness to go forward for funding, the PRC made the decision to assign a tier status to each project, using a three-tiered system: Tier 1 – ready-to-proceed with sufficient information submitted to complete a Guideline-compliance (A-L) analysis; Tier 1B ready-to-proceed, but lacking adequate match; Tier 2 – partially prepared; and Tier 3 – conceptual (see **Table 9-1**). Each project sponsor was contacted by a team member, resulting in a preliminary tier designation for each project. This tiered list was then presented to the PRC.

At the October 30, 2012, PRC meeting, it was determined that each Tier 1 and 1B applicant should be interviewed again to determine if each project met all the critical Tier 1 criteria. (Since some of

the projects had well over 25 percent match, they could supplement the total match package for Tier 1B projects lacking adequate match.) This activity was undertaken (again using personal communication). As a result of this activity, the Tier 1 list was reduced to 11 Tier 1 and 1B projects (see **Table 9-2**). Over the course of the project-tiering activities, it became clear to the PRC that the relatively low number of Tier 1 projects was a direct result of a lack of capacity and/or resources of project sponsors to fully develop their projects. These deficiencies ranged from lack of staff and necessary technical expertise, to lack of funding to gain CEQA/NEPA compliance, as well as lack of match and/or ability to complete cost/benefit analyses.

Further, the PRC decided at its December 2012 meeting that Tier 2 and 3 projects would all have an asterisk or some distinctive marking in the Plan which makes it clear that Tier 2 and 3 projects cannot claim IRWMP support; the Tier 2 and 3 projects still need to go through the PRC and RWMG approval process to become Tier 1 and obtain IRWMP support. A letter template will be developed that shows the status of the project from the PRC/RWMG for project funders. As Tier 2 and 3 projects become sufficiently developed to achieve Tier 1 status, they too will be reviewed for Guideline compliance and endorsement by the Plan. It is important to note that even though these projects are not yet endorsed by the Plan, the concepts embodied in them go a long way to implementing the objectives in the Plan. For a complete list of projects by tier, please see **Appendix 9-2.**

TABLE 9-1. Criteria for Establishing the Appropriate Tier for a Project
Tier 1 *Tier 1A – All information complete* • CEQA/NEPA completed (documentation done or available by May 1, 2009) • Measurable outcomes identified • Project work plan and schedule complete • Budget complete • Partners confirmed • Scientific/technical analysis underway – project objectives demonstrably achievable • DAC determination complete • Consistency with goals and objectives evaluation complete • Minimum 25 percent match documented, or DAC exemption from match requirement *Tier 1B – All information complete – Less Than Minimum Match* • As above, but less than the minimum 25 percent match
Tier 2 Any one or several of the following criteria not yet met. • CEQA/NEPA not yet completed • Measurable outcomes not yet identified • Project work plan and schedule incomplete or lacking detail • Budget incomplete or lacking detail • Project partners not confirmed • Integration options not yet explored • Technical feasibility not yet documented • Ability of project to deliver identified outcomes unknown or unproven • DAC determination not yet done • Match less than 25 percent
Tier 3 A project that would meet Plan objectives, but that is still at the developmental stage. • Project work plan and schedule not yet prepared • Partners not identified • No measurable outcomes yet identified • Project feasibility not yet determined

2.5.1 Guideline Compliance

Once project tiers were established, projects were reviewed for Guideline compliance. They underwent an evaluation to determine if they were sufficiently developed to provide substantive answers to DWR Guidelines Project Review Criteria A–L (see **Table 9-2**). To be sufficiently developed, a project must have a complete project description, work plan, schedule and budget, as well as a clearly defined set of project outcomes. The technical feasibility of the project must be known as well as: its relationship to various key IRWMP sections (e.g., objectives, resource management strategies, adaptations to climate change); the benefits to DAC/EJ/Tribal communities; and how the project assists in fulfilling the strategic implementation of the IRWMP itself. Finally, all permits and environmental review must be completed. These same general criteria constitute, for the purposes of this Plan, a ready-to-proceed status.

Table 9-2.
DWR Project Review (A-L) Criteria

Projects must be evaluated using the following criteria prior to endorsement by the Plan:

A. How the project contributes to the IRWM Plan objectives
B. How the project is related to resource management strategies
C. Technical feasibility of the project
D. Specific benefits to critical DAC water issues
E. Specific benefits to critical water issues for Native American Tribal communities
F. Environmental Justice considerations
G. Project costs and financing
H. Economic feasibility
I. Project status
J. Strategic considerations for IRWM Plan implementation

One of the advantages of IRWM planning is to use the regional perspective to leverage any efficiencies that might be gained by combining or modifying local projects into regional projects. In reviewing projects for inclusion in the IRWM Plan, the RWMG must consider a project's merit in light of strategic aspects of Plan implementation such as:

- Purposefully restructuring or integrating projects
- Purposefully implementing a project as-is
- Purposefully meeting project goals with an alternative project/modified project Plan objective priorities
- Purposefully implementing regional projects
- Purposefully implementing projects with multi-benefits

K. Contribution of the project in adapting to the effects of climate change
L. Contribution of the project in reducing GHG emissions as compared to project alternatives

The 11 projects in **Table 9-3** were reviewed for endorsement by the Plan using the project-review criteria (A-L) in the IRWM Guidelines; these evaluations are contained in **Appendix 9-5**.

Table 9-3. Tier 1 Guideline-Compliant Projects				
Project	**Sponsor**	**Total Budget**	**Match**	**% Match**
Joint Leak Detection Program	FRVCSD	$133,750	$33,250	25%
Fall River Mainline Replacement*	FRVCSD	$4,555,500	$700,000	15%
McArthur Sewer Installation	FRVCSD	$5,333,000	$1,696,900	32%
McArthur Water Tank	FRVCSD	$1,491,000	$700,000	47%
Bieber Water Tank*	FRVCSD-LCWW	$218,600	$5,000	2%
Home Field Water Supply Reliability**	Upper Pit Tribe	$250,000	$0	0%
Pit River Tribe Critical Water Supply and Quality Assessment and Repair**	Upper Pit Tribe	$500,000	$0	0%
South Ash Valley Watershed Restoration	Pit RCD	$1,975,000	$1,375,000	70%
Little Valley Watershed Restoration	Pit RCD	$1,199,600	$849,000	71%
Ash Valley Irrigation Efficiency	Pit RCD	$399,846	$100,000	25%
Beaver Creek Restoration	Fall River RCD	$429,077	$247,700	58%

Note: *indicates Tier 1B – lack of sufficient match **indicates DAC match exemption

2.6 Priority Information Elements

During the project development and review process it rapidly became clear that there were a considerable number of projects that addressed education, data management, and data gaps and studies. The PRC determined that each Tier 1 project would have a line item for these project elements, *as appropriate to the project and the funding source*. In this way, funding for information elements that address critical issues/objectives can be secured through the implementation process. The rationale for this decision was that educational and data collection and evaluation projects are inherently at a disadvantage when compared to projects that result in "brick and mortar" implementation. Examples of this approach would be inclusion of a groundwater basin study in conjunction with well development for critical water supply, the development of water conservation materials for consumers/customers as part of a leak detection project, or the preparation of materials documenting the values of wetlands and mountain meadows as part of a restoration project.

2.7 Ranking and Scoring/Evaluation

Over the course of several meetings, the PRC determined it did not want to conduct an overall project prioritization or ranking process because it determined that collaboration and integration are critical to maximizing benefits to the watershed through strategically aligning opportunities, particularly in the face of limited financial resources. Integration of projects reduced conflict and actively demonstrated the benefits of a multi-strategy approach.

With integration and collaboration an overriding principle for long-term stewardship, it would be counterproductive to parse apart the numerous projects in an attempt at prioritization; projects

often were, and are anticipated to remain, interrelated or interdependent. The PRC determined *at every opportunity* to emphasize collaboration, and not competition, for limited resources, both in financial and human capital. They determined instead that when a grant opportunity arose, the PRC might choose to first score projects using a general scoring criteria (see **Appendix 9-3**). Projects that scored high would then be further ranked against a group of similar project types (e.g., restoration, irrigation efficiency). The highest scoring projects for that funding source would then be considered for integrative opportunities that best fit the grant/source.

2.8 Identification of Project Development Framework

In its first few meetings, the PRC determined that they did not want to use a programmatic framework for developing projects. Instead, the group decided to use the goals and objectives identified by the Plan as a framework for developing and ranking projects, as well as a mechanism for identifying gaps in project development (i.e., goals/objectives for which no projects have been developed or proposed).

Table 9-4 illustrates how the PRC used this approach to both develop projects and identify project gaps. Though the evolution of projects and goals and objectives were undertaken on parallel tracks, it became obvious over time that this comparison was a useful exercise. It should be acknowledged that not every issue in the Plan is addressed by an objective, nor is every objective addressed by a project; the RWMG wants to be realistic in what it can accomplish.

Table 9-4. Project Development by Goal	
Goal	**Example Project Types**
1. Improve Water Quality	Sewer system repairs, replacement or installation Septic system assessments, replacement, repair and/or installation Groundwater monitoring and/or testing Riparian bank stabilization Culvert replacement Levee enhancement Instream impoundment repairs and maintenance Livestock exclusion fencing
2. Improve Water Supply and Availability for Irrigation	Improvements to raw water conveyance systems Piping and/or lining of raw water distribution canals Irrigation efficiency Flash board management protocols
3. Sustain/Improve Aquatic and Terrestrial Communities, Habitat, and Ecological Function	Habitat restoration – wetlands, riparian, meadows, instream Forest Management Roads decommissioning and/or modification and native plant re-vegetation Fuel load reduction Rangeland restoration (e.g., use of fire to restore native bunch grasses) Habitat improvements, including increased water quantity Spring development and improvement Parkways and trails installation and/or improvement Wildlife water development Boat inspection program for invasive aquatic species Species reintroduction (salmon specifically mentioned) Flood plain restoration
4. Control and Prevent the Spread of Invasive Species	Direct removal of invasive species Pilot projects to develop more effective containment or control methods Direct application of approved management techniques (e.g. herbicides, manual treatments)
5. Improve Efficiency and Reliability of Community Water Supply and Other Water-Related Infrastructure	Treatment plant improvements Repair and replacement of distribution lines and systems Leak detection and repair Water tank repair, replacement, or installation Creation of water supply redundancy (new wells) Levee enhancement Water conservation improvements and education
6. Strengthen Community Watershed Stewardship and Encouraging Better Coordination of Data Collection, Sharing, and Reporting	DNA analysis Habitat requirement studies Expand Collaborative relationships with UC Davis, CSUC, Shasta College
7. Support Community Sustainability by Strengthening Natural Resource-Based Economies	Enter into stewardship contracting with the Forest Service Pursue biomass projects
8. Improve Agency Programs and Policies by Increasing Accuracy and Effectiveness	Pursue re-evaluation of the 303(d) listing with DWR
9. Provide Adaptive Management Strategies to Conserve Energy and Decrease Greenhouse Gas Emissions	Solar array installation to replace pumps Irrigation and distribution efficiency infrastructure

2.9 Conflict Resolution Process

In the Upper Pit region, as with many IRWM regions across the state, the development of projects can result in the identification of conflicts. These conflicts can take the form of differences of opinion about: project location, the validity or likelihood of the identified project outcomes, the science upon which a particular project or type of project is based, due diligence with which the project was developed, timing of project implementation, level of participation by concerned or interested stakeholders in project design, project methodology/technical attributes, and other similar topics. Experience suggests that many of these differences of opinion can be resolved if a process is in place to assist stakeholders in dispute resolution.

The PRC has developed a process to address conflicts about projects, summarized below. The PRC expects to refine and further develop the following process in direct response to the outcomes of existing and future project development and funding applications:

- The PRC identifies there is a difference of opinion between stakeholders.
- The differences are specifically identified by the PRC in writing.
- The parties who have differing perspectives or opinions are then asked to undertake a four-step process:

  Step 1 – Perform a site visit to the project location or (if too remote or timing is too difficult) a similar landscape or location and discuss the proposed project while in the field, using the list of issues developed with the PRC. RWMG members and other relevant experts will be invited to the conflict-resolution field trips by the project sponsor.

  Step 2 – After the site visit, conduct at least one meeting where the list of issues and the outcomes of the field visit are used to identify areas of common ground and to determine if differences can be addressed by revising the project description or methodology, or by creating a new project that addresses one or more of the disputed issues.

  Step 3 – The project sponsors report back to the PRC as to the results of the discussion, as a formal agenda item.

  Step 4 – The final decision on conflict resolution will be made by the PRC.

3.0 ONGOING PROJECT DEVELOPMENT

Tier 2 and 3 projects are expected to go through further development, and thus potentially advance to Tier 1 status over time. Some projects will advance by further developing technical feasibility, while others will secure required match or environmental review.

3.1 Projects under Development

It is expected that the PRC will continue to meet on a basis necessitated by advancement of projects, perhaps quarterly or bi-annually as directed by project sponsors or the RWMG. A similar exercise of project refinement and integration is expected to be undergone for this Plan: meeting to review and refine projects, possible site visits to identify improvements or avoid misunderstandings, creative integration of project suites, and eventual scoring/ranking to best satisfy a funding source.

3.2 Next Steps for Project Development

Submittal of applications for projects will be available on a continuous basis. Rather than an annual call of projects, the application forms will be made available as needed, both on the IRWMP Website and at local RCD offices. The RWMG has determined that addition of projects would not require a formal Plan update.

Project sponsors interested in advancing their projects to a ready-to-proceed status and thus eligible for funding, need to satisfy all requirements of the general scoring criteria and the funding criteria of the identified funding source (e.g., DWR project review criteria). If applying for DWR funding, aside from generating documentation, they need to secure a minimum 25 percent project match unless qualifying as having a direct DAC benefit (e.g., critical water-quality or water-supply project for a DAC community). Please see also **Appendix 9-4 Project Development Manual**.

In evaluating a project for DWR funding, the PRC needs to consider the contribution of the project to climate adaptation and the contribution the project makes to reducing greenhouse gas emissions (GHG), including improvements in energy efficiency. When undertaking CEQA analysis, the project sponsor needs to take into account: estimated GHG emissions, identification of those project components that could support carbon sequestration, and, if applicable, explain how the project helps the region adapt to climate change. The lead agency also needs to establish significance criteria for CEQA reviews of projects per DWR requirements.

Further, sponsors need to seek assistance from PRC members in refining their proposal, anticipate any opposition to their project, and attempt to reconcile disagreements over approach. If there is Tribal Consultation potentially involved, that needs to be addressed. The degree of environmental compliance needs to be determined and accomplished. Finally, project proponents need to assure that their sponsoring entity has adopted the Plan.

As projects are initiated and/or refined for advancement in the tiering process, they will need to be submitted to the PRC for review, integration, and scoring.

To vote on PRC projects and matters, PRC members must participate in two out of three previous meetings. A sponsor can have a proxy, but the process for designating a proxy will need to be specifically spelled out and approved by the RWMG.

The PRC will then submit a list of additional or more fully developed projects to the RWMG for formal endorsement by the Plan – either at its annual update meeting, and/or as a funding source emerges, and/or as projects become ready through the PRC process.

The procedure for communicating the list of selected IRWMP projects will include posting of the list on the Website, providing hard copies of the list to the local RCD offices, and mailing a list in a response to a request.

4.0 PROCESS FOR SELECTING PROJECTS FOR FUNDING OPPORTUNITIES

The PRC has developed a process for selecting projects for funding. It is anticipated that a wide variety of funding sources will be pursued in addition to those that may be available through Proposition 84, or any subsequent bond issue. In fact, it is the uncertainty of bond-based funding that motivated the PRC to develop a process that specifically is not DWR-focused.

Projects included in the Plan may go forward for non-DWR funding independently of PRC and RWMG approval. However, any project that is included in the Plan and that goes forward for non-DWR funding will include a line item, where possible, to cover the cost of RWMG administration and integration of the project outcomes into the Plan.

The outcomes of all projects that support Plan objectives (and by incorporation resource management strategies), regardless of funding source or their inclusion in the Plan, will be reported under annual Plan performance reviews. The PRC could annually query all of its members about projects they had accomplished or knew of that helped meet Plan objectives.

The selection process will proceed as follows:

1. PRC members with assistance from RWMG members will research all available funding options (see **Chapter 12 Finance**), using a strategy developed by the PRC. The strategy needs to include consideration of the most appropriate funding source(s) for each project to ensure that projects with limited funding opportunities are given focused attention.
2. When a funding source is identified, the PRC will review the guidelines for that funding entity and determine which of the existing Tier 1 projects (or Tier 2 if the guidelines are compatible with the level of development of an individual project) are potentially both eligible for and competitive with that funding source.
3. Using the scoring strategy already developed, the projects deemed consistent with the guidelines for the funding source will be ranked by the PRC.
4. Based on the scoring and a group assessment of the overall compatibility and integration of the project(s), a recommendation will be made to the RWMG as to which projects should be 'bundled' or included in the funding application. The RWMG will make the final determination as to inclusion in a grant.
5. PRC members will provide whatever support they can to the project sponsors as the application is readied for submittal. In the past, this support has included in-kind labor for writing and reviewing the application, technical assistance in refining project descriptions or technical analysis as needed, and other similar activities. In addition, the group will have access to materials developed as part of the Plan process which support both project development and the assessment of the cost/benefit of individual projects.

CHAPTER 10. IMPACTS AND BENEFITS

1.0 INTRODUCTION

Implementation of this Plan will potentially generate a range of benefits and impacts, at both the Plan and project-specific levels. The intent of this chapter is to describe, at a screening level, the impacts and benefits associated with the Integrated Regional Water Management Plan (IRWMP) implementation.

Prior to implementation of projects, a project-specific impact analysis will occur, associated with environmental compliance documents (e.g., California Environmental Quality Act [CEQA], National Environmental Policy Act [NEPA]). Please see **Chapter 9 Project Development and Implementation** for greater discussion of the timing and process for ensuring adequate environmental analysis at a project level.

2.0 PLAN-LEVEL IMPACTS AND BENEFITS

The benefits of Plan implementation are wide ranging and primarily qualitative. These benefits include: increased understanding and information sharing between area stakeholders and interests, opportunities for collaboration on project development and solving regional conflicts, identification of a more diverse set of funding sources to increase investment in the region for integrated projects that will benefit the region's water and environment, opportunities for cost savings and creating an economy of scale, creation of a venue to address regulatory issues facing the region, and benefits to other regional resources.

These benefits already have been experienced within the region during the Plan preparation phase and, with the continued activities of the Regional Water Management Group (RWMG) and various committees, will continue during the Plan implementation stage. In particular, inclusion of the Pit River Tribe in the group dialogue has served to highlight a variety of opportunities for increased communication and collaboration.

Additional benefits from Plan preparation have included the creation of the Project Review Committee (PRC) that has overseen the development and integration of over 80 projects from a diverse group of project sponsors, substantive collaboration on project integration, and development of a Website. The Website has provided an access point for data and information that assists water and resource managers in their activities, as well as informing the general public. The Website can, if maintained, continue to provide one-stop shopping for water/watershed planning and management for the region.

The capacity-building efforts associated with Plan preparation included three funding workshops to enhance local ability to bring resources into the region, and an updateable tab on the Website will provide access to current funding sources for proposed projects. Trainings on the use of Sacramento River Watershed Information Module (SWIM) data also increase the technical capabilities of area stakeholders to both share and access water management information. Project committee input has substantially broadened and improved project design.

At this point there are no negative impacts identified at the Plan level, except that the RWMG will have increased responsibility for funding, implementing, and managing the IRWMP. Review,

assessment, and revisions of the impacts and benefits section of the Plan will occur, as necessary, during annual Plan review.

2.1 Fostering Understanding and Information Sharing Within the Region

Perhaps one of the greatest and most positive impacts this Plan can offer is to improve understanding of the diverse interests and points of view among stakeholders. If conflict resolution strategies offered in this Plan are pursued, greater collective efforts will help achieve proposed objectives.

Planning within a regional framework allowed stakeholders to evaluate whether it was best to respond to a watershed-wide need as opposed to a localized issue, to share knowledge and resources, and to minimize inter-entity conflict.

Ongoing posting of SWIM data will provide a ready repository of regional information that has been identified as a data gap in this Plan.

2.2 Opportunities to Collaborate on Project Development and Solving Regional Conflicts

The Plan provides a vehicle for local entities not only to collaborate and develop joint projects of multiple benefits, but also to identify and problem-solve for issues and areas for which no projects are currently proposed. The Project Review Committee has proven to be a powerful venue for project development and integration and enabled stakeholders to be better informed and to collaboratively review the outcomes of both a project and its overall plan implementation. This allows for a more comprehensive overview of and feedback on the methodologies used, and cumulative magnitude and benefit of projects that can be implemented or developed in the future and linked together. It can also provide for a greater economy of scale by allowing for shared technical expertise, equipment, labor.

The ongoing efforts of this group will include developing projects for individual application to a variety of funding sources, including Proposition 84 – IRWM Implementation Grants. An additional significant outcome of the group effort has been the willingness of project sponsors to assist each other in developing project materials – a sharing of expertise that will only increase the overall capacity of the region to pursue funding for needed projects.

2.3 Identification of Diverse Funding Sources

Admittedly, many project sponsors became involved with the planning process because they recognized an opportunity, through Plan participation, to access much-needed funding through Department of Water Resources (DWR) grant programs. While securing Implementation Grant funding is a distinct possibility, the Plan increases the potential for investment in the region to a much greater degree.

Funding entities wish to see that a proposed project is a component of a larger, deliberate process to achieve a stated goal. They anticipate greater benefit from the cumulative effects of a project, (i.e., that it is being implemented with similar projects, all aimed at watershed improvement). Further, most funding sources require demonstrated collaboration among stakeholders for the very reasons stated above: improved understanding, reduced conflict, better project design, data

sharing, and cost savings. Projects that are part of an adopted plan also demonstrate buy-in by local entities.

These combined factors of collaboratively developed projects, included in a deliberate local process and adopted by local entities, improve chances for individual projects or project suites to be funded by a variety of sources. The extensive work that went into project development for this Plan will queue up projects for both private and public resources, to a far greater degree than what DWR programs alone can offer.

2.4 Opportunities for Cost Savings

Coordination also helped eliminate redundancy of project planning and development and provided for potential cost savings related to implementation. Integration of project suites will potentially allow for shared equipment, technical expertise, and personnel.

2.5 Venue to Address Regulatory Issues

One of the prominent incentives for Northeastern California Water Association (NECWA) to pursue a Proposition 84 Planning Grant was to help develop solutions to water-quality issues or regulatory inaccuracies contributing to the 303(d) impairment listing of many regional stream segments.

An offshoot of this planning effort has been the formation of a small working group to pursue funding for an amendment to the Basin Plan that will address regulatory inaccuracies upon which the listings were based. If this effort can be fully implemented over time, it will result in better scientific defensibility and a corollary reduction in work effort and cost for local stakeholders who must demonstrate compliance. This working group demonstrates that the RWMG can serve as a meaningful venue for discussion and problem-solving for a wide array of issues, including regulatory compliance and processes.

2.6 Benefits and Impacts to Other Resources

A short-term boost to the local economy and employment would occur from projects associated with this Plan, and long-term benefits could accrue from improvements to natural resources and habitat that support hunting, fishing, other recreational pursuits, and tourism. Energy conservation would result primarily from irrigation efficiency projects and improvements in municipal water delivery. Individual assessments of reductions in greenhouse gas emissions will be conducted as part of project evaluations and updated accordingly. Localized biomass and other alternative energy projects could conserve energy, employ construction workers, and potentially improve air quality.

3.0 BENEFITS AND IMPACTS FOR DISADVANTAGED COMMUNITIES (DACs)

As discussed in **Chapter 3 Region Description**, a DAC is defined by the State of California as a community with an annual median household income (MHI) of less than 80 percent of the statewide MHI. As previously noted, 97 percent of the communities in the region are considered DACs, and 43 percent are considered severely disadvantaged (having less than or equal to 60 percent of the statewide MHI). CWC §10540(c)(7) states that identifying and considering water-related needs of DACs within the region is "*among the basic items an IRWM Plan must address*."

IRWMPs must also consider Environmental Justice (EJ) when formulating objectives and projects that can alleviate inequitable distribution of environmental problems to DACs and provide access to clean air and water, parks, and other resources that improve quality of life. EJ issues arise where residents have been intermittently or frequently excluded from policy setting and decision making. Please see **Chapter 2 Stakeholder Involvement and Coordination** for a discussion of the extensive process employed to involve DACs in this planning effort.

Impacts to under-represented groups in the region would most like be attributable to short-term construction, and to a lesser degree, restoration projects that are generally more remote. These impacts can include increased dust, noise, traffic disruptions and, in the case of restoration, sedimentation, temporary road closures, and potential short-term loss of access to recreation areas. Increases in fees and assessments for infrastructure projects can also occur, but these potential impacts are assessed in environmental compliance documents and mitigated where possible. The IRWM process is also able to bring in funding for project costs that otherwise might be borne by local DACs.

Benefits to DACs are primarily associated with infrastructure improvements and associated employment across the region. All of the community infrastructure projects in this Plan would *directly* benefit disadvantaged communities by any of the following: 1) providing clean domestic water supply for the first time, 2) through a proposed inventory of Tribal water needs, and 3) from infrastructure improvement that would assure community water quality and supply into the future. Proposals to improve parkland along Fall River would also benefit disadvantaged local residents although these benefits are not critical to water quantity or quality issues. Each project proposed in this Plan has been evaluated as to its ability to address DAC and EJ issues.

Numerous issues and objectives identified in this IRWMP address concerns of the Pit River Tribe. In addition to the infrastructure projects listed above, projects that address natural resource concerns and increase employment are of paramount interest to this community.

4.0 PROJECT-LEVEL IMPACTS

For the purposes of this section, project-level impacts have been identified based on the goals articulated in the Plan. A variety of possible project types will be implemented over time to address Plan goals.

Adverse physical impacts of Plan implementation are related to potential environmental or social impacts of project implementation. The projects submitted for inclusion in the Plan are in varying stages of development. Some are fully ready to proceed, while others are at the conceptual stage. An important aspect of project inclusion in the Plan is the specific and articulated assumption that disturbance to the landscape, or construction-related activities associated with implementation, will undergo environmental compliance evaluation under CEQA or NEPA. In many cases, projects such as feasibility studies, public education and outreach, and/or best management practice implementation would not result in direct physical environmental impacts. Additionally, small habitat restoration projects (under five acres with some provisions) are exempt from CEQA review.

Construction projects would result in environmental impacts that would be largely localized and/or temporary. The likely types of projects that would occur with Plan implementation are listed in the previous chapter in **Table 9-4 Project Development by Goal**. **Table 10-1** (at the end of this chapter) assesses at a screening level the probable physical impacts of implementing these project types.

5.0 REGIONAL IMPACTS FROM PROJECT IMPLEMENTATION

Plan-associated benefits far outweigh impacts, particularly since each project will necessarily undergo environmental review. This review will include assessing alternatives and developing mitigation to reduce negative impacts prior to project implementation.

The greatest area of impact will derive from costs and potential volunteer time to implement goals, objectives, and projects. Since the area has limited financial resources relative to more prosperous IRWM regions, the impact on volunteers and local agencies to oversee Plan implementation could be substantial, and/or slow or prevent some implementation measures.

Project-related impacts could temporarily delay services (e.g., infrastructure replacement), initiate rate increases, cause construction-related delays in traffic or facility use, and/or result in short-term disturbance to habitat from restoration activities. Again, the costs and benefits of each project will be weighed prior to funding.

5.1 Impacts from Failure to Implement the Plan

First and foremost, innumerable hours by watershed stakeholders were dedicated to this planning effort, not to mention the investment in the expertise of the Project Team. Previous watershed assessments alongside the IRWMP display a deep commitment to watershed stewardship; indeed, if the Plan were not implemented, an opportunity to repeat this exercise might not arise for some time to come.

The nature of some of the watershed's problems is severe: Some residents are without potable drinking water, and some natural resource problems threaten the survival of natural communities and species. Conservation of water for agricultural use has a direct link to the financial well-being of the region. In some cases, failure to implement may at best cause problems to deteriorate and, at worst, hasten irreparable damage to community infrastructure, culture, or natural resources.

Funding match has been obtained for many of the projects included in this Plan, and most of that match has associated time limitation. Failure to implement the Plan could promulgate loss of substantial match and thus investment in the region. In-kind contributions of volunteers and landowners would also be lost, cumulatively adding up to a substantial forfeiture of investment in a region that sorely needs resource-based infusions of capital.

5.2 Comparison of Regional Benefits and Impacts

Substantive benefits, and fewer and mostly short-term impacts, are likely to result from implementation of the goals, objectives, and projects included in the Upper Pit IRWMP. A qualitative assessment of benefits and impacts is included in **Table 10.1**, and is tied directly to the nine goals formulated by area stakeholders to improve watershed conditions and management. Quantitative measures linked with objectives will give the RWMG benchmarks by which to assess future benefits of the Plan.

Benefits displayed in the table are associated with improved water quality; water supply and availability for irrigation; aquatic and terrestrial communities, habitat, and ecological function; controlling and preventing infestations of invasive species; efficiency and reliability of community water supply and other water-related infrastructure; strengthening community watershed

stewardship and encouraging better coordination of data collection, sharing, and reporting; supporting community sustainability by strengthening natural resource-based economies; improving agency programs and policies by increasing accuracy and effectiveness; and providing adaptive management strategies to conserve energy and decrease greenhouse gas emissions.

6.0 INTERREGIONAL BENEFITS AND IMPACTS

Interregional benefits from this IRWMP will primarily derive from improvements to water quality that could affect interconnected but out-of-region water bodies such as Lake Shasta and, ultimately, the Sacramento River, and from habitat improvements that affect migratory species and their well-being, such as waterfowl and trout. Benefits to other regions could also occur from clarification and amendment of regulations, such as upper-elevation-relevant modifications to the Irrigated Lands Regulatory Program (IRLP) and better notification of weather modification projects.

The relative physical isolation of the Upper Pit watershed makes it less likely for interregional impacts to occur. For example, it is not immediately proximal to large population centers, or sensitive natural areas.

Interregional impacts could result from Plan implementation in the following way: Since area stakeholders are opposed to out-of-region water transfers, potential out-of-region water use, especially from groundwater basins, would be highly unlikely. Fuel and fire management within the region could also have interregional impact: If regional management cannot reduce fuels loads, it is more likely that widespread, intense fires would spread elsewhere. The extent to which weather modification is pursued in the watershed also has potential effects on other regions, although the full spectrum of these effects is not scientifically documented at present. Future projects associated with the Plan would be evaluated for off-site, including interregional, impact prior to implementation.

Table 10-1. Potential Regional Benefits and Impacts from Implementation		
IRWMP Goal	**Potential Benefits**	**Potential Impacts**
1. Improve Water Quality	• Improved health and safety for residents, including high percentage of DACs, from infrastructure improvements • Decreased treatment costs • Potential to increase cropland production • Potential to aid in removal of specific 303(d) listings and indirectly reduce monitoring efforts and costs • Improved habitat quality for wetland-dependent and stream-dependent species, and subsequent potential to increase species resiliency and populations • Collectively and substantively address irrigation water delivery system to relieve chronic contributing factors to water-quality degradation • Improved Tribal water management via a new RCD	• Short-term construction-related costs, and often site-specific disruptions to traffic, noise levels, water quality, habitat quality, service delivery, aesthetics, and cultural resources
2. Improve Water Supply and Availability for Irrigation	• Reduced vulnerability from climate-related reductions in seasonal or overall water supply • Better ability to address seasonal low flows • Potential to increase cropland production • Potential to better manage, understand, and prevent over-drafting of groundwater supply, and understand the relationship of surface and groundwater • Reduction in irrigation water-delivery losses of up to 50 percent through improved delivery systems	• Potentially reduced water supply available for habitat, fisheries, and wildlife, both in in-stream flow • Reduced groundwater recharge, including sources of recharge for springs and other wetlands • Indirect rises in temperature of some stream segments from stored water or loss of flow • Increased concern by conservation interests over the balance between agricultural and natural resource water use • Increased pumping costs and energy use if groundwater use rises

Table 10-1. *continued* **Potential Regional Benefits and Impacts from Implementation**		
IRWMP Goal	**Potential Benefits**	**Potential Impacts**
3. Sustain/Improve Aquatic and Terrestrial Communities, Habitat, and Ecological Function	• Better habitat and species resiliency in the face of potential climate-related increased variability, or reductions in flow • Potential to increase natural recharge and storage to augment late-season low flows • Improved water quality from reduced sedimentation, decreased temperatures, and reduced introduction of surface water bacteria and nutrients • Enhanced habitat quality and habitat connection for both fish and wildlife that could indirectly increase population numbers and overall species health • Potential reductions in flood risks by reconnection of up to 1,000 acres with historic floodplains • Increased ecological function from additional shade canopy, improved summer base flows, increased wetland extent and function, decreased peak flows, and improved bank and channel stability • Reduced potential for large uncontrolled fires, and thus subsequent erosion and runoff and property loss by conducting forest health and small fuels reduction projects on at least 20,000 acres • Restored sage-steppe habitat on portions of the watershed to increase watershed function and habitat resiliency • Decreased invasive species extent and potential for invasion • Increased water quantity (in some cases) through more efficient water use practices and improved infrastructure • Increased quantity of riparian, wetland, and instream habitat	• Short-term construction-related, and often site-specific disruptions to traffic, noise levels, water quality, habitat quality, service delivery, aesthetics, and cultural resources • Short-term disturbance to wildlife and fisheries from restoration activities • Potential for introduction of non-native species from poorly managed equipment or limited restoration success • Alterations in downstream flow regimes from upstream restoration • Short-term reduction in air quality from prescribed fire
4. Control and Prevent the Spread of Invasive Species	• Expanded collaborative strategic weed management on at least 500 acres of noxious weeds annually • Increased aquatic health and resiliency of the Fall River by implementing Eurasian watermilfoil pilot projects establishing four monitored locations, 30,000 weevils cultured and stocked, and five randomly selected sites sampled with fully assessed results • Prevented introduction and/or expansion, or reduction of non-native animal species (e.g., muskrat, non-native bass, quagga mussels, and/or address genetic mixing)	• Additional herbicide contamination if application protocols not properly followed

Table 10-1. *continued* Potential Regional Benefits and Impacts from Implementation		
IRWMP Goal	**Potential Benefits**	**Potential Impacts**
5. Improve Efficiency and Reliability of Community Water Supply and Other Water-Related Infrastructure	• Reduced potential for contamination of water supply from leak detection and replacement projects • Greater security of water supply to local communities, including DACs, from provision of improved and/or redundant infrastructure • Reduced vulnerability from potential climate-related reductions in seasonal or overall water supply • Increased opportunities for per-capita water conservation from metering and education • Greater flood attenuation in two DACs and an outlying rural area, also addressing EJ concerns • Decreased potential for loss of life or property • Decreased flood insurance costs • Decreased habitat degradation from bank erosion during flooding events • Improve water treatment facilities and methods in three DACs • Potential expansion of wetland acreage • Improved water quality from reduction in sedimentation	• Short-term construction-related costs, and often site-specific disruptions to traffic, noise levels, water quality, habitat quality, service delivery, aesthetics, and cultural resources • Potential loss of riparian/wetland acreage (not including Alturas)
6. Strengthen Community Watershed Stewardship and Encourage Better Coordination of Data Collection, Sharing, and Reporting	• Improved stewardship at lower overall cost through sharing best management practices and restoration success stories • Enhanced access to data from participation in SWIM and by updating and sharing the IRWMP Website • Increased understanding and reduction in conflict between Tribal stewardship perspectives and others	• Increased costs to provide education and coordination in a watershed with few financial resources
7. Support Community Sustainability by Strengthening Natural Resource-Based Economies	• Increased temporary employment from implementing projects associated with this Plan • Increased sustained employment from pursuing other initiatives, such as potential biomass, fuel reduction, and stewardship contracting projects • Increased recreational opportunities and tourism from development of parks, habitat improvement, and invasive species reduction projects	• Initial costs associated with startup of projects and with habitat improvements

Table 10-1. *continued* Potential Regional Benefits and Impacts from Implementation		
IRWMP Goal	**Potential Benefits**	**Potential Impacts**
8. Improve Agency Programs and Policies by Increasing Accuracy and Effectiveness	• Decreased costs and work efforts to meet regulatory requirements • Improved relationships between area stakeholders and agencies • Enhanced information sharing over projects that could have adverse impacts on the watershed • EJ concerns will be alleviated by posting of water advisories for impaired water bodies in both English and Spanish	
9. Provide Adaptive Management Strategies to Conserve Energy and Decrease Greenhouse Gas Emissions	• Improved economic efficiencies from cost savings related to energy use • Decreased us of fossil fuels tied to greenhouse gas emissions	• Initial costs to install energy efficiency measures

CHAPTER 11. PLAN PERFORMANCE AND MONITORING

1.0 INTRODUCTION

Performance measures are necessary for gauging the success of Plan implementation. Plan performance and monitoring generally falls into two categories: 1) Rural Water Management Group (RWMG) evaluation and measurement of the Plan's performance (progress toward accomplishing goals and objectives), and 2) monitoring and evaluation of individual projects against their respective measures and outcomes, conducted by project sponsors and reported to the RWMG. The following discussion provides a blueprint for both areas of performance measurement.

2.0 PLAN-LEVEL PERFORMANCE MEASURES

Department of Water Resources (DWR) Guidelines for Integrated Regional Water Management Plans (IRWMPs) includes the standard that IRWMPs *"shall include performance measures and monitoring to document progress toward meeting Plan objectives."*

The Upper Pit IRWMP has set forth a set of objectives that contain either quantitative or qualitative measures (see **Chapter 7 Goals and Objectives**), as required by the DWR Guidelines. It is the progress made toward those objective metrics that will provide the substantive determination of implementation success, as well as future measures as identified by the RWMG. The specific format for displaying the evaluation results will be developed in the context of the first year's performance evaluations.

However, the RWMG could also choose to measure success by:

- how robust the IRWMP process has been post-Plan development (e.g., the number of meetings the RWMG has versus identified benchmarks for evaluating the Plan;
- the number of attendees and range of attendees targeted by the RWMG (would need to set benchmarks, identify stakeholder groups);
- the amount of additional funding for and employment associated with projects identified in the Plan; and
- reduction of conflicts identified in the Plan, as measured by implementing systems for greater collaboration, and by qualitative perceptions of stakeholder participants.

2.1 Process for Plan Evaluation

The group responsible for evaluating IRWMP implementation and performance is the RWMG. The RWMG will convene a meeting to evaluate Plan performance at least once annually, and more often if needed to enhance chances for project funding, for incorporation of updates to regulations, for opportunities to improve the Plan, and/or recognize and document circumstances in the watershed that substantively affect the Plan. The schedule for evaluation will be set forth when the RWMG adopts the Plan.

At minimum, the evaluation will consist of measuring Plan progress against the adopted Plan-level performance measures listed in section **2.0 Plan-level Performance Measures**. As part of its adaptive management strategy to stay current and revise the Plan, the RWMG will compare implemented projects and their outcomes against objectives metrics to determine progress toward

achieving the Plan's goals and objectives. New scientific data, regional conditions, or natural resource events could substantively alter the understanding of issues or solutions within the watershed. Potential alterations to the Plan goals and/or objectives will necessarily need to consider/address changes in water demand, water supply, water quality, and effects on Disadvantaged Communities (DACs). For guidance on amendments to the IRWMP, please see **Chapter 15 IRWMP Management, Governance, and Implementation**.

The RWMG will determine whether objectives and their metrics continue to be relevant and appropriate. For instance, some objectives may be met, either by a change in circumstance, regulation, or implementation of projects. Objective metrics might need to be changed at that point, or a timeframe added to the metric to give it additional timeliness or urgency. New strategies and adaptations or mitigation may also emerge that warrant a change in objective or its metric.

Significant changes that affect aspects of the Plan may promulgate more frequent-than-annual Plan evaluations and revision. However, formal update and will occur at the discretion of the RWMG, and could be triggered by significant changes in governance structure, catastrophic changes to natural resources, or significant changes in regulations. Re-adoption will occur at least every five years to assure widespread buy-in by area stakeholders.

It is anticipated that additional information and data and, potentially, additional localized effects of climate variability will manifest in coming decades. While new studies and technologies may emerge for this relatively new science, localized climate information will unlikely need annual updates as climate is the record of weather phenomena over the *long-term*. Therefore, the RWMG may wish to search and review new climate studies annually, but revisit climate projections at longer intervals. Revisions to the Plan will accommodate these updated data and studies accordingly. IRWM Guidelines encourage RWMGs to stay involved with the California Natural Resource Agency's California Adaptation Strategy process and to consider joining the California Climate Action Registry at: http://www.climateregistsry.org.

The RWMG will write up its Plan evaluations (annually at minimum) and will post evaluations on the IRWMP Website.

3.0 PROJECT-LEVEL PERFORMANCE MEASURES

Monitoring project performance is tied directly to project implementation; projects won't be evaluated unless they become either partially or wholly funded and implemented. The outcomes of project implementation then contribute to achieving the metrics in objectives. For example, if a Plan objective metric is to accomplish five miles of ditch lining while recovering 50 percent water loss, accomplishing three miles of ditch lining and the targeted conservation over a year would be documented against desired Plan outcomes.

During the preparation of this Plan, 11 projects were identified as "ready-to-proceed"; that is, they had a sufficiently developed a work plan, budget, schedule, and performance measures, among other components, to proceed to a funding source application (also see **Chapter 9 Project Development and Implementation**). Each project sponsor formulated their respective list of measures and expected outcomes. Sponsors of future projects would be expected to provide measures and outcomes for their projects as well. Project sponsors will submit relevant information about projects and project performance to the RWMG's preferred data management system, either its Website, and/or SWIM (see **Chapter 14 Data Management**).

In no particular order, ready-to-proceed projects and their performance measures are listed below.

Table 11-1. Ready-to-Proceed Projects with Performance Measures	
Fall River Main Line Replacement	19,250 linear feet of mainline replaced, post-project leakage reduction (78 million gallons per year), replacement of inoperative or poorly operating valves, and preparation and distribution of 2,000 water conservation materials distributed to 500 households
McArthur Sewer Project	9,750 linear feet of sewer line installed. Construct lift station, including pumps and generator, build evaporation ponds
McArthur Water Tank	Installation of 350,000-gallon water storage tank, increased PSI of water pressure post-project, reduced operating costs from off-peak electrical usage and preparation and distribution of water conservation materials
Bieber Water Tank	Completed repairs and reconditioning of the water tank, reduced particulates and corrosion in water supply
Home Field	Installation of backup well and backup storage tank, installation of solar array for system operation, reduced operational energy use
Pit River Tribe Critical Water Supply and Quality Assessment and Repair	Number of water supply systems assessed, number of wells replaced, number of new wells, number of wastewater treatment systems assessed, repaired, replaced, or installed
Coordinated Leak Detection	Purchase of leak detection equipment, four staff trained in Burney, Fall River Mills, and Bieber in equipment operation and maintenance, and prioritized list of leaks for repair
South Ash Valley Restoration	Number of acres treated per treatment protocol, tons of biomass produced for renewable energy production, acres of riparian corridor restored (specific numbers dependent on funding of this phased project)
Little Valley Restoration	Number of acres treated per treatment protocol, tons of biomass produced for renewable energy production, acres of riparian corridor restored (specific numbers dependent on funding of this phased project)
Ash Valley Irrigation Efficiency	Pre-project diesel consumption will be compared to post-project electricity use to document the reduction in overall energy use, and pre-project water pumping time will be compared to post-project water pumping time to document the reduction in overall water use per acres irrigated
Beaver Creek Restoration	Total number of acres treated, 12,250 linear feet of streambank restored, successful reconnection of stream to floodplain, linear feet of livestock fencing installed

In the future, projects may be measured against any of the following list of measurement examples. This is not an exhaustive list, but gives an indication of the types of measurement that can indicate progress toward objectives and success/progress of a project.

Restoration/Natural Resource Projects

Number of fish successfully migrating
Extent of flooding reduced from baseline
Linear feet of channel bottom and bank erosion repair
Linear feet of vegetated steambank created
Miles of riparian corridor restored to specified condition
Number and distribution of native species
Number and diversity of waterfowl populations

Achieving a population threshold for a particular species
Number of fish passage barriers removed, number of stream miles made accessible to fish by barrier removal
Reduction in aerial extent of noxious or encroaching species
Desired channel morphology achieved for a stream segment

Water Quality

Number of reservoirs re-operated to provide temperature-appropriate flows
Improvement of domestic water supply/number of people and DACs affected
State or federal protocols or standards for water quality testing or measurements
Reduction in 303(d) listed parameters (salinity, turbidity, nutrients, and pathogens in specified stream reaches
Removal of water body from 303(d) list

Recreation

New park acreage established/developed to specifications
Number of access points to XX stream segment
Linear feet of new trails

Land Conservation and Stewardship Projects

Acres of voluntary land conservation
Number of participants/acreage affected by collaborative stewardship projects
Establishment of a stewardship award
Best Management Practices collectively identified

Infrastructure Projects

Increment of improvement to water quality
Flow rate/capacity increases
Percent of Capital Improvement Program implemented
Frequency of infrastructure issues/problems reduced
Stabilization of the XX dam/canal
Increase in capacity of existing plant
Stormwater infiltration area established

Water Supply

Linear feet or percent of water system assessed for leak detection and repair
Water supply infrastructure repaired and replaced
New wells drilled
XX years of supply projected
Quantity of recycled water produced

Education and Outreach

Number of individuals educated
Number of viewing platforms erected
Number of participants in region-wide technical committees for discussing data collection, management, disbursement, coding, presentation techniques
Remove of properties from FEMA Flood Zone A
Development of a manual/guidebook
Increase number of people interested in XX

Planning and Data

Model completed
Vulnerabilities assessed
Development of feasibility assessment
Development of groundwater assessments/management plans
XX data gap filled

3.1 Development of Project-level Monitoring Plans

Project sponsors will be responsible for development of monitoring plans for their respective project when applying to a funding source. These plans will specify who will conduct the monitoring and how it will be funded. Either the RWMG, or a specific committee, such as a Project Review Committee, will evaluate the monitoring plans at a specified interval to inform plan progress. Monitoring outcomes and plans likely will also be evaluated by the respective funding source. As findings and the resulting lessons learned from monitoring become available, they will be a valuable tool in: improving project design in the future, amending resource management strategies, and altering objectives to be more responsive to watershed needs.

Both outputs (e.g., tank replaced) and outcomes (e.g., water supply improved for a DAC for the life of the project) should be addressed where possible. In other words, monitoring needs to address not only that the project was achieved, but what it accomplished toward achieving Plan goals and objectives.

Monitoring plans will be prepared to the specifications required by a funding source. The following guidance is given for what DWR would expect in the typical contents of a project-specific monitoring plan:

1) Clearly and concisely (in a table format) describe what is being monitored for each project. Examples include monitoring for water quality, water depth, flood frequency, and effects the project may have on habitat or particular species (before and after construction).

2) Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Game if a species or its habitat is adversely impacted during construction or after implementation of a project.

3) Location of monitoring.

4) Monitoring frequency.

5) Monitoring protocols/methodologies, including who will perform the monitoring.

6) Data Management System or procedures to keep track of what is monitored. Each project's monitoring plan will also need to address how the data collected will be or can be incorporated into statewide databases. Note that standards and guidance related to the integration of data into statewide databases is included in Data Management Standard.

7) Procedures to ensure the monitoring schedule is maintained and that adequate resources (funding) are available to maintain monitoring of the project throughout the scheduled monitoring timeframe.

As this Plan is implemented over time, the RWMG will need to reflect an update of impacts and benefits from the myriad projects undertaken during Plan implementation. Please see **Chapter 10 Impacts and Benefits**.

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3.1 Development of Project-level Monitoring Plans

Project sponsors will be responsible for development of monitoring plans for their respective project when applying to a funding source. These plans will specify who will conduct the monitoring and how it will be funded. Either the RWMG, or a specific committee, such as a Project Review Committee, will evaluate the monitoring plans at a specified interval to inform plan progress. Monitoring outcomes and plans likely will also be evaluated by the respective funding source. As findings and the resulting lessons learned from monitoring become available, they will be a valuable tool in: improving project design in the future, amending resource management strategies, and altering objectives to be more responsive to watershed needs.

Both outputs (e.g., tank replaced) and outcomes (e.g., water supply improved for a DAC for the life of the project) should be addressed where possible. In other words, monitoring needs to address not only that the project was achieved, but what it accomplished toward achieving Plan goals and objectives.

Monitoring plans will be prepared to the specifications required by a funding source. The following guidance is given for what DWR would expect in the typical contents of a project-specific monitoring plan:

1) Clearly and concisely (in a table format) describe what is being monitored for each project. Examples include monitoring for water quality, water depth, flood frequency, and effects the project may have on habitat or particular species (before and after construction).

2) Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Game if a species or its habitat is adversely impacted during construction or after implementation of a project.

3) Location of monitoring.

4) Monitoring frequency.

5) Monitoring protocols/methodologies, including who will perform the monitoring.

6) Data Management System or procedures to keep track of what is monitored. Each project's monitoring plan will also need to address how the data collected will be or can be incorporated into statewide databases. Note that standards and guidance related to the integration of data into statewide databases is included in Data Management Standard.

7) Procedures to ensure the monitoring schedule is maintained and that adequate resources (funding) are available to maintain monitoring of the project throughout the scheduled monitoring timeframe.

As this Plan is implemented over time, the RWMG will need to reflect an update of impacts and benefits from the myriad projects undertaken during Plan implementation. Please see **Chapter 10 Impacts and Benefits**.

CHAPTER 12. FINANCE

1.0 INTRODUCTION

The intent of this chapter is to provide adequate information to the Regional Water Management Group (RWMG) and area stakeholders so they understand and can plan for the full array of the potential costs and revenues to sustain the RWMG, and implement the Plan and plan projects over time.

This first Integrated Regional Water Management (IRWM) planning effort for the Upper Pit watershed was funded by a Proposition 84 IRWM Planning Grant. With a regional population of about 14,000 and a high percentage of communities classified as Disadvantaged Communities (DACs), no other sources of funding were secured for Plan preparation. That being said, the dedication and perseverance of volunteers and their hundreds of hours of in-kind, Plan-development support are testament to the spirit of resourcefulness and self-determination so often encountered in this watershed. The Project Team preparing this Plan also provided in-kind support.

The need for project funding detailed in this and other IRWMPs from around the state far exceeds the state's IRWM Program funding capacity. Project funding will necessarily come from a variety of sources for which IRWM Program funding often provides a jumpstart.

Other costs of the IRWM Plan (IRWMP) implementation and updates, and operation and maintenance costs of projects, also require close examination to best prepare Plan managers and stakeholders for a successful IRWMP experience.

2.0 FUNDING OF ONGOING PLAN IMPLEMENTATION

As mentioned above, this Plan was funded by a Proposition 84 IRWM Planning Grant, supplemented by volunteer time from both the Project Team preparing the Plan and numerous in-kind hours from stakeholders. The Northeastern California Water Association (NECWA) contributed contract oversight and ongoing content review. For the purposes of this chapter, the activities associated with implementing the programmatic aspects of the Plan (e.g., monitoring progress against objectives, Plan revisons) are considered to be of a different nature than those of project-specific implementation.

The costs associated with the programmatic aspects of Plan implementation are of two general categories: administrative and RWMG-related. Some costs will be borne through an expenditure of time and/or materials by regional stakeholders and Plan adoptees. For full details on all aspects of Plan implementation, please refer to **Chapter 15 Management, Governance, and Implementation**.

2.1 Ongoing Costs and Potential Funding Sources

The RWMG is currently staffed as needed by a Project Team preparing this Plan and funded by the IRWM Planning Grant. Once the IRWMP is complete and adopted, the RWMG will need to secure ongoing revenues to support the cost of implementation. Projected costs of Plan implementation are primarily associated with three items:

1) Administrative support for internal communications, public involvement, tracking entities to make sure all project sponsors have adopted the IRWMP, Plan updates at set intervals, monitoring of Plan-level performance, some level of database management, Web maintenance, and tracking the implementation grant proposal process with the Department of Water Resources (DWR) and other funders.

2) Securing necessary staffing to help prepare DWR implementation grant proposals and other sources of funding for region-wide projects or initiatives. The cost is difficult to estimate because much of the proposal work likely will be done by project sponsors. The bottom line is that the level of expertise required will dictate the cost.

3) Potential technical updates to the Plan. For instance, if the RWMG determined it needed to update emerging issues or refine existing section analyses based on new data, then the technical capacity to accomplish this might need to be sought from a future IRWM planning grant or other source.

It is estimated by the RWMG that it will need, at a minimum, a 25 percent full-time equivalent (FTE) for a cost of $10,000/year, plus $1,000 expenses for travel and supplies over the next five years. (Beyond this five-year window, costs would need to be re-evaluated.) This position could be funded via the following mechanisms:

- Each member organization of the RMWG could commit a minimum dollar amount annually for support of the grant efforts (e.g., 20 organizations @ $500/year = $10,000). Alternatively, the amount could be reduced and in-kind support could be pledged in the form of a vehicle, supplies, use of copiers, staffing time, or other appropriate contributions.
- Foundation and public support is possible. Public and private and family foundations connected to the watershed or its attributes need to be approached. Additionally, when stakeholders write grants, they may be able to include support for the RWMG associated with the grant (e.g., overhead fees, direct support, line-item task support). (Please see **Chapter 15 Management, Governance, and Implementation** and **Appendix 12-1**.)
- Private fundraising support is another, though limited, supplemental option. A Pit River Watershed Alliance (PRWA) "Give Back to the Rivers Day" or other fundraising mechanism may be possible. As well, a letter once a year to targeted groups who value the watershed's resources may bring in donations. However, the costs of planning and delivering these events and activities would need to be closely calculated.
- DWR IRWM planning grants may be a source of future funding for Plan updates.

3.0 PROJECT-LEVEL FUNDING – CURRENT TIER 1 PROJECTS

Project listing as Tier 1 is a result of both meeting minimum standards for required information, and having secured either a minimum 25 percent match, or having a match exemption because a project has direct benefit to a DAC.

As of this writing, over 80 proposed projects are showcased in this Plan, estimated at a total cost of over $40 million. Eleven of these projects are considered Tier 1 and identified as such. Project sponsors have lined up $5.7 million in match and will need to secure $16.2 million to cover total project costs.

3.1 Certainty of Project Funding

Table 12-1 exhibits the sources of funding secured and requested for initial Tier 1 implementation projects proposed in this Plan, the status of grant agreements, future funding that will be sought for operations and maintenance, and the certainty of that funding.

Securing initial Proposition 84 grant funds to implement projects would be a substantial economic boost, but the region will need to identify and successfully pursue a wide variety of funding sources to accomplish the identified water management improvements. To that end, several of the most likely funding options are discussed below. Local revenue bonds and other more complex financing options are not discussed as they are seen as a very remote possibility over the next five years, especially due to local political resistance, the low population base to support such measures, and the increasingly challenging budget cuts and realignments necessary to fund the full spectrum of local needs and interests that are not water- or infrastructure-related.

4.0 PROJECT-LEVEL FINANCING – TIERS 2 & 3 AND FUTURE PROJECTS

The current Plan includes over 70 projects that range in nature from fully designed projects that need to confirm match sources to conceptual projects that are based on the objectives of the Plan. The Project Review Committee will continue to meet as necessary and it is expected to both advance the readiness of Tiers 2 & 3 projects and also to develop new projects based upon ongoing evaluations of "project gaps" that result from unfulfilled Plan objectives. All of these project sponsors will need to pursue funding and/or financing sources. The following sections describe key elements of this process.

4.1 Environmental Compliance Funding Options

One of the greatest impediments to implementing IRWMP projects is securing funding for requisite environmental compliance – federal National Environmental Policy Act (NEPA) and/or California Environmental Quality Act (CEQA) documentation. The exception is for projects that directly benefit DACs, for which environmental compliance can be funded with Proposition 84 program dollars when applied for under the IRWM Program. Direct benefit for DACs, however, is generally associated with infrastructure, leaving most remaining projects to seek alternative funding.

Financially strapped public agencies, that are more familiar with environmental review and often have staff to prepare such documentation, are sometimes reluctant to pay upfront for compliance when project approval is still uncertain. There may be some opportunity for environmental compliance to be prepared by public agencies if bridge funding can be secured.

Further, any of the following steps could be taken either singly or in conjunction with one another to establish a more robust approach to funding environmental compliance. If *all* steps were taken, they could potentially create a sustainable environmental-compliance funding mechanism available to the region, and thus potentially bring in substantially more project funding.

Table 12-1. IRWM Plan and Project Financing					
Activity Description	**Approximate Total Cost (match)**	**Funding Source and Percent of Total Cost (% may be off slightly due to rounding)**	**Funding: Certainty/Longevity**	**Operations and Maintenance (O&M) Finance Source**	**Operations and Maintenance (O&M) Finance Certainty**
Joint Leak Detection Program FRVCSD	$133,750 ($33,250)	$100,500 – State DWR grant (75%) $33,250 (25%) – Funding generated by user fees from all involved entities	Application will be submitted March 2013 Match is guaranteed through 2015	Water rates	Secure. Ability to fund repairs through water rates assures long-term O&M
Fall River Mainline Replacement[1] FRVCSD	$4,555,500 ($700,000)	$3,855,500 – State DWR grant (85%) $500,000 – low-interest loan from USDA (11%) $200,000 – grant from USDA (4%)	Application will be submitted March 2013 Match is guaranteed through 2016	Water rates	Secure. Ability to fund repairs through water rates assures long-term O&M
McArthur Sewer FRVCSD	$5,333,000 ($1,696,900)	$3,636,100 – State DWR grant (68%) $500,000 low-interest loan from USDA (9%) $296,900 – grant from USDA (5%) $200,000 – donation of land from the Fairgrounds (4%) $700,000 – USDA grant for residential hookups (13%)	Application will be submitted March 2013 Match is guaranteed through 2016 USDA loans/grants to individuals to be applied for with assistance FRVCSD	Sewer rates	Secure. Ability to fund system through sewer rates assures long-term O&M

[1] Despite its DAC status, the Fall River Valley Community Service District (FRVCSD) will provide a match for each of its projects

Table 12-1. *continued* IRWM Plan and Project Financing					
Activity Description	**Approximate Total Cost (match)**	**Funding Source and Percent of Total Cost (% may be off slightly due to rounding)**	**Funding: Certainty/Longevity**	**Operations and Maintenance (O&M) Finance Source**	**Operations and Maintenance (O&M) Finance Certainty**
McArthur Water Tank FRVCSD	$1,491,000 ($700,000)	$791,000 – state DWR grant (53%) $500,000 – low-interest loan from USDA (34%) $200,000 – grant from USDA (13%)	Application will be submitted March 2013 Match is guaranteed through 2015	Water rates	Ability to pump off-hours and control the pumps remotely creates enough savings to pay off the USDA loan. Remainder is secure from water rates.
Bieber Water Tank Lassen County Water Works District #1	$218,600 ($5,000)	$213,600 (98%) – State grant, DWR $5,000 (2%) – in-kind from applicant, funds spent on preliminary investigations of tank	Application will be submitted March 2013. Match in-kind funds spent	Water rates	Less O&M is anticipated with a new tank; water rates will secure long-term O&M
Home Field Water Supply Reliability Pit River Tribe	$250,000 (not required)	Grant sources, unknown at this time	N/A	If funded by IHS, the Tribe pays for in its annual budget; if on Trust or private lands, O&M under contractual arrangement with landowner	Unknown at this time

Table 12-1. *continued* IRWM Plan and Project Financing					
Activity Description	**Approximate Total Cost (match)**	**Funding Source and Percent of Total Cost (% may be off slightly due to rounding)**	**Funding: Certainty/Longevity**	**Operations and Maintenance (O&M) Finance Source**	**Operations and Maintenance (O&M) Finance Certainty**
Pit River Tribe Critical Water Supply and Quality Assessment and Repair	$500,000 (not required)	State grant, DAC assistance, DWR, 100%	Application will be submitted March 2013.	If funded by IHS, the Tribe pays for in its annual budget; if on Trust or private lands, O&M under contractual arrangement with landowner	TBD: part of grant will be to develop a long-term O&M program
South Ash Valley Watershed Restoration Pit RCD	$1,975,000 ($1,375,000)	$600,000 – State DWR grant (30%) $500,000 – Honey Lake Power (25%) $25,000 – Caldeer (1%) $350,000 – Sierra Nevada Conservancy (SNC)(18%) $500,000 – Natural Resources Conservation Service/CIG (NRCS) (25%) Note: 1% rounding error on percentages	State DWR grant application will be submitted in March 2014 pending Project Review Committee approval; Honey Lake Power Contribution is certain and there are no restriction timeframes; Caldeer Contribution is certain, expect 12/31/12 completion SNC – Applied 10/12, expect decision 2/13 NRCS – Applied 10/12, expect decision 2/13	Long-term secured through Ash Valley Ranch (Owner & BLM Permittee)	Secure/sustainable adaptive management practices to be implemented as part of ranch operations

Table 12-1. *continued* IRWM Plan and Project Financing					
Activity Description	**Approximate Total Cost (match)**	**Funding Source and Percent of Total Cost (% may be off slightly due to rounding)**	**Funding: Certainty/Longevity**	**Operations and Maintenance (O&M) Finance Source**	**Operations and Maintenance (O&M) Finance Certainty**
Little Valley Watershed Restoration Pit RCD	$1,199,600 ($849,800)	$349,800 – State DWR grant (29%) $349,800 – Sierra Nevada Conservancy (29%) $500,000 – Honey Lake Power (42%)	State DWR grant application will be submitted in March 2014 pending Project Review Committee approval; Sierra Nevada Conservancy Contribution is certain, expires 12/14; Honey Lake Power Contribution is certain and there are no restriction timeframes;	Long-term secured through landowner agreements	Secure/sustainable adaptive management practices to be implemented by landowners
Ash Valley Irrigation Efficiency Pit RCD	$399,846 ($100,000)	$299,846 – State DWR grant (75%) $100,000 – Ash Valley Ranch	State DWR grant application will be submitted in March 2014 pending Project Review Committee approval; Ash Valley Ranch Contribution is certain and there are no restriction timeframes	Long-term secured through Ash Valley Ranch (landowner)	Secure/sustainable adaptive management practices to be implemented as part of ranch operations
Beaver Creek Restoration Fall River RCD	$429,077 ($247,700)	$155K - North American Wetland Conservation Act (NAWCA) grant (36%) $181,378 – State DWR grant (42%) $82,700 - Sierra Nevada Conservancy (19%) $5,000 - CA Dept. of Conservation (1%) $5,000 - in-kind (1%)	NAWCA funding must be spent by 2014; state funding secured and allocated; state DWR grant application will be submitted in March 2014 pending Project Review Committee approval	Short-term secured through NAWCA grant and landowner	RCD will develop budget for future O&M

Table 12-1. *continued* **IRWM Plan and Project Financing**					
Activity Description	**Approximate Total Cost (match)**	**Funding Source and Percent of Total Cost (% may be off slightly due to rounding)**	**Funding: Certainty/Longevity**	**Operations and Maintenance (O&M) Finance Source**	**Operations and Maintenance (O&M) Finance Certainty**
Administration By fiscal agent managing application	Depends on grant source and amount	Unknown at this time	Unknown at this time	N/A	N/A

Step 1) Approach existing funding entities/private donors/foundations that provide CEQA funding, support rural self-determination, and/or those who are interested in conservation in the northern Sierra/Southern Cascade region. An example of a state agency that is interested in all three topics and has funded CEQA preparation in the past is the Sierra Nevada Conservancy. One option would be to take all the steps listed below and offer it as a comprehensive package to funders.

Step 2) The RWMG would create a revolving fund of up to $100,000 from Step 1 that could supplement or fully fund compliance documents as the need arose. Revolving funds would be reimbursed by either of the following two mechanisms: First, public agencies would seek or budget for compliance funding over a grace period once they had proposed a project and then reimburse the fund, or second, each entity in the region capable of doing so would adopt a policy of requiring a one percent overhead fee on any grant or loan request that would go directly to this fund.

Step 3) Using a memorandum of understanding, the RWMG would create an "environmental compliance collaborative" made up of regional experts who could use their respective skills to create compliance documents. When a project needed compliance work, the RWMG would contact the coordinator for the collaborative and determine which skill sets were needed for the respective project. The RMWG would give preference to this collaborative for all work and reimburse its work from the revolving fund at set fees.

The coordinator of the collaborative would meanwhile have contacted regional and extra-regional environmental and engineering firms who had already worked in the region, or saw the opportunity to either benefit financially from future work, or had a charitable-giving program where staff could volunteer for such work. The pool of local experts could then be supplemented by regional or statewide experts. These regional experts would also have agreed to work pro bono, or at reduced fees.

It is assumed that local experts could provide services much more cost-effectively because of reduced local rates and minimal need for travel. It is also assumed that the collaborative could serve the larger northern California region more cost-effectively than distant consultants, and that this could be an exportable model for other regions.

Step 4) Approach other regional IRWM groups and see if they would help persuade DWR to extend the opportunity to apply for compliance funding for other categories of projects in future Proposition 84 funding rounds.

Step 5) Hire the compliance collaborative to create a library of environmental documentation in the region that could help inform new project compliance documents. Regional conditions, for instance, don't change rapidly, or they at least provide background that informs trends. Offer already-completed documentation as models and information sources for similar proposed projects, perhaps using the Website as a data library.

Step 6) Have the compliance collaborative offer an "environmental documentation 101" class to regional stakeholders so that local capacity is built for at least the less complex documents (i.e., below an EA or EIS/EIR). Provide a how-to handbook with CDs of samples.

4.2 Federal, State, Regional, and Private Grant and Loan Sources

A wide variety of grant sources could be sought to meet the needs of natural resources, infrastructure, disadvantaged communities, wetlands/meadows, education, data collection, forest management and restoration, agricultural water efficiency, and capacity building. Please see **Appendix 12-1** for a listing of federal, state, regional, and private grant and loan sources relevant to IRWMP projects. It is assumed that this listing is merely a starting place and that it will be updated as new sources arise.

Additionally, several entities offer or publicize training workshops either on specific sources, or general fundraising. Over time, these entities have included: DWR, Sierra Nevada Institute, and the Foundation Center and are listed in **Appendix 12-1**.

As part of determining the capacity of the region to secure funding, individuals who had been quite successful at bringing grants and other funding for water-related projects into the region were identified alongside sources of funding. These individuals and project sponsors have shared their experience with others and have offered to help with certain funding opportunities.

4.3 California Financing Coordinating Committee

The California Financing Coordinating Committee (CFCC) was formed in 1998 and is made up of eight funding agencies: five state and three federal. CFCC members[2] facilitate and expedite the completion of various types of infrastructure projects by helping customers combine the resources of different agencies. Project information is shared between members so additional resources can be identified. CFCC members conduct free Funding Fairs[3] statewide each year to educate the public and potential customers about the different member agencies and the financial and technical resources available. General CFCC inquiries can be sent via email to: ibank@ibank.ca.gov.

Member agencies include:

- State Water Resources Control Board
- California Department of Public Health
- U.S. Department of Public Health
- U.S. Department of Agriculture
- California Department of Housing and Community Development
- California Department of Water Resources
- U.S. Environmental Protection Agency
- California Infrastructure and Economic Development Bank (I-Bank)
- Bureau of Reclamation

4.4 National Revolving Loan Fund (RLF)

The National Rural Water Association (NRWA) Revolving Loan Fund was established under a grant from U.S. Department of Agriculture's Rural Utilities System (USDA/RUS) to provide financing to eligible utilities for pre-development costs associated with proposed water and wastewater projects. RLFs can also be used with existing water/wastewater systems and the short-term costs

[2] http://cfcc.ca.gov/res/docs/2012_CFCC_Member_Directory.pdf
[3] http://cfcc.ca.gov/funding_fairs.htm

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 up to 10,000 population and rural areas with no population limits. Please see: http://www.nrwa.org/benefits/revolvingloan.aspx.

4.5 Adding a Hazards Mitigation Component to the IRWMP

Local jurisdictions that have a Multi-Hazard Mitigation Plan (MHMP) in place qualify for federal pass-through dollars through Cal Emergency Management Agency (Cal EMA) for local hazards mitigation. Local hazards planning includes the consideration of and preparation for potential disasters, such as flood, fire, and seismic activity.

Cal EMA's Grants Management Division is responsible for administering more than $2 billion in funds for homeland security, emergency management, justice programs, and victim services, a majority of which are distributed to local and regional entities to enable the most effective prevention, detection, response, and recovery efforts. Improving and enhancing local agencies' capabilities through grants is one of Cal EMA's most important missions. The Public Safety Branch and the Victim Services Branch develop and manage grant programs that provide victim services through a combination of government agencies and non-profit organizations.

Cal EMA representatives recently communicated that for those jurisdictions that did not have an MHMP in place, it was possible to add hazards analysis to an IRWMP that could be submitted as a MHMP. While this information came to light too late in the planning process to include, it could lead to funding eligibility with a Plan update. http://www.calema.ca.gov/LandingPages/Pages/Grants-and-Funding.aspx

4.6 Special Districts

Although fees have not proven popular in the region, a segment of the population may agree to form a special district and assess taxes for a much-needed service, improvement, or natural resource protection. Fire Safe Councils (FSCs) are one such example; some FSCs have been successful in the region and others have failed due to an inability or unwillingness to pay.

4.7 User Fees

Municipalities can choose to go through a public process to raise rates to pay for new or improved services. Rates need to be set commensurate with debt service costs, capital costs, equipment, and administration of the service. In a region such as the Upper Pit, where a high proportion of the population earns lower than the state's average household income, considerations of Environmental Justice and ability to pay are of high importance.

4.8 Watershed Services Charge

Several upper watersheds are exploring "watershed services charges," fees levied on out-of-region water users of upstream sources that could help fund local non-profit groups and stewardship

projects. The establishment of such charges would be complex, especially in an area such as the Upper Pit where water is co-mingled with other sources once it reaches Shasta Dam. The RWMG decided to wait and see what other watersheds are able to develop before determining whether to pursue this idea.

5.0 FINANCING OPERATIONS AND MAINTENANCE (O&M)

Project development sponsors and committee members were queried about the general state of operations and maintenance in the region in 2012. Some respondents painted a picture of substantial deferred maintenance in the region; some water and sewer pipe, for instance, is so old and crumbling it cannot be assessed with modern leak-detection equipment. Others brought up the additional concern that while much of the area's infrastructure is still quite functional, state and federal infrastructure standards continue to increase, rendering that infrastructure non-compliant.

O&M support of municipal and district infrastructure is currently provided via rate structure. Sometimes grants are received for upgrades, although this is rare. In the case of infrastructure replacement, upkeep is usually anticipated to be covered by cost savings from the replaced infrastructure. This allows payoff of federal loans that will, in turn, allow for payment of O&M.

5.1 Sewer & Water Systems and Flood Protection (Community Infrastructure)

User rates typically finance the operations and maintenance of public water and sewer systems and agencies, and would be expected to in the future. Customers can pay fixed rates, as is the case in much of the Upper Pit region, or variable rates tied to metering. Fixed rates often fund new infrastructure, and remain on customer bills until the tank, pipeline, or other item is paid off. These rates are often tied to debt service and credit rating. The economic status of the region – largely disadvantaged with a significant portion severely disadvantaged – makes raising rates particularly difficult for local agencies in some cases. Rate raises are not always made at an adequate pace to keep up with expenses. Significantly or abruptly raising sewer and water rates is unlikely.

The Pit River Tribe pays for O&M of its Indian Health Service-funded projects via its annual budgeting process. Project-related O&M costs on Indian Trust Lands and private lands are paid for via contractual arrangements with landowners.

One way of "paying for" O&M over time is to reduce this long-term cost through system design. Two examples would be use of solar or wind generators to power pumps, or use of gravity feed where possible. Alternative energy systems can be more costly upfront, but offer substantial savings once initial costs are amortized. One example is a Tribal project included in this Plan that incorporates a solar water pump.

The City of Alturas is the only entity contemplating flood protection in the region in 2012. O&M for flood protection projects would be funded by taxes contributed to the city's general fund.

5.2 Agricultural Water Delivery/Efficiency

Agricultural water delivery projects' O&M would most likely be funded by landowners for individual projects. For multi-party projects, such as ditch lining and piping, O&M would likely come via assessments on water users by irrigation districts or water master programs.

5.3 Parks and Recreation

Funding for O&M for parks and recreation varies by the type of entity proposing such projects. Fall River Valley Conservation Service District (CSD), for instance, is using diverse sources of funding to pay for current and future parks maintenance. The diversity and long-term nature of this funding will help ensure sustained O&M for parks over the 20-year planning horizon. Sources include: 1) a land lease to a solar developer generating $30,000/year for 20 years, with four, five-year renewal clauses; a potential water rights lease on the Fall River anticipated to generate $15,000 to $20,000/year for ten years; and a small hydropower generation plant anticipated to bring in $40,000 to $80,000/year for 50-plus years.

Burney has chosen to fund some of its parks and recreational facilities' O&M using a voter assessed fee on water and sewer bills, and by contracting with local service groups for lower-cost maintenance.

Cities and towns are able to allocate general funds toward park maintenance, or create special maintenance districts. Alturas formed a special recreation district and approved a board, but not funding. Funding could ultimately come with voter approval.

5.4 Natural Resource Restoration

According to area sponsors, post-restoration monitoring and maintenance agreements generally contain a two- to three-year term. The Pit River Resource Conservation District (RCD) has established an account funded by proceeds from grazing and hay leases for any required remediation until restoration work is established on its projects. Fall River RCD will establish a maintenance account funded by grazing fees when it assumes ownership of Big Swamp. There may also be potential to add a small percentage under the indirect rate requests for O&M within grant proposals, depending on individual grant restrictions.

O&M on other restoration projects in the region have included term-limited maintenance agreements with the private or public landowner, or grazing permittee, until the restoration objectives are established.

CHAPTER 13. TECHNICAL ANALYSIS

1.0 INTRODUCTION

This chapter illustrates the breadth of data and information used to prepare this Plan, analyses of that data and information, and the methodology used for analyses. Plan guidelines assert that the planning horizon is 20 years; therefore, information was gathered and analyzed to illustrate water management needs over that time period when possible.

Over the course of Plan preparation, extensive data gathering was conducted by numerous individuals preparing this document, including the Project Team, and volunteers who also served on technical committees, such as the Climate Variability Working Group, Project Review Committee, Plan Review Committee, and Regional Water Management Group (RWMG). Additionally, Extension personnel from U.C. Davis provided oversight and suggested protocols for analysis of climate data, and the University of San Diego, Scripps Institute staff conducted the climate projections for the region, directed by the local knowledge and parameters set by confidence in data from the Climate Working Group members. Climate science staff at the Conservation Biology Institute in Corvallis, Oregon, aided in interpretation of vegetation modeling used in this Plan as well.

Table 13-1 provides the RWMG and other interested parties the primary sources of data used to prepare Plan sections, how the data/documents were used, and any other relevant notes about the data/information, such as timeliness and relevance to more than one section of the Plan. For a list of all references used to prepare this document, please see **Bibliography**.

For more highly technical discussion of how climate projections and potential vegetation scenarios under climate variability could occur, please see **Appendices 8-1 and 8-2.**

Over time, more recent and relevant technical data, information, and resources will become available to the RWMG and area stakeholders. **Chapter 11 Plan Performance and Monitoring** and **Chapter 15 Management, Governance, and Implementation** set forth intervals for Plan revisions and updates relevant to water management in the region.

Table 13-1. A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Water quality		
California Environmental Protection Agency, Central Valley Regional Water Quality Control Board. *The Integrated Report - 303(d) List of Water Quality Limited Segments and 305(b) Surface Water Quality Assessment.* Sacramento, CA; State of California. 2011. http://www.swrcb.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/index.shtml.	These analyses were used to characterize the nature and status of water quality impairment for stream reaches.	These data are updated, so should be consulted periodically when updating the Plan.
California Department of Water Resources. 2012. Sacramento Watershed Coordinated Monitoring Program (SWCMP). March 2012.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	These data are updated, so should be consulted periodically when updating the Plan.
Department of Water Resources, Northern District. 1982. Pit River Water Quality Study. December 1982.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	Provided water quality information
NECWA. 2003 to present. Pit River monitoring of Upper Pit River sites. Unpublished data.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	Provided water quality information
Regional Water Quality Control Board Redding Office. *Pit River Watershed Alliance Water Quality Monitoring Program 2003-2005*. March 2007. Prepared by Todd Sloat Biological Consulting, Inc. 2007.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	Provided water quality information
Regional Water Quality Control Board. 2003-2005. Fall River Water Quality Study. For: Fall River Resource Conservation and Development and Pit River Alliance. Prepared by Todd Sloat Biological Consulting, Inc. 2007.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	Provided water quality information
State Water Resources Control Board. 2001-2002. Pit River Water Quality Study. For: North Cal-Neva Resource Conservation and Development.	The water quality study was used to evaluate water quality constituents of concern in the watershed and present background and historical information.	Provided water quality information

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Water quantity		
U.S. Geological Survey. *National Hydrography Dataset*. Washington, D.C. 26 July 2011. 4 August 2011. Available from: http://nhd.usgs.gov/.	These GIS data layers were used to determine water bodies found in the watershed and for presentation of informational graphics.	These data are updated, so should be consulted periodically when updating the Plan.
Water demand		
Population estimates as described in the Region Description (from CA Department of Finance) and water use as estimated at purveyors' treatment plants.	These data points were used to estimate water demand and to project demand with future population estimates.	These data should be updated periodically as the State provides updates and implementation projects are completed that update regional water systems.
Water supply		
Order issuing new license regarding PG&E Company's Pit #1 Hydroelectric Project #2687.	This information was used to describe the environmental water demand mandated in the Upper Pit River.	The license was issued for 40 years beginning when awarded (2003); one change to monitoring protocols has been established, but other than that the license is unchanged.
Order issuing new license regarding PG&E Company's Pit #3, #4, and #5 Hydroelectric Project #233-081.	This information was used to describe the environmental water demand mandated in the Upper Pit River.	The license was issued for 40 years, beginning when awarded (2007).

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Groundwater		
Brown and Caldwell. Big Valley Management Area Basin Management Objective Development Guidance Document. Prepared for Lassen County, CA. Rancho Cordova, CA. August 2011. http://www.lassenbmos.org/index_htm_files/Big%20Valley%20BMO%20Guidance%20Document.pdf.	This information was used for information regarding groundwater in the Big Valley area of the watershed.	Provided groundwater information
California Department of Water Resources. *California's Groundwater: Bulletin 118.* Sacramento, CA 2011. 20 July 2011. Available from: http://www.water.ca.gov/groundwater/bulletin118/gwbasin_maps_descriptions.cfm.	This GIS data layer was used to determine groundwater basins that are present in the watershed and for presentation of information graphics.	These data are updated, so should be consulted periodically when updating the Plan.
California Department of Water Resources. *Groundwater Information Center*. Sacramento, CA. 2011. 20 July 2011. Available from: http://www.water.ca.gov/groundwater.	These data were used to collect information regarding groundwater elevations throughout the watershed.	These data are updated, so should be consulted periodically when updating the Plan.
Flooding		
FEMA 2005. Zone A – Areas subject to inundation maps. Available from: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1.	These data were used to understand both infrastructure and climate vulnerabilities and to determine data gaps for flooding.	
Natural Resources		
California Department of Fish and Game, Biogeographic Data Branch. *California Natural Diversity Database*. Sacramento, CA. July 2011. Available from: http://www.dfg.ca.gov/biogeodata/cnddb/.	These data were used to identify species of special concern as identified by the state.	These data are updated, so should be consulted periodically when updating the Plan.
U.S. Fish and Wildlife Service. *Critical Habitat Portal*. Washington, D.C. 4 August 2011. Available from: http://criticalhabitat.fws.gov/crithab/.	These data were used to identify areas of critical habitat as identified by the U.S. Fish and Wildlife Service.	These data are updated, so should be consulted periodically when updating the Plan.

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
California Natural Resources Agency, California Environmental Resources Evaluation System. *Cal-Atlas Geospatial Clearinghouse*. 2010. 15 August 2011. Available from: http://atlas.ca.gov/.	This online data library of GIS data layers was used to capture data relevant to the watershed including transportation corridors, jurisdictional boundaries, and public ownership.	These data are updated, so should be consulted periodically when updating the Plan.
Pit Resource Conservation District. *Pit RCD Watershed Management Strategy: Prioritizing Management Actions To Improve Watershed Conditions*. December 14, 2006.	Assembles resource management issues, goals and objectives for the watershed and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
Pit River Watershed Alliance. *Upper Pit River Watershed Management Strategy*. 2010.	Assembles resource management issues, goals and objectives for the watershed and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
VESTRA Resources, Inc. *Hat Creek Watershed Assessment and Watershed Management Plan*. 2010.	Assembles resource management issues, goals and objectives for the Hat Creek drainage and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
Sierra Institute for Community and Environment. *Burney Creek–Hat Creek Community Forestry Project*. May 2010. Available from: http://www.sierrainstitute.us/index.php/forests-and-watersheds/burney-hat-creek.	Assembles resource management issues, goals and objectives for the Hat Creek and Burney Creek drainages and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
VESTRA Resources, Inc. Fall River Watershed Assessment and Watershed Management Plan. 2010.	Assembles resource management issues, goals and objectives for Fall River drainage and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
VESTRA Resources, Inc. *Burney Creek Watershed Assessment and Watershed Management Plan*. 2010.	Assembles resource management issues, goals and objectives for the Burney Creek drainage and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
VESTRA Resources, Inc. *Upper Pit River Watershed Assessment*. 2004.	Assembles resource management issues, goals and objectives for the watershed and was used as a platform to refine and inform the Region Description, issues, and goals and objectives.	Provided noxious weed information
U.S. Forest Service, Pacific Southwest Region. *Existing vegetation data (CALVEG) by Forest*. McClellan, CA. 1 December 2009. 18 August 2011. Available from: http://www.fs.fed.us/r5/rsl/clearinghouse/forest-eveg.shtml.	Used to characterize existing vegetation for the Region Description.	Also used in the climate analysis for vegetation projections
Southwest Regional Office, Marine Fisheries Service. Central Valley Chinook Salmon Historic Stream Habitat Distribution. Available from: http://swr.nmfs.noaa.gov/hcd/cvschshd.htm.	Data sets based on historic studies and fisheries monitoring were used to assess historic presence of salmon in the watershed.	
Population		
California Department of Finance. *Population Projections by Race/Ethnicity for California and Its Counties 2000–2050.* Sacramento, CA. May 2012. http://www.dof.ca.gov/research/demographic/reports/projections/p-1/.	These statistical analyses were used to project future population and demographics and, subsequently, water demand and potential land use changes.	These data are updated, so should be consulted periodically when updating the Plan.
U.S. Census Bureau. *Census 2010*. Washington, D.C. 2011. 15 August 2011. Available from: http://2010.census.gov/2010census/index.php.	These statistical analyses were used to project future population and demographics and, subsequently, water demand and potential land use changes.	These data are updated, so should be consulted periodically when updating the Plan.
Socioeconomic		
Indian Claims Commission in its July 29, 1959, findings of fact and opinion in Docket No. 347.	Used in the Region Description to delineate the jurisdiction of the Tribe.	

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
The Pit River Native History in the Federal Archives, 1850 to 1940. Jason C. Newman PhD thesis. U.C. Davis. March 2004.	Describes various aspects of the Pit River Tribe's historic way of life and culture for the Region Description.	
Land Use		
General Plans for Siskiyou, Modoc, Lassen, and Shasta Counties.	Used for population estimates, development projections, and planning priorities.	Update will be required as the general plans are updated by County Boards of Supervisors.
Climate		
The Natural Resources Agency, Department of Water Resources, Division of Integrated Regional Water Management. *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines.* Sacramento, CA; State of California. August 2010. Available from: http://www.water.ca.gov/irwm/guidelines.cfm.	Guidance for the Plan on aspects of climate to be discussed, strategies to be considered, and assessment of GHG emissions	Guidance for all Plan sections
Climate Change Scoping Plan: A framework for change. December 2008. Prepared by the California Air Resources Board for the State of California, Sacramento, CA. Available from: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.	Was most relevant when considering adaptive resource management strategies and GHG reduction associated with project development.	
California Department of Water Resources. *Managing An Uncertain Future: Climate change adaptation strategies for California's water.* Sacramento, CA, State of California. October 2008. Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.	Provided a profile of the observed climate phenomena at the state level that have bearing on the Upper Pit watershed.	
California Natural Resources Agency. (2009). 2009 California Climate Adaptation Strategy. Retrieved from CAKE: http://www.cakex.org/virtual-library/1959.	Proposes a set of recommendations for policy development to protect the state from the effects of climate change and generally focuses on GHG reduction strategies that may be relevant; used in the climate chapter.	

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Sierra Nevada Alliance. Sierra Climate Change Toolkit, 3rd Edition. South Lake Tahoe, CA. 2010. Available from: http://www.sierranevadaalliance.org/publications.	Excellent reference for resource management strategies, climate adaptation strategies, and project development and funding, used when developing the climate chapter.	Helpful for Finance, Project Development
Ag Innovations Network. Agricultural Water Stewardship: Recommendations to Optimize Outcomes for Specialty Crop Growers and the Public in California. California Roundtable on Water and Food Supply. June 2011. Convener: Ag Innovations Network, Sebastopol, CA. Available from: http://aginnovations.org/articles/view/stewardship_recs/.	Emphasizes the regional watershed management approach to agricultural water efficiency and conservation, used as guidance in the climate vulnerability analysis.	Its recommendations can be used as a checklist during the planning process to assess whether ag-related water issues have been addressed.
Merriam, K.E. and H. D. Safford. 2011. A summary of current trends and probable future trends in climate and climate-driven processes in the Sierra Cascade Province, including the Plumas, Lassen, and Modoc National Forests. 31 pp. USDA Forest Service, Pacific Southwest Region internal report. Available at: http://fsweb.r5.fs.fed.us/program/ecology/.	Synthesized a sizeable compendium of weather data, research papers, climate models, and climate impact analyses into an accessible accounting of what the watershed is likely to experience based on today's capabilities to project, and used to inform the vulnerability analysis.	Similar analyses have been prepared for each of California's national forests. IRWM planners can substantively benefit from their respective use.
CDM. Draft Handbook: Regional Water Management Planning with Climate Change Adaptation and Mitigation. Prepared for: U.S. Environmental Protection Agency Region 9 Water Division, In partnership with California Department of Water Resources, U.S. Army Corps of Engineers – San Francisco District, Resources Legacy Fund, USEPA Office of Research and Development. May 17, 2011. Available from: http://www.water.ca.gov/climatechange/docs/DraftClimateChangeHandbook-May-17-2011-FINAL.pdf.	Offered exceptional guidance on all aspects of IRWM climate considerations from impact assessment and vulnerability analysis to adaptive resource management strategies and project development.	Climate TAC used vulnerability checklist to conduct vulnerability analysis.

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Modoc National Forest-Alturas Field Office, Bureau of Land Management, Modoc County. Sage Steppe Ecosystem Restoration Strategy Final EIS. April 2008. RS-MB-161. Available from: http:// www. blm.gov/ca.	Focuses on and was used when considering the restoration of sage-steppe ecosystems that have become dominated by juniper over time, and its relevance to climate change. The management strategy identifies restoration methodologies by ecological conditions and provides guidelines for design and implementation of effective restoration treatments.	Provides guidance for sage-related restoration projects
Sacramento River Watershed Program. The Sacramento River Basin: A Roadmap to Watershed Management. October 2010. Available from: http://www.sacriver.org.	Sets the stage for future watershed management actions to be taken at the sub-watershed level in the Sacramento Basin, with the intent of implementing projects that address key issues in each watershed. Many of these were considered during preparation of objectives and project development.	
Freeman, G. J. 2003. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G._Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf.	Was used to extrapolate possible impacts on water management for several sectors, including potential realignment of irrigation district delivery contracts, and concludes with compensating strategies for hydropower generation.	
Freeman, G. J. 2007. A program to increase aquifer outflow in northern California's McCloud and Pit River watersheds. Western Snow Conference, 75:31-42. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2007/Freeman.ProgramToIncreaseAquiferOutflow.pdf.	Cloud seeding conducted in the Pit watershed for sustained hydro power is the topic of this paper. The analysis offers a good description of local geology and its relationship to groundwater storage, as well as comparative fluctuations of deep aquifers over time in response to severe drought for the climate vulnerability analysis.	Implications for cloud-seeding in the future by PG&E

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Freeman, G. J. 2008. Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation - a mountain hydroelectric system perspective. Western Snow Conference 76:23-34. Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2008/Freeman.RunoffImpactsOfClimateChangeOnNorthernCalifornia'sWatersheds.pdf.	This paper characterizes the relationship of geology to groundwater flows in the watershed, the relationship of groundwater and runoff from reduced snowmelt and their combined effects on runoff trends. It forecasts how lower-elevation watersheds (such as the Pit) will be affected by reduced snowpack, used in the climate vulnerability analysis.	Further study: paper notes that PG&E is assisting the Lawrence Livermore National Laboratory to model "some of PG&E's hydroelectric systems on these rivers" in hopes of understanding flows under climate regimes and developing adaptive strategies in response.
Freeman, G. J. 2010. Tracking the impact of climate change on central and northern California's spring snowmelt sub-basin runoff. Western Snow Conference 78:107:118. Available from: http://www.sierrainstitute.us/ALMANOR/Freeman_Climate_Change_and_Snowmelt.pdf.	Used to examine the influences of and correlation between topography and rain shadow effect on climate impacts to reduced snowmelt, spring runoff, and sometimes total runoff for the water year.	
Mai, Christine, F. Levitan, S. Bachman, and W. Brock. Watershed vulnerability to Climate Change, Shasta Trinity National Forest Pilot Project. November 2011. Unpublished presentation.	Provided one framework for assessing climate vulnerability using a PowerPoint presentation and was shared with the Working Group as one approach.	
Climate projections from Mary Tyree, California Nevada Applications Program, Scripps Institution of Oceanography, UCSD. April 2012.	A series of climate projections produced under the guidance of UCSD and the Climate Vulnerability Working Group for the Upper Pit watershed and then included in the Plan.	Projections are inherently uncertain, but provide a framework for consideration.
Wieslander, A.E. 1935. A vegetation type map of California. Madroño **3:** 140-144.	Mapping used to analyze vegetation and effects on vegetation from climate change projections.	
Bouldin. J. 1999. Twentieth-century changes in forests of the Sierra Nevada, California. Ph.D. dissertation, University of California, Davis, CA, USA.	Analysis of vegetation and effects on vegetation from climate change used to help inform the climate vulnerability analysis.	

Table 13-1. *continued* **A Summary of Primary Studies and Data Sets Used in Preparing the IRWMP**		
Name of Study/Data Set	**Use in the IRWM Plan**	**Other (e.g., status of data, certainty of data/ analysis, relevance to other sections)**
Lenihan, J.M., et al. 2008. The response of vegetation distribution, ecosystem productivity, and fire in California to future climate scenarios simulated by the MC1 dynamic vegetation model. Climate Change 87 (Suppl 1): S215-S230. Output of potential natural vegetation for California (model simulations). Available from: http://www.enerty.ca.gov/pier/project_reports/500-03-58cf.html.	Analysis of vegetation and effects on vegetation from climate change using modeled data used to help inform the climate vulnerability analysis.	Uncertain because modeled data were used
California Nevada Applications Program/CASPO, Scripps Institution of Oceanography, UCSD. 2012. Global climate model (GCM) simulations of 1950-1999, downscaled to the 12km grid by comparing the simulated data to the library of local data.	Technical projections of specific parameters for the region used to inform localized climate projections.	Projections are inherently uncertain, but provide a framework for consideration.
Greenhouse Gas Calculations		
World Resources Institute. 2006. *The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool.* June 2006. Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf	Provided the formulae used to calculate GHG emissions from Tier 1 projects.	
U.S. Environmental Protection Agency. 2010. *The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document*. Prepared by: E.H. Pechan & Associates, Inc. December 2010. Available from: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010TechnicalSupportDocument.pdf	Used to calculate construction-related electric energy use emissions.	

2.0 METHODOLOGY

Throughout the document references were added when assertions were made about particular topics. But chapters that relied heavily on technical data for their preparation included Region Description, Water and Land Use Planning, and Climate Vulnerability; therefore, methodology for preparing those chapters is provided below.

2.1 Region Description

Technical information and datasets were primarily gathered from the previous watershed assessment documents that were conducted for the Upper Pit River, Fall River, Hat Creek, and Burney Creek watersheds. Other information and datasets were recruited from participants in the Integrated Regional Water Management (IRWM) process (e.g., county planning departments, federal agencies) and researched online. Other supplemental data used in the Upper Pit IRWM development were found on agency websites. These documents were initially assessed for validity. Generally, if the data or documents were accepted by an outside agency or other entity as being satisfactory – for example, by the review process required for public planning documents – the items were judged of adequate quality for use in the IRWM Plan. If a document was potentially out-of-date, the author organization was contacted regarding its veracity.

A substantial amount of water-quality monitoring data that has been collected for the past several decades were available for the region. These data were collected from state agencies (including Department of Water Resources [DWR], Regional Water Quality Control Board [RWQCB], and State Water Resources Control Board [SWRCB]) as well as grant-funded water-quality studies. These data were compiled and analyzed to identify trends and historical background information for the individual constituent write-ups.

GIS datasets from state and federal agencies were captured for the region. These datasets were used to prepare map graphics for the IRWMP. These data were also clipped to the region boundary and acreage calculations were made to gather information for the region. For example, the California Natural Diversity Database maintained by the California Department of Fish and Game was queried to identify sensitive species locations found in the region.

Population trends were developed using 2000 and 2010 Census data by county. These data were then compared with population within the watershed attributed by zip code. Estimated watershed population was then compared with growth rates projected by county by California Department of Finance[1] through the 20-year planning horizon and beyond, and in relation to trends in local school enrollment.

2.2 Land Use

Technical information and datasets were recruited from participants in the IRWM process (e.g., county planning departments, federal agencies) and researched online. The majority of land use planning data used in the Upper Pit IRWM development was found on agency websites. The only County General Plan that is solely available in hard copy is Modoc County's. Federal land

[1] California Department of Finance. *Population Projections by Race/Ethnicity for California and Its Counties 2000–2050.* Sacramento, CA. May 2012. http://www.dof.ca.gov/research/demographic/reports/projections/p-1/.

management plans and strategies were available electronically, and often a search for one particular document led to several others that proved useful.

These documents were initially assessed for validity. Generally, if the data or documents were accepted by an outside agency or other entity as being satisfactory – for example, by the review process required for public planning documents – the items were judged of adequate quality for use in the IRWMP. If a document was potentially out-of-date, the author organization was contacted regarding its veracity.

2.3 Climate Change

In the summer of 2010, at the request of Pit River Watershed Alliance (PRWA) and before the IRWM planning effort began, Burdick & Company staff was asked to determine if the Variable Infiltration Capacity (VIC) model could generate climate projections that would be useful for understanding climate effects in the Upper Pit watershed. To determine if the VIC model could be useful, Burdick & Company staff contacted and set up a working relationship with Mary Tyree, Programmer/Analyst at the California Nevada Applications Program/CASPO, Scripps Institution of Oceanography at UCSD.

Ms. Tyree generated numerous raw data runs from the VIC model. These consisted of extremely large spreadsheets – extensive numerical data runs. Staff then worked with Mary to learn how to transform the data runs into a graphic format so that staff and the PRWA could examine the first-level output. Data points at Fall River Mills and Canby were run and subsequently examined for both a high- and low-emissions scenario (future projections) and for eight parameters (e.g., precipitation, temperature, snow water equivalent). Thus, 16 graphs were generated for each of the two locations.

The graphs and short narratives gave the PRWA enough confidence to proceed toward climate analyses using the VIC model. Thus, they were a necessary exercise to allow the in-region stakeholders to evaluate a product they could then reject or accept for further evaluation.

When preparation of the IRWMP began and a Climate Variability Working Group (Group) formed, members looked at the output of the VIC model and determined they did not feel comfortable with the veracity of historical flow data from the region, nor the precipitation data from Canby (a compromised weather data collection site), upon which the VIC model was based. Mary Tyree then suggested she would work on behalf of the Group to conduct correlation between historic weather data and climate scenario output, interpreting trend data, and producing synthesized graphics that meaningfully displayed historic trends, climate projections over time, and answers to specific questions, such as: “Will weather variability increase in the region.”

A complex, multi-step, and time-consuming process for understanding climate change was then pursued by the Group, with the Project Team providing extensive research to supplement projections by UCSD, and the Group providing review and local knowledge. Statistical analyses used for the climate section was informed by four global climate models and data from the local weather stations at Adin, Alturas, Canby (temp only), Burney, and Hat Creek. (A thorough description of the process for producing the climate projections is contained in **Appendix 8-1**.)

The Group acknowledged that climate modeling introduces a level of uncertainty into any analysis, and agreed that simulated and modeled data should not only be treated cautiously, but revisited as this Plan is updated.

To better understand how vegetation might change in the watershed under differing climate scenarios, the Group looked at two examples from a set of mapped simulations generated for a project called "Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy."[2]

The Group took a closer look at the future vegetation projections covering the IRWMP region under two of the climate scenarios used in the Project. The technical methodology for producing these two regional vegetation projections are presented in more detail in **Appendix 8-2**, and were based upon future climate models with different temperature and moisture assumptions, but the same socioeconomic assumptions. Again, there is much uncertainty inherent in these modeling efforts, and they may profit from future updates.

2.4 Greenhouse Gas (GHG) Analyses

GHG analyses were calculated for Tier 1 projects in this Plan (see **Appendix 8-3**). To determine the average annual total GHG emissions, short-term construction emissions were divided over the life of the project. The total construction activity emissions are the sum of the emissions from the construction equipment, from transportation of construction workforce, from transportation of construction materials, and the construction electricity emissions.

Emissions from construction equipment were calculated by evaluating each equipment type. The maximum number of a specific equipment types per day was multiplied by the total operation days of that equipment to find the total operation hours. The fuel consumption per hour was determined either by a table from the California Air Resource Board, or by the sponsor of the project if they were familiar with the equipment. The total fuel consumption was calculated by the product of the total operation hours and fuel consumption per hour. Finally, the total CO_2 equivalent emissions were determined in metric tons by multiplying the total fuel consumption by the CO_2 emissions per gallon diesel which is 0.010, (from the World Resources Institute-Mobile combustion CO_2 emissions tool[3]). This process is repeated for each equipment type. The sum of these numbers is the total CO_2 equivalent emissions for the construction equipment.

The emissions from transportation of construction workforce were calculated next. The total miles traveled were determined by the product of the average number of workers per day, the total number of workdays, and average distance traveled (round trip). The total fuel consumption in gallons of gasoline is determined by dividing the total miles traveled by the average passenger vehicle fuel efficiency, (which is provided by the United States Environmental Protection Agency). This number is multiplied by the CO_2 emissions per gallon gasoline, (0.009) to obtain the total CO_2 equivalent emissions in metric tons for the transportation of construction workforce.

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[2] Lenihan, J.M., et al. 2008. The response of vegetation distribution, ecosystem productivity, and fire in California to future climate scenarios simulated by the MC1 dynamic vegetation model. Climate Change 87 (Suppl 1): S215-S230. Output of potential natural vegetation for California (model simulations). Available from: http://www.enerty.ca.gov/pier/project_reports/500-03-58cf.html

[3] World Resources Institute. 2006. *The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool.* June 2006. Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf

The emissions from transportation of construction materials were subsequently calculated. There are two "trip types": delivery and spoils. The total emissions were calculated the same way for both. The total miles traveled are determined by the product of the total number of trips and average trip distance. This number is then divided by the average semi-truck fuel efficiency to find the total fuel consumption, and then multiplied by the CO_2 emissions per gallon diesel to find the total CO_2 equivalent emissions in metric tons. The sum of this number for the two trip types is the total emissions from the transportation of construction materials.

The construction electricity emissions are calculated simply by multiplying the amount of electricity needed in mega-watt hours by the amount of CO_2 per mega-watt hour, which is 0.310 (provided by eGRID2010[4]).

The total construction activity emissions are the sum of the total of emissions from construction equipment, transportation of construction workers and materials and construction electricity. The average annual total GHG emissions are finally determined by the quotient of the total construction activity emissions and estimated project useful life in years.

3.0 DATA GAPS

The following numerous data gaps were identified during the course of Plan preparation. Projects have been developed to address some of these data gaps, but resources will need to be identified to address the remainder.

- Assessments of groundwater quantity and quality by basin need to be completed for the entire watershed to allow for long-term management of groundwater and to meet state guidelines for counties wishing to apply for groundwater-associated project funding via the IRWM program.
- Streamflow monitoring is inconsistent within the watershed. Priority streams need to be identified and systematically monitored over time. Without this, surface water flow trends will be difficult to understand and manage.
- Fisheries data and analysis needs identified by state Department of Fish and Game, especially for redband trout, need to be conducted to manage and prevent further decline of that species.
- Water-quality monitoring is required for particular parameters under the 303(d) listing and needs to be prioritized and conducted in other stream reaches, such as portions of Burney Creek, to stay on top of water-quality management and pollution prevention. High concentrations of non-point-source pollutants in Rattlesnake Creek, including chronically poor temperature and dissolved oxygen conditions, unusually high sediment loads, and bacteria concentrations unhealthy to humans and livestock, limit local residents from any beneficial use of this surface water.
- Absence of regionally relevant and collaboratively developed best management practices to mitigate impacts and educate regional communities on the importance of clean water and pollution prevention programs hinders some collaborative project development.
- A comprehensive wetland inventory, including springs, fens, and vernal pools, is needed throughout the watershed to enable restoration and protection of these resources that are highly beneficial to hydrologic recharge and habitat health.

[4] U.S. Environmental Protection Agency. 2010. *The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document*. Prepared by: E.H. Pechan & Associates, Inc. December 2010.

- From the Tribal perspective, a lack of core scientific data exists for sustainable management of juniper.
- Scientific data are lacking on the full, long-term, and cumulative effects of cloud-seeding, both from the perspective of potential chemical contamination and regarding the effects that this weather modification has on neighboring regions.
- A full hydrologic modeling effort to better understand the effects of climate on the region's water balance has been suggested as a data gap by U.C. Extension staff.
- Tribal interests express the need for population trends monitoring for goshawks, pileated and white-headed woodpeckers, and neo-tropical song birds to better inform restoration and land use management.
- Tribal interest also express the need to establish historic forest structure and composition – diversity, size class, species, mortality – to better determine restoration prescriptions, and to determine understory vegetation – composition – shrubs, grasses, forbs, and micorrhizal connectivity (layer count and composition), riparian plants, and noxious and invasive species to better determine restoration prescriptions.
- The need has been identified to conduct more extensive noxious weed inventories and mapping, and to have a central repository that illustrates the aerial extent of various infestation, and treatment history and methodologies used throughout the watershed.
- A need has been identified for GIS data on flooding to be accessible for use in the watershed, to be added to the Sacramento River Watershed Information Module database where available, or generated if currently unavailable.
- Surface water monitoring is needed to provide a baseline of current conditions that exist on Reservation lands, as well as track changes in water quality over time.

CHAPTER 14. DATA MANAGEMENT

1.0 INTRODUCTION

This chapter describes not only data needs in the region, but which data management systems are appropriate. How these tools are managed, publicized, and updated into the future will make a difference in accessibility and usability of region-specific data.

In the first stakeholder meetings held in the watershed, data management was identified as a challenge; stakeholders identified the necessity for a greater understanding of the breadth of activities and research completed for the watershed, ability to access existing information, and how to inform future research and data gathering. Stakeholders wanted to ensure that the information-gathering systems identified would be compatible with all data types and with the variety of stakeholder capabilities throughout the region.

1.1 Data Needs in the Region

Specific data gaps are identified in **Chapter 13 Technical Analysis**. While information about regional watershed resources and use has been assessed for decades, there remain gaps in this knowledge. These gaps appear to stem from several factors, including a lack of funding to pay for expensive and long-term studies, a reluctance to gather data that could be used to invoke further regulation, and the difficulty of assessing such natural phenomena as volcanic geology and complex groundwater basins.

Region-specific data and analyses include, but are not limited to: watershed and sub-watershed assessments and management strategies; flood assessments for specific parts of the region; water-quality investigations done by the state and some agricultural and other private entities; soils mapping and geologic feature identification useful to city and county planners; and wildlife and habitat assessments conducted by public and private entities to gauge, among other things, the presence of endangered species, habitat health, and the effects of human activity on the surrounding natural world. Also helpful are planning documents, including general plan findings, hydroelectric power operation permits, and U.S. Forest Service management plans. All of this information combines to give stakeholders a snapshot of the status of regional resources and potential gaps in knowledge.

Groundwater supply, connectivity to surface water, and recharge and residence rates/times remain largely unstudied in much of the watershed. The water supply status of the larger purveyors and their capacity for dealing with long-term drought throughout the region remains unknown. Each of these separate components represents important knowledge to one or more interest groups active in the watershed. It is expected that these stakeholders will continue to pursue greater understanding of their specific issues and then share that information to better complete the local water-management picture. This more complete picture will then allow stakeholders to truly integrate water planning and management and thereby raise the level of preparedness for all stakeholder entities in the region.

1.2 Data Collection Techniques

Calls for information and data were put out to the Regional Water Management Group (RWMG) early in the Integrated Regional Water Management (IRWM) development process. Information submitted included purveyors' capital improvement plan lists, management plans for National Forests and Lassen Volcanic National Park, general plans for the four counties included in the region and the City of Alturas, wildlife management plans for the state and federal wildlife refuges throughout the watershed, weather tracking data, and a variety of other research and planning documents. No primary data was collected specifically for IRWM Plan (IRWMP) development.

In the event that a mandated document was submitted for one entity but not for another of similar type, that information was researched online. For example, general plans for Shasta, Lassen, and Modoc Counties were submitted to the process, but Siskiyou County did not submit one. Because stakeholders know that this is a document mandated by the state, they knew that it should be available. The information was then found online.

1.2.1 How Stakeholders Access Data

A need often cited by regional stakeholders was for a central repository of watershed information. Stakeholders believe that they are losing opportunities to learn from one another, are duplicating efforts, and are taking longer to produce documents because of a lack of a "one-stop-shop" of information sources.

Two solutions have emerged from this IRWM process: The first is to use the upperpit.org Website as a means of communication and data upload and the other is the Sacramento River Watershed Information Module (SWIM). Data gathered during the preparation of the IRWM process has been uploaded to both of these Data Management Systems (DMS).

SWIM allows users to load their own data into the online data library through either downloading a digital file or "pointing" to the online location of the file. Immediately upon loading information into the SWIM digital library, it is also submitted to the California Environmental Information Clearinghouse (CEIC),[1] developed as part of the California Environmental Resources Evaluation System (CERES).

One of the more valuable elements of the SWIM tool is that it allows the user to geo-locate the data and/or document by giving it a GIS point. This step immediately adds the data or document to the SWIM digital atlas. After being loaded into the digital atlas, SWIM allows users to identify the document, data, or project through turning various GIS layers on and off within the tool itself. This allows use of the GIS data even by those users who do not have access to GIS software, creating a powerful tool for communication.

SWIM includes three major components:

[1] The Catalog is a repository of information about environmental data resources in California. Its primary purpose is to provide users of environmental information with information that will help them identify existing resources, evaluate them, and simplify access to the information resource data. The Catalog may be viewed as a "Yellow Pages" of environmental information by indexing and organizing metadata that facilitates identification and access to the data.

Digital Atlas: The SWIM digital atlas includes interactive, Web-based GIS maps that allow Web users to explore the Sacramento River watershed. Users can add their own data layers, edit and highlight features, and save copies of their developed maps to print or share digitally. The atlas data layers are extractable for use in GIS software or on Google Earth.

Geofinder: This map-based search tool allows users to browse water- and resource-related documents in the Sacramento River Watershed Program's Resource Library. In addition to providing access to these resources, the Geofinder also provides a portal to the CEIC's statewide data catalogue.

Resource Library: This is the heart of the SWIM tool – a publicly accessible digital library for water- and natural resource-related information within the Sacramento River watershed. Authorized users can upload documents, photos, or other information, tag it on a map, and describe their project or data using forms. This information is archived on the Sacramento River Watershed Program Website. New library entries are processed nightly, and the abstracts are sent to the CEIC database and accessible through SWIM's Digital Atlas and Geofinder.

This tool features a very user-friendly interface, making it simple to search for and identify regionally specific, geo-located data.

1.3 How Stakeholders Contribute and Share Data

Stakeholders will be able to submit information to data management systems in two ways: To the RWMG, that will in turn have the responsibility as part of its ongoing functions to perform updates to and upload data to the Website (see **Chapter 11 Plan Performance and Monitoring** and **Chapter 15 Management, Governance, and Implementation**) and will share uploads to SWIM with project sponsors.

The process of contributing data to the SWIM system is simple and straightforward. A user first needs to create a user account, accessible through http://swim.sacriver.org/. After gaining access, the user can then add their personal profile and/or the profile of their organization. They can also add "pages" (documents and data) and GIS layers to the SWIM library interface.

Part of the IRWMP process includes a training of all project sponsors and interested RWMG members in the use of SWIM. This ensures that stakeholders will be able to use the tool, in addition to populating the tool with information. Three SWIM trainings were offered February 5 and 6, 2013, in Burney, Fall River, and Alturas, with 13 total attendees. Training stakeholders to use the tool also increases regional capacity to complete maps for grant applications and planning purposes, and also allows all stakeholders to view data that is relevant throughout the watershed. In addition to this, the tool covers the entire Sacramento River watershed, creating the opportunity to research projects and programs completed or in process throughout neighboring IRWM regions.

When stakeholders are interested in retrieving information from SWIM, they can log on to the tool and either visit the map of the watershed, clicking on boxes to "show layers" including project locations, 303(d) sites, planning documents, or other relevant information, or they can visit the library and type in key words to identify the documents relevant to their search. There is not a way in SWIM to selectively show information. If an entity does not want something publicly available, this is not the place to share it with the RWMG. In these cases, it is likely that the RWMG would identify a Web page on the upperpit.org Website to host behind a firewall. "Qualifying" members would then be able to sign in to view the information. This process was used in some cases during

the development of the IRWMP and project submittals, and could be easily implemented in the future.

1.3.1 DMS Support

The Sacramento River Watershed Program (SRWP) has made a commitment to keep the SWIM tool active and updated. The tool was upgraded in 2012, making it more user-friendly. A photo-management capability was added to the tool in order to enable stakeholders to load and geotag photos of projects, habitat, wildlife, or anything relevant to regional resource management.

In addition to technical support, the SRWP staff acts as a gatekeeper for the information and photos added to SWIM and for users making use of the tool.

1.4 Entity Responsible for Maintaining Data

The RWMG will have responsibility for updating the Website and will share updating SWIM with project sponsors. It is expected that all project sponsors will submit relevant information to enable a regional picture of proposed projects.

1.5 Data Quality Control and Dispute Resolution

There are two components to data quality control for the Upper Pit Region: 1) the quality of the data submitted to the Website and/or to SWIM, and 2) the process for submitting data to SWIM and ensuring that it is submitted in a way that makes it compatible with the SWIM system (where possible without undue expense), and useful to the region.

Data submitted by an entity that has an obvious financial stake in the outcome or process and/or that runs contrary to generally accepted findings may be worthy of additional review. Disagreements regarding facts must be backed up by data supplied by the parties differing in viewpoint.

While most data would likely be submitted by federal and state agencies, and possibly academic institutions, it is expected that all primary data submitted to the process be collected using standards and methods specific to the particular process and/or topic, and analyzed using the same or similar standards.

One example of a data dispute in the planning process was about the 303(d) listing backup data for the Upper Pit River. Stakeholders disagreed with the validity of the data submitted to and used by the Board for the listing. They have worked with the Department of Water Resources and the Board to identify alternate data sources, especially current conditions, as replacement for that disputed information. This represents an excellent example of regional problem solving and dispute resolution in a collaborative and constructive way.

The standards for the SWIM library include an adherence to the Federal Geographic Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) for all metadata[2] submitted. This allows for greater searchability of the database.

[2] Metadata is "data about data." It is used to catalog, organize, search for, and describe documents, datasets, and any other pieces of information. It answers who, what, where, when, why, and how about every facet of the data being documented. For metadata to be compatible with an online system they must be predictable

1.6 Contributions to State Databases

Part of the IRWMP grant award was to create a data collection manual for regional stakeholders. The purpose of this task is to ensure that stakeholders are aware of the places their data could be commonly stored, as well as to highlight where to go for more information on environmental and resources status throughout the state. This process will also be helpful to the performance measures tracking and the region's process for evaluating success (see **Chapter 11 Plan Performance and Monitoring**). The data collection manual will largely serve to direct members to the appropriate state databases for reporting specific information (see **Appendix 14-1**).

One challenge with much of the historical data available is that it is in hard-copy formats that do not readily allow for comparison, analysis, and sharing. Also, much of the digital information (e.g., soils, topography, stream flow, and rainfall time series data) from public sources is distributed across multiple databases with incompatible formats. RWMG members have agreed that historic information, while important, will not be updated to be compliant with current database standards and/or formats. This would be too expensive and time-consuming.

Regional data management should provide the following benefits:

- Increase staff efficiency and effectiveness;
- Reduce cost of long-term information management;
- Provide a one-stop-shop for basin-wide, water-related data; and
- Provide the highest level of support to member entities.

in both form and content – adherence to standards ensures this predictability. The FGDC standards are also employed by the National Spatial Data Infrastructure and the GeoSpatial One-Stop program, http://geo.data.gov/geoportal/catalog/main/home.page, to support national clearinghouse and cataloging functions.

CHAPTER 15. IRWMP MANAGEMENT, GOVERNANCE, and IMPLEMENTATION

© Lisa Bay

Fall River in September

1.0 INTRODUCTION

The purpose of this section is to describe how the Upper Pit River Regional Water Management Group (RWMG) and its committees were established, how the RWMG has conducted the decision-making and document-adoption process, and how future governance of the group will be undertaken. The presence of a well-defined governance structure is essential to the implementation of the Plan into the future, and needs to be inclusive of all entities in the region with an interest in integrated water management.

1.1 Group Responsible for Development of Plan

1.1.1 Background

In April 2009, Northeastern California Water Association (NECWA) and Pit River Watershed Alliance (PRWA), as joint applicants, submitted a Regional Acceptance Process (RAP) application to the California Department of Water Resources (DWR), seeking recognition as a formal region within the Integrated Regional Water Management (IRWM) Program. That application was approved by DWR in late 2009, thereby recognizing the Upper Pit River watershed as a formal IRWM area.

In mid-2010, a grant cycle was initiated by DWR, enabling recognized regions to submit a planning grant application to support preparation of an Integrated Regional Water Management Plan (IRWMP). Subsequently, NECWA and PRWA collaborated in the preparation of a funding application to DWR. The application was submitted in late 2010 and funded in February 2011.

Following the successful receipt of a planning grant, and prior to signing the formal grant agreement, NECWA held conversations with PRWA to develop a formal understanding covering preparation of the Plan. As both groups had limited resources, it was agreed that NECWA would take responsibility for contract management and billing/financial oversight, with support from North Cal-Neva Resource Conservation and Development Council (RC&D), while PRWA would manage the planning process and Plan preparation.

A Letter of Agreement was executed between PRWA and NECWA to formalize this relationship. PRWA also agreed to serve as the RWMG, with the responsibility for confirming both a short-term and a long-term decision-making structure.

In August 2011, NECWA signed an agreement with DWR to manage the preparation of an Upper Pit River IRWMP. The agreement identified the work plan, schedule, and budget for the work effort, as well as the list of deliverables that preparation of the Plan would require.

Northeastern California Water Association: NECWA was formed to assist and educate farmers and ranchers on agricultural management practices that improve resource values, as well as ensure protection of regional water resources. In 2012, it served 160-plus members covering approximately 74,000 acres.

Pit River Watershed Alliance: PRWA was initiated in 1999 to foster cooperative stewardship to the Upper Pit River region. PRWA states that "*those stakeholders participating in the Alliance believe improvements in the watershed can best be solved by those living and working in the watershed*." The group has successfully developed a variety of watershed assessments and other plans including: the Upper Pit River Watershed Assessment 2004; Pit River Watershed Alliance Water Quality Monitoring Program 2005, Upper Pit River Watershed Management Strategy 2010; Burney, Fall River, and Hat Creek Watershed Assessments and Watershed Management Plans 2010 (in collaboration with others); and the 303(d) Delisting Support and Strategy Progress Report in 2010 (VESTRA 2010) that cover the majority of the IRWMP area. PRWA has also collaboratively developed projects to benefit the region.

© Todd Sloat

Upper Big Bear Flat meadow restoration

Table 15-1, below, provides a list of the organizations, agencies, and groups that have formally joined PRWA via a Memorandum of Understanding.

Table 15-1. PRWA Members	
North Cal-Neva RC&D	Modoc National Wildlife Refuge
Bureau of Land Management (Alturas Office)	Modoc County Farm Bureau
Big Valley Water Users Group	Natural Resource Conservation Service (Alturas, Redding, and Susanville Offices)
High Mountain Hay Growers	Pit Resource Conservation District
Modoc National Forest	Modoc-Washoe Experimental Stewardship Program
Central Valley Regional Water Quality Control Board	Sierra Pacific Industries
Department of Water Resources	Modoc County Board of Supervisors
Lassen County Farm Bureau	City of Alturas
Northeastern California Water Association	Sacramento River Watershed Program
Fall River Wild Rice Growers Cooperative	Modoc County Noxious Weed Management Group
Fall River Valley Resource Conservation District	

Regional Water Management Group: According to DWR guidelines, each IRWM region must form an RWMG:

> *"RWMG means a group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a joint powers agreement, Memorandum of Understanding (MOU), or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies."*

In spring 2011, consistent with its agreement with NECWA, PRWA held its first meeting as the RWMG. At that time, a determination was made that: 1) existing PRWA members were automatically considered members of the RWMG, 2) that entities not currently part of PRWA would be recruited to join the RWMG over the life of Plan preparation and after Plan adoption (with a special focus on agencies with statutory authority over water management), and that 3) PRWA wished to identify a long-term decision-making structure during Plan preparation, and until that time would continue as RWMG.

In June of 2012, PRWA determined that its mission was both broader than and complementary to the IRWM planning effort. As a result, some groups might want to be members of PRWA but not the IRWM governance structure and vice versa. Subsequently, PRWA designated a subcommittee of the group to act as the RWMG, ensuring that recruited members did not have to join PRWA or its mission to participate in Plan development. It is this committee – consisting of all PRWA members (see **Table 15-1**) plus the Bureau of Indian Affairs (BIA) as represented by the Pit River Tribe – that was designated as having responsibility for developing and ultimately adopting the Plan. During the meeting at which this determination was made, the PRWA further decided that any existing PRWA members, as well as any new entities, could participate in all discussions of the RWMG, but that voting would be limited to representatives who attended two out of every three previous meetings. In this way the group sought to ensure continuity of thought process and to avoid having to redo decisions because of voting by infrequent attendees.

RWMG Members with Statutory Authority over Water Management: **Table 15-2** displays RWMG members that have statutory authority over water.

Table 15-2.
RWMG Members with Statutory Authority of Water Supply or Water Management

Agency/Stakeholder	Basis and nature of authority
City of Alturas	Water supply, wastewater and storm water treatment, and control
Modoc County	State of California Water Master Program
Modoc National Forest	Federal authority to manage water on Forest Lands
Bureau of Land Management	Federal authority to manage water on Forest Lands
Pit River Tribe (A federally recognized Tribe and Sovereign Nation)	Manage water rights and delivery for Tribal members
Modoc National Wildlife Refuge	Federal authority to manage water on the refuge
Fall River Valley Community Service District	Manage and deliver water supply

1.1.2 RWMG Process for Plan Preparation

To ensure a systematic evaluation of the region and a logic to development of Plan sections, the RWMG focused on the following progression of section development: Region Description, Issues and Conflicts, Resource Management Strategies, Goals and Objectives, and Project Development. Ancillary section work proceeded throughout this same timeframe; however, the group focused most of its attention on these five core sections.

The group designated three committees to support Plan development: 1) a Project Review Committee with responsibility for identifying and developing projects for inclusion in the Plan, 2) a Plan Review Committee to review sections of the Plan and recommend edits and content to the RWMG, and 3) a Climate Variability Working Group to assist in the development of the climate analysis for the document. Membership in these committees is displayed in **Chapter 2 Stakeholder Involvement and Coordination**. Each of these groups reported back to the RWMG regularly to ensure that the work of both groups was coordinated and would produce coherent results.

Generally, the process for review of each Plan section was the same – review of input generated by the public review meetings in September/October 2011, review of guideline compliance by the Project Team, preparation of initial section outlines for review by the RWMG and/or committees designated by the group, drafting of review sections, and submittal of sections for review and edit by the Plan Review Committee to ensure accuracy and inclusion of multiple perspectives.

Once all Plan sections had been adequately completed, the RWMG prepared a public review draft, released for a 30-day review between February 15 and March 15, 2013. Announcement of public review draft availability was made via the IRWMP Website upperpit.org, PSAs on local radio stations, and paid advertisements in three local newspapers, as well as placing both electronic and hard copies at local libraries.

The Project Team subsequently compiled public comments for presentation to the RWMG, which then directed the Project Team on how to address the comments.

1.2 Description of Chosen Long-term Governance Structure

1.2.1 Responsibilities

Into the future, at a minimum, the RWMG will be responsible for:

- Recruiting additional members to participate on the RWMG;
- Ensuring that all the project sponsors adopt the Plan;
- Supporting adoption of the Plan by regional stakeholders regardless of whether they have a project in the Plan;
- Coordinating and adopting annual updates to the Plan;
- Annual review of Plan performance measures;
- Monitor Plan changes that may evolve from the implementation experience (both Plan and project-specific);
- Annual update of project list;
- Assuring Plan implementation (e.g., revising and/or updating Plan, ongoing project development, pursuit of funding for project implementation);
- Coordinating ongoing committees and work groups (e.g., Project Review Committee, Climate Variability Working Group, Plan Review Committee);
- Coordinating with the BIA/Pit River Tribal Council;
- Monitoring evolving DWR requirements/standards for Plan updates or revisions;
- Securing staff or a strategy for internal communications and public involvement;
- Tracking opportunities for grant funding of the RWMG and/or Plan projects for a variety of grant sources, including DWR Proposition 84 Implementation grants; and
- Securing staffing or a strategy for grant application preparation.

1.2.2 Process for Developing Governance Structure

Throughout the first six months of 2012, the RWMG initiated a recruitment program to identify and involve additional water management-related entities, organizations, and agencies in the RWMG. Please see **1.3.4 Additional Recruitment to the RWMG**, below.

Many entities indicated they would prefer to join the group via adoption of the Plan by their respective boards, or via an agreement developed by the RWMG subsequent to Plan adoption. There were a variety of additional reasons that prospective members gave for being unable or unwilling to participate in the RWMG during Plan preparation. These included: severely reduced budgets, insufficient staff, inability to cover the travel and participation expense of staff, lack of confidence that the existing RWMG adequately represents their interests, and/or a lack of support for the IRWM program in general.

This effort was completed in June 2012, and resulted in the Pit River Tribe joining the RWMG. Following the close of recruitment activities, the group debated a variety of possible governance and decision-making structures. Some members advocated for a structure that was made up entirely of agency staff or elected officials, others argued for RWMG membership that reflected the various constituencies in the region, including agency staff and elected officials, but without limiting membership to that group. The ultimate decision was to retain current membership, because those entities were the dedicated participants over time, but to continue to pursue a more systematic recruitment effort as described below. In January 2013, Fall River CSD also joined the RWMG.

1.2.3 Governance Structure

The RWMG will manage Plan implementation, using consensus as the preferred decision-making process. However, if consensus cannot be reached, a 75 percent super majority vote will be used. RWMG members must be an assigned representative of an entity with a water-management interest or obligation. The requirement that voting would be limited to members who have attended at least two out of the three previous meetings was confirmed, as was the one-entity/one-vote process. A member can designate a proxy representative if he/she is unable to attend a meeting.

Committees and subcommittees designated by the RWMG will remain empowered to develop recommended content to the IRWMP, develop projects to ensure implementation of objectives and resource management strategies, address conflicts between stakeholders and members, and consider future recruitment and governance options. Committees will use the same consensus/75 percent supermajority, attendance, and proxy voting process as described above to reach decisions. However, the RWMG retains final approval over all committee recommendations. Further, the RWMG during Plan implementation will identify a process for assignment of a proxy, and participant codes of behavior (if needed).

The RWMG affirmed the Project Review Committee's (PRC's) role as having all project development, scoring, evaluation, and funding recommendations for projects occur within that committee. The RWMG retained the ability to review materials generated by the PRC, assist in resolving any disputes arising from project development, and have final approval of all projects recommended for inclusion in the Plan. For additional discussion of the role of the PRC, see **Chapter 9 Project Development and Implementation**.

Membership on committees can occur via recruitment by the RWMG and/or by self-identification with approval from the RWMG.

In summary:

- The RWMG will determine how often it will meet.
- Committee recommendations need final approval of the RWMG.
- Consensus is the preferred decision-making approach.
- If consensus cannot be reached, then a super majority of 75 percent of those present will decide the issue.
- In order to vote at any meeting:
    - A participant must be designated by their organization/agency as the official representative or alternate for the entity (one vote per entity), and
    - The participant must have attended two out of the previous three RWMG meetings.
- Existing committees will continue as needed and new committees may be designated by the RWMG as required.

How to communicate with RWMG: The Website for the IRWM program will remain functional into the future; contact information will be provided there. The North Cal-Neva RC&D will remain the contact point for individuals who do not have Web access, at least through the end of 2013 when an alternative contact may be designated.

Mechanism of Relationship: The RWMG considered and decided against forming a non-profit organization or a Joint Powers Authority (JPA). The decision against a JPA was based on the fact that such a structure does not provide a voting capacity for non-governmental organizations

and does not suit the profile of probable project sponsors, thus leaving them out of the decision-making process.

The development of a new non-profit in the region was seen as taking too much effort and expense, a structure that would not be readily accepted by many of the governmental organizations in the region. The RWMG is using the original MOU that created PRWA as its organizational agreement.

The RWMG has deferred the creation of a charter or an updated memorandum of understanding at this time and will re-evaluate this decision as part of Plan implementation.

List of committees: The RWMG designated three standing committees during Plan preparation: Project Review Committee, Climate Variability Working Group, and Plan Review Committee. Please see **Chapter 2 Stakeholder Involvement and Coordination** for a discussion of these committees.

How these committees and groups support Plan development and implementation: The three standing committees listed above were essential to Plan development. Hundreds of person-hours were expended by individuals who participated in these committees. Implementation of the Plan will be fully supported by the RWMG as well as any committees that remain or are formed to support implementation.

How people serve on committees: Individual participants on committees are recruited by the RWMG or self-identify as having an interest in the work of a particular committee via communication with and approval by the RWMG. At present, committee members have no term limits, work using a consensus-based model with a provision for 75 percent super majority votes, work at the direction and behest of the RWMG, and meet as required rather than on a standing basis.

Sub-regional meetings have, to date, been the primary vehicle for organized public outreach and involvement, and would be expected to continue as such. However, RWMG outreach has been conducted to a large degree by individual contact with water-management interests.

How the RWMG gathers data: RWMG members have a long history of gathering data on the region, including: preparation of several watershed assessments and plans, review and cataloguing of extensive materials used in the preparation of the Region Description, posting of gathered data on the Website and the Sacramento River Watershed Information Module (SWIM) data site, an ongoing data recruitment effort by RWMG and committee members, requirements for posting on the Web and/or distribution of data developed as a result of project implementation, and updates by individual RWMG members as their entities produce new data and information relevant to the issues identified in the IRWMP.

Communication between RWMG and other groups: The RWMG communicates with groups in the region via email, its Website, public meeting announcements, and personal contact. Members of the RWMG are specifically tasked with relaying information about the RWMG activities to their group and/or boards. Posting to the Website has and will continue to be used to keep members and stakeholders informed.

Updating and/or revising and implementing the Plan: The RWMG will have sole responsibility for implementing the Plan. Please see **Chapter 11 Plan Performance and Monitoring** for a complete discussion on revising and implementing this Plan and the

Implementation Guide at the end of this chapter for a timeline and process by which such revisions or updates will be accomplished.

1.3 Governance Process

1.3.1 Public Notice Requirements

Per Section 6066 of the government code, notice of the IRWMP preparation process was made by the Project Team submitting press releases to three local newspapers (see **Appendix 15-2 Press Releases and Outreach Materials**. This is a commonly used communication practice in the watershed. In addition, extensive outreach was completed by the Project Team to notify potential stakeholder groups directly about the process, in the event that they did not see the newspaper articles.

In early 2012, a blog was posted that contained general information under the following category headings: About IRWMP, The Plan, Projects, Maps, Library, and Calendars. This blog was replaced by a formal Website in mid-2012. See **Chapter 2 Stakeholder Involvement and Coordination** for a more complete description of stakeholder communications.

At sub-regional meetings in October and November 2012, two of three local newspapers failed to publish meeting press releases for the first time. Subsequently, events of interest, such as public review of the draft Plan were publicly noticed as explained above, and by paid advertisement and PSAs on local radio stations**.**

1.3.2 Plan Adoption and Update

IRWM Guideline require that:*"The governing bodies of each agency that is part of the RWMG responsible for the development of the IRWM Plan and have responsibility for implementation of the Plan must formally adopt the IRWM Plan. Each project proponent named in an IRWM Grant application must also adopt the IRWM Plan. Project proponents are permitted to adopt the Plan after it has been adopted by the RWMG, until the submittal of an IRWM Grant application. Proof of adoption is a resolution (or other written documentation) with signatory blocks for each governing body adopting the Plan."*

To provide public notice of the Final Draft Plan adoption meeting, a Website posting of the Final Draft Plan was made (November 7, 2013 to December 5, 2013). During that period, the RWMG also gave notice of its intent to adopt the Upper Pit IRWMP by: Press releases sent to all three local newspapers serving the region, including the Goose Lake area; PSAs provided to the local radio station; sending three local libraries hard copies and discs of the Plan; sending all RCD and Tribal offices copies; RWMG and NECWA members receiving electronic or hard copy versions; and publishing legal notice of intent to adopt in three local newspapers, once a week for two consecutive weeks (see **Appendix 15-1**).

Public notice (per §6066 of the Government Code, CWC §10543) and press releases are also required for any formal update (as opposed to annual revisions) of the Plan. A Plan update *will be* conducted every five years, or sooner if DWR IRWM guidelines are revised to require additional/different information or procedures for regions to qualify for project funding. The RWMG *may also* update the Plan for other reasons and with stakeholder support, such as a catastrophic event in the region that would require substantive changes to objectives.

1.3.3 Public Outreach

Direct outreach was made to water purveyors: irrigation districts, municipal and county water-management agencies, community service districts, resource conservation districts, federal and state agencies, and Tribal interests; in other words, all water-related management stakeholders in the region. Outreach was also made to various constituencies and the general public via personal communications and contacts, telephone, letter, paid advertisement, PSAs on local radio, Website and blog postings, email, and attendance by RWMG members at relevant meetings conducted by interest groups or agencies. This outreach has sought to ensure both maximum participation by local agencies and stakeholders, and that the general public is informed about process outcomes and has an opportunity to inform the process of Plan preparation and implementation.

With respect to exposure in the local media, experience in the region confirmed in fall 2012 that the submittal of a press release to a local newspaper does not guarantee the paper will publish it; therefore, important IRWM dates were sometimes submitted to the papers in the form of advertisements. Additionally, the local radio station was contacted to provide PSAs and opportunities for interviews in conjunction with the implementation of the Plan.

Please see **Chapter 2 Stakeholder Involvement and Coordination** for a more fulsome discussion of outreach to public agencies and disadvantaged communities.

1.3.4 Additional Recruitment to the RWMG

During its fledgling stages, the interim RWMG acknowledged that PRWA, its parent organization, had functioned primarily as a resource management group in the central and southwestern portions of the watershed and that it wished to expand not only its geographical but entity representation. The PRWA/RWMG formally revised its boundaries to be coincident with the IRWM boundaries. A list of individuals and organizations was drawn up, and RWMG members assigned to contact potential new members. The list included, in particular, additional representation from conservation interests and from entities in the north watershed. This recruitment process took place during mid-2012 and generated the addition of the Pit River Tribe.

The method that has proved most effective for additional recruitment to the RWMG has been project development and sponsorship. This process has brought about more consistent and wider participation from Tribal interests, the Fall River Valley RCD, and Fall River Valley CSD.

Many of the contacted agencies and organizations elected to participate in the process primarily through the PRC, with some 15 entities represented. In some cases, entities have declined to participate due to cost and staffing limitations, but have indicated that they are monitoring the progress of the work effort and Plan preparation via the Website or communication with committee members.

During lengthy discussions with the RWMG over a long-term governance structure, it was agreed that a second RWMG recruitment process would be pursued throughout 2013. This would include a formal recruitment letter being sent to entities within the watershed that have a clear nexus with water management, and personal follow-up by RWMG members.

1.3.5 Effective Decision-Making

PRWA's original adopted decision-making process was consensus – in other words, no action is taken by the group unless 100 percent of the members agreed. That process proved effective for the group, as they have prepared a watershed assessment, watershed management strategies and documents, grant applications, and addressed stewardship issues of concern. The initial decision of PRWA, when it began its tenure as the RWMG, was to continue to use the consensus decision-making model.

As the RWMG went through extensive examination of the *long-term* decision-making for Plan implementation, it was agreed that the group wanted to retain consensus as the primary decision-making strategy. However, to ensure that a single individual or group, particularly if they had not consistently participated, could not delay critical decisions or processes, the RWMG determined that a 75 percent super majority vote process would be adopted. The RWMG expressed that consensus was the goal; the super majority vote will be used only when and if it is clear that the group would otherwise be unable to reach a decision. As of the December 5, 2013, adoption of the Plan, this super majority vote has not been used.

As part of its annual evaluation of the governance performance, the RWMG will refine its decision-making process if the group determines that it is necessary to ensure organized, predictable, and coherent Plan implementation.

Information collection and dissemination: A key aspect of Plan implementation (and hence informed decision-making) is the collection, processing, and distribution of data and information. Numerous forms of information will result from Plan implementation, such as project-specific performance and monitoring data, annual assessments of overall Plan performance, emergence of new data from scientific and institutional sources, emergence of new issues in response to changing environmental, social, and/or economic conditions, and the need to refine or revise objectives in response to ongoing data collection and interpretation. At present, the best way to ensure access to this information remains the RWMG Website (upperpit.org). The Website has the capacity to support distribution of emails to entities and individuals to inform them of the availability of new data. In addition, the SWIM website will continue to be updated with new documents and datasets furnished by RWMG members and regional stakeholders.

How decisions are vetted with stakeholders in the RWMG: RWMG agendas and meeting notes are distributed to its members, and attendance at two out of three meetings is required to maintain a voting status; therefore, RWMG members will all be directly informed of upcoming topics on an agenda. The RWMG begins each meeting with a review of the minutes from the previous meeting, thereby ensuring that a RWMG representative will have an opportunity to reopen a topic if they are not satisfied with the outcome at a previous meeting, or if they need further specificity as to how the issue was handled or discussed.

1.3.6 Balanced Access and Opportunity for Participation

Equal Distribution of Power: The existing RWMG has purposefully recruited participants from across the spectrum of regional water management-related stakeholders who have a constructive interest in the Plan (as described in **Additional Recruitment to the RWMG**).

The RWMG intends to continue recruitment throughout the region with the goal of providing ongoing opportunities for participation, not only in the governance and decision-making body, but

also in future working groups and/or advisory committees. For the RWMG, ability to participate is not limited, except that the participants must be members of a recognized group, agency, or organization. To serve on working groups or committees, an individual can be identified by the RWMG, or self-identify, but then must be approved by the RWMG to serve. There are no current requirements for dues or financial support for participation. The meetings are run using an open dialogue format that enables all participants to listen and contribute.

Participation Options: The RWMG is well aware that the disadvantaged nature of the majority of the region's communities, the low staffing levels that have emerged as a consequence of recent economic events, the small population, and the travel distances conspire to make full participation difficult across the region. In response to this, the RWMG has identified several options for phone-based and email/proxy participation that will serve to partially mitigate some of these challenges. The RWMG has also created a committee structure that enables participants to target their involvement to the topics of greatest interest or import to their entity.

The RWMG has the option for teleconferencing and they also have a phone capable of accommodating meeting participation via a speaker phone. However, the meeting facilities in the region which have phone line access *and* suitable acoustics for a conference call (group meetings are often held in gymnasiums) are limited, so this method will not always be a reliable strategy for participation. Additionally, the Website will provide a communication routing system that could make effective use of email. Several stakeholders have indicated a preference for hard-copy communication and those individuals have received a mailed version of the relevant material prior to and after meetings.

Equal opportunity and representation: As stated above, the RWMG is not currently fee-based, has recruited participation widely across the region, and has several options for formalizing membership. The RWMG has also created a structure of meetings that give interested parties the ability to participate directly, or an opportunity to provide input and receive updates and information. The group has already instituted a system of "alternates" by which participating organizations and agencies can have a proxy representative. However, the group has made it clear that attendance by the primary representative should be the norm to ensure continuity of thought and discussion.

Currently the group has no formal structure or elected officers, but can designate signatories as needed. The meetings are facilitated on a revolving basis, usually based on the subject matter and who placed an item on the agenda. The RWMG has determined that the decision-making will be based on a "one-entity/one-vote" system. Therefore, any RWMG member entity carries equal decision-making power.

Terms of Service: There are currently no terms of service as there are no formal roles within the group. It is assumed that all participants will be able to continue their attendance unless and until there is a reason given to the contrary.

1.3.7 Effective Communication – Both Internal and External To the IRWM Region

Internal Communications within the Region: Because the Upper Pit River watershed covers approximately 4,500 square miles, includes portions of Modoc, Siskiyou, Lassen, and Shasta Counties, has few population centers and only one incorporated city, and has an extremely low population density, local residents are accustomed to serving on multiple committees and groups at

any one time. Further, residents are accustomed to using word-of-mouth, chance encounters at local events and facilities, and joint attendance on several committees to keep one another informed about local activities, including the outcomes of meetings and processes. This informal network of communication, while effective, is not a reliable substitute for a more formal and regularized communication strategy. Nor does this informal network result in reliable feedback of information.

With these factors in mind, the ongoing "two-way" communication and update strategy will consist of: 1) regular updates to the Website, 2) a formalized process for stakeholders to both offer and request updates and notice of important events or availability of new data or information, 3) targeted use of press releases to inform the general public of IRWMP activities, 4) stakeholder ability to attend meetings of interest, 5) targeted use of local radio stations to provide information via PSAs, 6) wide distribution of contact information for the RWMG, and 7) a specific feedback menu on the Website as well as an "Upcoming Events/News" section on the home page.

External Communications: Four IRWM regions adjoin the Upper Pit region: Upper Sacramento-McCloud, North Sacramento Valley, Upper Feather River, and Lahontan Basins. Over time a variety of topics will need to be discussed, both formally and informally, between and amongst the regions. These topics include: project development, boundaries, emerging issues, impacts of Plan implementation, and opportunities for interregional collaboration on funding and Plan update activities. For more detailed discussion of these communications, please see **Chapter 2 Stakeholder Involvement and Coordination.**

1.3.8 Long-Term Implementation of IRWM Plan

The IRWMP's 20-year planning horizon needs assurance of long-term implementation strategies and ability for revision. **Chapter 11 Plan Performance and Monitoring** and the Implementation Guide help assure long-term implementation by illustrating protocols and sequencing for continuing activities of the RWMG. Moreover, **Chapter 12 Finance** helps assure long-term implementation by providing funding options and strategies for administrative and functional sustainability over time.

1.3.9 Coordination with Neighboring IRWM Efforts, State Agencies, and Federal Agencies

Extensive coordination with neighboring IRWM regions and public agencies with water and resource management responsibilities was undertaken during the planning process. See **Chapter 2 Stakeholder Involvement and Coordination.**

At the latter stages of the planning process, the Goose Lake RCD requested and was approved by the RWMG and DWR to explore adding land area in the California portion of the Goose Lake basin to the Upper Pit watershed IRWM planning area. This exploratory phase will take place through 2014, unless public opposition or lack of resources causes the RCD to withdraw its participation. Please see **Chapter 3 Region Description**.

1.3.10 Collaborative Process Used to Establish Plan Objectives

To honor countless hours over a decade of work accomplished by area stakeholders in developing goals and objectives for previous watershed management strategies, the consulting team drafted a preliminary list of existing goal statements and objectives by thoroughly reviewing these

documents. This preliminary list was then cross-checked and refined by talking with locally hired Project Team members, comparing it to issues identified across the region at sub-regional meetings, and pulling in considerations to be addressed per the IRWM planning guidelines.

At this preliminary stage, the goals and objectives were not intended as final, but to generate discussion and modification. For purposes of mutual understanding, a goal was defined as a general statement of purpose; an objective is a quantifiable (either qualitative or quantitative) action that would implement a goal. None of these objectives negated any of the actions recommended in the previous strategies or plans.

Little feedback was offered at the sub-regional meetings on objectives, but during Project Team interviews with stakeholder organizations, such as Tribal, RCD, NRCS, and NECWA, additional objectives were identified to address identified issues.

The Project Team then created a discussion draft of Goals and Objectives that was discussed and refined at two consecutive RWMG meetings. The RWMG directed its Plan Review Committee to then revise the section again in spring 2012 to eliminate redundancy and propose a method for addressing prioritization of objectives. Once the Review Committee accomplished this task, a Goals and Objectives draft served as the basis for additional refinements as stakeholder groups and the RWMG prepared for a formal public review draft process.

1.3.11 Interim Changes, Formal Changes, and Updating the Plan

As described in the **Chapter 11 Plan Performance and Monitoring**, a process and timeframe has been set forth for revising, updating, and re-adopting the Plan. The RWMG will convene a meeting to evaluate Plan performance at least once annually, and more often if needed, to enhance chances for project funding, for incorporation of updates to regulations, for opportunities to improve the Plan, and/or recognize and document circumstances in the watershed that could substantively affect the Plan, or promulgate its re-adoption. These could include interim changes, such as additional information that alter an objective, or formal changes, such as a new DWR guideline that requires updating to make the Plan compliant. The annual schedule for evaluation will be set forth after the RWMG adopts the Plan. Significant changes that affect aspects of the Plan may promulgate more frequent than annual Plan evaluations, or re-adoption, which would occur at least every five years.

New scientific data, regional conditions, climate data, or natural resource events in the watershed could substantively alter the understanding of issues or solutions within the watershed. Potential alterations to the Plan goals and/or objectives will necessarily need to consider/address changes in water demand, water supply, water quality, and effects on DACs.

2.0 IMPLEMENTATION GUIDE

An Implementation Guide follows. It offers step-by-step guidance for all aspects of implementation, including revising, funding, and implementing the Plan and its attendant projects. This guidance should help not only the current RWMG, but its successors in understanding and carrying out implementation processes in sequence and to an acceptable level.

The Implementation Guide is based on narrative provided in previous chapters, primarily **Chapters 9, 11, 12, and 15**. Please refer to those chapters for more in-depth discussion of the topics covered in the Guide.

IRWMP IMPLEMENTATION GUIDE			
TOPIC	**WHAT**	**WHEN**	**WHO**
GOVERNANCE			
Ongoing recruitment	- Identify specific individuals and entities for recruitment - Draft letter – review by RWMG - Assign outreach relationships	- List, February/March 2014 - Letter, February/March 2014 - Assign, February/March 2014 - Evaluate success, end 2014	- RWMG members
Adoption of IRWMP	- Wait for DWR compliance review - Draft adoption resolution - Hold meeting to adopt - Adoption by RWMG member entities (coordinated by individual members)	- Winter 2013/14 - Review November 2013 - Adoption winter 2013 - Starting after adoption	- RWMG - RWMG - Member entities
Update process, policies, structure	- Review//monitor/identify revisions, as required - Consider development of a charter, other governance updates - Review criteria for membership and structure for voting	- At least annually, year-end - At year end - Year end, then when necessary	- RWMG
COORDINATION			
In region	- RWMG meetings - Sub-regional meetings - PRC	- Annual at minimum - At discretion of RWMG - As needed	- RWMG
Adjacent IRWMP	- Use Roundtable of Region phone calls, DWR-convened meetings - Coordination with the North Sacramento-McCloud IRWM to address Medicine Lake	- Quarterly or less, as convened	- RWMG represent-ative
Develop staffing strategy	- For administration, communications, and funding opportunities	- By March 2014	- RWMG
Annual review	- Ensure all project sponsors have adopted Plan, review performance measures and project monitoring, confirm project list and update Plan project appendix to include added projects, discuss options for project and Plan funding, ensure ongoing Tribal collaboration, monitor DWR website for IRWM announcements (monthly), Plan- and project-specific impacts and benefits, consider new climate studies, consider evolving options to fund environmental compliance activities, determine if re-adoption is warranted	- At least annually	- RWMG
COMMITTEES			
Project Review Committee	- Considers new projects, revises and recommends project tiering and scoring, monitors project performance, addresses conflicts - Tracks funding opportunities (from project sponsors, RWMG staff, DWR)	- Ongoing - Ongoing	- PRC

IRWMP IMPLEMENTATION GUIDE, *continued*			
TOPIC	**WHAT**	**WHEN**	**WHO**
COMMUNICATION			
Public notice for meetings	- PSAs, ads, legal notice (when required), Web – write copy/text	- As needed	- RWMG staff
Web	- Training RWMG Web manager in Web update process and assign access codes (designated members for internal communications) - Use access protocol developed by RWMG for internal communications	- When Web manager is determined - Designate members, April 2014 - Ongoing	- Project Team trains RWMG Web manager
Call for projects	- Application form available on Website and made available at RCD offices - Call for projects	- Continuous - If desired	- RWMG staff with prompt from PRC
Updates	Web postings (see below)		
Email	Use as main communication tool between RWMG members (need to maintain list)	- Ongoing	- RWMG staff
PLAN REVISIONS & UPDATES			
DWR Guideline Revisions	- Formal updates only in response to new DWR guidelines or important regulatory changes (requires legal notice) - Develop protocols for responding to DWR-required updates	- Every 5 years at minimum	- RWMG staff- - RWMG
Project-specific	- Revise project list as result of changes in individual project tier or addition of new projects	- As request of PRC	- PRC & RWMG
Changes in watershed	- Revise text per changing conditions in watershed, including materials for potential addition of Goose Lake	- At least annually	- RWMG staff, project sponsors, PRC, and Goose Lake RCD
Issues/Conflicts	- Track emergence of new issues and/or conflicts and update Plan if they would affect objectives (adding new, changing measurement criteria), or importance of particular projects, or in response to new regulations or standards by regulatory agencies	- At least annually	- RWMG

IRWMP IMPLEMENTATION GUIDE, *continued*			
TOPIC	**WHAT**	**WHEN**	**WHO**
Plan	- Performance evaluation at least annually - Determine if technical or regulatory revisions are needed - Post on Website - Submit to DWR if appropriate	- Date set when Plan is adopted - At least annually	- RWMG
Project	- Develop a protocol for how to generate a performance evaluation of the project (both interim, if needed, and final)	- By September 2014	- PRC & RWMG
PROJECT DEVELOPMENT			
Application process	- Application process on Website - All applications routed to PRC: PRC reviews first to tier – makes recommendation to RWMG	- Continuous - As needed	- Project sponsor - RWMG staff
Project recruitment	- RWMG members and PRC members identify opportunities to design projects, integrate emerging projects and discuss options for developing projects to address objectives of Plan - PRC has meeting(s) to advance project recruitment	- Informally and at meetings (at least annually) - At least annually	PRC & RWMG
Project development	- Include a noxious weed treatment element in all restoration projects - Project sponsors prepare tiering and Plan evaluation materials as needed, and present technical feasibility analyses to PRC, as well as work on community acceptance for their projects - Evaluate projects for climate adaptation and GHG contributions - Include performance measures as line item in each project application (regardless of funder) and conduct performance monitoring as needed - Determine if Tribal Consultation is involved and conduct if necessary	- When developing project - When preparing for a funding source and as projects are more fully developed - For relevant funders - Pre- and post-project implementation	- Project sponsors

IRWMP IMPLEMENTATION GUIDE, *continued*			
TOPIC	**WHAT**	**WHEN**	**WHO**
Tiering, scoring	- Perform a review of the current project list – determine if individual project tiering has changed, tier new projects that have not yet been evaluated, assess options for integration and review tiering criteria for any needed updates - PRC can include/revise status of tiered projects at any time following approval by RWMG, at which point the projects are considered to be officially endorsed by the Plan - Tier 1 projects are then evaluated under the A-L Guideline compliance criteria - Post the list of Tier 1 projects on the Website, at RCD offices, and by mailing in response to a request - As funding sources become available, apply scoring criteria to Tier 1 projects	- At least annually - Ongoing/as needed - As funding becomes available	PRC/RWMG
FINANCING - GENERAL			
Project-specific	- Update funding-source appendix materials - PRC and RWMG members track funding opportunities and notify fellow members of new or emerging funding opportunities - Tab on Website to track funding options - RWMG evaluates funding sources against projects to determine if the most appropriate use of funds is being made	- At least annually - Ongoing - At least annually - At least annually	- RWMG or staff
Plan-specific	- Technical updates to Plan	- As needed	- Paid or volunteer technical experts
RWMG-specific	- Secure funding for RWMG staff	- Ongoing	- RWMG
GRANT/FUNDING APPLICATIONS			
Scoring and applications	- PRC develops process for identifying and tracking funding opportunities - PRC scores projects for inclusion in a funding source, identifies the appropriate applicant, prepares the application (may include: coordination with individual project sponsors, developing pass/fail timeline for inclusion in any given application package, preparing summary and Web submittal materials, coordinating submittal, and monitoring submittal) - Recommendation to and approval by RWMG	- As grant and other funding sources emerge	PRC & RWMG

IRWMP IMPLEMENTATION GUIDE, *continued*			
TOPIC	**WHAT**	**WHEN**	**WHO**
DATA MANAGEMENT			
SWIM	- Post new data to SWIM site	- At least annually	- RWMG staff
State Database Uploads	- Post new data to appropriate state database sites	- At least annually	- RWMG staff
Web	- Keep Upper Pit Website current on all tabs - Training in Website management and allocation of necessary passwords done in conjunction with annual RWMG meeting, as required - Web content prepared and submitted by members, reviewed by RWMG	- As much as staffing allows (quarterly at minimum) - Annually - Quarterly at minimum	- RWMG staff - Staff - RWMG

Upper Pit IRWMP

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