

CHAPTER 4.0 REGIONAL WATER ISSUES

4.1 Introduction

Through a series of open meetings, the four Integrated Regional Water Management (IRWM) workgroups identified and vetted regional water management issues within the Upper Feather River (UFR) Plan area. The issues identified are directly tied to the Plan's goals and objectives and focus resource management and project recommendations for four areas of long-term interest within the UFR watershed: agricultural land stewardship; uplands and forest management; floodplain, meadow, and waterbodies management; and municipal services. Workgroups consist of stakeholders and interested individuals within the region and are open to anyone wishing to participate in the IRWM planning process. A more detailed description of the IRWM workgroups and their role in the planning process is provided in Chapter 2 *Governance, Stakeholder Involvement, and Coordination*.

4.2 Regional Water Issues

This section presents a summary of the current issues identified by workgroups during public meetings held in 2014 and 2015. Each issue is presented as a statement of the issue, followed by a brief discussion, if needed, for clarity. A summary table is provided at the end of the section (Table 4-1).

4.2.1 Agricultural Lands Stewardship

- Issue: *Lack of consistent supply of surface and groundwater.*

Variations in annual water availability and shifting management priorities, particularly of surface water resources, result in uncertainties for agricultural users regarding sources of irrigation water.

- Issue: *Too little availability of public and private lands for grazing.*

Recent efforts to emphasize resource protection on U.S. Forest Service (USFS) grazing allotments, most notably the standards and guidelines required by the 2004 Sierra Nevada Forest Plan Amendment decision, have resulted in many grazing permittees reducing their number of animal units per month (AUM) on many allotments. A few recent NEPA decisions for particular allotments have, in turn, reduced the number of AUMs allowed, similar to the operation levels that permittees have recently used to meet resource protection standards. Other recent NEPA decisions have authorized the same level of use that has been authorized for decades, but permittees often need to run fewer animals than authorized in order to meet resource standards, particularly in years of drought. There is a concern that resource protection standards that result in a reduction of the number of animals allowed to graze on U.S. Forest Service lands may put more pressure on private pastures and rangeland within the UFR watershed.

- Issue: *Capacity of groups and individuals in the agriculture community to access funding resources and provide management.*

A significant challenge to improving resource management in the region is the lack of a sufficient base of people trained and equipped in grant writing, staffing and administration to obtain and administer funds for management projects. Local groups such as the Sierra Valley Resource Conservation District (SVRCD), the Feather River Resource Conservation District, the Sierra Valley Groundwater Management District, and the Upper Feather River Watershed Group do not have enough trained staff or budget to seek and obtain

grants and other outside funding, or to administer grants once obtained. The lack of capacity goes beyond grant procurement and includes capacities for management of data, fiscal, project, and people.

- Issue: *Changing climate patterns of precipitation from snow to rain and higher temperatures.*

The recent trend in the region of winter precipitation coming in the form of rain instead of snow affects the timing of water available for irrigation. Rainfall has a much lower retention time in the watershed than snow, which changes the seasonal availability of water in irrigation ditches and on non-irrigated, seasonally wet meadows. Rain is released quickly in short-duration peak flows following winter precipitation events, while snow is released slowly allowing for a more uniform flow during the summer dry season.

- Issue: *Inefficiencies in irrigation management.*

Surface irrigation via old open ditch conveyances is a highly inefficient method for water delivery and is often time consuming to manage. However, most small districts and individuals find it difficult to justify the cost of replacing open ditches with buried pipe. While converting ditches to pipelines increases water supply efficiencies, it can also mean less water being returned to the local groundwater basin and, in some places, less for habitat. This also applies to the degraded conveyance system issue identified below.

- Issue: *Degraded and inadequate surface water storage facilities.*

See discussion under next issue.

- Issue: *Degraded and inadequate conveyance system infrastructure.*

Similar to aging municipal water and wastewater infrastructure, many of the diversion dams, storage reservoirs, irrigation ditches and pipes in the region have deteriorated from age and deferred maintenance. Aging infrastructure results in inefficiencies in irrigation water management including water loss through leakage and reduced capacity of storage and conveyance infrastructure.

- Issue: *Need for greater collaboration among water users.*

There is need for greater collaboration and suitable infrastructure in the region to promote matching water quality to use and creating more efficient water use, such as treated municipal wastewater being made available for irrigation.

- Issue: *Decreasing groundwater basin recharge.*

Changes in precipitation patterns, loss of montane meadows, and increased evapotranspiration in forests with high stand densities have caused a reduction in the rate of groundwater recharge in the region. Decreasing groundwater recharge results in less groundwater available for irrigation from wells. Furthermore, as in recent years, drought places a greater reliance on groundwater for irrigation, which taxes diminishing groundwater resources.

- Issue: *Management activities in the upper watershed affect availability of water downstream for irrigation.*

Restoration projects implemented in the upper watershed affect timing and quantity of downstream flows, which could impact downstream irrigators.

- Issue: *Conflicts between upstream and downstream water rights holders.*

Upstream management activities often affect the timing and availability of water to downstream water rights holders. This problem is exacerbated by efforts to increase retention time in the upper watershed, particularly during periods of declining total water availability.

- Issue: *Over allocation of declining water supply and conflicts between current and historical uses.*

Recent declines in precipitation and groundwater supplies, combined with the increased economic importance of tourism-related water uses in the region, result in over allocation of resources and conflicts between agricultural, municipal, and environmental uses. In adjudicated areas, users are allocated flows based on current supplies and water decrees, which limits such conflicts.

- Issue: *Lack of holistic management for soil health and forage mixes.*

Improving soil health increases water holding capacity, organic matter, and improved drought resiliency. Management practices in the Plan area have tended to focus on individual goals or projects rather than holistic resource management. Compliance with the Irrigated Lands Regulatory Program (ILRP) has been supplemented with ongoing research efforts funded through Proposition 50. Additionally, coordination through the IRWM process is anticipated to facilitate sharing and problem solving among land managers within the region.

- Issue: *Burdensome regulations and lack of resources for compliance.*

Regulations in the Plan area are enforced by numerous local, state, and federal agencies and often place an excessive burden on water users, and individuals and groups lack the time, money, and leadership required to comply. Also, Central Valley Regional Water Quality Control Board (CVRWQCB) waivers of waste discharge requirements for agricultural operations in the Plan area are tied to overall watershed water quality that is affected by sources of pollution other than agriculture.

- Issue: *Lack of resources for water quality management of agricultural and ranch lands.*

Currently, there is insufficient funding to promote improved management of agricultural and grazing lands to protect water quality in the Plan area. For example, fencing wetlands and streams to exclude cattle is costly. Additionally, agricultural land managers may benefit from technical guidance on where to locate fences, and what types of measures work best to protect water resources without negatively affecting wildlife. Much work toward complying with water quality regulations has been accomplished in the region.

- Issue: *Need for increased management of agricultural lands for wildlife habitat enhancement.*

With increased funding and education from local agencies and organizations, improvements to agricultural management practices could improve wildlife habitat in the region. Agricultural lands are managed by the owner to maximize profit, and usually sustainability, as income is derived directly from the land. While enhancing wildlife is not the main goal, they do not have to be competing activities.

- Issue: *Need for greater clarification of water rights in the region.*

Communication and understanding of existing water rights (i.e., agricultural and others such as PG&E) within the region would be beneficial to water and land managers and decision-makers within and outside the region.

4.2.2 Floodplains, Meadows, Waterbodies

- Issue: *Impacts from abandoned mines.*

Copper and gold mining in the Upper Feather River watershed has caused copper, cadmium, mercury, and zinc impairments in several of the Upper Feather River tributaries. The largest mine in the region is the Walker Mine, an inactive copper mine approximately 12 miles east of Quincy, in Plumas County. Acidic and metal-laden water (acid mine drainage) discharging from the mine portal and tailings impoundment has historically affected the nearby streams of Dolly Creek and Little Grizzly Creek. However, site improvements in 1987 and 2009 have reduced mine runoff by as much as 98 percent in Dolly Creek and recent macroinvertebrate surveys indicate good water quality conditions. While impacts from the Walker Mine site have greatly improved, hundreds of other historic mine sites exist in the watershed. Additionally, the historic practice of hydraulic mining in the region resulted in the removal of large amounts of upper soil horizons and steepening of slopes in the upper watershed.

- Issue: *Lack of collaboration between agencies and people.*

Effective, collaborative relationships among agencies, watershed management groups, and local stakeholders have been challenged over the past several years on the topic of meadow restoration, in particular. Meadow restoration efforts for the past 25 years were focused on improving water quality by reducing the sediment load and reversing the trend of warmer stream-water temperatures that were negatively affecting aquatic habitat. With recent drought conditions, downstream water users are again concerned with the need to work toward re-building strong collaborative relationships among all stakeholders (public and private) for the future management of this important headwaters region.

Active adaptive management will encourage transparency and collaboration when all stakeholders are participating, when a strong, watershed-wide monitoring program (including third-party oversight) has been established, and when a central database is maintained and available to the public. In addition, continuing and building upon the various outreach and education programs already available in the region is important for having informed stakeholder dialogue on water-related issues.

- Issue: *Tree encroachment into meadows.*

Stream incision caused by changes in flow regimes leads to drying of montane meadows by lowering the water table and severing the hydrologic connection between the stream and surrounding uplands. Many meadows have been invaded by conifer species, which lowers the water table further and contributes to continued drying of the meadows.

- Issue: *Degraded meadows.*

The most sensitive landforms in the watershed are meadow areas associated with the upper subwatersheds. Meadows are the remnant lake bottoms of highly erodible soil types, and when allowed to persist in a degraded state, are a source of large volumes of sediment to rivers and human-made infrastructure downstream. Historic, unregulated mining, logging, grazing, and related infrastructure, along with the removal of beavers, have resulted in some level of degradation in nearly every meadow of the watershed. Restoration goals have been defined for many meadows and prioritized, which has focused efforts in the region. The lack of fire in the area may also contribute to encroachment of conifers into the meadows. Meadow restoration continues through incremental progress in implementation of projects and through improved land management practices.

Restoration of degraded meadows is a priority and has numerous benefits such as protection of plant and animal species diversity and re-establishing hydrologic function. In addition, recent studies indicate that mountain meadows restored to a healthy condition have the potential to sequester up to 40 percent more carbon than degraded meadows.

- Issue: *Altered stream hydroperiod.*

Throughout the Upper Feather River watershed, incised active stream channels have reduced retention times, resulting in less water infiltration in meadows and wildfire-damaged uplands. This has led to rapid loss of precipitation to surface runoff in high peak flows, followed by greatly reduced stream flows during the summer dry season.

- Issue: *Loss of fisheries habitat.*

Water flows in the watershed are highly regulated by the Department of Water Resources (DWR) and PG&E for hydroelectric purposes and water storage for downstream users. In addition to creating insurmountable fish barriers, some of the hydroelectric dams on the Feather River create shallow reservoirs (i.e., Rock Creek and Cresta) that result in increased water temperatures. Increased water temperatures and the loss of channel pools, the loss of riparian vegetation and undercut banks, increased sediment loads, and seasonal drying of streams from decreased water retention in upland watersheds have resulted in loss of fisheries habitat throughout the region.

The Feather River watershed above Oroville dam once supported diverse and productive fish communities. A combination of anthropogenic activities have functionally removed over 150 miles of anadromous fish stream habitat from the Basin and degraded hundreds of miles of native freshwater fish habitat.

Poor watershed conditions have long been recognized by the public and resource managers. Considerable resources have been invested to improve conditions but broad-scale improvements to fish habitat from prior restoration efforts have been limited.

Preliminary results of an assessment of fish distribution and habitat conditions that is currently underway have identified several common problems in the watershed that could be addressed by improvement efforts. These problems include:

- **Fish Passage:** the presence of numerous barriers to fish passage. Most of these barriers are associated with roads on forested land in both public and private ownership. Others are the result of State Highways and Railroads crossings and hydro-electric and other water development infrastructure.
- **Fish Stranding:** There are numerous water diversions throughout the watershed, especially in the large meadow systems now currently the site of ranching and agriculture associated with cattle production. Very few of the diversions are screened which leads to the entrainment of trout in ditches and other irrigation infrastructure, and commonly leads to stranding of these fish.
- **Road Erosion:** Most sub-watersheds the watershed have high road densities. Most of the roads were built before the impact of roads on stream processes was fully understood. Most are unsurfaced, many are poorly drained, and many have road stream crossing with the potential to divert stormflows unto roadways. As such, they alter both sediment and flow

regimes and negatively impact fish habitat. Other facilities that produce similar effects in the watershed are state and county roadways, and railroad beds.

- **Vegetation with High Risk of Sustaining Severe Wildfire:** Fire is an integral element of Sierra forest ecosystems. Unfortunately, suppression of fire over the past hundred years has altered natural fire regimes. The result is fires that burn at higher severity than in the past. In the short term, large fires with a high percentage of high severity burn have devastating effects on trout and trout habitat. Ground cover is removed, resulting in accelerated erosion, large wood recruitment to channels is disrupted and stream temperatures are increased.
- **Pathogens:** At least one fish pathogen (Whirling Disease) is known to occur in the watershed, with devastating impacts to rainbow trout. The ability of pathogens to expand their range is poorly understood. The potential for pathogens needs to be considered in any improvement activity intended to benefit native fishes.
- **Non-Native Species:** The basin has seen wide spread introduction of non-native fish species. While introduced trout species are valued by anglers, they do compete with native rainbow trout. As suitable habitat is constricted by climate change, the interaction between these species may become a problem for the sustainability of native populations.
- **Water Diversions and Releases:** The Feather River Watershed's water regime has been significantly altered, especially along the river's main stems and in the large valleys. With the exception of the Middle Branch, river flows have been altered by storage and manipulated release of flows for hydroelectric production. Reservoirs in the headwaters also store water. Flows below these facilities are highly altered. Diversions for irrigation are prevalent in the project area's large valleys. Water rights were adjudicated in most of these valleys before adequate consideration for in stream flow needs was realized.
- **Habitat Connectivity:** The combination of barriers, degraded habitat, reduced stream flows and increased temperatures may pose threats to the connection between habitats needed to sustain genetic diversity of the species.

➤ *Issue: Need for improved flood management.*

Flood management can decrease groundwater infiltration and promote erosion when floodwaters are not allowed to spread across floodplains and be retained, thereby resulting in high flows downstream that scour channels. In addition, loss of water retention in uplands exacerbates the problem by causing higher floodwaters in streams that then require channelization management.

➤ *Issue: Need for better grazing management on public lands.*

Grazing on lands in the upper watershed may lead to changes in the vegetation, i.e., away from grass and forb communities that have high water retention and toward shrub communities with lower water retention. Livestock may also cause soil compaction, disturbance to wetlands, physical damage to stream banks, and waste pollution.

➤ *Issue: Impacts of wildfire.*

Widespread, intense wildfires in upland forests lead to erosion and sediment discharge into streams in subsequent rain events, increased peak flows, and significantly reduced capacity for water infiltration and retention in the watershed. Additionally, recent climate change studies have focused on the substantial

release of climate change emissions from catastrophic wildfires including greenhouse gases, aerosols, and black carbon.

- Issue: *Deteriorating and inadequate recreational facilities.*

Recreational facilities, including forest roads, are often poorly located and poorly maintained. Roads, campgrounds, and trails located in seasonal wetlands and meadows can cause erosion, pollution, and channelization of runoff. Forest roads are the largest source of sediment in the watershed. Many roads were designed without adequate erosion control measures and have become rutted and gullied, which further accelerates sediment discharge. Additionally, as the economy transitions from the traditional resource base towards tourism, more and better managed recreational facilities will benefit the region.

- Issue: *Loss of wildlife habitat.*

Riparian corridors are beneficial for maintaining wildlife diversity, and function as an interface between aquatic and terrestrial habitats. Riparian buffers are also important in filtering runoff from meadows and pastures, which protects water quality. A majority of the montane riparian habitat in the UFR watershed is unprotected from conversion to other land uses, and is fragmented by inconsistent land management practices. Fencing off riparian corridors, providing off-site watering, and implementing improved grazing strategies are ways in which agencies and private stakeholders can work collaboratively to help enhance this vital habitat for wildlife while protecting the interests of private landholders.

- Issue: *Lack of integration of programs.*

Water resource management in the UFR watershed has been guided over the past decade by the following eight plans and water rights decrees with authority over parts of the Plan area:

1. FERC License 1962;
2. FERC License 2105;
3. FERC License 619;
4. Monterey Settlement Agreement;
5. Feather River Watershed Management Strategy (expired 2014);
6. Feather River Coordinated Resources Management Plan;
7. Quincy Library Group Act – Management Plans for Lassen, Plumas, and Tahoe National Forests;
and
8. Sierra Valley Groundwater Management District Legislation.
9. Indian Valley Decree
10. Sierra Valley Decree

Although the statutory terms of some of these plans have expired, they have shaped and continue to shape water management in the upper watershed. Each of these plans deals in part with some water management issues of the watershed, but the plans collectively do not address all water issues and do not geographically encompass the entire watershed. Additionally, local plan requirements sometimes conflict with the requirements or interests of plans in other localities, and the piecemeal nature of planning in separate jurisdictions creates difficulties in addressing issues on a watershed scale. There have also been extensive restoration and land and water management efforts by various agencies, groups, and non-governmental organizations that would benefit from a more holistic approach, rather than site- or project-specific efforts.

➤ Issue: *Degraded floodplains.*

Streambank and channel degradation has led to deeply incised stream channels throughout the watershed, disconnecting the channel from its historic floodplain. New floodplains usually cannot be established in the incised channels, and those that are established are often too narrow to accommodate and spread out the water during peak flows.

➤ Issue: *Loss of salmon from the upper watershed.*

Dams have progressively excluded salmon from the main branches of the Feather River over time, culminating in the Oroville Dam, causing complete extirpation of ocean-run salmon from the upper watershed. In addition to creating insurmountable fish barriers, some of PG&E's Stairway of Power hydroelectric dams on the Feather River create shallow reservoirs (i.e., Rock Creek and Cresta) that result in increased water temperatures. Channel incision, head cutting, and increased water temperature have also degraded potential salmon spawning habitat in the upper watershed.

➤ Issue: *Need for better sediment management.*

Managing all sources of sediment export from the watershed should remain a high priority to protect water quality, prevent permanent loss of soil downstream, and protect reservoirs from filling in. The primary sources of sediment loss are streambank erosion and erosion from road cuts and fill slopes.

➤ Issue: *Threats to listed species.*

A total of 13 species listed as threatened or endangered under federal and/or state endangered species acts occur in the Plan area (see discussion in Chapter 3 *Region Description*, Table 3-6). Many of these, including two amphibians, four birds, one mammal, and one plant are associated with riparian or aquatic habitats and are, therefore, especially sensitive to water quality issues. Declining water quality from sedimentation, increased temperature, and pollution from mines has had deleterious effects on these listed species. In addition to general watershed issues with environmental water quality, rodenticides and herbicides used in illegal cannabis cultivation leach into streams and pose a particular threat to all species that depend on aquatic habitats.

➤ Issue: *Declining water quality.*

Increased water temperatures, sedimentation, reduced dissolved oxygen, and potential toxins from aging debris dams (historic gold mining) remain as primary reasons for declining water quality in the watershed. While some progress has been made towards improvement, it has not removed the threat posed to aquatic species. Building on existing monitoring efforts by DWR and Plumas Corporation, in addition to outreach and education, could lead to increased awareness of the issues and a framework to guide future water quality improvement efforts.

➤ Issue: *Decreasing water quantity.*

Climate change models predict a 48 to 65 percent reduction in snowpack from the 1961–1990 average in the Sierra Nevada by the end of the 21st century (DWR 2015c).

A network of monitoring stations such as those established by the California Data Exchange Center (CDEC) that measures streamflow is needed throughout the watershed, particularly in the upper watersheds. These stations should be located at important confluences or below critical river reaches such that a complete picture of water quantity can be seen over time.

- Issue: *Timing of water storage and release.*

Water storage and release for uses such as agriculture, hydroelectric generation, and flood control are often incompatible with the needs of natural ecosystems. The natural hydroperiod of streams has been altered, resulting in accelerated seasonal drying of tributaries and increased “flashiness” due to decreased retention in the upper watershed, unseasonal peaks in lower reaches due to releases for hydroelectric generation, and reduced seasonal flood peaks in lower reaches.

- Issue: *Increasing sediment load in streams.*

Increased turbidity in upper watershed streams negatively affects aquatic organisms, reduces fish spawning habitat, and increases water temperature. Increased turbidity by fine sediments inhibits photosynthesis, chokes aquatic animals, fills channel pools and covers rocky substrates, and raises water temperature by absorbing solar radiation. Approximately 1.1 million tons of sediment are transported out of the Upper Feather River watershed annually (Plumas Co. 2005).

4.2.3 Municipal Services

- Issue: *Aging infrastructure.*

Twenty-two special districts provide either or both domestic water and/or wastewater services in the Upper Feather River region (Chapter 7 *Land and Water Use Planning*, Table 7-3). Infrastructure in many of these districts is old and in need of maintenance and/or upgrades. Aging infrastructure results in water loss, infiltration/inflow, broken service mains, inadequate capacity, accidental releases, and increased operating costs. The small populations in these service districts are burdened with high per-connection costs of water systems, which limit the revenue available to districts. Statutory restrictions on utility rate increases also often prevent service districts from raising needed revenue when voters reject rate increases.

- Issue: *Dam and reservoir integrity.*

There are 40 major dams and diversions in the Plan area (ibid.): the newest is 36 years old and the oldest is 150 years old (Chapter 3 *Region Description*, Table 3-10). Declining structural integrity may result in a dam leak, or force the lowering of maximum water levels to prevent failure, both of which reduce storage capacity. The risk of dam failure also poses a threat to communities downstream.

- Issue: *Inadequate storage.*

Despite the large number of dams in the watershed, many of which are owned and regulated by DWR and PG&E, there is inadequate storage to meet all the needs of water users in the region.

- Issue: *Infiltration and inflow into wastewater systems.*

Aging wastewater infrastructure can allow inflow of freshwater during precipitation events or floods. This results in flows that exceed the capacity of wastewater treatment facilities, which force releases of untreated or incompletely treated wastewater.

- Issue: *Insufficient flow capacity of wastewater infrastructure.*

Insufficient capacity in wastewater treatment facilities or collection lines can result in release of untreated or incompletely treated wastewater.

- Issue: *Insufficient operations and maintenance revenue.*

Many small special districts do not have a sufficient revenue base to cover the increasing costs of operations and maintenance. Statutory restrictions on utility rate increases often prevent service districts from raising needed revenue when voters reject rate increases. When small projects in rural communities are submitted to granting agencies, they often do not fare well when competing with larger projects in more populous areas. Small districts also have difficulty raising required matching funds.

- Issue: *Limited staff and budget.*

Many small service districts do not have enough staff to cover the increasing range of issues and tasks that water and wastewater service providers face, and lack funding to meet growing administrative needs.

- Issue: *Lack of data on location of private wells.*

A large proportion of the residents of the region rely on private wells for water. Many of these wells are vulnerable to contamination or may be located illegally. The State of California has mandated that regional water management authorities determine the location of all private wells in their management area. This is a significant effort in the region for which there is insufficient staff and funding.

- Issue: *Lack of integrated regional facilities.*

The large number of small special districts in the region can result in redundancies and inefficiencies that may be reduced by combining services, say, in larger regional facilities.

- Issue: *Financial strain of meeting regulatory requirements.*

The management and compliance responsibilities of local special districts have increased markedly under state and federal mandates. Small special districts in the region lack a sufficient revenue base to meet the increasing regulatory requirements.

- Issue: *Reservoir capacity loss.*

Increased sediment load in rivers and streams in the watershed is resulting in sedimentation of reservoirs.

- Issue: *Need for staff training and replacement.*

Local special districts and agencies are experiencing a shortage of trained staff as the current generation retires. Many operational and maintenance procedures require a certified operator of a particular grade. Local entities have not been able to train a new generation of operators, in part due to a lack of funding to support junior operators and in part due to a declining population, especially of young working people.

- Issue: *Wastewater pond/levee integrity.*

Similar to dam integrity, the declining integrity of wastewater treatment ponds leads to increased risk of leaks and failure, and to reduced capacity to avoid failure.

- Issue: *Lack of wastewater reuse programs.*

Recycled wastewater has great potential to help meet future water needs. Currently, the Plan area does not have significant wastewater recycling capacity, and developing such capacity is costly. Typical recycled wastewater must be distributed in separate parallel infrastructures.

- Issue: *Water quality.*

Municipal water in the region must be treated for high levels of toxic metals in some cases. Copper mining in the Upper Feather River watershed has caused copper, cadmium, mercury, and zinc impairments in several of the Upper Feather River tributaries. Water in the Sierra Valley is unusually high in arsenic from natural sources in thermal springs. Groundwater in the Sierra Nevada region is also unusually high in uranium from natural sources.

The Plumas Eureka Community Services District (PECSD) is a small special district that provides water and wastewater services to between 340 and 1,500 customers near Graeagle, depending on the season. Water from PECSD groundwater wells consistently exceeds standards for arsenic, iron, and manganese. Because alternative sources of water are not feasible, PECSD proposes to construct an arsenic filtration facility. The City of Portola has recently installed an arsenic filtration facility to meet state standards for drinking water quality.

- Issue: *Inadequate flood management.*

Floodwaters can enter municipal wastewater systems that then tax the flow capacity of treatment facilities and lead to release of untreated or incompletely treated wastewater.

4.2.4 Uplands and Forest

- Issue: *Historic impacts to soils from mining, roads, fires, grazing, and other land uses in the watershed continue to affect forest soil health, water quality, and groundwater infiltration.*

It is difficult to separate cumulative impacts to soils into discrete problems. The regulatory enforcement of best management practices (BMP) is effective in reducing impacts to soils from modern grazing, mining, road construction, and road drainage maintenance. However, catastrophic wildfires have significant potential to increasingly impact soil infiltration and productivity. Declines in forest soil productivity, water quality, and groundwater recharge, depend on factors such as fire severity, post fire treatments, soil characteristics and forest vigor.

- Issue: *Drought, disease, accumulation of biomass, increased stand densities, have dramatically increased the probability of catastrophic wildfire. Residential and recreational development in high fire hazard areas increases the probability of severe wildfire damages to natural resources, and human life, and property.*

Current stand densities in the region are six to eight times higher than estimates of prehistoric densities, and ground and ladder fuels have accumulated due to suppression of natural low-intensity fires. Forests today are choked by small conifer thickets that threaten the survival of mature trees from drought and severe intensity wildfire. Even age tree plantations result in dense forest stands that are especially susceptible to wildfire damage, drought, pests, and disease. Thinning forest ground and ladder fuels through tree removal and through the use of managed fire is required throughout the watershed to conserve forest productivity and drought resiliency, to reduce the risk of forest conversion to grasses and

brush from catastrophic wildfires, and to begin restoring historic water infiltration capacity in forest soils and aquifers.

- Issue: *Regional wood processing facilities require upgrades in capacity to support needed forest management and economic initiatives.*

High stand densities in forests in the region increase the risk of catastrophic wildfires, increase evapotranspiration and water competition among trees, decrease groundwater infiltration and streamflows, and generally decrease forest ecosystem health. Stand thinning is needed throughout the Plan area; however, regional wood processing facilities currently lack capacity to process the increased quantities of wood waste or "biomass" that stand thinning produces. Also, capacity to produce wood products other than lumber, such as pellets, posts, biochar, forest residue soil amendments, electricity (e.g., value-added wood products from biomass), are important investments for a diverse forest-based economy in the Region. Sustainable forest stewardship is an essential component of economic recovery in this severely economically disadvantaged region as forests cover over 70 percent of the UFR land base.

- Issue: *Regional active biomass power generating facilities require upgrades in capacity to support needed forest management initiatives.*

High stand densities in forests in the Plan area increase the risk of catastrophic wildfires, increase evapotranspiration and forest moisture stress, decrease groundwater infiltration and streamflows, and generally decrease forest resiliency to drought. Stand thinning is needed throughout the Plan area; however, regional active biomass power generating facilities currently lack the economic incentives that are needed to reopen and upgrade existing biomass facilities in the Region and to diversify the utilization of increased quantities of wood biomass that stand thinning would create. The State of California has a goal of generating 6.6 percent of its total energy from biomass by the year 2020. Currently, biomass provides approximately 3 percent of total energy production and biomass electrical price support and investment lags far behind other sources of renewable energy, despite new information on the threats to global climate stability from black carbon emissions generated by forest wildfires.

- Issue: *Deficiencies in transparency, monitoring, data sharing, and integration of data into management plans have led to inefficiencies and redundancies in past management.*

Forest management was not a priority in the 2005 UFR IRWM Plan (Plumas Co. 2005), as it was incorporated into the California Water Plan (CWP) for the first time in 2013. The current record drought and the exponential increase in severe wildfires in forests have stimulated additional research and data collection. Many published studies and guidance manuals for forest management and monitoring, such as GTR 220 and GTR 237, are posted in the IRWM Documents library (UFR 2016). They are referenced in public NEPA documents for proposed forest management actions on federal forest lands and will provide a scientific basis for updating USFS land and resource management plans for the Region's National Forests within the Plan implementation period.

IRWM forest improvement projects include scientific references, published data, and programs for data collection and sharing.

- Issue: *Riparian forests are declining throughout the Plan area due to stream incision, impacts to floodplains from grazing and agriculture, and groundwater depletion.*

After decades of fire suppression and reduced logging due to controversial management practices and lawsuits, conifers have invaded ecologically and culturally important stands of hardwood trees including black oak (*Quercus kelloggii*) and have greatly reduced the historic diversity of key riparian forest and

streamside species such as cottonwoods, willows, and maples. Conifers also have invaded aspen (*Populus tremuloides*) groves, thereby altering wildlife habitat and aspen regeneration vigor. Reduced groundwater recharge during the dormant season--combined with shading out sunlight during the growing season--weakens riparian, aspen, and black oak stands. The suppression of managed fire and the interruption of tribal stewardship of these important forest habitats are important issues raised in the Plan update.

- Issue: *Declining rates of groundwater infiltration are changing the hydroperiod of streams in the Plan area.*

Reduced snowpack and groundwater retention throughout the watershed has led to an increase in precipitation runoff during high peak flows, followed by reduced stream flows during the summer dry season when vegetation evapotranspiration is highest. As the climate trends towards a change in precipitation from snow to rain and higher summer and winter temperatures, the current trend of reduced water retention may continue to accelerate without active watershed management.

- Issue: *Reduced groundwater availability and increasing temperatures are causing forests to convert to brush after disturbance.*

Reduced precipitation retention times from reduced snowpack storage in the upper elevation parts of the watershed, and from damaged soils in severely burned forests, can lead to rapid loss of precipitation to surface runoff. This occurrence typically results in highly turbid peak flows followed by increasingly reduced stream flows during the summer dry season. Over months and decades, effects of severe fires can vary depending on burn severities, soils, geology, precipitation, and vegetation response. The past decade (2005-2015) has included several years of severe drought. In the region's forestlands, drought stress is killing the biggest trees and threatening vast stands in mature forests. Drought also increases the flammability of dense understory forest thickets, which are "ladder fuels" for crown fires that kill mature trees. Severe multi-year, drought-stressed forest landscapes across the region are at increasing risk for destruction by catastrophic wildfire and pests and diseases. Watershed recovery after severe wildfire is identified as an increasingly important management priority along with reducing forest fuels in order to enhance and sustain watershed functions including stream hydrology and quality. Altered stream hydrology and increasingly severe wildfires threaten the future of mature forests and summer streamflow ecology, intensifying conflicts over forest and water management. Including stream hydrology rehabilitation and groundwater recharge recovery in designing ecological recovery for both unburned and severely burned mature forests and other key forest habitats, such as streams, is the focus of multiple UFR IRWM watershed and forest ecosystem enhancement and recovery projects. Initiating landscape scale and integrated approaches to forest and water conservation should help to reduce management conflicts over impaired stream hydrology as monitoring and evaluations are used to inform adaptive an integrated forest and watershed management.

- Issue: *Loss of critical riparian habitats.*

Riparian habitats in the region are valuable to wildlife and ecological processes. Stream incision and meadow drying are causing declines in riparian habitats. Riparian habitats are increasingly prone to destruction by severe fire when conifer thickets provide fire ladders into mature cottonwoods and maples in riparian forests.

- Issue: *Recent catastrophic fires have created a need for post-fire recovery efforts in burn areas.*

The natural fire regime of forests in the watershed consists of relatively frequent, low-intensity ground fires that clear the underbrush and allow for natural regeneration of forest understory vegetation. Widespread, catastrophic wildfires can result in the conversion of forest biomass and mature forest trees

to black carbon greenhouse gas emissions and decaying forest carbon stocks and will require intensive recovery efforts to restore affected areas to forested conditions.

- Issue: *Tree encroachment into meadows.*

Stream incision caused by changes in flow regimes leads to drying of montane meadows by lowering the water table and severing the hydrologic connection between the stream and surrounding uplands. Conifer trees and sometimes hardwood trees including black oak (*Quercus kelloggii*) and aspen (*Populus tremuloides*), as well as sagebrush (*Artemisia tridentata*), have reduced the extent of wet meadow ecosystems in the region.

- Issue: *Reduced groundwater infiltration.*

Changes in precipitation patterns, increased forest stand densities, and impacts to soils from land use and severe wildfire can reduce the rate of precipitation that is available for groundwater infiltration and thereby, also reduce the amount of soil moisture that is available to forest trees and vegetation.

- Issue: *Increases in forest stand densities lead to increased evapotranspiration and reduced groundwater infiltration.*

Historic forest management practices and forest fire suppression have led to a marked increase in stand densities over natural conditions and what is considered optimal for forest health. High stand density increases evapotranspiration, which depletes soil moisture and dense forest canopy cover decreases groundwater infiltration.

- Issue: *Insufficient water available for forest and fire management.*

The increased frequency and extent of catastrophic wildfire also increases the demand for water for firefighting.

Table 4-1 Summary of Regional Water Issues Identified by Workgroups, 2014-2015

Workgroup	Regional Water Issue
Agricultural Lands Stewardship	
	Lack of consistent supply of surface and groundwater.
	Too little availability of public and private lands for grazing.
	Capacity of groups and individuals in the agriculture community to access funding resources and provide management.
	Changing climate patterns of precipitation from snow to rain and higher temperatures.
	Inefficiencies in irrigation management.
	Degraded and inadequate surface water storage facilities.
	Degraded and inadequate conveyance system infrastructure.
	Need for greater collaboration among water users.
	Decreasing groundwater basin recharge.
	Management activities in the upper watershed could affect availability of water downstream for irrigation.
	Conflicts between upstream and downstream water rights holders.
	Over allocation of declining water supply and conflict between current and historical uses.
	Lack of holistic management for soil health and forage mixes.
	Burdensome regulations and lack of resources for compliance.
	Lack of resources for water quality management of agricultural and ranch lands.
	Need for increased management of agricultural lands for wildlife habitat enhancement.
	Need for greater clarification of water rights in the region.
Floodplains, Meadows, and Waterbodies	
	Impacts from abandoned mines.
	Lack of collaboration between agencies and people.
	Tree encroachment into meadows.
	Degraded meadows.
	Altered stream hydroperiod.
	Loss of fisheries habitat.
	Need for improved flood management.
	Need for better grazing management on public lands.
	Impacts of wildfire.
	Deteriorating and inadequate recreational facilities.
	Loss of wildlife habitat.
	Lack of integration of programs.

Workgroup	Regional Water Issue
	Degraded floodplains.
	Loss of salmon from the upper watershed.
	Need for better sediment management.
	Threats to listed species.
	Declining water quality.
	Decreasing water quantity.
	Timing of water storage and release.
	Increasing sediment load in streams.
Municipal Services	
	Aging infrastructure.
	Dam and reservoir integrity.
	Inadequate storage.
	Infiltration and inflow into wastewater systems.
	Insufficient flow capacity of wastewater infrastructure.
	Insufficient operations and maintenance revenue.
	Limited staff and budget.
	Lack of data on location of private wells.
	Lack of integrated regional facilities.
	Financial strain of meeting regulatory requirements.
	Reservoir capacity loss.
	Need for staff training and replacement.
	Wastewater pond/levee integrity.
	Lack of wastewater reuse programs.
	Water quality.
	Inadequate flood management.
Uplands and Forest	
	Impacts to soils from grazing, mining, roads, fires, and other land uses in the watershed have reduced overall forest health, water quality, and groundwater recharge.
	Drought, disease, accumulation of biomass, increased stand densities, and residential development have dramatically increased the probability of catastrophic wildfire and the threats of wildfire to natural resources, life, and property.
	Regional wood processing facilities require upgrades in capacity to support needed forest management and economic initiatives.
	Regional active biomass power generating facilities require upgrades in capacity to support needed forest management initiatives.

Workgroup	Regional Water Issue
	Deficiencies in transparency, monitoring, data sharing, and integration of data into management plans have led to inefficiencies and redundancies in past management.
	Riparian forests are declining throughout the Plan area due to stream incision, impacts to floodplains from grazing and agriculture, and groundwater depletion.
	Declining rates of groundwater infiltration are changing the hydroperiod of streams in the Plan area.
	Reduced groundwater availability and increasing temperatures are causing forests to convert to brush after disturbance.
	Loss of critical riparian habitats.
	Recent catastrophic fires have created a need for post-fire recovery efforts in burn areas.
	Tree encroachment into meadows.
	Reduced groundwater infiltration.
	Increases in forest stand densities lead to increased evapotranspiration and reduced groundwater infiltration.
	Insufficient water available for forest and fire management.

4.2.5 Capacity

4.2.5.1 Capacity definition and needs

Many of the significant water and watershed management issues in the Upper Feather River IRWM region are rooted in environment – both the natural environment and the built environment. Issues rooted in the natural environment include trends of decreasing snow precipitation; shifts from snow to rain that result in decreases in soil retention and groundwater infiltration; changes in the frequency and intensity of precipitation events that result in higher peak flood flows and reductions of dry season stream flows; more severe drought impacts to native vegetation; increased fire risk from hotter summers and drier fuels; and increasing mature forest mortality from drought stress, pests, disease, and competition from invasive shade and drought tolerant vegetation. Issues rooted in the built environment include aging or inadequate infrastructure; land management practices that have led to degraded meadows and headwaters, unhealthy forests, and diminished water quality; land and water management practices that have led to loss of species and aquatic habitats, and altered stream hydrology; conflicting water uses during water shortage periods; and increasing water demand as temperatures rise. These environmental issues interact to create complex, and intertwined watershed management challenges for the Plan area.

A capacity issue facing the region is rooted in the cumulative management needs themselves, that is, the issue of enhancing capacity to meet those increasingly urgent and complex management needs. Capacity refers to the availability of working age residents to staff, and provide continuity in water and watershed management expertise, data, and base funding that is a prerequisite for successful competing for and implementing grants, without which the management needs of the Plan area cannot be met given the low population and economic depression that characterizes most of the region. Additionally, there is a general lack of capacity within the region to meet regulatory requirements that are typically written with larger, more intensive operations or more highly populated or resourced locations in mind.

In an average year, the State Water Project and Central Valley Project deliver approximately 10 million acre-feet of water to 23 million Californians, of which the Upper Feather River watershed contributes approximately 3.2 million acre-feet annually. Thus, the region is a major exporter of water to the rest of California, and the health of the Upper Feather River watershed is vitally important to far more than the 32,000 residents of the Plan area. The Plan area includes all of Plumas County and portions of Sierra, Butte, Lassen, Shasta, and Yuba counties. In addition, state and federal laws guarantee that water rights appropriations cannot deprive the 'Area of Origin'¹ of the water it needs for the development of the area and must adequately supply the needs of the area and its inhabitants. Investments into the region have, to date failed to match the rhetoric.

¹ An "Area of Origin" is generally considered an area where a headwaters of a river or other significant water body originates. The "area" may be a county, region, or other geographic region of the state. The IRWM region boundary follows the watershed boundary for the Upper Feather River. Area of Origin protections emerged initially when the California legislature adopted the Feigenbaum Act in 1927, which authorized the State to file for unappropriated water to enable the State to develop the SWP (CWC Sections 10500-10507). The SWP, when operational, would divert water for export at the Delta for use elsewhere. Upstream areas became concerned about the potential loss of water, and in 1931 the Legislature amended the Feigenbaum Act to protect the rights of those sources or Counties of Origin (CWC Sections 10504-10506). California law now provides that no water rights appropriation or assignment may be granted by the SWRCB that will deprive the county in which the water originates for any such water as may be needed for the development of the county (CWC Section 10505). Areas of Origin are also protected by the federal Central Valley Project Improvement Act (later incorporated by reference into the Burns-Porter Act of 1959, Section 12931) that provides that the watershed of origin areas shall not be deprived of the prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed, area, or any of the inhabitants or property owners (CWC Section 11460).

Restoring and maintaining the health of the Upper Feather River watershed benefits millions of people far beyond the watershed boundaries but requires financial resources that are not available from within the watershed itself, and so funding to implement the Plan must come from outside the Plan area. However, taking money from outside sources obligates recipients to the conditions those sources place on the funding. Although funds are available for watershed restoration and municipal services projects, most are in the form of competitive grants rather than being available to small disadvantaged community in targeted funding pools. Small special districts, agencies, and organizations in rural areas are at a substantial disadvantage when competing with larger metropolitan areas for grant funding. Nor do poor rural communities have the financial resources to sustain efforts while waiting for grant reimbursements for expenditures.

Many small special districts and agencies are understaffed, and either lack experienced staff or the time it takes to develop and retrain staff between grants to secure and administer ongoing grant funding. Nor are funds available to pay for training or for the upfront investments in time and data collection needed to prepare a competitive application. Outside consultants may be too expensive for small districts and agencies to employ, and there simply may not be any locally affordable consultants. Competitive grants often require a substantial amount of technical data to support applications, such as water quality testing, geotechnical exploration, hydrology studies, and monitoring data, that are costly and time consuming to obtain. Past success is a principal predictor of future success in grant writing: Grants tend to be awarded to applicants with a track record of winning and implementing similar grants. This in itself discourages small districts and agencies from entering the competitive process as first-time applicants because they do not already have pilot programs or initial infrastructure in place from previous grants. Recently, the Proposition 1 DAC funding program has real potential to soften the devastating effects of this viscous cycle for the poorest urban communities in California.

Many grants require an accompanying CEQA or NEPA process, which is itself expensive, time consuming, and requires further expertise that may be lacking at the local level especially in rural poor communities. Many grants focus on specific functions, such as urban stormwater or water-use efficiency--that are not applicable to small rural communities because they don't meet the grant eligibility thresholds. Additionally, grants may be targeted to certain regions such as the Central Valley, Delta or the coast and not to mountain communities, such as the Upper Feather River region. Difficulties in obtaining grants can also be affected by the nature of the infrastructure in the region. Very old infrastructure such as ditches and flumes dating from the 19th century, or untreated wells, may not meet the basic infrastructure definitions that grants mandate for eligibility. A very large percentage of the region is administered by the federal government; state grant money may be either unavailable or require the cooperation of a federal agency to be used in those areas. Finally, grants often require matching funds that a small district or agency or community cannot raise.

A third capacity issue is the staffing and expertise necessary to administer basic operations and funds. Because of budget limitations, small districts and agencies often cannot afford to train junior skilled technicians and operators to fill vacancies when more senior employees retire. Some service districts find that they have no staff with the required certifications to perform operations and maintenance tasks, or with the experience and training to perform certain administrative functions. Private land owners also face the issue of capacity: Agency staff and technicians are stretched thin and may not be available to provide requested guidance and support for land management activities or obtaining funds targeted at individual landowners to improve private land management practices.

4.2.5.2 *Integration as means of capacity building*

Fully addressing the issue of capacity in the Plan area, and in similar rural watersheds in the Sierra Nevada, will require a more holistic approach to water resources management and investment in California. Water resources should be viewed as an interconnected ecological system that extends from the highest peaks in the Sierra Nevada to the Pacific Ocean, integral to the quality of life of every human and natural community from the mountains of the upper watersheds, through the major rivers and the San Francisco Bay Delta, California's water hub, to the coastal and Southern regions of the state. Water management should also be viewed as an integrated system in which funding and administrative resources are applied wherever they are most needed and provide high public values instead of entirely through competition mechanisms that, in effect, discriminate against poor rural communities and regions. Water resources management should be integrated for regional equity, statewide, while respecting the sovereignty and value of local communities. Coordination between the California Water Plan and regional watershed plans such as the UFR IRWMP is an important step for statewide integration of equitable and effective water management. State agencies such as and the regional water boards are mandated to work for the good of all the state but often lack effective mechanisms for doing so.

Integration at a regional or watershed level can also help address the chronic under-capacity issues faced by poor rural areas. As a result of the 1993 Monterey Settlement Agreement, the DWR paid \$4,000,000 to Plumas County for watershed improvement and environmental restoration. Upon final settlement of outstanding litigation, another \$4,000,000 will become available to Plumas County for watershed rehabilitation and other needs. These funds were administered by the Plumas Watershed Forum (PWF) according to goals and criteria set forth in the Feather River Watershed Management Strategy. The PWF has funded high-priority projects that have demonstrated positive results in improving watershed retention and reducing sedimentation. Although the second phase of Monterey funding will not come encumbered by the requirements of competitive grants, the administrative capacity for IRWM implementation is an important regional prerequisite for administering Monterey funds for environmental restoration and other UFR IRWM water management priorities. Other examples of past capacity for integrated watershed management in the Plan area include investments into the three National Forests in the UFR region from the Herger Feinstein Quincy Library Group Act that mandated inclusion of the Quincy Library Group Stability Proposal into the forest management plans of the Plumas, Lassen, and Sierra National Forests, and the Upper Feather River Roundtable, a voluntary program for coordinating management projects with private landowners and funding sources. The 2005 UFR IRWMP itself was funded by DWR under Proposition 50, while Proposition 84 funded the 2016 update.

In summary, there are past examples of enhancing capacity for environmental resources management through integrating goals and administration at a regional scale that offer important lessons for future investment programs based on the UFR IRWM Plan and implementation. Adapting past regional integration efforts to current and future challenges would include enhancing capacity for community services in DAC communities for water, wastewater, and flood control needs and fully incorporating TEK and independent scientific review into watershed and forest restoration projects. Meeting such needs at a regional level can create opportunities for economies of scale not currently available to small local special districts; warranting cost-benefit analyses of integration and consolidation of individual small-scale projects and administrative functions. A regional wastewater treatment facility, for example, could have higher capacity, lower administrative costs, and a larger revenue base than numerous separate local wastewater facilities. A single wastewater authority for the region may take advantage of staffing efficiencies, thereby making the highest utilization of available operators as well as freeing resources for grant writing and other capacity-building functions. A wastewater authority serving most of the approximately 24,000 residents of the Plumas and Sierra county portions of the region would be more competitive for grant funding, by returning a benefit to a larger number of people, which is often a

concern for funding agencies. In addition, integrating such services throughout the Plan area would address disparities of capacity and service within the region itself that are similar to the disparities between the Plan area and other regions of the state described in the previous section. Finally, regional integration of all water management would increase capacity by bringing together expertise, experience, effort, and knowledge of stakeholders with disparate interests.

4.3 Conflicts in the Region

Conflicts in the region arise mostly from the allocation of finite water resources to a variety of competing needs and uses, both in the region and beyond.

The most pervasive conflict arises from the fact that disadvantaged rural communities in the region exist in an abundance of immensely valuable water resources but receive very little compensation (i.e., more disadvantaged communities have fewer resources to pursue grant funding, or the grants are geared towards more urbanized areas). Flood control, electrical power generation, agriculture, urban development, recreation on foothill reservoirs and Central Valley rivers, and environmental uses in the Central Valley and Bay/Delta--all beneficial uses of the region's area water--are primarily or entirely directed by entities outside of the watershed. Management of water in the region for maintenance of these outside-the-region beneficial uses of water can conflict with economic, social, beneficial uses of water within the region, and cultural development needs within the region as well.

Competing needs and uses within the region include agricultural, municipal, residential using private wells, hydroelectric, and environmental water uses. Agriculture is the largest consumptive use of water in the watershed, and in dry years increasingly relies on groundwater pumping. Groundwater overdraft during prolonged droughts could cause conflicts between competing water uses if farms and municipalities and environmental needs are reliant on the same aquifer. If lowered water tables affect stream flows or riparian habitat, environmental and economic needs are pitted against each other. Irrigation for hay crops in the Sierra Valley resulted in significant groundwater pumping, which has steadily increased from approximately 7,500 acre-feet in 2001 to 13,117 acre-feet in 2015. The Sierra Valley Groundwater Management District Technical Reports identify a safe groundwater basin yield of 6,000 acre-feet. Ranching is an important economic activity as well as a cultural tradition in the watershed. However, in some areas within the region historic sheep and cattle grazing in meadows and uplands resulted in impacts to wetlands, streams, vegetation, and soils, and decreases in water quality from streambank erosion. Restoration projects today usually include investments in riparian and pasture fencing and the development of off-stream water for improved grazing management and forage production. The reintroduction and management of beaver is becoming a more accepted aspect of watershed rehabilitation and is being included in irrigation, floodway, and roadway infrastructure improvement designs.

Dams on the region's rivers constructed for hydroelectricity and water management have caused the extirpation of salmon above Oroville Dam. Salmon are an important part of local Native American culture and traditional lifeways. Restoring salmon to the Upper Feather River would require modification of water management and infrastructure for hydroelectric production as well as substantial restoration of upper watershed streams that would need investments for compatibility with land and water management infrastructure and uses.

Environmental water uses involve stream flow levels necessary to maintain aquatic, wetland, and riparian habitats as well as aesthetic values. The Middle Fork of the Feather River between Mohawk Valley and Lake Oroville has been designated a Wild and Scenic River. The headwaters of the Middle Fork are in Sierra Valley, which is the largest agricultural area in the watershed with over 40,000 acres of irrigated

farmland and includes the two incorporated cities in the region. Consumptive water uses in Sierra Valley and Mohawk Valley could conflict with flow needs in the downstream Wild and Scenic reach of the Middle Fork if current water demands or conditions change.

Hydroelectric uses often result in conflicts over how the timing of water releases affects recreation, water temperature, and sensitive species habitat in downstream rivers. Over the past 15 years, FERC relicensing has been controversial at Rock Creek, South Feather, Oroville, Lake Almanor, and Poe because of issues related to water temperature, recreation, species habitat, and changing runoff patterns.

Other conflicts in the watershed arise from land management practices. The vast majority of the watershed is forested uplands, and past management of those lands has resulted in substantial conflicts including water resource issues. Past mining and logging activities have left a legacy of toxic pollution from tailings and a large number of legacy and poorly maintained roads that are susceptible to erosion. Logging has declined since the late 1980s which has exacerbated the buildup of fuels and increasing forest densities, impairing forest health, all of which can affect the quantity and quality of surface and ground water in a variety of ways. The most important forest management strategies for watershed improvement are stand thinning and road restoration. However, these activities are uneconomic, controversial and frequently opposed. Conflicts over closures of forest roads will continue when roads are developed for emergency firefighting access.

Meadow restoration projects also can create conflicts with downstream water users. Many meadows in the watershed have become degraded. As streams become disconnected from their floodplains, formerly wet meadows transition to dry shrub lands, and groundwater recharge and flood attenuation functions are impaired. Meadow restoration can have long-term benefits to the entire watershed, but depending on site characteristics and restoration designs, reversing meadow degradation can result in temporary or long-term reductions in nearby stream flows as aquifers refill with water, and groundwater recharge absorbs a greater percentage of surface water that downstream water users rely upon for their water needs.