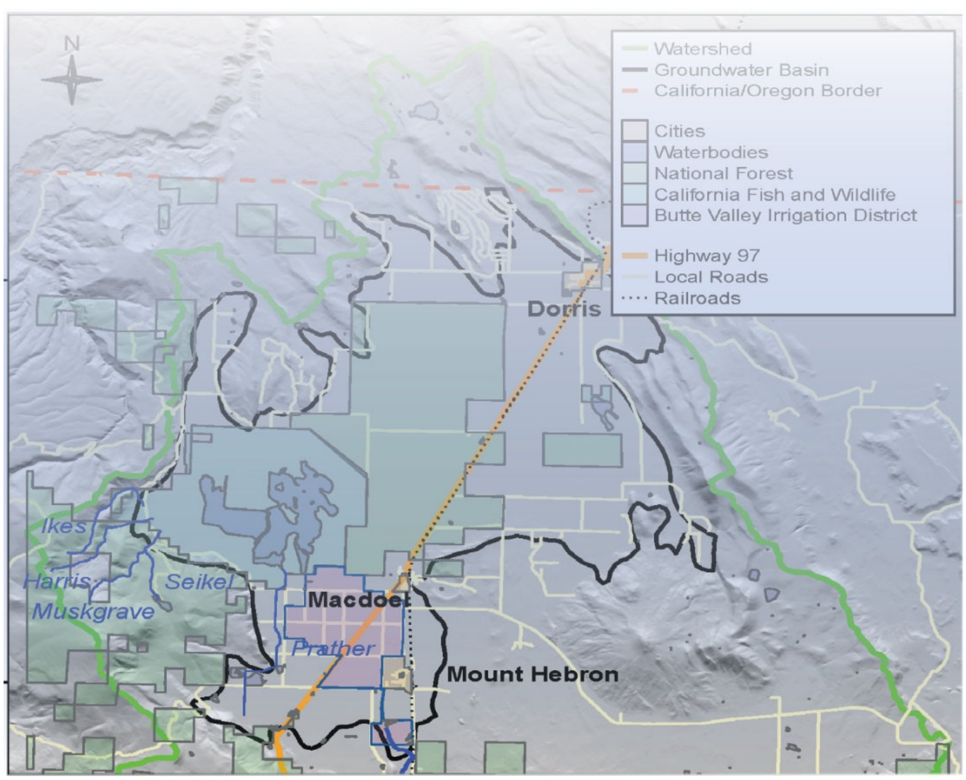
AUGUST 2021

CHAPTER 4: PROJECTS AND MANAGEMENT ACTIONS

SISKIYOU COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

Butte Valley Groundwater Sustainability Plan

PUBLIC DRAFT REPORT



SISKIYOU COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT GROUNDWATER SUSTAINABILITY AGENCY BUTTE VALLEY GROUNDWATER SUSTAINABILITY PLAN (Public Draft)

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Suggested Citation: Siskiyou County Flood Control and Water District Groundwater Sustainability Agency, Butte Valley Groundwater Sustainability Plan (Public Draft), August 2021, https://www.co.siskiyou.ca.us/naturalresources/page/sustainable-groundwater-management-act-sgma

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Chapter 4 - Project and Management Actions

4.1 INTRODUCTION AND OVERVIEW

To achieve this Plan's sustainability goal by 2042 and avoid undesirable results as required by SGMA regulations, multiple projects and management actions (PMAs) have been developed for implementation by the GSA. This section provides a description of PMAs necessary to achieve and maintain the Butte Valley groundwater basin (Basin) sustainability goal and to respond to changing conditions in the Basin. PMAs are described in accordance with §354.42 and §354.44 of the SGMA regulations. Projects generally refer to infrastructure features and other capital investments, their planning, and their implementation, whereas management actions are typically programs or policies that do not require capital investments, but are geared toward engagement, education, outreach, changing groundwater use behavior, adoption of land use practices, etc. PMAs discussed in this section will help achieve and maintain the sustainability goal and measurable objectives, and avoid the undesirable results identified for the Basin in Chapter 3. These efforts will be periodically assessed during the implementation period (see Chapter 5).

In developing PMAs, priorities for consideration include effectiveness toward maintaining the sustainability of the Basin, minimizing impacts to the Basin's economy, seeking cost-effective solutions for external funding and prioritizing voluntary and incentive-based programs over mandatory programs. As the planned or proposed PMAs are at varying stages of development, complete information on construction requirements, operations, permitting requirements, overall costs, and other details are not uniformly available. A description of the operation of PMAs as part of the overall GSP implementation is provided in Chapter 5.

In Butte Valley, the PMAs are designed to achieve a single major objective:

- to prevent chronic lowering of groundwater levels;
- to protect wells from outages; and
- to protect beneficial users of groundwater (see Section 3.4.1.5).

The identified PMAs reflect a range of options to achieve the goals of the GSP and will be completed through an integrative and collaborative approach with other agencies, landowners, beneficial users, and stakeholders. Few PMAs will be implemented by the GSA alone. The GSA considers itself to be one of multiple parties collaborating to achieve overlapping, complementary, and multi-benefit goals across the integrated water and land use management nexus in the Basin. Furthermore, PMAs related to water quality will be most successful if implemented to meet the multiple objectives of collaborating partners. For many of the PMAs, the GSA will enter into informal or formal partnerships with other agencies, NGOs, or individuals. These partnerships may take various forms, from GSA participation in informal technical or information exchange meetings, to collaborating on third-party proposals, projects, and management actions, to leading proposals and subsequently implementing PMAs.

The GSA and individual GSA partners will have varying but clearly identified responsibilities with respect to permitting and other specific implementation oversight. These responsibilities may vary from PMA to PMA or even within individual phases of a PMA. Inclusion in this GSP does not forego any obligations under local, state, or federal regulatory programs. Inclusion in this GSP also does not assume any specific project governance or role for the GSA. While the GSA does have an obligation to oversee progress towards groundwater sustainability, it is not the primary regulator of land use, water quality, or environmental project compliance. It is the responsibility of the implementing partner agency to collaborate with appropriate regulatory agencies to ensure that the PMAs for which the lead agency is responsible are in compliance with all applicable laws. The GSA may choose to collaborate with regulatory agencies on specific overlapping interests such as water quality monitoring and oversight of projects developed within the Basin.

PMAs are classified under three categories: demand management, supply augmentation, and recharge. Examples of project types within these three categories are shown in Table 1.1. Further, PMAs are organized into three tiers reflective of their timeline for implementation:

1. **TIER I**: Existing PMAs that are currently being implemented and are anticipated to continue to be implemented.
2. **TIER II**: PMAs planned for near-term initiation and implementation (2022-2027) by individual member agencies.
3. **TIER III**: Additional PMAs that may be implemented in the future, as necessary (initiation and/or implementation 2027-2042).

A general description of existing and ongoing (Tier I) PMAs are provided in Section 4.2, Tier II PMAs in Section 4.3, and Tier III PMAs in Section 4.4. The process of identifying, screening, and finalizing PMAs is illustrated in Figure 1.1. Existing and planned projects were first identified from different through review of reports, documents, and websites. Planned and new projects also received stakeholder input in their identification. These projects were then categorized into the three categories: supply augmentation, demand management, and recharge. In the next step, all projects were evaluated to identify those with the highest potential to be included in the GSP. Using the Butte Valley Integrated Hydrogeological Model (BVIHM), the effectiveness of each project, or a combination of projects, was assessed to identify those projects that, if implemented, will bring the Basin into sustainability. Monitoring will be a critical component in evaluating PMA benefits and measuring potential impacts from PMAs.

Funding is an important part of successfully implementing a PMA. The ability to secure funding is an important component in the viability of implementing a particular PMA. Funding sources may include grants or other fee structures. Under the Sustainable Groundwater Management Implementation Grant Program Proposition 68, grants can be awarded for planning activities and for projects with a capital improvement component. As such, funds for reimbursing landowners for implementation of PMAs, including land fallowing and well-shut offs, currently cannot be obtained under this program.

The existing PMAs have been extracted from the following documents:

- Supply Enhancement (in Streams)
  - Butte Valley Wildlife Area / California Department of Fish and Wildlife
  - United States Forest Service (website)
- Demand Management (of Groundwater)
  - City of Dorris
  - County of Siskiyou General Plan
  - Siskiyou County Code of Ordinances
  - Permit required for groundwater extraction for use outside the basin from which it was extracted (Title 3, Chapter 13 - Groundwater Management, Siskiyou County Code of Ordinances)
  - Siskiyou County Groundwater Use Ordinance (Title 3, Chapter 13, Article 7 - Waste and Unreasonable Use, Siskiyou County Code of Ordinances)
  - Well Drilling Permits
    - Siskiyou County Well Drilling Permits (Standards for Wells, Title 5, Chapter 8 of Siskiyou County Code of Ordinances)
- Recharge
  - Existing reports, proposals

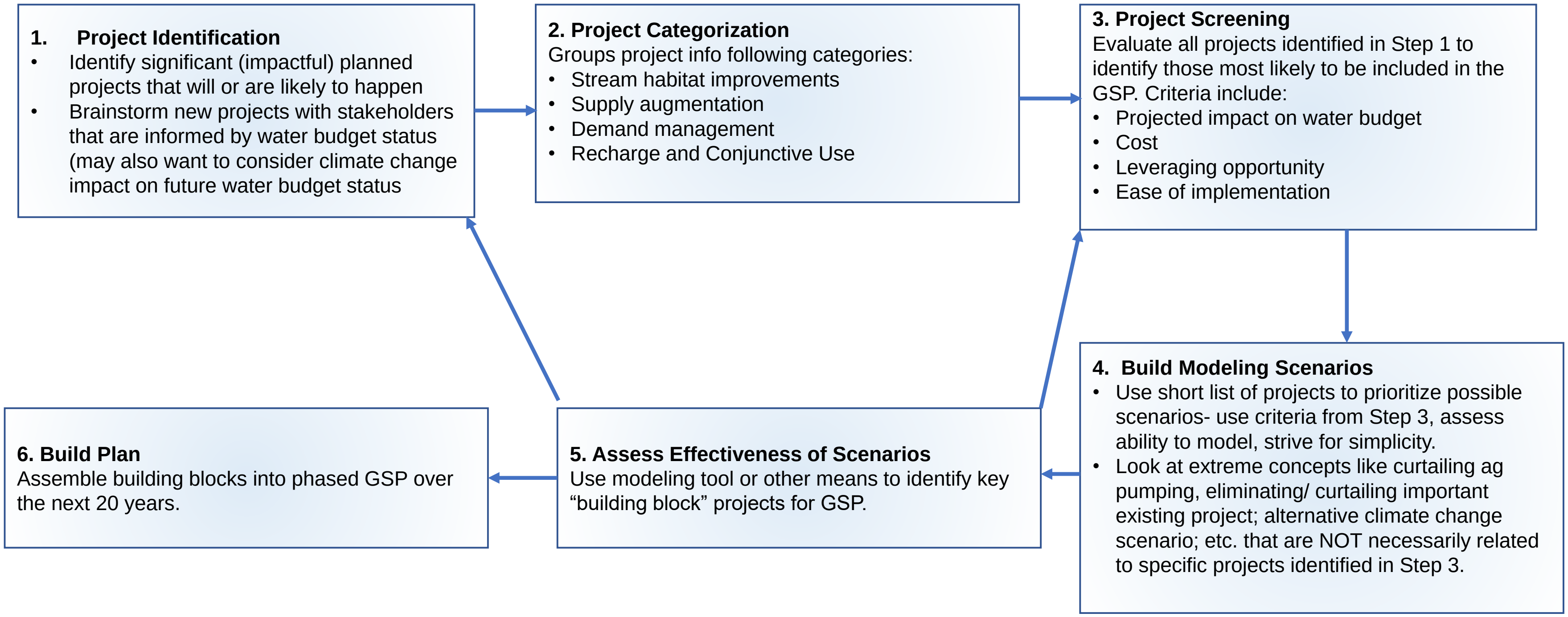

Figure 1.1: Process for identification and prioritization of PMAs. Further details, such as authority and finalized prioritization, are shown in Chapter 5.

Table 1.1: Projects and Management Actions Summary.

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
I	Well Drilling Permits	Siskiyou County Well Drilling Permits (Standards for Wells, Title 5, Chapter 8 of Siskiyou County Code of Ordinances). Location limitations for new wells with respect to the interconnected zone (per Scott River Adjudication Decree No. 30662).	County of Siskiyou	Demand Management	Existing/ Ongoing	Active	Groundwater levels, Interconnected surface water.
I	Groundwater Use Restrictions	Prohibition of the use of groundwater underlying Siskiyou County for cannabis cultivation (Article 7, Chapter 13, Title 3 of Siskiyou County Code of Ordinances).	County of Siskiyou	Demand Management	Existing/ Ongoing	N/A	Groundwater levels
I	Permit required for groundwater extraction for use outside the basin from which it was extracted (Siskiyou County Code of Ordinances)	Permit requirement for extraction of groundwater underlying the Basin for use outside the Basin.	County of Siskiyou	Demand Management	Existing/ Ongoing	Active	Groundwater levels
I	Abandonment of Sam's Neck Flood Control Facility	Expand the wetlands in the Butte Valley Wildlife Area to store all Meiss Lake floodwater and eliminate the need for the Sam's Neck Flood Control Facility.	CDFW	Supply Enhancement	Completed	Completed	Groundwater levels
I	City of Dorris Water Conservation	Water conservation measures outlined in the City of Dorris Municipal Code	City of Dorris	Demand Management	Active	Active	Groundwater levels

Table 1.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
I	Groundwater Use Restrictions	Prohibition of the use of groundwater underlying Siskiyou County for cannabis cultivation (Article 7, Chapter 13, Title 3 of Siskiyou County Code of Ordinances).	County of Siskiyou	Demand Management	Existing/ Ongoing	N/A	Groundwater levels
I	Kegg Meadow Enhancement and Butte Creek Channel Restoration	Restoration of a properly functioning, resilient wetland ecosystem and aquatic habitat in Kegg Meadow by returning streamflow to the original meadow/channel elevations. Reverting stream to original channel will rewet overall meadow and restore riparian habitat. The site is 1 to 2 acres in size.	USFS	Supply Enhancement	Completed	Completed	1. Habitat restoration 2. Groundwater recharge
I	Permit required for groundwater extraction for use outside the basin from which it was extracted (Siskiyou County Code of Ordinances)	Permit requirement for extraction of groundwater underlying the Basin for use outside the Basin.	County of Siskiyou	Demand Management	Active	Active	Groundwater levels
I	Upland Management	Upland management includes removal of excess vegetation. This can occur on US Forest Service, Bureau of Land Management, or private land.	USFS	Supply Enhancement	Active	Active	1. Improved groundwater recharge

Table 1.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
							2. Raise groundwater elevations 3. Improved habitat
I	Watermaster Butte Creek Flow Management	A Watermaster manages flow of Butte Creek into Butte Valley.	GSA/ USFS	Supply Enhancement	Active	Active	1. Groundwater Recharge 2. Flood control
~~	~~~~~	~~~~~~~~~~~~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
II	Avoiding Significant Increase of Total Net Groundwater Use from the Basin	Avoid significant future expansion of total net consumptive water use within the Basin and its surrounding watershed through planning and coordination	GSA, County of Siskiyou, local land use zoning agencies	Demand Management	Planning Phase	No later than January 31, 2024	Groundwater levels
II	Dorris Water Meter Installation Project	The City of Dorris is upgrading their water system by installing water meters and replacing old pipelines.	City of Dorris	Demand Management	Invitation for Bids sent out Feb 2021. Contractor proposals due March 18, 2021	Planning Phase	Groundwater levels

Table 1.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
II	Irrigation Efficiency Improvements	Increase irrigation efficiency (and in some cases, yields) through infrastructure or equipment improvements. This PMA will focus on low efficiency practices. Exceptions may include landowners that have already implemented irrigation efficiency improvements and best management practices.	GSA	Demand Management	Planning Phase	Planning Phase	Groundwater levels
II	Voluntary Managed Land Repurposing	Reduce water use through other voluntary managed land repurposing activities including term contracts, crop rotation, irrigated margin reduction, conservation easments, and other uses	GSA, TBD	Demand Management	Conceptual Phase	Conceptual phase	Groundwater levels
II	Well Replacement	Monetary compensation for replacing groundwater levels in cases of well outage due to dropping groundwater levels. This management action is intended to be activated in support of the groundwater level SMC. This only applies to wells within the GSA border.	GSA	Demand Management	Planning Phase	Planning Phase	Groundwater levels
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III	Alternative, lower ET crops	Pilot programs on introducing alternative crops with lower ET but sufficient economic value. Incentivize and provide extension on long-term shift to lower ET crops.	GSA, UCCE, TBD	Demand Management	Conceptual Phase	Conceptual Phase	Groundwater levels

Table 1.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
III	Butte Creek Diversion Relocation	Move the diversion of Butte Creek to Cedar Lake/Dry Lake	GSA/ USFS	Supply Enhancement	Conceptual Phase	Conceptual Phase	Groundwater levels
III	Butte Valley National Grassland Groundwater Recharge Project	Explore recharge benefits in National Grasslands from Meiss Lake overflow.	GSA/ USFS	Recharge	Conceptual Phase	Conceptual Phase	Groundwater levels
III	Strategic Groundwater Pumping Curtailments	Strategic timing of groundwater pumping curtailments. This management action would only be developed if Tier I and Tier II PMAs are insufficient. It would be an alternative for the GSA in support of the groundwater level SMC.	GSA	Demand Management	Conceptual Phase	Conceptual Phase	Groundwater levels

4.2 TIER I: EXISTING OR ONGOING PROJECTS AND MANAGEMENT ACTIONS

As shown in Table 1.1 there are multiple existing and ongoing PMAs in the Basin (Tier I). The Basin has a range of existing PMAs in place to provide demand management, supply enhancement, and recharge.

Abandonment of Sam’s Neck Flood Control Facility

Historically the Sam’s Neck Flood Control Facility has pumped flood waters of Meiss Lake to the Klamath River. The long-term goal of the Butte Valley Wildlife Area (BVWA) and County is to eliminate the need for the Sam’s Neck pumping project and instead use the flood waters to create and maintain wetland habitat. BVWA had a memorandum of understanding with Siskiyou County to utilize as much creek and lake water as possible for wetlands to minimize pumping to the Klamath River. In 2017, the County sent a formal request to the US Army Corps of Engineers to abandon the Sam’s Neck Flood Control Facility. (References: Butte Valley Wildlife Area Management Plan (1996) and 2017 County letter “Meiss Lake Sam’s Neck Project” letter to US Army Corps of Engineers).

Benefits of this project include:

- Meiss Lake flood waters are kept within the groundwater basin for groundwater recharge instead of being pumped to the Klamath River.
- Increased habitat for wildlife.
- New flood control mechanism for the Valley.

City of Dorris Water Conservation

The City of Dorris Municipal Code (Title 13, Chapter 5) outlines water conservation regulations. The City’s Public Works Director (Director) determines the extent of conservation required based on the projected supply and demand of customers. Through a public announcement and notice, the Director orders the implementation or termination of water conservation stages. These stages range from “voluntary compliance” to “mandatory compliance – water emergency” and restricts activities such as lawn watering, landscape irrigation, mobile washing (cars, boats, airplanes), non-emergency fire hydrant use, pavement washing, serving water in restaurants, and ornamental fountains. More severe stages restrict new permits for unmetered water service, limited water for construction, no water for air conditioning purposes, and water for commercial, manufacturing, and processing purposes cut 50% by volume.

Well Drilling Permits and County of Siskiyou Groundwater Use Restrictions

There are several existing regulations that are included in the demand management category of PMAs. These include the permitting requirements for new wells, as detailed in Title 5, Chapter 8 of the Siskiyou County Code of Ordinances. Siskiyou County also has ordinances that require permitting for extraction of groundwater underlying the Basin for use outside the Basin (per Title 3, Chapter 13) and a prohibition on wasting groundwater with underlying Siskiyou County for use cannabis cultivation (Article 7, Chapter 13, Title 3 of Siskiyou County Code of Ordinances). Providing demand management, these management actions benefit multiple sustainability Providing demand management, this MA benefits sustainability multiple indicators, including declining groundwater levels, groundwater storage, and depletion of interconnected surface waters.

Kegg Meadow Enhancement and Butte Creek Channel Restoration

This project is an example of wetland reconstruction and groundwater recharge using Butte Creek surface waters. The location of the project is outside the Basin along Butte Creek between Mt Hebron and Orr Mountain. The project returns streamflow to the original Butte Creek channel to rewet Kegg Meadow, restore riparian habitat, and locally raise groundwater levels. Kegg Meadow was damaged by channel diversion of Butte Creek to new stream channels in the 1930s. Construction returned streamflow to 2,000 ft of historical channel and 1,400 of prior channel was abandoned and converted into a permanent wetland feature. Willow cuttings were planted along the rewetted historic channel to increase habitat and utilize the raised groundwater levels. Construction was completed in 2013. (Aug 23, 2013 Letter to NCRWQCB, “KNF Kegg Meadow Wetlands Restoration Project Inspection”, Bell & Harrington 2011 - “Kegg Meadow Groundwater Study”).

Permit required for groundwater extraction for use outside the basin from which it was extracted (Siskiyou County Code of Ordinances)

Permit requirement for extraction of groundwater underlying the Basin for use outside the Basin (Article 1, Chapter 13, Title 3 of Siskiyou County Code of Ordinances) (https://library.municode.com/ca/siskiyou_county/codes/code_of_ordinances?):

It is unlawful for any person, firm, corporation, or governmental agency (except an agency of the United States, to the extent, if any, that federal law preempts this chapter) to extract groundwater by any artificial means from any of the groundwater basins underlying the County, directly or indirectly, for use outside the basin from which it was extracted, without first obtaining a written permit as provided in this chapter.

Upland Management

Upland management includes removal of excess vegetation, to reduce evapotranspiration and increase rainfall percolation to groundwater. This can occur on US Forest Service, Bureau of Land Management, or private land.

The US Forest Service regularly manages sections of US Forest Service land and currently active projects within the Butte Valley watershed includes the Harlan Project, through the Klamath National Forest Goosenest Ranger District (https://www.fs.usda.gov/project/?project=43915). The project will complete vegetation management and fuel reduction with an emphasis on improving forest resilience to wildfire, insects and disease, while improving mule deer habitat. The project will treat 21,000 acres in an area five miles northwest of Tennant. Implementation of the Harlan Project was given permission to proceed on Feb 9, 2021.

Watermaster Butte Creek Flow Management

A watermaster manages flow of Butte Creek into Butte Valley and the Butte Creek diversion of flood waters to Cedar Lake / Dry Lake, a bedrock fracture that recharges the Butte Valley Basalt aquifer (County of Siskiyou 1996). The diversion of Butte Creek restricts stream flow to less than 25 cfs, with excess water diverted to a Cedar Lake / Dry Lake. Streamflow of Butte Creek is a data gap so the frequency of diversion use is unknown. Two flood events have occurred recently that exceeded several hundred cfs (USGS Kegg Meadow Restoration Design Report, 2012). After diverted Butte Creek water is recharged into groundwater at Cedar Lake/Dry Lake, the direction of this groundwater recharge is unknown and a data gap (ie., Butte Valley or Red Rock groundwater basins). See section “Tier III - Butte Creek Diversion Relocation” for more information on the Butte Creek diversion.

4.3 TIER II: PLANNED PROJECTS AND MANAGEMENT ACTIONS

Tier II PMAs, planned for near-term initiation and implementation (2022-2027) by individual agencies, exist at varying stages in their development. Project descriptions are provided below for each of the identified Tier II PMAs. The level of detail provided for the eight PMAs described below depends on the status of the PMA; where possible the project descriptions include information relevant to §354.42 and §354.44 of the SGMA regulations.

- **i. Avoiding Significant Increase of Total Net Groundwater Use from the Basin**
- **ii. Management of Groundwater Use and Recharge**
- **iii. Conservation Easements**
- **iv. Dorris Water Meter Installation Project**
- **v. Irrigation Efficiency Improvements**
- **vi. Voluntary Managed Land Repurposing (not including Conservation Easements)**
- **vii. Well Replacement**

Avoiding Significant Increase of Total Net Groundwater Use from the Basin

Project Description

The goal of this MA is to avoid water level declines in Butte Valley that would result from significant expansion of total net groundwater use relative to the practice over the past decade. Net groundwater use is defined as the difference between groundwater pumping and groundwater recharge in the Basin. Under conditions of long-term stable recharge (from precipitation, irrigation, streams, floods) and long-term stable surface water supplies in the Basin, significant increases in long-term average ET (or other consumptive uses) in the Basin lead to significant increases in long-term average net groundwater use. Such expansion of net groundwater use would result in a new dynamic equilibrium of water levels in the Basin, bringing water levels in the Basin or portions of the Basin to levels lower than the minimum threshold (MT) for significant periods of time. This would then set in motion basin-wide reductions in groundwater pumping (see MA “Strategic Groundwater Pumping Reductions”).

The MA sets a framework to develop a process for avoiding significant long-term increases in net groundwater use in the Basin, while protecting current groundwater and surface water users, allowing Basin and watershed total groundwater extraction to remain at levels that have occurred over the most recent ten-year period (2010-2020). By preventing declining water levels, the MA will help the GSA achieve the measurable objectives of several sustainability indicators: groundwater levels, groundwater storage and subsidence.

Implementation of the MA is measured by comparing the most recent five and ten-year running averages of agricultural and urban ET over both the Basin and watershed, to the maximum value of Basin ET measured in the 2010-2020 period, within the limits of measurement uncertainty. Basin ET from anthropogenic activities in the Basin and surrounding watershed cannot increase significantly in the future without impacting sustainable yield. This design is intended to achieve the following:

- To avoid disruption of existing urban and agricultural activities.
- To provide an efficient, effective, and transparent planning tool that allows for new urban, domestic, and agricultural groundwater extraction without expansion of total net groundwater use through exchanges, conservation easements, and other voluntary market mechanisms while also meeting current zoning restrictions for open space, agricultural conservation, etc (see chapter 2).
- To be flexible in adjusting the limit on total net groundwater extraction if and where additional groundwater resources become available.

Critical tools of the MA will be monitoring and assessment of long-term changes in Basin and surrounding watershed hydrology (ET, precipitation, streamflow, groundwater levels, see chapter 3), outreach and communication with stakeholders, well permitting, collaboration with land use planning and zoning agencies, and limiting groundwater extraction to not exceed the sustainable yield.

Measurable Objectives Expected to Benefit

This MA directly benefits the measurable objectives of the following sustainability indicators:

- Groundwater levels – Stabilizing declining water levels at depths not to exceed those corresponding to the most recent ten-year period.
- Groundwater storage – Stabilizing declining storage levels at depths not to exceed those corresponding to the most recent ten-year period.
- Subsidence – Stabilization of water levels will reduce the risk of compaction in fine-grained aquifer materials and associated land subsidence.

Circumstances for Implementation

This MA is appropriate because the threat of declining water levels in Butte Valley is not due to overdraft conditions. Future threats to groundwater levels fall into three categories, further explained below:

- Increased Basin net groundwater use (Basin net groundwater use: difference between Basin recharge and Basin pumping).
- Reduced subsurface inflows from the volcanic aquifer system underlying the watershed surrounding the Basin, which would be the result of:

  - Reduced recharge across the upland watershed; or
  - Increased pumping in the watershed surrounding the Basin.

This MA ensures that future declining water levels are not the result of significant expansion of groundwater pumping in the Basin (first category), which would lead to new, lower dynamic groundwater level equilibrium conditions possibly exceeding the MT.

Increasing Basin Net Groundwater Use

Groundwater levels in the basin are fundamentally controlled by:

- The elevation of water levels in groundwater basins to the northeast and east of Butte Valley.
- The amount of groundwater outflow through the volcanic bedrocks to the northeast and east of the Butte watershed.
- The amount of recharge in the Butte Valley watershed, especially to the south and west of Butte Valley
- The amount of recharge from the Butte Valley landscape due to precipitation, irrigation return flows, flooding, and managed aquifer recharge (MAR).
- The amount of groundwater pumping for irrigation (Note: the net consumptive groundwater use by domestic and public users is relatively small after accounting for return flows from septic systems and wastewater treatment plants to either groundwater or streams).

Groundwater flow is generally from the south and west to the northeast and east, through the Basin itself, with some local, stable pumping depressions in the Basin. A dynamic equilibrium exists between the recharge into the volcanic uplands south and west of the Basin, groundwater pumping, and groundwater discharge through the volcanic bedrock to the northeast and east of Butte Valley.

Continued or renewed increase in groundwater pumping within the Basin leads to a continued or renewed lowering of the water table in the basin due to lower total groundwater outflow to the northeast and east of the basin and, hence, flattened groundwater gradients toward the neighboring, downgradient groundwater basins. By halting or preventing a long-term increase in net groundwater uses through keeping total net groundwater uses at current conditions, a groundwater basin that is not in overdraft remains at a dynamic equilibrium in water level conditions if groundwater inflows and outflows to and from the Basin remain stable. The impact of drought conditions and increased pumping in neighboring groundwater basins is currently a data gap.

Decreasing Recharge or Runoff, or Increasing Pumping in the Surrounding Watershed

Butte Valley is a groundwater basin that is receiving significant groundwater inflow from surrounding groundwater areas and is contributing significant groundwater outflow to downgradient groundwater areas. Hence, water levels within the groundwater basin are affected by recharge and pumping not only inside, but also outside the GSA.

The Basin is part of the much larger Butte Valley watershed, in the southwest portion of the Upper Klamath watershed (Gannett 2010; Gannett, Wagner, and Lite 2012). Much of the watershed outside of the predominantly alluvial groundwater basin consists of volcanic rocks of varying hydraulic conductivity. Much of the precipitation over the watershed percolates into the volcanic groundwater system surrounding the alluvial basin and flows into and out of the alluvial basin as subsurface flow. Butte Creek is the major surface water feature (see Chapter 2). All Butte Creek flows are recharged to groundwater or diverted for irrigation. For all surface water, the Basin is a terminal, closed basin: all surface inflows are recharging to groundwater or subject to ET.

Due to this immediate connectivity of the alluvial groundwater basin that constitutes the Butte Valley GSA with its surrounding volcanic (and partially alluvial) groundwater, water levels in the GSA can be affected by changes in recharge and groundwater uses occurring outside its boundaries, within the larger Butte watershed.\

Historic Trends of Basin Net Extraction and of External Watershed Pumping and Recharge

In Butte Valley, Basin net groundwater use, estimated as the total amount of annual agricultural evapotranspiration in the Basin over the past 25 years, has generally been increasing as evidenced by the increase in ET from applied water in the Basin Figure 1.2. Between the early 1990s and the 2010s, the total increase has been on the order of 40% (David's Engineering ET Memo - see Appendix 2-E).

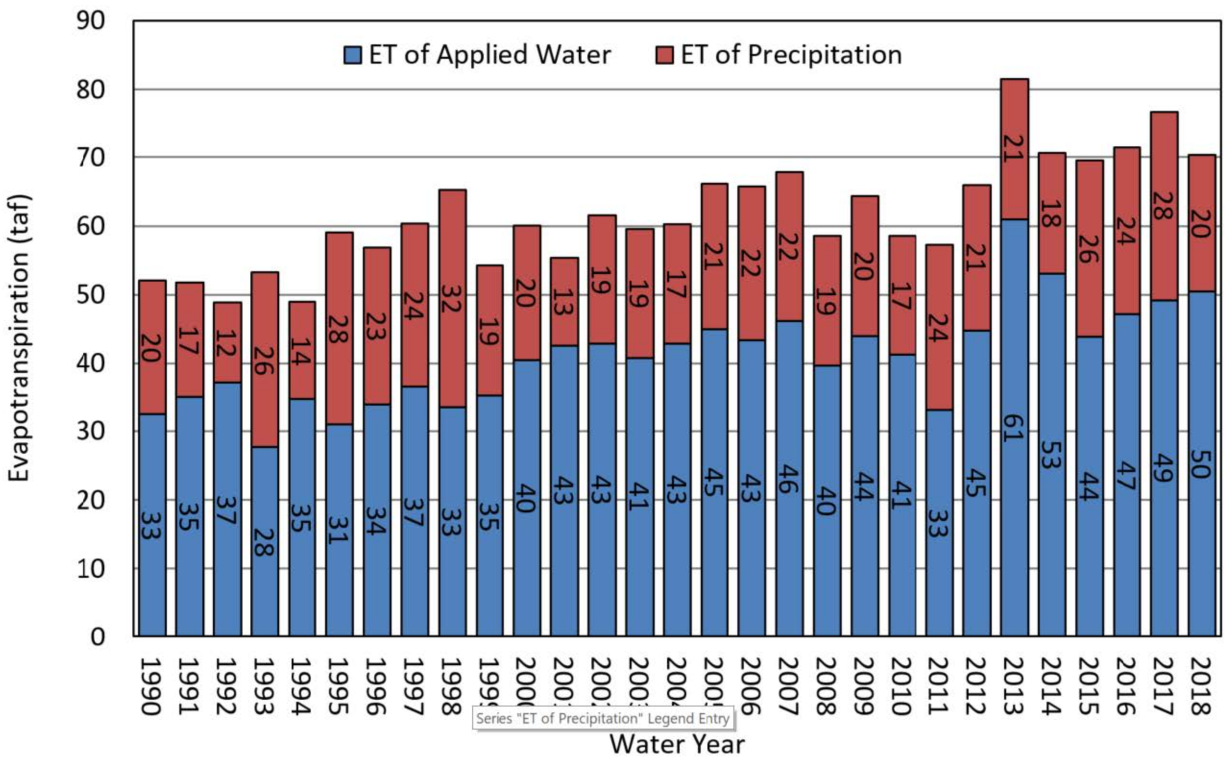

Figure 1.2: ET from applied water (blue) and from precipitation (red) on irrigated lands within the Butte Valley GSA (David's Engineering ET Memo - see Appendix 2-E).

For the 8-year period from 1990-1997, agricultural ET varied from 28 to 37 thousand acre-feet per year, averaging 34 thousand acre-feet. For the 8-year period from 2011-2018, agricultural ET varied from 33 to 61 thousand acre-feet per year, averaging 48 thousand acre-feet (David's Engineering ET Memo - see Appendix 2-E).

Over the same period, precipitation trends have been decreasing Figure 1.3. The 10-year rolling average precipitation remained well above the 1941-2020 mean precipitation until 1980, but has since been below the long-term mean precipitation except during the wet years of the late 1990s.

Water levels in areas south (upgradient) and east-northeast (downgradient) have been declining. Chapter 2 describes the Butte Valley Integrated Hydrologic Model (BVIHM). The model can be used to determine whether potentially decreased recharge into surrounding volcanic aquifer units

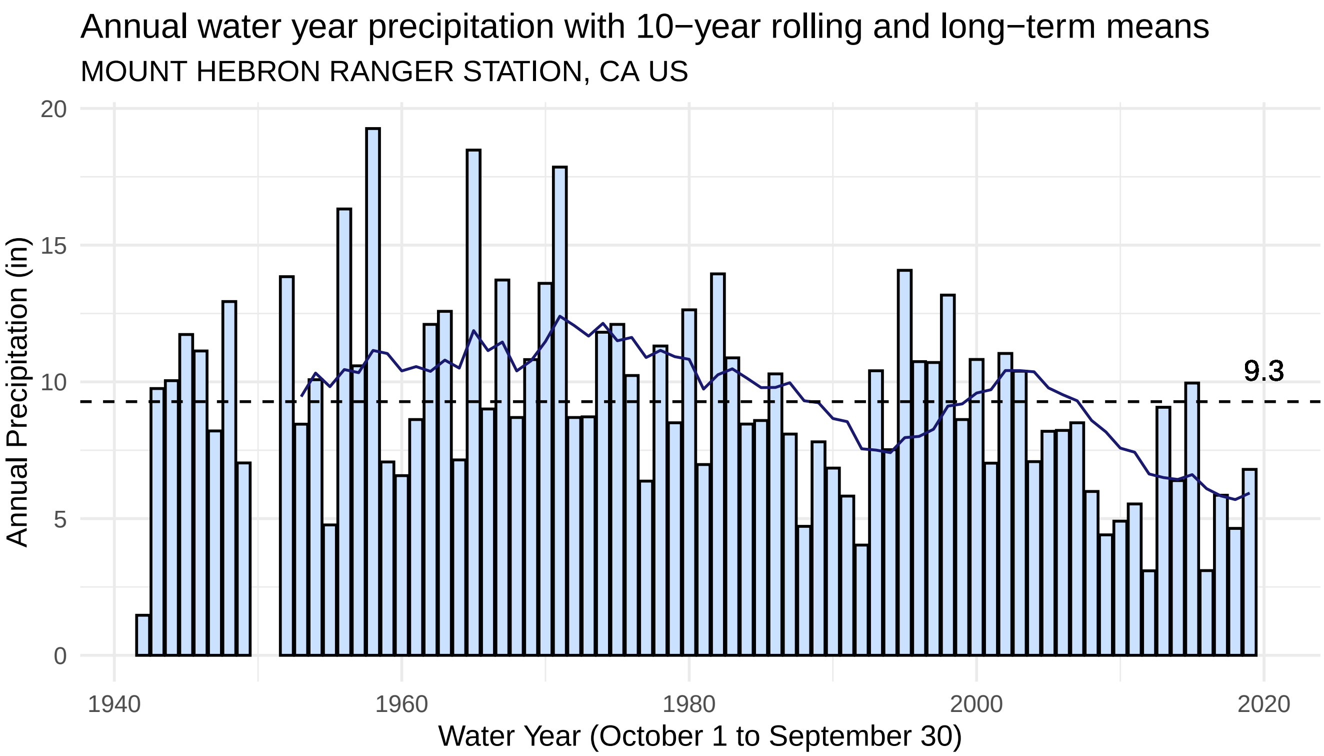

Figure 1.3: Annual water year precipitation with 10-year rolling and long-term means for water year 1941 through 2020 as measured at the Mount Hebron weather station (USC00045941).

and a commensurate decrease in groundwater inflow to the Basin may have contributed to recent groundwater level declines.

Groundwater levels over the past 30 years have generally been observed to be declining at a rate of about 0.25 to 1 ft/year, depending on location, reflecting adjustments of the groundwater system to declining recharge and increased pumping. From a water budget perspective, the increased pumping is matched by increased groundwater inflow from outside the Basin, particularly from the south and southwest. With this increased inflow, a new dynamic water table equilibrium is achieved as groundwater use has stabilized at recent conditions while precipitation rates have not been further declining over the past half decade. It remained relatively steady albeit at low levels.

Based on current conditions in the Basin, this MA will be implemented immediately upon approval of the GSP in partnership with other relevant agencies. During MA implementation, if groundwater levels stabilize at higher elevations due to GSA activities or climate change, the groundwater use cap and the sustainable yield may be adjusted or removed altogether. The mechanism for off-ramping the MA is described in the implementation section below.

Public Noticing

The GSA will implement the following education and outreach actions regarding the MA:

- Post and advertise the progress of MA implementation through the submittal of annual progress reports to DWR.

Implementation: Collaboration with Permitting and Regulatory Agencies

Implementation of the MA is focused on developing active coordination between the GSA with other planning, permitting, and regulatory entities within the Basin, including the Siskiyou County Department of Environmental Health and local land use zoning agencies (see below).

Siskiyou County Department of Environmental Health

The GSA will develop a formal partnership with the well construction permitting agency that operates within the Basin, the Siskiyou County Department of Environmental Health. The objective of the partnership is to develop a well permitting program for agricultural, urban, and large domestic wells that is supportive of and consistent with the GSA's goal not to expand total net groundwater use in the Butte Valley watershed surrounding the Basin and in the Basin itself. The permitting program would ensure that construction of new extraction wells does not expand current total net groundwater use in the Basin itself and across the watershed as a whole (to the degree that such expansion may cause the occurrence of undesirable results). This can be achieved through well retirements and through voluntary water market instruments.

> Well replacement may not require that the new well has the same construction design as the old well, including well capacity. Here are two illustrative examples of an appropriate use of well replacement:
>
> **Example 1**: Replacement of a 1,000-gpm agricultural well that will be properly decommissioned with a new 1,000-gpm agricultural well is permissible.
>
> **Example 2**: Replacement of a 1,000-gpm agricultural well that will be properly decommissioned with a new 2,000-gpm capacity agricultural well is permissible with the explicit condition that the 10-year average total net groundwater extraction within the combined area serviced by the old and the new well does not exceed the average groundwater extraction over the most recent 10-years.

Land Use Zoning Agencies

The GSA will develop a partnership with all relevant land use zoning agencies in the watershed. Land use zoning agencies and relevant stakeholders in the Butte Valley watershed include:

- Siskiyou County
- City of Dorris
- Macdoel (census-designated place)
- Mount Hebron (census-designated place)
- Tennant (census-designated place)
- Red Rock Valley Groundwater Basin
- Bray Town Area Groundwater Basin
- Lower Klamath Groundwater Basin (outside watershed)
- Tulelake Groundwater Basin (outside watershed)

The objective of the partnership is for those agencies to inform land use zoning and land use permitting programs to ensure that zoning decisions are based on a full understanding of groundwater conditions in the watershed and in the Basin and that such decisions are supportive of and consistent with the GSA's goal not to expand total net groundwater use in the Butte Valley watershed.

Developing close partnerships and timely transfer of information will best prevent an expansion of total anthropogenic consumptive water use in the watershed.

Preventing an expansion of total net groundwater use in the Basin and surrounding areas still allows for both urban and agricultural growth.

Urban expansion is made possible primarily by expansion into agricultural or rangeland that will be retired. Agriculture-to-urban land use conversion does not increase net groundwater use within the footprint of that conversion. Sometimes the net groundwater use may be lower after conversion (due to lower evapotranspiration). The total annual volume of net groundwater use reduction can be made available for net groundwater use increase elsewhere in the Basin through designing appropriate land use zoning and permitting processes, and after considering ecological, public interest, and any hydrologic or hydrogeologic constraints to such exchanges.

Agricultural expansion, where permissible under zoning regulations, is similarly made possible, e.g., primarily by voluntary managed land repurposing of existing agricultural activities in the same location or elsewhere within the Basin and ensuring that there is no increase in net groundwater extraction between the expansion on one hand and land repurposing on the other. This may be achieved through land purchasing or trade of net groundwater extraction rights (water markets) or through contractual arrangements for land repurposing (e.g., conservation easements) to balance expansion and reduction of net groundwater use. If additional Basin total net groundwater extraction capacity becomes available (after a pro-longed period of water level increase), the GSA will work with the land use zoning agencies to ensure land use zoning and permitting is adjusted accordingly, following a hydrologic assessment.

Market instruments encompass a wide range of management tools that rely on monetary transactions to efficiently and effectively trade water uses in ways that do not affect the overall water balance of a basin. The following are two hypothetical examples of water market transactions to illustrate how such instruments may be applied, if circumstances and zoning regulations are appropriate:

Example 1: Expansion of urban groundwater use into agricultural lands, where consistent with zoning and land use planning - Net groundwater use per acre of urban land is generally similar to or lower than under agricultural land use (this accounts for the fact that wastewater is recharged to groundwater and that the largest consumptive use in urban settings is ET from green landscapes). A hypothetical example: lets assume that urban net groundwater use is 1.5 acre-feet per acre, whereas it is 3 acre-feet per acre on agricultural land. Net water use is the difference between groundwater pumping and groundwater recharge over the area in question. Let's further assume that an urban expansion occurs into 500 acres of agricultural land. Prior to the land use conversion, net water use was 3 x 500 = 1,500 acre-feet. After the land use conversion, net water use is 1.5 x 500 = 750 acre-feet. The land use conversion makes 750 acre-feet available for additional annual groundwater pumping elsewhere in the Basin.

Example 2: Expansion of urban groundwater use into natural lands, where consistent with zoning and land use planning - Net groundwater use of urban land is generally larger than under natural land use. A hypothetical example: urban net groundwater use is 1.5 acre-feet per acre, whereas it is 0.5 acre-feet per acre prior to the land-use conversion. Let's again assume that the urban expansion is 500 acres. Prior to the land use conversion, water use on the 500 acres was 0.5 x 500 = 250 acre-feet. After land use conversion, the net water use is 1.5 * 500 = 750 acre-feet. The land use conversion therefore requires an additional 500 acre-feet of water.

If the city also purchases 500 acres of agricultural land for urban development, as in example 1, it already has a credit of 750 acre-feet, of which it may apply 500 acre-feet toward this additional 500 acre expansion into natural land.

Alternatively, the city would need to purchase a conservation easement on 200 acres of agricultural land elsewhere in the basin (net groundwater use: 3 acre-feet per acre, or 3 x 200 = 600 acre-feet) that converts that agricultural land to natural land (net groundwater use: 0.5 acre-feet per acre, or 0.5 x 200 = 100 acre-feet). The net groundwater use on the easement would be reduced from 600 acre-feet to 100 acre-feet, a 500 acre-feet gain to balance the city's development into natural lands, above. Costs for the easement may include costs for purchasing or leasing that land and the cost for maintaining the conservation easement. We note that conversion to natural land may require significant and habitat development and management as appropriate.

The above examples do not account for possible water rights issues that will also need to be considered. In California, urban groundwater rights are generally appropriative, while agricultural water rights are overlying, correlative rights.

De minimis exceptions to net groundwater use expansion: domestic water use, up to 2 acre-feet per house-hold, contributes minimally to net groundwater extraction of a basin. Nearly all household water use other than irrigation is returned to groundwater via septic systems leachate. Larger household water use, above *de minimis* levels is typically due to irrigation of pasture or lawn and therefore, will be considered a net groundwater extraction.

If additional net groundwater extraction becomes available (after a prolonged period of water level increase), the partnership will ensure that well permitting is adjusted accordingly.

Status

The schedule for implementing the MA is as follows:

- The GSA will create partnerships within the first year of the GSP, by January 31, 2023.
- The partnerships will have the MA program in place no later than January 31, 2024.
- Benefits are to be seen immediately; that is, net groundwater use during the 2020-2030 decade will not exceed net groundwater use during the 2010-2020 baseline period.

Expected Benefits

Benefits generated by the MA will include:

- Security of groundwater pumping for existing groundwater users.
- Efficient, effective, and transparent planning tools available for new groundwater uses through market instruments involving the retirement of existing groundwater uses.

Implementation: Monitoring

In a groundwater basin where agricultural pumping exceeds 95% of applied groundwater use in the basin, the total long-term change in the amount of net groundwater use (groundwater pumping minus irrigation return flows to groundwater) can be estimated by quantifying the long-term changes in the Basin's evapotranspiration (ET) from irrigated landscapes. This assumes that long-term trends in precipitation and applied surface water are sufficiently negligible such that only a significant increase in Basin ET leads to changes in the long-term groundwater balance or that their impacts are separately assessed using a model (Section 2.2.4).

Butte Valley is a closed surface water basin. All surface water inflows captured for irrigation represent flows that would otherwise be subject to groundwater recharge. Hence, surface water irrigation is an indirect form of groundwater pumping (a kind of "in lieu pumping"). Therefore, from a hydrological perspective, the net agricultural groundwater use in Butte Valley is effectively equal to the amount of agricultural ET.

In Butte Valley, the net groundwater use in urban areas is largely due to ET from lawn areas and suburban pasture. Most household water use other than irrigation is subject to recharge back to groundwater via septic systems or recharge of treated wastewater. For the Basin, the California Department of Water Resources (DWR) will provide estimates of annual agricultural ET and ET from urban lawn and suburban pasture areas. Spatially distributed ET rates are obtained through use of remote sensing data. The accuracy of a basin-total annual agricultural and urban ET value is on the order of +/-10% (Medellin-Azuara et al., 2017). DWR estimates of ET provide an inexpensive, readily available data source to estimate net annual groundwater use from individual fields, and from the Basin as a whole.

Groundwater storage will be evaluated continually to assess the effectiveness of the avoiding the expansion of total net groundwater use. If a sustained long-term (5-10 year) increase in groundwater levels is observed in the representative monitoring network (or an expanded version of that network, which may include wells outside the GSA boundary but within the watershed), appropriate scientific-technical assessments, including groundwater modeling, will be used to determine the amount of expanded total net groundwater use capacity available. If groundwater levels have increased due to long-term increase in recharge in the surrounding watershed, the GSA may work with land use zoning agencies to allow for a gradual expansion of total net groundwater use that will allow water levels to remain within the measurable objective.

Legal Authority

The GSA only has authority for groundwater within the Butte Valley Groundwater Basin. The GSA has no land use zoning authority. The GSA will work collaboratively with the County of Siskiyou, other land use zoning agencies, and stakeholders within the Butte Valley Basin to implement this MA.

Estimated Costs and Funding Plan

[A description of the estimated cost for each project or management action and a description of how the Agency plans to meet those costs.]

[For economic analysis contractor to fill in]

Management of Groundwater Use and Recharge

Management of groundwater uses and recharge will be evaluated to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods. Assumptions that will be used to evaluate management of groundwater use and recharge include:

- There is currently no overdraft in the Basin.
- The goal of this MA is to avoid renewed water level declines in Butte Valley that are due to further expansion of net groundwater use.
- The MA sets a framework to develop a process for avoiding significant long-term increases in net groundwater use in the Butte Valley GSA as well as in the surrounding watershed, while allowing basin and watershed total groundwater use to remain at levels that have occurred over the most recent ten-year period (2010-2020).
- Monitoring: Compliance with the MA is measured by determining whether the most recent ten-year running average Basin/watershed sum of agricultural and urban ET remains at or below levels measured for the 2010-2020 period, within the limits of measurement uncertainty.

Dorris Water Meter Installation Project

Project Description

To improve water conservation, the City of Dorris is in the process of adopting a metered water rate structure by installing water meters. The project is also replacing old pipelines. Following the installation of meters, water consumption can be tracked and water rates adjusted based on actual water volume used. This project will begin in 2021. This project is fully funded through grants from the Department of Public Health Safe Drinking Water State Revolving Fund and State Revolving Fund.

Irrigation Efficiency Improvement

Project Description

Achieving increases in irrigation efficiency through equipment improvements are anticipated to reduce overall water demand with the potential to decrease overall consumptive water use, predominantly through a reduction in evaporation. This is expected to support stable water level conditions.

Currently, this project is in the planning phase and funding options will be explored during the first five years of GSP implementation. This project involves an exploration of options to improve irrigation efficiency, assessment of irrigator willingness, outreach and extension activities, and development of funding options, primarily by cooperators, possibly in cooperation with NRCS. This PMA is likely to be accomplished through a voluntary, incentive-based program. Cost estimates have not yet been completed for this PMA.

Monitoring data collected in this irrigation efficiency improvement program include, but are not limited to:

- Total acreage with improved irrigation efficiency equipment.
- Location of fields under improved irrigation efficiency equipment.
- Assessment of the increase in irrigation efficiency, with particular emphasis on assessing the reduction or changes in consumptive water use (evaporation, evapotranspiration) based on equipment specification, scientific literature, or field experiments.
- Cropping systems in fields with improved irrigation efficiency equipment.

Voluntary Managed Land Repurposing

Project Description

Voluntary managed land repurposing programs include a wide range of voluntary activities that make dedicated, managed changes to land use (including crop type) on specific parcels in an effort to reduce consumptive water use in the Basin to improve and increase groundwater levels This voluntary land repurposing program will encourage a range of activities that would reduce water use in the Basin. These activities may include any of the following:

Term Contracts: In some circumstances, programs like the Conservation Reserve Program (CRP) could provide a means of limiting irrigation on a given area for a term of years. Because of low rates, the CRP has not been utilized much in California, but this could change in the future. In addition, other term agreements may be developed at the state or local level.

Crop Rotation: Landowners may agree to include a limited portion of their irrigated acreage in crops that require only early season irrigation. For example, a farmer may agree to include 10% of their land in grain crops that will not be irrigated after June 30.

Irrigated Margin Reduction: Farmers could be encouraged to reduce irrigated acreage by ceasing irrigation of field margins where the incentives are sufficient to offset production losses. For corners, irregular margins, and pivot end guns, this could include ceasing irrigation after a certain date or even ceasing irrigation entirely in some instances.

Crop Support: To support crop rotation, particularly for grain crops, access to crop support programs may be important to ensure that this option is economically viable. Some type of crop insurance and prevented planting payment programs could provide financial assurances to farmers interested in planting grain crops.

Other Uses: In some circumstances, portions of a farm that are currently irrigated may be well suited for other uses that do not consume water. For example, a corner of a field may be well suited for wildlife habitat or solar panel, subject to appropriate zoning requirements to avoid undesirable outcomes. Depending on the circumstances of an individual project, conservation easements may include habitat conservation easements, wetland reserve easements, or other easements that limit irrigation with surface water or groundwater on a certain area of land. It may be established that certain portions of a property may be suitable for an easement, while the rest of the property remains in irrigated agriculture. Many form of such temporary, seasonal, or permanent easements are possible. They may additionally specify restrictions or requirements on the repurposed use, e.g., to ensure appropriate habitat management.

Currently in the planning phase, this project type is to be developed throughout the next 5 years.

Implementation of this project type includes consideration of the following elements:

- Role of the GSA versus other agencies, local organizations, and NGOs
- Development of education and outreach programs in collaboration with local organizations
- Exploration of program structure.
- Contracting options.
- Exploration and securing of funding source(s).
- Identification of areas and options for easements or other contractual instruments (especially within the Adjudicated Zone).

Monitoring data collected in this voluntary managed land repurposing program include, but are not limited to:

- Total acreage and timing of land repurposing.
- Location of parcels with land repurposing.
- Assessment of the effective decrease in evapotranspiration (consumptive water use) and applied water use.
- Description of the alternative management on repurposed land with:
  - Quantification and timeline of groundwater pumping curtailments, including water year type or similar rule to be applied and specified in the easement.

Well Replacement

Project Description

A well replacement program will deepen or replace wells impacted during implementation of the groundwater level sustainability plan. While other PMAs begin to be implemented, groundwater levels may continue to decline for a number of years and cause stakeholders wells to go dry.

A well replacement program will address undesirable results stemming from the need to deepen or replace existing wells due to a continued decrease in groundwater levels below trigger levels, if that were to occur (see Chapter 3).

Funding for this project is more restricted compared to other PMAs. Under the Sustainable Groundwater Management Implementation Grant Program Proposition 68, grants can be awarded for planning and for projects with a capital improvement component. As such, funds for reimbursing landowners for implementation of PMAs including land fallowing and well-shut offs cannot be obtained under this program.

Currently, this project is in the planning phase and funding options will be explored during the first five years of GSP implementation. Cost estimates have not yet been completed for this PMA.

As shown by the basin model (Chapter 2), the historic decline in water levels is due to a combination of a decreasing trend in precipitation over the watershed and an increasing trend in groundwater pumping over the past 30 years. Without further significant expansion (increase) in groundwater pumping, groundwater levels are anticipated to stabilize at current conditions, even if precipitation levels remain at recent lower annual levels. The basin is not in overdraft. The likelihood for this PMA to be needed is low.

4.3 TIER III: POTENTIAL FUTURE PROJECT AND MANAGEMENT ACTIONS

Alternative, Lower ET Crops

Project Description

The “alternative, lower ET crop” PMA is a pilot program to develop and introduce alternative crops with lower ET but sufficient economic value to the Basin’s agricultural landscape. The implementation of such crop changes would occur as part of the Tier II Voluntary Managed Land Repurposing PMA. The objective of this PMA is to develop capacity in the basin to facilitate crop conversion in some of the agricultural landscape that would reduce total crop consumptive use (evapotranspiration) of water in the Basin as needed. The management action is to develop a program to develop and implement pilot studies with alternative crops that have a lower net water consumption for ET, and to provide extension assistance and outreach to growers to facilitate and potentially incentivize the crop conversion process. This PMA will be implemented jointly with University of California Cooperative Extension, the Siskiyou County Farm Bureau, the Siskiyou County Resources Conservation District, and/or other partners. Currently in the conceptual phase, this project involves:

- Scoping of potential crops.
- Pilot research and demonstrations.
- Defining project plan.
- Exploration of funding options.
- Securing funding.
- Development of an incentives program.
- Implementation of education and outreach.

Anticipated benefits from this project include introduction of lower consumptive water use crops and either an increase in recharge (on surface water irrigated crops) or a reduction in the amount of irrigation or both. As a result, water levels in the aquifer system will rise. Implementation of this project is contingent on the evaluation of alternative, lower ET crops that provide sufficient economic value. Future benefits of actual implementation status will be evaluated and assessed with BVIHM using monitoring data describing the implementation of the alternative, lower evapotranspiration program.

Monitoring data collected in this alternative, lower evapotranspiration program include, but are not limited to:

- Total acreage with alternative, lower ET crops.
- Location of fields with alternative, lower ET crops.
- Assessment of the effective decrease in ET.
- Cropping systems used as alternative, lower ET crops.

Butte Creek Diversion Relocation

Project Description

For emergency flood control, the Army Corps of Engineers created two Butte Creek diversions in 1965 into storage reservoirs for groundwater recharge. One diverts to Dry Lake and the second east of Orr Mountain, where the Butte Valley Irrigation District (BVID) later constructed a dam and canal for the diversion (Bell & Harrington 2011 - “Kegg Meadow Groundwater Study”). The impact of the groundwater recharge due to the creek diversion is unknown due to the lack of stream flow data, diversion flow data, and the direction of recharged groundwater (ie., Butte Valley or Red Rock groundwater basins).

This PMA is broken into two steps:

- Firstly, to fill data gaps related to streamflow and groundwater levels and recharge at the creek diversions. This will also increase the GSA’s understanding of groundwater inflows into the Basin.
- Secondly, investigate if moving or altering the Butte Creek diversion would increase groundwater flows in the Basin. A complication is the need to avoid harming the Red Rock groundwater basin if the Butte Creek diversion is providing recharge.

Butte Valley National Grassland Groundwater Recharge Project

Project Description

The Butte Valley National Grasslands may be developed to store Meiss Lake floodwaters for groundwater recharge. This project could be tied to Management Project #3 to prevent flooding of populated and agriculture lands by Butte Creek winter flows if the current diversion is moved. This project will require infrastructure development to divert excess floodwaters from Butte Creek to Meiss Lake and the National Grasslands.

Strategic Groundwater Pumping Reductions

Project Description

To reach sustainable groundwater levels, management actions such as strategic groundwater pumping reductions to prevent well outages may need to be temporarily or permanently implemented. This may involve reductions in groundwater pumping during particular months of the year near impacted groundwater wells. The GSA has the authority to impose pumping reductions (WC 10726.4(a)(2).) This PMA requires additional planning before implementation.

The benefits of this program will be to avoid undesirable well outages. Future benefits will be evaluated and assessed with BVIHM using monitoring data describing the implementation of strategic groundwater pumping reductions that result from the irrigation efficiency improvement program, while also accounting for reduced recharge return flow from irrigation.

SGMA legislation allows for charging fees for pumping in excess of allocations, or for noncompliance with other GSA regulations (CWC Section 10732 (a)). The GSA will consider adoption of fees and/or other penalties for violations of pumping allowance and/or reporting if curtailments are implemented.

In the event of a need to restrict pumping, pumping restrictions could also be placed on new wells. Restrictions on permits for new groundwater wells would be considered if there was high demand for wells that, if constructed, could lead to the basin water extractions exceeding the sustainable yield for the basin. Alternative, restrictions on permits in specific areas would be considered if additional localized pumping could drive one or more sustainability indicators below the minimum threshold. In the absence of a basin adjudication, pumping restrictions on new uses would need to be applied equitably and in a similar proportion to restrictions on existing users.

Monitoring data collected in the Strategic Groundwater Pumping Curtailment Program include, but are not limited to:

- Well construction records.
- Land area serviced by the well through irrigation.
- Metering of extraction
- Amount of historic pumping, if known.
- Amount and timing of curtailed pumping.

4.4 Other Management Actions

Monitoring Activities

Chapter 3 and the data gap Appendix (Appendix 3-A) clearly describe the importance of establishing an extensive monitoring network which will be used to support future GSP updates. A summary of the proposed monitoring activities includes, but is not limited to:

- Development of new RMPs (Representative Monitoring Points) to support the groundwater quality SMC
- Development of new RMPs to support groundwater level SMC

- New stream gauges in Butte Creek
- Use of satellite images, twice per year, to evaluate status of groundwater dependent ecosystems

Well Inventory Program

In feedback from DWR on other GSPs, a better inventory and definition of active wells was requested along with discussion of impacts to these wells in annual reports, as some shallow wells may be impacted if MTs are reached.

A detailed well inventory will improve the understanding of the Basin conditions and will be valuable for modeled results. It will also help solve ongoing issues with evaluation of *de-minimus* users and their proper inclusion in BVIHM.

Voluntary Well Metering

This project would facilitate the collection and reporting of groundwater extraction data. Accurate groundwater extraction data improves the quality of information used in modeling, and in decision-making. Additionally collection of pumping data is useful for tracking the effectiveness of the proposed demand reduction PMAs.

Future of the Basin

This project would entail developing a study of the economic impacts of the projects and management actions included in the GSP. This would include an evaluation of how implementation of the project could affect the economic health of the region and on local agricultural industry. It would also consider the projected changes to the region's land uses and population and whether implementation of these projects would support projected and planned growth.

Note: Several additional PMAs have been suggested through the public comment process and will be evaluated for inclusion in this chapter. These suggestions include a water market, forage support programs, pilot studies of existing PMAs (i.e., drip vs sprinkler irrigation impact on groundwater levels and recharge), and Basin boundary realignment.

References

County of Siskiyou. 1996. “Siskiyou County Comprehensive Land & Resource Management Plan.” *Siskiyou County*.

Gannett, M. W. 2010. “Ground-Water Hydrology of the Upper Klamath Basin, Oregon and California, Scientific Investigations Report.” https://pubs.usgs.gov/sir/2007/5050/.

Gannett, M. W., B. J. Wagner, and K. E. Lite. 2012. “Groundwater Simulation and Management Models for the Upper Klamath Basin, Oregon and California, Scientific Investigations Report.” https://pubs.usgs.gov/sir/2012/5062/.