Chapter 4 [June 2024 Draft Revision]

Project and Management Action

4.1 INTRODUCTION AND OVERVIEW

To achieve this Plan's sustainability goal by 2042 and avoid undesirable results as required by Sustainable Groundwater Management Act (SGMA) regulations, multiple projects and management actions (PMAs) have been developed for implementation by the groundwater sustainability agency (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. This chapter has been updated as part of the revisions to the Butte Valley GSP, made to address deficiencies in the determination issued by the Department of Water Resources (DWR) on the Butte Valley Groundwater Sustainability Plan (GSP), issued by DWR on January 18, 2024.

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 (MO), and avoid the undesirable results identified for the Basin in Chapter 3. These efforts will be periodically assessed during the implementation period, at minimum every five years (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. After GSP adoption, the GSA will prioritize certain PMAs for feasibility reviews and preliminary engineering studies. Based on review and study results, PMAs may move forward to implementation.

In Butte Valley, the PMAs are designed to achieve three major objectives:

- To prevent chronic lowering of groundwater levels.
- To protect wells from outages.
- To protect beneficial users of groundwater.

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, non-governmental organizations (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 four categories: demand management for groundwater, supply augmentation, habitat improvement, and groundwater recharge. Demand management projects reduce the demand for groundwater and can include projects such as irrigation efficiency improvements. Surface water supply augmentation projects contribute to increases in surface water in the Basin. Habitat improvement projects can include restoration and upland management projects and groundwater recharge projects. Examples of project types within these three categories are shown in Table 4.1. Three tiers are used to separate PMAs by timeline for implementation. Note that the tiered system is **not necessarily indicative of priority for implementation**. Additionally, PMAs are not organized within tiers in priority order Please refer to the "circumstances for implementation" part of each PMA description, or the "status" and "anticipated timeframe" columns of **Table 4.1** for more information on implementation timelines of individual PMAs. The three tiers used to categorize PMAs are:

1. **TIER I**: PMAs that were already being implemented at the time of GSP submittal and are anticipated to continue to be implemented.
2. **TIER II**: PMAs with initiation and early implementation planned ~~(~~in 2022 through 2027~~)~~ by individual member agencies.
3. **TIER III**: Additional PMAs that may be implemented in the future, as necessary (initiation and/or implementation in the 2027 to 2042 time period).

A general description of existing and ongoing (Tier I) PMAs is 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 4.1. 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, stream habitat improvement, and groundwater 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, will be 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. More details on how projects will be evaluated and a road map to discuss feasibility and potential for success of each project (or a combination of projects) is presented in Chapter 5.

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 (Appendix 5-C). 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. Funding will also be sought from other local, state, federal, and private (NGO) sources.

The existing PMAs have been extracted from the following documents:

- Supply Enhancement (in Streams)
  - Butte Valley Wildlife Area (BVWA) / California Department of Fish and Wildlife (CDFW)
  - United States Forest Service (USFS) 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

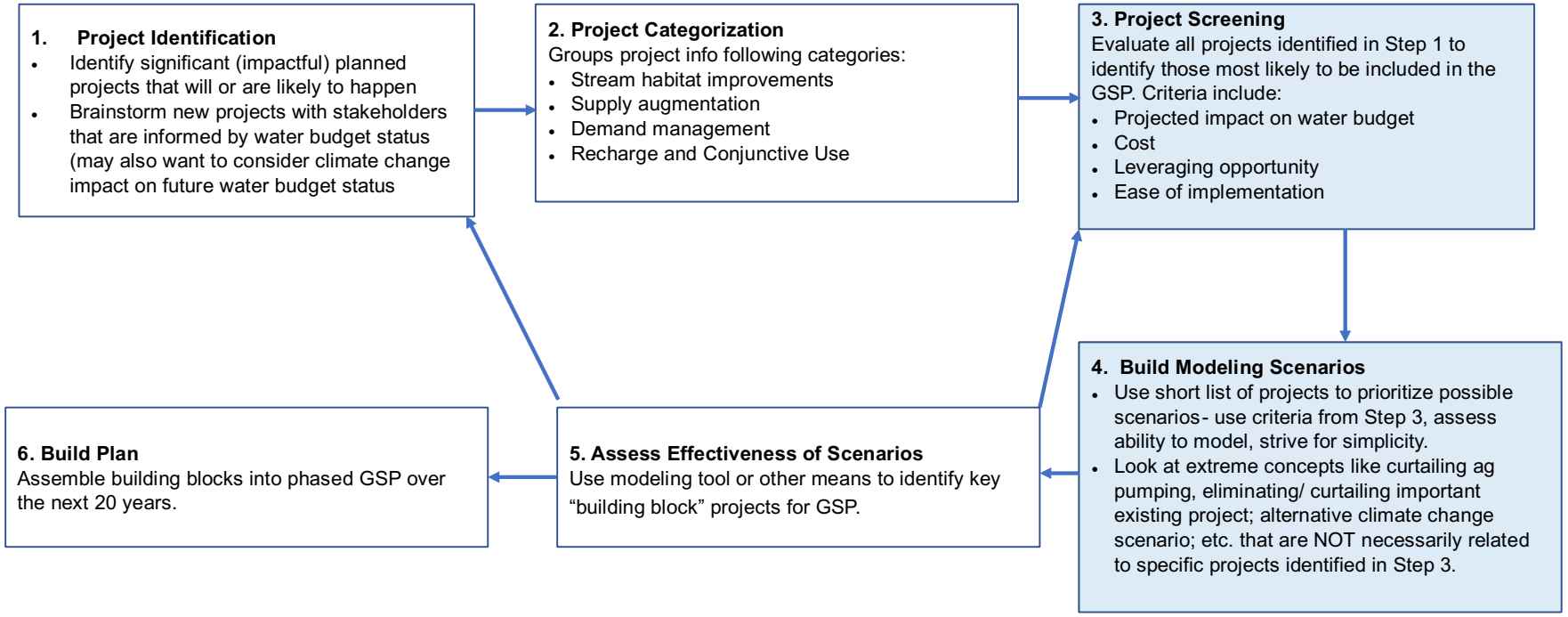

Figure 4.1: Process for identification and prioritization of PMAs. Further details, such as authority and finalized prioritization, are shown in Chapter 5.

Table 4.1: Projects and Management Actions Summary.

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
	Tier I PMAs						
~~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	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

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
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
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. 2.	Habitatrestoration Groundwaterrecharge
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	

Table 4.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
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 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
	Tier II PMAs~~Tier II PMAs~~						
II~~I~~	Well inventory and Mitigation Program	Development and implementation of a program to address well outage issues due to groundwater level declines for domestic well owners. -	GSA	Supply Enhancement	Active	Active	GSA Implementation
II	Preliminary Groundwater Allocation Program	Development of a draft program for groundwater allocation as a potential	GSA	Demand Management	Active	Conceptual phase	Groundwater Levels, groundwater storage

Table 4.1: Projects and Management Actions Summary. *(continued)*

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits
		management action.					
II~~I~~	Groundwater Demand Management	Reduction of groundwater use by 10-15% through implementation of irrigation efficiency improvements, demand reduction, or a combination of both.	GSA	Demand Management	Active	Active~~g~~	Groundwater Levels, groundwater storage
II	City of Dorris Well Deepening and Pipeline Replacement Project	Replace or repair water distribution system, City well and up to 4 Butte Valley wells.	GSA	Supply Enhancement	Active	Active	GSA implementation
II	Avoiding ~~Significant~~ Increase of Total Net Groundwater Use ~~f~~Above Sustainable Yield~~rom 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

Table 4.1: Projects and Management Actions Summary. *(continued)*

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
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	Public Outreach	Public outreach and education for GSA stakeholders.	GSA	GSA Implementation	Planning Phase	Implementation	GSA Implementation
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~~easements, and other uses	GSA, TBD	Demand Management	Conceptual Phase	Conceptual phase	Groundwater levels

Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits

Table 4.1: Projects and Management Actions Summary. *(continued)*

~~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~~
~~II~~	~~Well Inventory Program~~	~~Improve the GSA database of wells within the Basin.~~	~~GSA~~	~~GSA Implementation~~	~~Planning Phase~~	~~Planning Phase~~	~~GSA Implementation~~
	Tier III PMAs						
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
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
Tier	Title	Description	Lead Agency	Category	Status	Anticipated Timeframe	Targeted Sustainability Indicator(s) / Benefits

Table 4.1: Projects and Management Actions Summary. *(continued)*

III	Strategic Groundwater Pumping Restriction	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 4.1 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, mitigation of outages for shallow wells, and supply augmentation.

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 United States Army Corps of Engineers to abandon the Sam's Neck Flood Control Facility (Kit Novick 1996; County of Siskiyou 2017).

Benefits of this project include:

- Meiss Lake flood waters are kept within the Basin for groundwater recharge instead of being pumped to the Klamath River.
- Increased habitat for wildlife.
- New flood control mechanism for Butte 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, this management action (MA) benefits sustainability multiple indicators, including declining groundwater levels, groundwater storage, and depletion of interconnected surface waters (ISWs).

To comply with the recent Executive Orders N-7-22[1] and N-3-23[2] regarding drilling of new wells, the County and the GSA developed new guidelines that were approved by the Board of Supervisors at the May 21, 2024 meeting.[3] Specifically for Butte Valley, a preliminary tool has been developed to simulate the impact of potential new wells on existing wells. This tool will be used by the County to define preliminary criteria to be used in the process of approval/denial of new wells.

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 feet 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 (Bell and Harrington 2011; NCRWQCB 2013).

[1] Executive Order N-7-22: https://www.gov.ca.gov/wp-content/uploads/2022/03/March-2022-Drought-EO.pdf 2
[2] Executive Order N-3-23: https://www.gov.ca.gov/wp-content/uploads/2023/02/Feb-13-2023-Executive-Order.pdf?emrc=b12708
[3] https://bosagenda.co.siskiyou.ca.us/467860/467869/480054/Documents.htm

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):[1][2]

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 USFS, Bureau of Land Management (BLM), or private land.

The USFS regularly manages sections of USFS land and current active projects within the Butte Valley watershed (Watershed) includes the Harlan Project, through the Klamath National Forest Goosenest Ranger District (USFS 2021). 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 cubic feet per second (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 (Todd Sloat Biological Consulting 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.

[1] https://library.municode.com/ca/siskiyou_county/codes/code_of_ordinances
[2] ~~{?}~~

4.3 TIER II: NEAR-TERM ~~PLANNED~~ PROJECTS AND MANAGEMENT ACTIONS (2022-2027)

Tier II PMAs, ~~planned for~~with near-term initiation and implementation (2022 to 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. Well Inventory and Mitigation Program
ii. Preliminary Groundwater Allocation Program
iii. Groundwater Demand Management
iv. City of Dorris Well Deepening and Pipeline Replacement Project
v. High Priority PMAs - Data Gaps and Data Collection

- Butte Valley Integrated Hydrologic Model (BVIHM) Update (High Priority)
- Drought Year Analysis (High Priority)
- Expand Monitoring Networks (High Priority)
- General Data Gaps (High Priority)
- Groundwater Dependent Ecosystem Data Gaps (High Priority) • Interconnected Surface Water Data Gaps (High Priority)

~~ii.~~vi. Avoiding ~~Significant~~ Increase of Total Net Groundwater Use ~~from the Basin~~Above Sustainable Yield
~~iii.~~vii. Management of Groundwater Use and Recharge iv. Conservation Easements
~~v.~~viii. Dorris Water Meter Installation Project
~~vi.~~ix. Irrigation Efficiency Improvements
~~vii.~~x. Public Outreach
~~viii.~~xi. Voluntary Managed Land Repurposing (not including Conservation Easements)
~~ix. Well Inventory Program~~
~~x. Well Replacement~~

Well Inventory and Mitigation Program

Project Description

A detailed well inventory will be developed to improve the understanding of the Basin conditions and to improve model performance. An improved inventory of domestic wells and other drinking water wells will assist the GSA in protecting beneficial users in times of drought and other critical times. It will also help solve ongoing issues with the identificationof *de-minimus* users and their proper inclusion in BVIHM.

A Well Mitigation Program (Program) will be developed and implemented concurrently with the well inventory. This program is intended to gain information on well issues effecting domestic well owners due to groundwater level declines since 2015. This Program includes both an expansion in groundwater level monitoring, specifically to support domestic well-owners, as well as development and implementation of measures to mitigate the identified well issues.

The GSA recognizes the importance of protecting the interests of all beneficial uses and users of groundwater, including domestic well-owners and especially those in Disadvantaged Communities (DACs). To support this effort, the GSA is in the process of developing a Domestic Well Advisory Group (DWAG) to include diverse domestic well owner perspectives and input to guide development of the Well Mitigation Program. The DWAG will provide important input to the GSA to aid in the development of the well inventory and mitigation program. Additionally, the DWAG will assist with community outreach and support implementation of both expanded groundwater level monitoring and implementation of the well mitigation program, to best support domestic well-owners.

Circumstances for Implementation

The Program will address well issues caused by groundwater level declines from 2015 and resulting from groundwater management on a basin-wide scale. Eligibility for support under this program will likely be determined through review of information from well-owners and physical inspection of candidate wells. The procedure and criteria for determining eligibility will be developed as an element of the Program.

Public Noticing, Permitting, and Regulatory Processes

The GSA will provide information related to this project, and updates on its progress through quarterly Advisory Committee meetings. The GSA also plans to coordinate with the County of Siskiyou Department of Environmental Health and Board of Supervisors on project progress and the implementation timeline.

This Program is not anticipated to require significant permitting in its development or implementation. Any permitting that may be required for potential mitigation actions, such as well

deepening, will be completed with support of the GSA and in coordination with the County of Siskiyou Department of Environmental Health.

Project Status and Timeline for Implementation

Expected timelines for major milestones associated with this project include:

- Development of the DWAG by December 2024
- Development of a preliminary assessment of well conditions as results of the well inventory PMA (the well inventory PMA is already active and has been funded through DWR GSP implementation grant) by March 2025
- Development of the draft well mitigation program by June 20254
- Development of the final well mitigation program by September 2025 (including opportunity for public review and comment)

Expected Benefits and Evaluation of Benefits

It is expected that benefits to well-owners through implementation of the well mitigation program will begin after the well mitigation program is finalized in September of 2025. Benefits from this program are expected to be primarily realized through well diagnostics and improvements, and well deepening. The GSA will also coordinate with Office of Emergency Services, as and the County of Siskiyou Environmental Health Department, as needed. The benefits and overall success of the program are anticipated to be tracked through the number of well outages reported, the number of applications under the Well Mitigation Program, the number of eligible wells under the Program and the number of wells that have received support.

Legal Authority

This project will be implemented under the authority of the GSA but will closely coordinate with all relevant local, state, and federal agencies depending on the situation. .

Estimated Cost

The estimated cost of the well inventory is anticipated to be from $50,000 to $80,00. The well mitigation –program development is estimated to be– $50,000 to $70,000. The cost of program implementation is estimated to be $50,000 to $100,000 per year, dependent upon the groundwater conditions and well outages reported. Program implementation will be funded through a combination of GSA funding. Grant funding (if available) will be coordinated with the office of Emergency Services.

The well inventory and the development ~~and initial stages of implementation~~ of the Well Mitigation Program ~~are~~will be funded through the Butte Valley GSP Implementation Funding obtained through the Department of Water Resources' Sustainable Groundwater Management Grant Program Round 2 Implementation Funding. The Well Mitigation Program was included under the Well Inventory Component. The implementation of the program, and well mitigation actions, will

be covered by the GSA, with support from other sources of funding including state and federal grant programs, as available. To ensure the avoidance of significant impacts (i.e. domestic wells outages that would cause failure to provide for human right to water), the GSA has committed to mitigating up to 20% of domestic wells in the Butte Basin (a total of up to 48 wells) over the GSP implementation period, as needed. The GSA will coordinate with the Office of Emergency Services (OES), and County of Siskiyou Department of Environmental Health, to evaluate the best pathway to fund the replacement of these wells.

This program is recognized as a critical implementation action and the GSA recognizes the necessity of a secure, on-going funding mechanism. This will be included as part of the Fee Study development~~.~~, as a necessary item to fund throughout the GSP implementation period. The GSA will also explore alternative funding sources including investigating grant opportunities and collaborating with other agencies.

Relevant Measurable Objectives

The Well Mitigation Program benefits the groundwater elevation measurable objective by protecting domestic well beneficial users and avoiding impacts to domestic well owners from wells going dry-, a part of the Basin's sustainability goal.

Preliminary Groundwater Allocation Program

Project Description

The GSA plans to develop a preliminary Groundwater Allocation Program (Program) as a management action to create a tool for implementation, as necessary. This Program will be developed through a stakeholder-driven process as a management tool to be used in the case of necessary, immediate, demand reductions. Elements of this program include the allocation, groundwater usage measurement and reporting, and implementation. This project is still in the conceptual phase. It is anticipated that a GSA-supported working group will spearhead this effort.

Circumstances for Implementation

This Program is anticipated as a measure to be implemented in circumstances where rapid action is required to address declining groundwater levels, and to fulfill the requirement of 10-15% reduction of groundwater pumping (which corresponds to the 65,000 acre-ft /year of sustainable yield.
The GSA intends to develop this Program as a potential tool to be used in the event circumstances require demand reduction quickly and the GSA has exhausted ongoing PMA's. Exact circumstances for implementation will be discussed and assessed by the Advisory Committee and stakeholders.

Public Noticing, Permitting, and Regulatory Processes

This project is currently in the conceptual phase. The GSA plans to coordinate with the advisory committee and local stakeholders in its development. This Program is not anticipated to require significant permitting in development or implementation.

Project Status and Timeline for Implementation

Expected timelines for major milestones associated with this project include:

- Development of the Program Working Group by December 2024
- Development of the draft water allocation program by December 2025
- Development of the final water allocation program by December 2028~~–6~~ (including opportunity for public review and comment, and expecting the need to evaluate different practical options in 2025 and 2026)

Expected Benefits and Evaluation of Benefits

It is expected that benefits resulting from Program implementation will be realized by mitigating groundwater declines. The Program will include metrics to evaluate benefits and to assess whether the Program's objectives are being achieved. This will include tracking changes in groundwater levels with Program implementation, and measurements of groundwater demands, among others.

Legal Authority

This project will be implemented under the authority of the GSA~~.~~.

Estimated Cost

The estimated cost of program development is $65,000. The cost of program development is anticipated to be funded through the Butte Valley GSP Implementation Funding obtained through the Department of Water Resources' Sustainable Groundwater Management Grant Program Round 2 Implementation Funding (specifically funding related to a water market analysis under Component 3d, Task 5).

Relevant Measurable Objectives

The Program benefits the groundwater elevation measurable objective through a reduction of the demand for groundwater, and the potential slowing or reversal of groundwater level decline.

Groundwater Demand Management

Project Description

The objective of this project is to manage groundwater use to achieve the sustainable yield. The goal of this management action is to ensure groundwater extraction is not exceeding a value that is sustainable for the Basin. The Basin's sustainable yield has been determined as the average of the baseline period between 1990 and 2014, a value of 65,000 acre-feet (AF). This value is also consistent with estimates reported in the 1970s. Capping groundwater extraction at this value would require a 10-15% reduction from present groundwater use. This will be achieved through a combination of irrigation efficiency improvements, better assessments of crop needs, and implementation of water allocations, if needed.

A key component of this action is the additional monitoring that is required, including estimates of evapotranspiration (from satellite and in-field data), flowmeters on representative wells to provide groundwater extraction data, and soil moisture data collection. This information will support improvements in irrigation efficiency methods and will increase water use efficiency.

Circumstances for Implementation

This effort is already underway and will continue to be implemented by the GSA.

Public Noticing, Permitting, and Regulatory Processes

No public noticing, permitting, or regulatory processes are anticipated to be required as part of this Program.

Project Status and Timeline for Implementation

Expected timelines for major milestones associated with this project include:

- Development of draft monitoring site list by March 2025
- Instrumentation and monitoring installations on all selected sites by March 2026

Data collection is anticipated to occur throughout the entirety of the GSP implementation period.

Expected Benefits and Evaluation of Benefits

It is expected that benefits resulting from Program implementation will be realized by reducing groundwater declines. The Program will include monitoring to confirm increased efficiencies in irrigation and water use.

Legal Authority

This project will be implemented under the authority of the GSA.

Estimated Cost

The estimated cost of program development is $60,000. The cost of program development is anticipated to be funded through the Butte Valley GSP Implementation Funding obtained through the Department of Water Resources' Sustainable Groundwater Management Grant Program Round 2 Implementation Funding. Specifically, land use and irrigation efficiency are included under Component 2d, Task 6 and well metering is funded under Component 5d, Task 1.

Relevant Measurable Objectives

The Program benefits the groundwater elevation measurable objective through reduction of demand for groundwater, and potential slowing or reverse of groundwater level decline.

City of Dorris Well Deepening and Pipeline Replacement Project

Project Description

This project is to 1) replace or repair water distribution infrastructure in the City of Dorris and add a new municipal well and, 2) identify wells in Butte Valley needing repair or replacement and the repair or replacement of up to 4 wells. Initial outreach was conducted to identify priority water users and to coordinate efforts with other County agencies and community groups. Mailing lists of local addresses were developed to distribute the well outage surveys. The well outage survey was developed and was –translated into Spanish and Hmong. The survey was mailed to approximately 400 local addresses, posted on the City of Dorris' website and posted at the Macdoel and Dorris post offices. In addition, well surveys were distributed during public meetings in Butte Valley. Of the 20 survey responses that were received, 10 reported wells needing repair or replacement.

Responses to the well outage survey were summarized and mapped to identify locations and to characterize reported issues with the wells. Additional surveys were mailed to property owners not previously contacted (i.e. Butte Valley property owners with non-local addresses). Site visits were conducted in June 2023 and 5 wells were identified as needing repairs or replacement. Additional site visits were conducted in the September 2023 to further evaluate the repairs needed. In addition, information was collected regarding shallow sediment and geology to determine well depths needed for long-term water security.

Based on this review and follow up with the well owners, 4 wells were identified to be replaced. Repairs for other wells that were evaluated will be done if funding is available after the completion of the 4 well replacements.

Circumstances for Implementation

This effort is already underway and will continue to be implemented by the city of Dorris, with support from the GSA.

Public Noticing, Permitting, and Regulatory Processes

Permits have been obtained for drilling the new municipal well for the City of Dorris and for well-deepening. No public noticing, or regulatory processes have been required as part of this project.

Project Status and Timeline for Implementation

The timeline for this project is December 2021 through June 2025, expected timelines for major milestones associated with this project include:

- Improvement of water distribution system by June 30, 2024
- Well Deepening Program by June 30, 2025

Expected Benefits and Evaluation of Benefits

Expected benefits from this project include ensuring reliable water supply and distribution for City of Dorris residents and repairing or replacing an additional four wells in Butte Valley. Benefits will be measured through tracking benefits associated with well repair or replacement, and improvements to the water distribution system.

Legal Authority

This project will be implemented under the authority of the GSA.

Estimated Cost

The total cost of this project is $3,762,436, and it is being funded through the Department of Water Resources' Small Community Drought Relief Program.

Relevant Measurable Objectives

The Program benefits the groundwater elevation measurable objective through a reduction of demand for groundwater, and potential slowing or reversal of the groundwater level decline.

Butte Valley Integrated Hydrologic Model (BVIHM) (High Priority)

Project Description

Planned futures updates to the Butte Valley Integrated Hydrologic Model (BVIHM) include:

- After the PMA "Interconnected Surface Water Data Gaps" has been addressed, the GSA will update BVIHM to include surface water, including irrigation canals.
- Update with more new data and extend the model to more recent years to capture additional climate and pumping patterns, particularly the last drought. Continuous groundwater level data will aid the calibration of the BVIHM by providing insight on seasonal groundwater level and storage fluctuations.

This PMA depends on expansion of current monitoring network and data collection, as outlined in other PMAs.

Drought Year Analysis (High Priority)

Project Description

The year 2021 was faced with an unprecedented drought. The GSA will analyze all data collected within the 2021 water year to study how the Butte Valley groundwater basin responded to an exceptional drought year.

Expand Monitoring Networks (High Priority)

Project Description

The GSA will expand the current monitoring networks to address identified data gaps, as defined in Appendix 3-A with implementation details in Chapter 5. This includes:

- Expansion of the groundwater level monitoring network to areas of interest, with an emphasis on continuous monitoring data. Expansion of the groundwater level monitoring network to areas of interest such as Sam's Neck, Meiss Lake, Butte, Prather, Ikes, Harris, and Muskgrave Creeks, and Butte Valley National Grasslands (see Section 3.3). Monitoring wells near surface water and potential groundwater dependent ecosystems (GDEs) are needed. Additional monitoring of domestic wells is needed.
- Expansion of the water quality monitoring network is needed to cover multiple needs such as:
  - Coverage of all beneficial users such as domestic, agriculture, and environmental users.
  - Improved spatial coverage of the Basin.
  - Representation of all major water bearing formations in the Basin, such as shallow units that primarily supply domestic wells and deep units that supply agricultural and municipal wells.

Completion of this project during the implementation process will depend on funding availability and cooperation of partner agencies and stakeholders (see Chapter 5).

General Data Gaps (High Priority)

Project Description

The GSA will aim to fill all data gaps described in the GSP and Appendix 3-A. Data gaps regarding the monitoring networks, GDEs, and ISWs are already addressed in separate PMAs. Additional data gaps that this PMA will address include:

- Increasing the current frequency of water quality sampling.
- Add continuous groundwater level monitoring to the groundwater level network.
- Add snow and weather stations to the Watershed.

Completion of this project during the implementation process will depend on funding availability and cooperation of partner agencies and stakeholders (see Chapter 5). This work is ongoing, and progress made towards filling the identified data gaps are reported each year with the annual report.

Groundwater Dependent Ecosystem Data Gaps (High Priority)

Project Description

The GSA will work with the California Department of Fish and Wildlife (CDFW) and other interested stakeholders to address the data gaps related to GDEs in the Basin (Appendix 3-A). This includes:

- Habitat maps of species that depend on GDEs based on local knowledge and surveys.
- Ad-hoc committee review of species lists, habitat maps, and GDE maps.
- Review species that depend on GDEs with a biologist or related expert.
- Extend the groundwater level monitoring network to areas with potential GDEs.
- Reanalyze potential GDEs after additional data is collected.
- Develop a biological monitoring methodology to monitor GDEs for unreasonable impacts due to groundwater conditions, such as through satellite images.
- Analyze if Meiss Lake and areas within the Butte Wildlife Area (BVWA) should be considered GDEs.

Completion of this project during the implementation process will depend on funding availability and cooperation of partner agencies and stakeholders (See Chapter 5). Completion of this PMA would enable setting sustainable management criteria (SMCs) to protect GDEs in the next five-year GSP update.

Interconnected Surface Water Data Gaps (High Priority)

Project Description

The GSA will work with the CDFW and other interested stakeholders to address the data gaps related to ISWs in the Basin (Appendix 3-A). This includes:

- Installing stream gages to record seasonal flow.
- Adjacent to surface water, including Meiss Lake and all other creeks that enter the Basin: Butte, Prather, Ikes, Harris, and Muskgrave (Chapter 2).

- Conduct a pilot study of shallow monitoring wells or alternative options to analyze if surface water bodies are connected or disconnected to groundwater.
- Collect surface water data for BVIHM such as surface water diversions, canal seepage, streamflow losses, and percolation from wetlands and Meiss Lake.
- Reanalyze potential ISWs after additional data is collected and surface water has been incorporated into the numerical model.
- If ISWs are found to be present in the Basin, create ISWs SMCs as needed and define undesirable results for a future GSP update.

Completion of this project during the implementation process will depend on funding availability and cooperation of partner agencies and stakeholders (see Chapter 5).

Avoiding ~~Significant~~ Increase of Total Net Groundwater Use Above Sustainable Yield~~from the Basin~~

Project Description

The goal of this MA is to avoid water level declines in Butte Valley that would result from ~~significant expansio~~increases~~n~~ of total net groundwater use over the sustainable yield of 65,000 acre-feet (AF)~~relative to the practice over the past decade~~. This MA is intended to avoid future sustained increases of total net groundwater use through a selection of planning and management actions. 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 evapotranspiration (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 Restrictions").

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 to 2020)~~. By preventing groundwater extraction above the sustainable yield~~declining water levels~~, the MA will help the GSA achieve the measurable objectives (MO) of several sustainability indicators: groundwater levels, groundwater storage, and subsidence.

Implementation of the MA is measured by comparing the most recent 5 and 10-year running averages of agricultural and urban ET over both the Basin and Watershed, to the average value of Basin ET measured in the 2010 to 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 10-year period.
- Groundwater storage – Stabilizing declining storage levels at depths not to exceed those corresponding to the most recent 10-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:

- Sustained, i~~I~~ncreased Basin net groundwater use above the sustainable yield –(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 Watershed.
- The amount of recharge in the 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 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 4.2). Between the early 1990s and the 2010s, the total increase has been on the order of 40% (see Appendix 2-E).

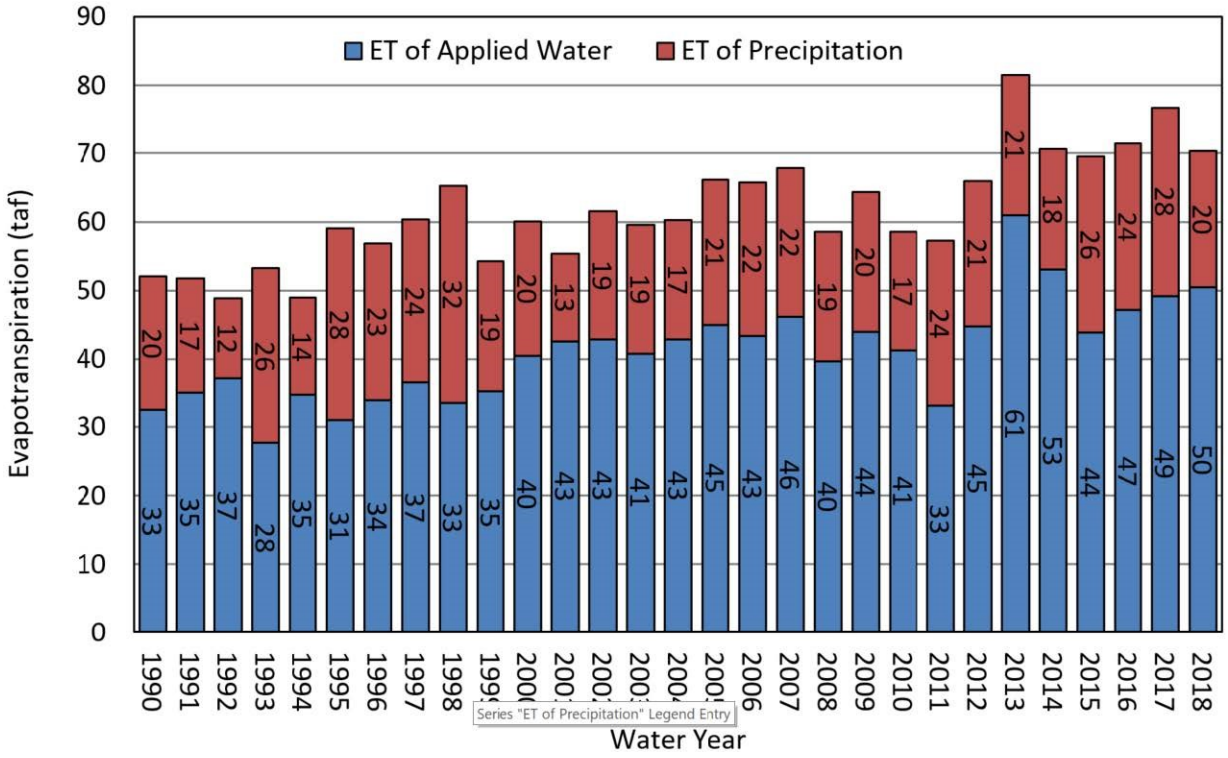

Figure 4.2: ET from applied water (blue) and from precipitation (red) on irrigated lands within the Butte Valley GSA (see Appendix 2-E).

For the 8-year period from 1990 to 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 to 2018, agricultural ET varied from 33 to 61 thousand acre-feet per year, averaging 48 thousand acre-feet (see Appendix 2-E).

Over the same period, precipitation trends have been decreasing (Figure 4.3). The 10-year rolling average precipitation remained well above the 1941 to 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 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 feet per 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.

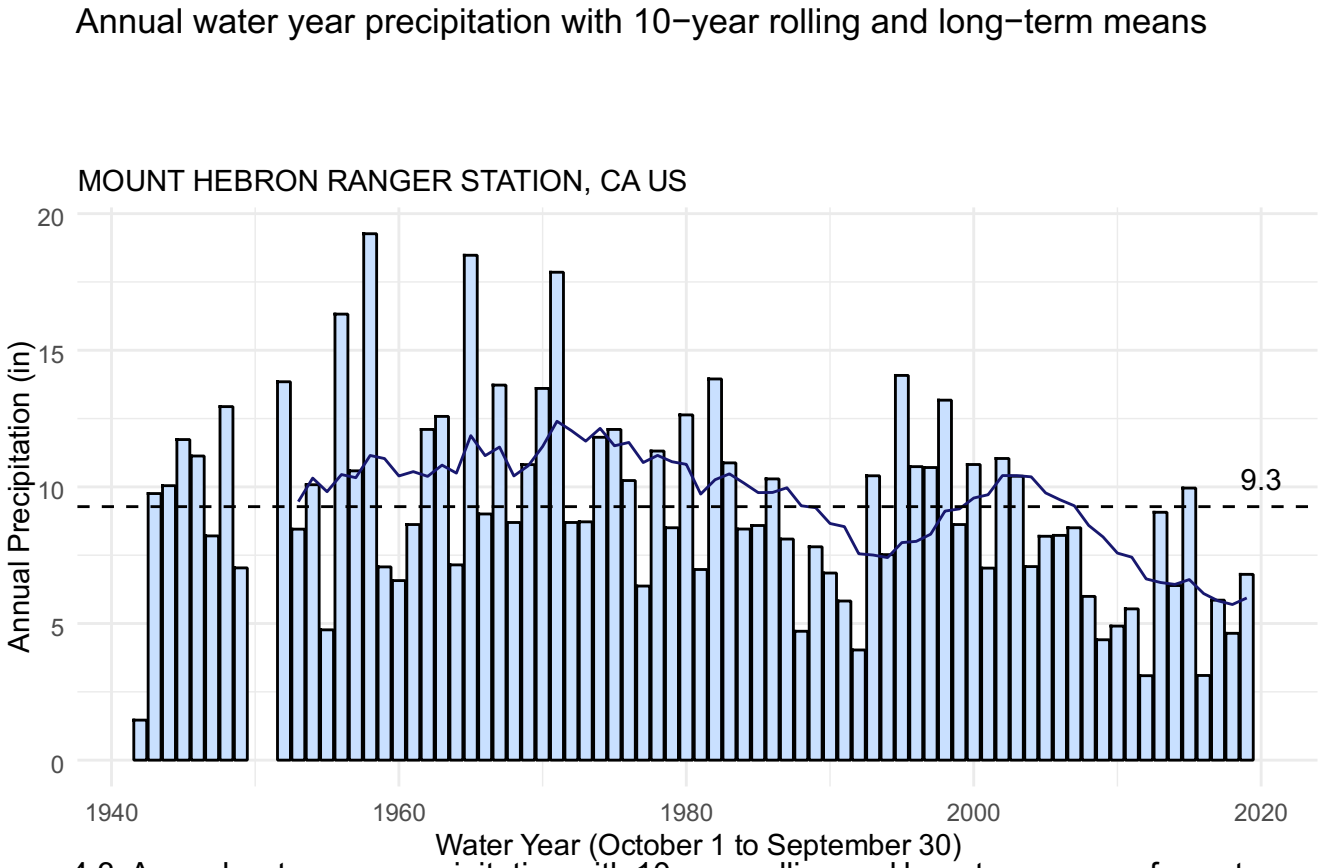

Figure 4.3: Annual water year precipitation with 10-year rolling and long-term means for water year 1941 through 2020 as measured at the Mount Hebron weather station (USC00045941).

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 the California Department of Water Resources (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.

Technical Example (Not a PMA)

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 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.

Technical Example (Not a PMA)

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 acrefeet. 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 groundwater 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 to 2030 decade will not exceed net groundwater use during the 2010 to 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, 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 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, 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. 2018). 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 to 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 (MO).

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 Basin to implement this MA.

Estimated Costs and Funding Plan

An economic analysis contractor will complete a description of the estimated cost for each project or management action and a description of how the Agency plans to meet those costs will be provided in the GSP update when the planning phase has been completed for a majority of PMAs.

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 to 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 to 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.

Public Outreach

This general PMA emphasizes the GSA's goal for public outreach and education among stakeholders to implement the spirit of the PMA and achieve groundwater sustainability within the

Shasta Valley groundwater basin. This includes outreach related to other PMAs and filling data gaps, as well as coordinated, widespread, voluntary conservation efforts and grassroots stewardship. The GSA will also work with municipal water agencies and other relevant organizations to coordinate residential, municipal, and small agricultural water conservation education, particularly in times of drought or critical times of the year. This outreach will help engage the public and create more meaningful opportunities for public interest representation within the GSA.

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:

TermContracts: 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 five 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.

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 restrictions, including water year type or similar rule to be applied and specified in the easement.

~~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. A better inventory of domestic wells and other drinking water users will assist the GSA protect affected beneficial users in times of drought and other critical times. It will also help solve ongoing issues with evaluation of *de-minimus* users and their proper inclusion in BVIHM.~~

~~Well Replacement~~

~~*Project Description*~~

~~A well replacement program will deepen or replace wells impacted during implementation of the groundwater level SMCs. 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 (ET) of water in the Basin as needed. The MA 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 ET program.

Monitoring data collected in this alternative, lower ET 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 and Harrington 2011). 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 with other PMAs 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 Restriction

~~In Butte Valley, the current level of Basin pumping is determined to be sustainable provided the implementation of Tier I and Tier II PMAs will assist in maintaining sustainability and help ensure that pumping at current levels can continue.~~ Through SGMA, the GSA has the ability to implement groundwater pumping restrictions within locations of the GSA's jurisdiction. Although the GSA has the ability to implement pumping restrictions, the development and implementation of Tier I, Tier II, and other Tier III PMAs are designed to maintain sustainability within the Basin, making pumping restrictions a last resort under this GSP.

Considerably more work, data collection and discussion would need to be done to define the policies and procedures for pumping restrictions, and the GSA would first determine, using the BVIHM, and other hydrologic assessment tools, the amount of water that affected pumpers could take sustainably prior to determining what may need to be restricted. Restrictions may be temporary, seasonal, or permanent.

4.4 Other Management Actions

Monitoring Activities

Chapter 3 and the data gap 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 GDEs.

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. While an agricultural economic analysis considering groundwater regulation has been completed (see Appendix 5-D) and provides a good starting point, additional work is needed.