Data Gap Assessment

INTRODUCTION

Multiple datasets were utilized during development of this GSP to characterize current and historical Basin conditions. Monitoring networks were designed to support the evaluation of Basin conditions throughout GSP implementation, particularly with respect to the six sustainability indicators. The representative monitoring points (RMPs) in these monitoring networks are sites at which quantitative values for minimum or maximum thresholds, measurable objectives, and interim milestones are defined. New RMPs will be considered for the 5-years update based on the suggested expanded monitoring network. Data gaps that were identified throughout the GSP development process can be categorized into:

I. Data gaps in information used to characterize current and historical basin conditions.
II. Data gaps in monitoring networks developed to evaluate future Basin conditions which will be used in reporting and tracking Basin sustainability.
III. Additional data or information valuable for measuring progress towards the Basin's sustainability goal. This information has been identified as information that may be useful but has not been confirmed as a data gap,

These data gaps were identified based on spatial coverage of data, period for which data are available, frequency of data collection and representativeness of Basin conditions. An overview of data gaps in the first category is provided in Chapter 2, as part of the characterization of past and current Basin conditions, and the data gaps in the second and third categories are in Chapter 3 as part of descriptions of the monitoring networks. This appendix details the identification of data gaps and uncertainties in each of the categories and the associated strategies for addressing them. The process of data gap identification, and development of strategies to fill data gaps is illustrated in Figure 1 below, sourced from the Monitoring Networks and Identification of Data Gaps Best Management Practice (BMP), provided by DWR (2016).

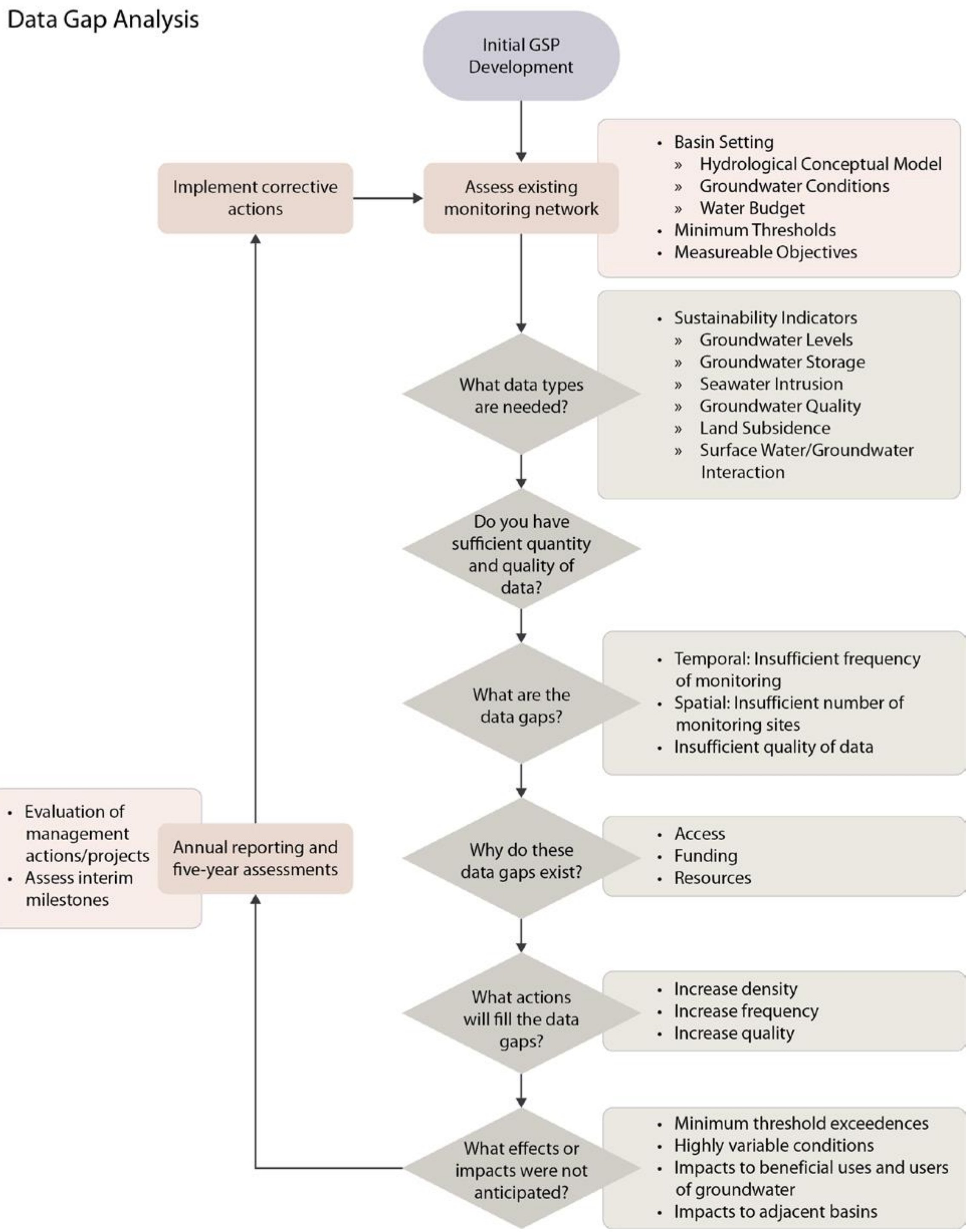

Figure 1: Data Gap Analysis Flowchart (DWR 2016)

I. DATA GAPS IN EXISTING INFORMATION USED FOR BASIN CHARACTERIZATION

Definition of the hydrogeological conceptual model (HCM) is a key requirement for understanding the Basin setting and characterizing existing and historical Basin conditions. An accurate assessment of the physical setting and processes that control groundwater occurrence in the Basin and is foundational to development of the sustainable management criteria and monitoring networks in Chapter 3 and identification of projects and management actions in Chapter 4.

Identification of data gaps and uncertainty within the HCM is a requirement per 23 CCR 354.14 (b)(5) and is important to inform locations and types of additional monitoring to reduce these gaps and uncertainties.

Identification of Data Gaps

The HCM is detailed in Chapter 2 of this GSP. Data gaps and uncertainties were identified throughout development of the HCM and are briefly discussed in Chapter 2 under applicable subsections. A discussion of the components of the HCM for which key datasets were used, associated data gaps, and uncertainties is provided below.

Climate

Long-term records are available from National Oceanic and Atmospheric Administration (NOAA) weather stations in and around Scott Valley. A list of the applicable NOAA weather stations used in development of the climate component of the HCM can be found in Section 2.2.1.2. Data from these stations were used to evaluate historical and current precipitation and evaluate spatial and temporal (seasonal and long-term) trends in precipitation. Maximum and minimum air temperatures from 1936 to 2020 were obtained from the Fort Jones Ranger Station (USC00043182), and reference evapotranspiration (ET) from 2015 to 2019 is calculated at CIMIS Station 225, near Fort Jones. Temperature and ET data was used to evaluate short and long-term trends in the Basin. Snow measurement data is available in multiple stations in the Scott River Watershed through the California Data Exchange Center (CDEC). A full list of these stations is included in Section 2.2.1.2.

Current and historical climate data is readily available for Scott River watershed (Watershed) and has sufficient spatial coverage, frequency of measurement and length of record to evaluate current and historical conditions and identify trends. Based on an initial assessment of the data, a rainfall gradient is suspected but not confirmed in the Watershed. The presence of a rainfall gradient is an uncertainty in this section of the HCM.

Rainfall data collected from rain gauges in additional locations (such as those where continuous groundwater monitoring sensors have been deployed) could be used to confirm the presence of a rainfall gradient.

Geology

The primary sources of information used in development of the geology section of the HCM are the California Geologic Survey digitized geologic map (Charles W. Jennings, with modifications by Carlos Gutierrez, William Bryant and Wills 2010), and the foundational geologic report (Mack 1958). The presence and/or extent of confining or semi-confining layers has been identified as a data gap in this section.

Soils

A 1983 soil survey of central Siskiyou County (USDA 1983) was the primary source used for development of this component of the HCM. Additionally, soil properties as they relate to groundwater recharge were characterized through the Soil Agricultural Banking Index (SAGBI) ratings for the soil series in the Scott Valley area can be viewed on a web application (app), developed by the California Soil Resource Lab at the University of California at Davis and University of California Agriculture and Natural Resources (UC Davis Soil Resource Lab and University of California Agriculture and Natural Resources 2019).

No data gaps were identified in the development of this section.

Hydrology

The hydrology and natural flow regime in Scott Valley have been discussed in detail in previous reports (i.e., SRWC 2005). Streamflow data is primarily available from the Fort Jones USGS stream gauge (11519500). This flow data is used to evaluate the long-term streamflow record (available dating back to the 1940s), trends in streamflow with water year types, and evaluate seasonal and long-term streamflow trends. As detailed in Section 2.2.1.6, shorter streamflow records are available for numerous tributaries in the Basin but long term, consistent records are not available.

Streamflow records on the tributaries were identified as a data gap, both for long-term records and for current conditions. A streamflow gauge on the mainstem of Scot River was also identified as a useful monitoring tool. Additionally, while the magnitude of flows on the tributaries to Scott River is recognized to be strongly correlated to flows at the Fort Jones gauge (Foglia et al., 2013, Deas and Tanaka, 2005), this relationship has not been well-defined. Quantifying impacts to streamflow in the tributaries with changes in flow rates at the Fort Jones gauge is therefore difficult. This relationship, particularly flow rates at which stream disconnection occurs, is important in defining ecological implications, particularly for anadromous fish, which rely on flows in the tributaries for several life stages, as discussed in Section 2.2.1.8.

In summary, new streamgauges in the tributaries and along the mainstem of the Scott river would be helpful to fill this data gap (see Figure 2).

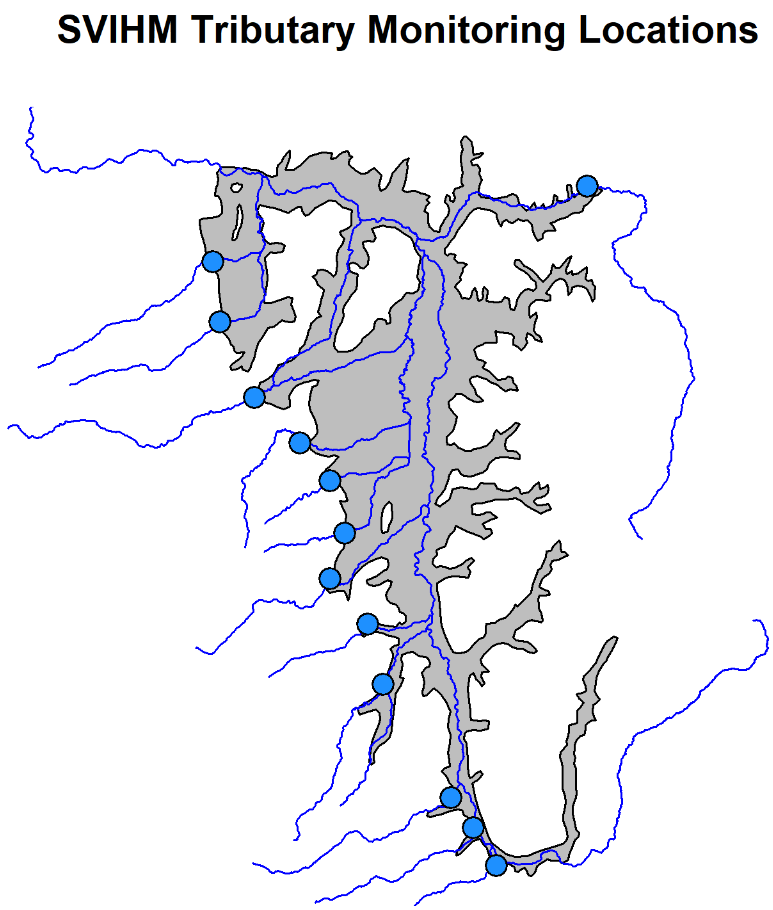

Figure 2. Ideally, tributary monitoring locations could geolocated in the vicinity of the inflows into the SVIHM model domain, as shown above.

Identification of Interconnected Surface Water Systems

While interconnected surface water systems were identified in Section 2.1.1.7, there are uncertainties in this identification. A continuous saturated zone between the stream and aquifer is assumed for all locations that were identified as interconnected surface waters, as no locations are known to be separated from the water table by thick unsaturated zones, but this has not been physically confirmed.

New streamgauges and new monitoring wells with continuous data collection, combined with seepage runs will provide stronger support to the conclusion presented in this GSP.

Identification of Groundwater Dependent Ecosystems

Data from the National Wetlands Inventory, The Nature Conservancy, and other sources (as detailed in Section 2.2.1.8) was used to identify groundwater dependent ecosystems (GDEs) in the Basin. While the results of the initial GDE inventory were evaluated by the Surface Water Ad Hoc Committee, physical verification has not been completed. There is therefore some uncertainty between riparian and non-riparian GDEs that were mapped and the existence and extent of these GDEs on the ground.

Ground truthing of the identified GDEs will help to verify the GDE identification and mapping that has been completed so far. Collaboration with CDFW, and/or other agencies with expertise in identifying, evaluating, and monitoring GDEs will support GDE consideration throughout the implementation of this GSP. Satellite images evaluated twice per year would provide information on the health of GDEs over time and would be critical to fully understand their seasonal cycles.

Groundwater Dependent Ecosystems Health and Habitat Requirements

Several species of fish are prioritized for management in the Basin. CDFW's juvenile salmonid outmigrant monitoring program tracks coho and Chinook salmon populations returning to the Basin. Additionally, juvenile salmonid outmigrant monitoring provides data on another critical life cycle stage of fish in the Basin. Within the groundwater dependent ecosystem discussion in Chapter 2, there are some data gaps in habitat requirements. For example, while there are return numbers for coho and Chinook salmon, there is less data available for steelhead as migration occurs largely outside of the time that the Scott River Fish County Facility is operational (Knechtle 2021). While juvenile outmigrant monitoring does exist, flow requirements for juvenile salmonids are not clearly known.

The GSA will continue to use monitoring data from existing programs and will coordinate with agencies that conduct this monitoring to gain a better understanding of flow requirements for all life stages for these species of anadromous fish.

Current and Historical Groundwater Conditions

Groundwater Elevation Data

A total of 85 wells with groundwater elevation data are available in the Basin. Groundwater elevation data is sourced primarily from the California Statewide Groundwater Elevation Monitoring Program (CASGEM), Quartz Valley Indian

Reservation (QVIR) and the Scott Valley Community Groundwater Measuring Program. Well data is available dating back to the 1960s and wells have adequate spatial coverage of the Basin, measurement frequency and period of record. CASGEM, QVIR and Scott Valley Community Groundwater Measuring Program wells are measured at a frequency of bi-annually, with the exception of the Scott Valley Community Groundwater Measuring Program which is measured monthly. These frequencies are sufficient to enable determination of seasonal, short-term, and long-term trends. With implementation of new Projects and Management Actions, pressure transducers with continuous record of water level and temperature have been considered essential. For the NFWF Scott Recharge Project (see Chapter 4 and Appendix 4-B) five transects with continuous groundwater data on existing groundwater wells are already being installed (5 wells are already collecting data). Other continuous data have been funded through a Bureau of Reclamation SmartWater grant and currently 10 wells had instruments installed in 2021.

A summary of the wells with groundwater elevation data, and additional available information is shown in **Error! Reference source not found.**. Continuous groundwater monitoring locations are shown in Figure 3.

Table 1: Wells with groundwater elevation data in the Scott River Valley Basin

Wells	Groundwater Basin
Wells with coordinates (including data from WCRs referenced to nearest PLSS section)	295
Wells with screen depth information	62
Wells with coordinates and recent[1] water level data	74
Wells with pumping data	None

[1] Recent is here used to refer to data from the past ten years.

Continuous Groundwater Monitoring Locations

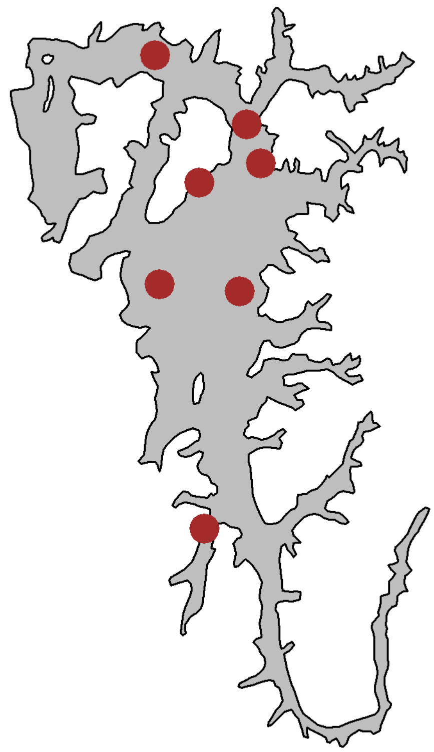

Figure 3. Continuous groundwater monitoring locations (as of September 2021).

Estimate of Groundwater Storage

Groundwater storage data is available from the foundational geological report (Mack 1958) and specific yield and storativity were estimated using the Scott Valley Integrated Hydrologic Model (SVIHM). No data gaps have been identified for this section, however continuous groundwater level data would be useful for evaluation of changes in groundwater storage.

Groundwater Extraction Data

No pumping monitoring program currently exists in the Basin and this data is not available for any of the wells with groundwater elevation data. Although this is estimated using the SVIHM, reported groundwater extraction data has been identified as a data gap.

Surface Water Diversion Data – stock water

Surface water diversions for irrigation are estimated using SVIHM. However, surface water diversion data for watering livestock is not explicitly modeled in SVIHM, and has been identified as a data gap.

Groundwater Quality

Groundwater quality data was obtained from several sources including the California Groundwater Ambient Monitoring and Assessment (GAMA) Program Database, the USEP Storage and Retrieval Data Warehouse (STORET), GeoTracker GAMA and data from QVIR groundwater quality monitoring. As detailed in Appendix 2-B, available water quality data were compared to regulatory standards and mapped. Constituents of concern were identified through visual analysis of recent data (within the past 30 years) of the generated maps and timeseries for each constituent (available in appendix 2-B). As seen on these maps, and noted in Section 2.2.2.3, there are multiple data gaps in the groundwater quality information used to develop the HCM. Spatially, groundwater quality data is frequently concentrated near Fort Jones and Etna and coverage in other areas of the Basin is missing for multiple constituents. Additionally, most of the groundwater quality data used in the assessment did not have a long record with consistent measurements, or measurements with a frequency that would be sufficient for determination of historical trends in groundwater quality. Further data gap discussion and the strategy for filling these data gaps is discussed under the groundwater quality monitoring network associated with Chapter 3, below.

Additional water quality monitoring data is being collected by the North Coast Water Quality Control Board and this data will be utilized by the GSA in future reporting.

Land Subsidence Conditions

Land subsidence data is entirely sourced from the TRE Altamira Interferometric Synthetic Aperture Radar (InSAR) dataset which provides estimates of vertical displacement from January 2015 to June 2015. No data gaps were noted in this section.

Water Budget

The water budget is dependent on monitoring data inputs. For data gaps in the water budget see previous sections on climate and hydrology (i.e., tributary) data gaps.

DATA GAPS MONITORING NETWORKS

Requirements

Multiple data gap requirements are relevant to the definition of monitoring networks for sustainability indicators. Per 23 CCR 354.38 ("Assessment and Improvement of Monitoring Network"):

(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.
(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency
(c) If the monitoring network contains data gaps, the plan shall include a description of the following:
    a. The location and reason for data gaps in the monitoring network
    b. Local issues and circumstances that prevent monitoring
(d) Each Agency shall describe steps that will be taken to fill the data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

The following discussion summarized the identified data gaps, description, and strategy to fill the identified data gaps.

Groundwater Level and Storage Monitoring Network

Though not identified as a data gap, continuous groundwater level and temperature data would be useful for the groundwater level and storage monitoring network (as discussed above).

Groundwater Quality Monitoring Network

Requirements

Requirements for the monitoring network for the degraded water quality sustainability indicator are outlined in 23 CCR 354.34 (c)(4): Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.

Data Gaps

Data gaps in the groundwater quality monitoring network were identified due to inadequate spatial coverage, monitoring frequency, and/or lack of representativeness of Basin conditions and activities. The three sites with existing and ongoing groundwater quality monitoring are public supply wells and are therefore concentrated near population, or seasonal population, centers near Fort Jones and Kidder Creek Orchard Camp, leaving much of the Basin without representative monitoring data. The location of these data gaps is shown on the map of the existing groundwater quality monitoring locations (see Figure 2 in Chapter 3). The south, central and northernmost parts of the Basin are not covered under the current monitoring network. These data gaps are due to the limited number of wells that conduct current and ongoing monitoring for the identified constituents of concern, all public supply wells. The wells in the existing groundwater quality network also have a temporal data gap with a frequency of measurement annually or greater, corresponding to the public water supply system sampling frequency. No local issues or circumstances are expected to prevent monitoring. As discussed in Section 3.3.3, the groundwater quality monitoring network will be expanded with a minimum addition of five wells within the first five years of plan implementation to address this data gap. Candidate wells have been identified for inclusion in this expansion including wells used by dairy operators to report groundwater data to NCRWQCB, domestic wells, QVIR wells, and wells included in the monitoring network for groundwater levels.

Depletions of Interconnected Surface Water Monitoring Network

Requirements

The requirements for the depletion of interconnected surface water monitoring network, as part of § 354.34. Monitoring Network, are detailed below:

(A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.
(B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.
(C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.
(D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.
(E) Changes in gradient between river and groundwater system

Data Gaps

While the Scott Valley Integrated Hydrologic Model (SVIHM) is the primary tool for estimating depletions of interconnected surface water, monitoring is necessary for inputs and calibration of the model. As a result, data gaps in the hydrology and climate sections of the Basin setting are also relevant here. Data gaps were identified for physical monitoring to be used in combination with the SVIHM. Wells near the mainstem of Scott River, to be used in observation of long-term trends in the hydraulic gradient between the aquifer and stream were identified as a data gap for the monitoring network associated with the depletions of interconnected surface water sustainability indicator. No local issues or circumstances are anticipated to prevent this monitoring. To fill this data gap, additional wells are planned to be added within the first five years of implementation.

ADDITIONAL DATA OR INFORMATION VALUABLE FOR MEASURING PROGRESS TOWARDS THE BASINS SUSTAINABILITY GOAL

Additional data has been identified that may be valuable to evaluations of progress towards the Basin's sustainability goal. This is primarily additional monitoring information that may be useful to identify adverse impacts on biological uses of surface water, in addition to existing biological monitoring in the Basin.

These include evaluation of streamflow depletion impacts on juvenile salmonids and use of satellite imagery for monitoring riparian and non-riparian vegetation. The GSA may consult other entities or specialists, as feasible, to determine the value of this data.

DATA GAP PRIORITIZATION

The identified data gaps are prioritized for actions to be taken to resolve them. Data gaps are categorized into "high", "medium", and "low" prioritization statuses based on the value to understanding basin setting or in comparison to the defined SMCs to evaluate Basin sustainability. Filling data gaps can be achieved through increasing monitoring frequency, addition of monitoring sites to increase spatial distribution and density of the monitoring network or adding or developing new monitoring programs or tools. Summaries of the data gaps discussed in this appendix, associated prioritizations, and strategies to fill the data gap are shown in Table 2.

New monitoring in the Basin includes collection of isotope data, water quality data and five transects with continuous groundwater data for the NFWF Scott Recharge Project (see Chapter 4 and Appendix 4-B). This information will be used to help fill the identified data gaps and supplement data collected through existing monitoring programs. Additionally, a minimum of eight continuous groundwater and temperature and eight soil moisture sensors has been funded by the Bureau of Reclamation. This additional monitoring will also help to fill data gaps.

Table 2: Data gap prioritization

Priority	Data Gap Summary	Strategy to Fill Data Gap
High	Groundwater quality monitoring network	Planned expansion of groundwater quality monitoring network in the first five years. Additional expansion will be evaluated at the five-year update.
High	Depletions of interconnected surface water monitoring network	Planned addition of continuous groundwater level and temperature measurement near the river to determine the gradient between the aquifer and stream and for use in calibration of SVIHM.
High	Continuous groundwater level monitoring network	Planned addition of these measurements through implementation of PMAs

Medium	Groundwater extraction data	
Medium	Identification and evaluation of Groundwater-Dependent Ecosystems	Using satellite imagery to confirm location and extent of GDEs and evaluate twice per year to assess GDE health over time.
Medium	Groundwater Dependent Ecosystems Health and Habitat Requirements	Collaborating with an agency and/or personnel with expertise in requirements for anadromous fish identified as high priority for management in the Basin.
Low	Additional precipitation data to confirm presence of rainfall gradient.	No strategy has been defined yet to fill this data gap.

REFERENCES

California Department of Water Resources (2016). BMP 2: Best Management Practices for the Sustainable Management of Groundwater Monitoring Networks and Identification of Data Gaps, December 2016. https://water.ca.gov/-/media/DWR-Website/WebPages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/BestManagement-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-andIdentification-of-Data-Gaps_ay_19.pdf

Knechtle, M., & Giudice, D. (2021). *2020 Scott River Salmon Studies, Final Report*. California Department of Fish and Wildlife.